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INTERNATIONAL REVIEW OF POULTRY SCIENCE

OFFICIAL ORGAN OF THE

WORLD'S POULTRY SCIENCE ASSOCIATION

EDITOR:
Dr. B. J. C. TE HENNEPE
ROTTERDAM (Holland)

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To the Present and Prospective Members of the World's Poultry Science Association

GREETINGS :

The World's Poultry Science Association has completed its 7th epoch in promoting the welfare of the poultry industry throughout the world. It has survived 27 years and has successfully demonstrated its value. This has been accomplished mainly by sponsoring seven triennial congresses and expositions in as many different countries of two hemispheres.

Briefly stated the success of this far-flung organisation is based upon the fundamental principle that all knowledge should flow freely throughout the world for the well-being of all mankind. The unselfish educational motive of the World's Poultry Science Association will endure.

But worthy motives and sound ideas are not sufficient in themselves. Good intentions and the best ideas must be put into motion and sustained by enlightened human interest and personal effort. They must be supported by heavy personal sacrifice of time, thought and money of those who care. Thus it is, that all worthwhile movements live and grow.

The history of the World's Poultry Science Association furnishes a striking example of the way in which the poultry minded men and women of all participating countries have pooled their ideas and united their efforts towards the success of a common undertaking in promoting the Seventh World's Poultry Congress and Exposition.

The four stated or implied main objectives or corner-stones upon which the World's Poultry Science Association is built are : (1) Encouragement of research in Poultry Husbandry and the spread of knowledge. (2) Building of friendship and goodwill among the people of all nations. (3) Ultimate establishment of commodity standards to simplify and facilitate the interchange of poultry and poultry products and supplies. (4) Aid in the development of poultry industry leadership through more efficient organisation throughout the world by the holding of World's Poultry Congresses and Expositions. These objectives facilitate the building of the foundation of a prosperous poultry husbandry. Good organisation is the cement which binds together all of the elements of any industry.

The World's Poultry Science Association, it should be understood, is the organisation which sponsors, but does not administer, the triennial congresses and expositions. These international events are organised, financed and managed by the host countries in which they are held.

On account of the present turbulent world economic conditions the World's Poultry Science Association faces the most important challenge in its 27 years of existence. However, our duty is clear. We must meet the challenge as both a duty and an opportunity. During times of both peace and war there is the vital need of education. the foundation upon which all permanently successful enterprises must be built.

To succeed, every worthwhile enterprise must have definite objectives for accomplishment and must render a large worthwhile service which cannot be secured as well in any other way.

One of the important services offered by the World's Poultry Science Association is the publication of the *International Review of Poultry Science*, which is furnished free to all members. The four annual volumes of this publication contain the most-up-to-date scientific and practical information garnered from all countries of the world. This service is the life-line which connects the World's Poultry Science Association with its members during the

three-year intervals between the poultry congresses. It is apparent that the larger the membership in the World's Poultry Science Association, the more valuable will be its official house organ.

The world at large can never know or adequately appreciate the many almost insurmountable problems which the poultry authorities in each of the seven host countries—The Netherlands, Spain, Canada, England, Italy, Germany and the U.S.A.—have been obliged to meet and overcome in organising, promoting and administering these international events. To meet these large responsibilities offers a large challenge to the poultry industry of any country.

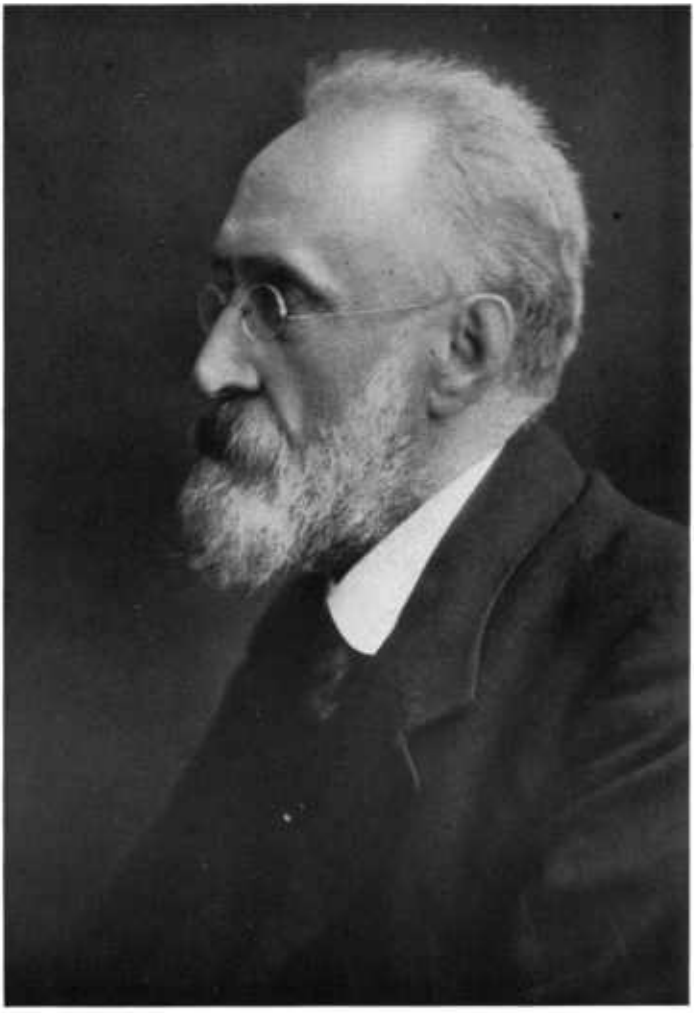
Following in the wake of each World's Poultry Congress and Exposition, there is an awakening of interest in poultry industry affairs which finds expression in educational and commercial development through the introduction of better methods of production and marketing and the expansion of the allied industries which profit by the prosperity of the poultry industry.

Thus the countries which promote World's Poultry Congresses and Expositions may be expected to reap their largest dividends in the advancement of the poultry industry as a whole for many years thereafter, in addition to the immediate benefits to be derived by the individuals and organisations who participate.

The poultry-minded persons in all countries and many wideawake governments should give earnest and early consideration to the wisdom of joining or supporting the World's Poultry Science Association and also consider the advisability of applying for the privilege of the country becoming Host to the Eighth World's Poultry Congress in 1942 or later Congresses. Success comes to those who have the vision to see the enterprise and have the courage to carry through large undertakings. The World's Poultry Science Association offers such an opportunity.

You are urged to request further information regarding membership from Dr. G. F. Heuser, Secretary-Treasurer, Ithaca, New York, U.S.A., or Dr. B. J. C. te Hennepe, Editor and Secretary for Europe, State Serum Institute, Rotterdam, Holland.

JAMES E. RICE, *President,*
World's Poultry Science Association.



SIR EDWARD BROWN.

A Tribute to a Great Leader

The death of Sir Edward Brown in Reading, England, on August 7th, 1939, at the age of 87, removed from our midst one whose life had been unselfishly, zealously and ably devoted to the welfare of the poultry industry.

Sir Edward Brown's life embraced a wide field of effort. He was exceedingly versatile, a prolific writer, a convincing speaker and a successful organiser. He had a broad outlook on life, and a comprehensive understanding of the field of poultry husbandry. This faculty in addition to his sterling character, sincerity of purpose, utter frankness and good judgment and vision, made him an outstanding leader in the poultry industry.

Progressively, Sir Edward endeavoured to secure government and private financial support for research and teaching in poultry husbandry as an essential basis upon which a successful poultry industry could be built. It was in order to accomplish these fundamental objectives that he early saw the necessity of uniting the poultry industry of Great Britain and threw himself unreservedly into the task of organising the National Poultry Council, of which he was for many years a guiding spirit and ably served successively as President and Secretary.

The wide and favourable reputation which Sir Edward had established in England over a period of many years as an experimenter, teacher and writer in his chosen field of poultry husbandry spread to many other countries which he frequently visited as a lecturer and consultant.

These many years of devoted effort toward the advancement of the poultry industry in his own and other countries provided precisely the experience necessary to qualify him for taking the chief responsibility for organising the International Association of Poultry Instructors and Investigators in July, 1912, later to be known as the World's Poultry Science Association of which for 15 years he was its President. In fact, for all these years he was the captain and pilot of this new poultry industry ship destined to carry the most progressive methods and goodwill to all quarters of the civilised world.

Following his retirement from active official life and during all of his declining years, Sir Edward continued to manifest keen interest in the success of the World's Poultry Science Association, and in the congresses and expositions which it sponsored. They were the crowning efforts of his career.

In recognition of his distinguished service to the poultry industry of the world, Sir Edward was knighted in 1930 by his King. This titled honour was a just recognition of a life devoted to a worthy cause.

It is quite possible that without Sir Edward's vision, faith and leadership in building, launching and steering this poultry industry international ship it might never have survived the inception or launching stages. Hence, to Sir Edward Brown's high quality of leadership, vision and faith, the poultry industry of the entire world owes a deep debt of gratitude.

How great his contribution was can be measured only by the flight of time. Its value will be cumulative and will depend upon those who in succeeding generations, continue to carry high the flaming torch in the long relay race of the poultry industry.

It now remains for those of us who have been charged with special responsibility for carrying on the work of the World's Poultry Science Association, and to all who take pride in the advancement of the poultry industry to do honour to the memory of its chief founder by extending its boundaries and spreading its humanising influences to all parts of the civilised world.

JAMES E. RICE, *President,*
World's Poultry Science Association.

DEPARTMENT OF AGRICULTURE,
EXPERIMENTAL FARM,
OTTAWA, CANADA,
October 25th, 1939.

To MEMBERS OF COUNCIL :

DEAR SIR,

Since the death of Sir Edward Brown there has been considerable discussion in North America as to the suitability of collecting a Fund that would act as a perennial memorial to the first President of the World's Poultry Science Association.

Up to the present practically all the members of Council living in the U.S. and Canada have expressed themselves entirely in favour of it and approved of my writing to the other members of Council to secure their approval and support.

Several suggestions have been made as to the nature of the memorial and for your information I will mention these briefly hoping, however, that you will feel free to make any suggestions you like. When the monies are finally collected a Committee could be appointed to decide what should be done.

The suggestions already made are : If sufficient funds are available a scholarship might be created, say at Harper Adams. If the amount is not sufficient for that a trophy of some kind might be placed in annual competition. Then a suggestion was made that as Sir Edward had so much to do with the formation of the Poultry Science Association and the Congresses, and guided them both for the first 15 years, that an honorarium might be given at each Congress for the most outstanding research in poultry husbandry.

The suggestion also has been made that a limit be put upon the contributions, say of $1.00 or $2.00 American funds or their equivalent. Also it is suggested that not only members of the Poultry Science Association be contacted, but all who have any interest in poultry keeping, especially those who have known Sir Edward, and have attended any of the Congresses.

I should be glad if you would see what can be done in your country, especially in your district, for I am writing this same letter to all Members of Council. When you have secured what you feel is the total I would be glad if you would remit anything you have collected to me, and when the contributions are all in I will let you know what the total is and what the next step will be.

Since the reply from the Members of Council in North America were so unanimously in favour I am not asking your advice as to the advisability of the scheme, but I am taking for granted that you will favour and do what you can in support of it.

With you I appreciate just what a loss our organisation has suffered in the passing of its first President.

Yours very truly,
F. C. ELFORD,
Special Poultry Commissioner.

Meetings of the World's Poultry Science Association

HELD AT THE

Seventh World's Poultry Congress and Exposition

July 28th to August 7th, 1939, Cleveland, Ohio, U.S.A.

The meetings were well attended. Thirty-two members of Council were present, representing 14 countries. At the General Meeting there were present 55 persons from 19 countries.

ELECTION OF OFFICERS

The following officers were duly elected or re-elected for the following three years.

President.—Prof. J. E. Rice.
First Vice-President for America.—Prof. R. B. Thompson.
First Vice-President for Europe.—Prof. S. Castello.
First Vice-President for Southern Hemisphere.—Mr. J. J. Jordaan.
Vice-Presidents.—Dr. K. Beller (Germany).
Mr. P. Francis (England).
Mr. C. S. Th. Van Gink (Holland).
Prof. Chas. Voitellier (France).
Secretary-Treasurer.—Dr. G. F. Heuser.

MEMBERS OF COUNCIL

(Nine Years except for Replacements)

AUSTRALIA	Mr. E. Hadlington (to replace Mr. J. B. Merrett).
	Mr. C. F. Anderson.
BELGIUM	Mr. K. deRycke.
BULGARIA	Mr. I. Tabakoff.
CANADA	Mr. W. A. Brown.
DENMARK	Mr. O. Nielsen.
	Prof. V. Adsersen (to replace Mr. H. Folden).
ENGLAND	Capt. E. T. Halnan.
FRANCE	Mrs. L. Grovlez.
GERMANY	Prof. Krallinger.
	Dr. Fangauf (to replace Dr. Hübner).
IRISH FREE STATE ...	Mr. Denis Philpott.
ITALY	Prof. E. Giacomini.
U.S.A.	Dr. M. A. Jull.
	Mr. W. D. Termohlen.
	Dr. O. B. Kent (to fill unexpired term of Prof. R. B. Thompson).

President Karl Vetter was appointed an Honorary Past-President of the World's Poultry Science Association.

Future Congresses.—Considerable discussion was given to this subject. Both 3 and 5-year intervals were favoured. As to the nature of the Congress, expression was received in favour of a Congress only, a Congress with a national exhibit and a Congress with an Exposition.

In this connection the following motion was carried :—

> " That the next World's Poultry Congress be held in 1942 and that it be a Congress of scientific sessions only, or of scientific sessions with a national exhibit depending on the desires of the host country."

It was also carried that in approaching countries as to their desire to act as host for the next Congress, the regular procedure be followed but that Mr. Vetter and Dr. teHennepe be authorised to consult specifically with Hungary.

The following resolution was presented by delegations from Brazil, Cuba, Peru, Guatemala and the Dominican Republic.

> " To study the possibilities of celebrating the Eighth World's Poultry Congress in one of the Latin American Republics, and that the World's Poultry Science Association Council, through the Pan-American Union, consult the Governments of the Latin-American nations and interested societies in these countries with the view of holding the Eighth Congress in one of these republics."

Small Animal Breeders.—Acting upon a resolution from the rabbit breeders, it was agreed that the Council of the World's Poultry Science Association should be restricted to members representing the interest of chickens (in the broad sense) only and should not include other small animals.

Committee on International Standards.—The work of this Committee was authorised to be extended until the next Congress meeting.

Experiments on Fowl Paralysis.—A proposal was made by Dr. Beller for experiments on fowl paralysis on an international basis. It was moved that the President of the World's Poultry Science Association be authorised to appoint a Committee to study this proposal and to present recommendations as to the establishment of an International Committee on Fowl Paralysis; further that the said Committee should be comprised of five members, that it report annually through the *International Review of Poultry Science*, and that it report fully at the next World's Poultry Congress.

Resolutions.—The following resolutions of interest to the membership were adopted at the Closing Assembly and referred to the Council of the World's Poultry Science Association for action.

Marketing.—

"Whereas: Developments of Marketing bring about profound changes in the Egg and Poultry Industry of the World, and

Whereas: It is the desire of members of the World's Poultry Science Association to maintain an effective exchange of information as to developments of marketing in the countries of the world to the end that each country may have an opportunity better to co-ordinate its own activities with those of other nations,

Therefore, be it resolved: That an International Marketing Committee of the World's Poultry Science Association be appointed by the President of the Association

and further be it resolved: That this Committee take appropriate steps to obtain and interchange available information as to developments of marketing."

International Institute of Agriculture.—

"Whereas, the Sixth World's Poultry Congress at Leipzig requested the World's Poultry Science Association to co-operate with the International Institute of Agriculture, in the improvement of national poultry statistics, resulting in improvement of the schedules for the 1940 World Agricultural Censors,

Therefore, be it resolved: That the World's Poultry Science Association continue to collaborate with the Institute in its efforts to improve and make more comparable the poultry statistics of various countries."

Resolutions regretting inability to be present were sent to Sir Edward Brown and Senor Castello.

Appropriate resolutions of appreciation were sent to the various persons and groups who helped to make the Congress a success.

G. F. HEUSER,
Secretary-Treasurer.

MEMBERS OF COUNCIL

	Terms Expiring 1942	1945	1948
AUSTRALIA	—	Mr. E. Hadlington	Mr. C. F. Anderson
BELGIUM	Mr. F. K. Chrispeels	Prof. J. E. Frateur	Mr. K. De Rycke
BULGARIA	Dr. G. S. Chlebaroff	Dr. P. Hadjidimitroff	Mr. I. Tabakoff
CANADA	Dr. F. N. Marcellus	Prof. R. K. Baker	Mr. W. A. Brown
BOHEMIA AND MORAVIA	Prof. F. Kral	—	—
DENMARK	Dr. J. Traberg	Prof. V. Adsersen	Mr. O. Nielsen
EGYPT	—	Dr. M. Askar Bey	—
ENGLAND	Mr. T. Newman	Mr. A. Arbuthnot	Capt. E. T. Halnan
	Mr. G. Stewart	Dr. E. M. Cruickshank	—
FRANCE	Mr. A. Fould	Prof. P. Lesbouyries	Mrs. L. Grovlez
GERMANY	Dr. L. Weinmuller	Dr. J. Filler	Prof. Krallinger
HOLLAND	Dr. B. J. C. teHennepe	Dr. I. DeBlieck	—
IRISH FREE STATE	—	Miss M. Hennerty	Mr. D. Philpott
ITALY	Prof. V. Vezzani	Prof. A. Pirocchi	Prof. E. Giacomini
NEW ZEALAND	Mr. J. A. Kissling	—	—
NORTHERN IRELAND	Miss M. J. Sheedy	Mr. J. Getty	—
POLAND	Dr. Laura Kaufman	Dr. M. S. Gutowska	—
SCOTLAND	—	Miss M. M. MacLeod	—
SOUTH AFRICA	Mr. W. A. Bartlett	Mr. D. Jacobs	—
SPAIN	—	Mr. R. de Escauriaza	—
SWITZERLAND	Mr. M. K. Kleb	—	—
U.S.A.	Prof. J. G. Halpin	Prof. L. F. Payne	Dr. M. A. Jull
	Prof. J. H. Martin	Dr. O. B. Kent	Mr. W. D. Termohlen

January 1*st*, 1940.

Financial Statement

January 1st to December 31st, 1939.

Receipts.	Dr. Heuser. $	Major Macdougall. £	s.	d.	Dr. te Hennepe. Fl.
Balance on hand, January 1st, 1939...	817.03	116	2	6	
Subscriptions...	593.12	125	0	0	705.60
International Review	188.20				150.00
Congress Report	3.00				
Transfer from Dr. Heuser		85	0	0	
Total receipts	$1601.35	£326	2	6	*fl. 855.60
Expenditure.					
Deficit, January 1st, 1939					68.08
International Review	346.40	294	4	11	93.13
Postage, Telegrams	43.03	3	2	2	54.20
Printing supplies	35.72	0	6	6	74.65
Translations	13.65				
Clerical Assistance	7·75	12	0	0	600.00
Travel...	124.67				355.00
Exchange on cheque		0	2	3	
Total Expenditure ...	$571.22	£309	15	10	fl. 1245.06
Balance on hand, January 1st, 1940...	$1030.13	£16	6	8	
Deficit					fl. 389.46

*Germany ... ... fl. 150.00 not received.
Italy, 1938 ... ... 120.00 „
Italy, 1939 ... ... 120.00 „

BREEDING.

The Results of Artificial Lights in Winter. IV. Die Folgen intensiver Winterbeleuchtung von Zuchthühnern auf die Eierleistung und auf den Ablauf der Brut. Dr. Bartsch. Archiv für Geflügelkunde, 1939, Nos. 10, 11.

Summary :

III. The experiment about the effect of artificial illumination upon breeders having been finished the progeny of the illuminated birds (pen I) and the birds not illuminated (pen II) was in the course of one year tested as to egg production and condition of health while being managed according to usual farming practice. No difference between the two groups could be established. In twelve months the pullets of the first group had an average production of 181·6 eggs, the pullets of the second group 180·0 eggs. The losses were 6·1 per cent. and 9·4 per cent. respectively. 41·9 per cent. of the birds of the first and 41·7 per cent. of the birds of the second group were kept for another laying year. No detrimental effects of the artificial illumination of the mothers could be noticed in their progeny.

IV. Intensive artificial illumination of breeding hens in the winter results in high winter egg production and does not impair spring production and hatching results provided fresh greenstuffs (cabbage, spinach) is given abundantly. When no greenfeed was available egg production was going down from January till March and hatching results were low. Fresh greenfeed could not be replaced by silage or sprouted oats.

Experiments on the expected Production of the Daughters of Cocks. Vergleichende Untersuchungen über die Vorhersage der Nachkommenleistung mit Hilfe von Ahnentafel und Kurzsippentafel. Krallinger. Archiv für Geflügelkunde, 1939, Nos. 7, 8.

Summary :

1. The paper presented aimed at finding an answer to the question, whether it is possible to make a more reliable estimate on the expected production of the daughters of cocks on the basis of the records of the sire's ancestors, or on the basis of the records of these combined with the records of the sisters of the sire's ancestors as well as of his own sisters.

2. First year production was used as criterion. The provincial departments of the German Reichsgeflügelherdbuch (German State Pedigree Breeders' Organisation) furnished the material for the investigations by putting at the disposal of the author all necessary pedigree records, hens' records, hatching and rearing records, for the years 1937, 1938, and 1939, and partly even back to 1935. On the basis of this material family production records were compiled to be used for the comparison of the partners' progeny and the production of the daughters of the various sires, and also family tables that made it possible to judge the same sires according to the production of their ancestors, the sisters of them, and their own sisters.

3. 48 cocks were used for the investigations and grouped in 53 pairs. In order to avoid all sources of error as possibly caused by the influence of different environmental conditions upon the birds, these were grouped very carefully. Particularly, the author did not compare average production figures as obtained by the various methods, but was using the method of correlation which he applied to the differences between the production records of

each pair of sires. In this manner all three methods of comparison were tested.

4. The following figures in comparing the differences in breeding value were obtained :—

$$r_{12} = + 0{\cdot}6837 \pm 0{\cdot}0732,$$
$$r_{13} = + 0{\cdot}2093 \pm 0{\cdot}1313,$$

whereby 1 is denominating the method of testing the genotype on the basis of the family production records (*i.e.* according to the actual breeding results), 2 the method of using the average production of the ancestors for the same purpose, while 3 applies to the method of using the production of the ancestors, theii sisters, and the sires' own sisters, combined. It is shown that the second method is giving a more reliable estimate on the future production of the daughters of sires than the third method if average first year production is used as criterion.

5. The most essential theoretical problems are discussed. According to the results of these investigations it seems that the inheritance of egg production cannot be entirely explained by the principles of homomeres according to Nilsson-Ehles, but dominant genes must be playing a great part.

6. It is still possible to improve egg production in average conditions by widely using cocks that have extraordinary breeding behind them, and by excluding cocks the ancestors of which had only medium or low production records.

7. Family records and production tables of the ancestors are of great value in pedigree work. The tables compiled according to the method 3 can be dispensed with.

It was not possible to include in this paper many of the hundreds of records and tables compiled in the course of the work. The tables had to be cut to a minimum and a great part of the figures had to be omitted in order not to exceed the available space. However, all material is filed and may upon request be obtained from Abteilung für angewandte Vererbungswissenschaft der Universitat Breslau, Hansastr. 25.

Some Impressions of the VIIth International Congress of Genetics. W. S. L. Hindaugh. The Lancashire Report, September, 1939.

Dr. Hutt (New York) instanced the White Leghorn, which compared with such breeds as the Rhode Island Red and Plymouth Rock, exhibits many marks of superiority. It shows greater resistance to *Salmonella pullorum*, no lack of vitamin B_1, its eggs normally have shells of denser texture. Fertility, too, is as a rule, at a consistently higher level. Such differences are not merely between these breeds but rather between Mediterranean and Asiatic breeds. This means that groups of breeds have certain characteristics which are peculiar to them.

The question of hybrid vigour obtaining by crossing highly in-bred strains cropped up during the Congress. The work at the Northern Breeding Station showed very clearly through the medium of the birds themselves and by their records of performance, the superiority of the hybrids.

Sexual Dimorphism in Down and Adult Plumage of the Pilgrim Goose. J. P. Quinn. Jour. Heredity, Vol. 30, 1939, No. 2, p. 55.

Sexual dimorphism in the Pilgrim goose permits ready sex identification in that males have white or light-grey plumage and light-coloured bills, whereas females have darker down and dark bills. Differences seem more pronounced with age. The similarity between these geese and the Alabama geese described by Gordon is noted.

Estimating the Influence of Heredity on the Tarso-Metatarsal Length of the Domestic Turkey. R. G. Jaap. Oklahoma Experiment Station. Oklahoma Acad. Sci. Proc., Oklahoma University, Vol. 18, 1938, p. 11.

The tarsometatarsal length in 511 male turkeys ranged from 6·8 to 8·4 inches and in 508 female from 5·2 to 6·5 inches in length. The analysis of variance in the shank length indicated that heredity was responsible for about 25 per cent. of the variability in male and 39 per cent. of that in female. The female shank length, therefore, serves as a better measure of breeding progress than that of males.

Effect of Rearing Environment on Sexual Development of Fowls. E. W. Callenbach and J. E. Nicholas. Pennsylvania Station Bulletin, No. 368, 1938.

This report substantiates findings that (1) the temperature and relative humidity of the brooder house had no measurable effect on the sexual development of pullets, (2) heavy grain consumption by immature pullets did not retard sexual development, and (3) the use of electricity for brooder heat, employing exposed, black-heat resistant coils, resulted in a slower rate of sexual maturity of pullets than comparable birds exposed to other sources of brooder heat.

The Guinhen : Hybrid resulting from Crossing a Guinea Hen and a Male Chicken. E. M. Funk. Missouri University. American Poultry Journal, Vol. 69, 1938, No. 10.

Four hybrids between Pearl guinea hens and a Rhode Island Red rooster are described. The hybrids had yellow skin, the plumage showed some red colour, and the combs were absent. Guinea shank colour predominated.

Factors affecting Fertility in Rhode Island Reds. F. A. Hays and R. Sanborn. Massachusetts Station Bulletin, No. 359, 1939.

Study was made of the effects of various factors on fertility in the Rhode Island Red flock from 1922 to 1936. Fertility rose with temperature variations until outside temperature was about 37° F. The fertility of both males and females declined with age, but males were mainly responsible for infertile matings. Variations in the number of females from 1 to 14 with which males were mated had no effect upon the fertility record. There was no correlation between fertility of dams and their daughters, suggesting that fertility was not hereditary. However, the percentage of fertile matings within and between different families varied.

Selective Fertilisation in Poultry. G. Bonnier and S. Trulsson, Hereditas, Vol. 25, 1939, No. 1, p. 65.

Two lots of five Rhode Island Red hens each were inseminated with sperm from Rhode Island Red and White Leghorn cocks on alternate days. There were produced 151 red chicks and 54 white chicks. Inseminations with mixed sperm from both breeds showed that 24 eggs were fertilised by White Leghorn sperm and 88 eggs by Rhode Island Red sperm. The results with the use of semen from the two breeds on alternate days showed that the highest frequency of fertilisation was for eggs laid 2 days after insemination. Although

simple microscopic examination indicated that the sperm from the two cocks were equally viable, when only the White Leghorn cock was used some hens produced only infertile eggs and others infertile eggs and white chicks. From the conclusions it was impossible to determine whether the individual cocks showed selective fertility with the different hens or whether racial differences were exhibited.

Breeding for Poultry Viability. D. R. Marble. Pennsylvania Station Bulletin, No. 377, 1939.

A 5-year programme of selection of breeders from the most viable families of Single Comb White Leghorns and Barred Plymouth Rocks has resulted in improved viability in the rearing flock and a 50 per cent. reduction in mortality in the laying flock, with only a slight decrease in chick viability. Greater viability of adult birds was obtained among birds hatched from eggs produced by hen breeders than from those by pullet breeders. Definite family differences were established in the extent to which resistance to the fowl paralysis complex developed. Subsequent laying flock mortality of 5-month-old pullets showing grey-eye condition was considerably greater than for pullets possessing normal eyes. Laying flock mortality was distributed rather uniformly over the laying year. Increased viability was obtained without significant losses in egg production, egg size, age at sexual maturity, and body weight.

The Effect of Dilution and Density on the Fertilising Capacity of Fowl Sperm Suspensions. S. S. Munro, Canadian Journal Res., Vol. 16, 1938, Section D, p. 281.

Study was made of the influence of dilutions up to 1 : 128 of fowl semen with a synthetic solution and reductions in the number of sperm of cockerels used for artificial insemination. Records of the fertility and hatchability of the eggs showed that 88 per cent. of the eggs laid on the second day after insemination were fertile. Fertility and hatchability were based on the eggs laid during the 10-day period beginning on the second day after insemination. Fertility dropped rapidly with dilutions, even of 1 : 2, and reached a zero point with semen dilutions of 1 : 64. Variations in the amount of semen injected at different dilutions showed definitely that the decrease in fertility with diluted semen was not due to a decrease in the number of sperm. When sperm serum was used as the diluent, there was almost no decrease in fertility with dilutions as great as 1 : 64 if the number of sperm per insemination was not decreased, but decreases in the number of sperm per injection from 231·5 million to 57·9 million were associated with some decreases in fertility. Fertility was further lowered as the number of sperm was decreased, and when the number reached 1 million almost complete sterility followed. There seemed to be no correlation between fertility and hatchability of the fertile eggs.

A Single Chromosome Explanation of Roberts and Quisenberry's Brahma × Barred Rock Mosaic. S. S. Munro. Journal of Heredity, Vol. 29, 1938, p. 389.

The Brahma-Plymouth Rock mosaic of Roberts and Quisenberry is explained on the assumption of linkage between the feathered-leg and extension genes and the failure of the Brahma chromosome carrying these genes to separate at the first chromatid division. Then the presence of two *e* genes would dominate *E* and cause lack of pigment, and the resulting feathers would resemble the light Brahma on one side. Thus, non-disjunction is considered to affect genic balance and the result obtained in this case.

The Role of Heredity versus Environment in Limb Bud Transplants between Different Breeds of Fowl. H. L. Eastlick. Missouri University Science, Vol. 89, 1939, No. 2297, p. 17.

The characteristics of the donor tissue in reciprocal grafts between White Leghorn and Brown Leghorn embryos were variable, *i.e.*, like the donor, like the host, or showing characteristics of both donor and host. Evidently, the degree of attachment determines whether an enzyme from the host reaches the graft and suppresses the colour of the donor and stimulates complete or partial expression of the plumage and pigment of the host.

Does Selective Breeding Pay ? V. S. Asmundson. University California. Californian Turkey News, 1938, August.

A discussion of possibilities for the improvement of market quality, livability, and egg production in turkeys by breeding.

The Significance of Bodyweight in Breeding for Egg Production. F. A. Hays. Agricultural Experiment Station, Amherst, Massachusetts Bulletin, No. 364, June, 1939.

Summary :

Body weight records were obtained on 2,283 Rhode Island Red pullets to study the significance of body weight in breeding for egg production. The data obtained seem to warrant the following deductions :—

1. Laying pullets increased in weight at the highest rate during the first month of laying. After the first month there was a monthly increase of about ¼ lb. up to the mature weight attained at 11 to 12 months. During summer there was a decrease in body weight up to September, averaging about ⅓ lb. for each individual.

2. There was considerable parallelism between mean monthly body weight and mean monthly egg weight. Maximum egg weight occurred about 1 month earlier than maximum body weight.

3. Satisfactory winter egg weight did not occur unless pullets averaged to gain 1 lb. or more in weight from housing to the end of the laying year. Increases greater than 1 lb. were accompanied by larger winter eggs.

4. There was a significant positive correlation between maximum body weight and annual egg weight.

5. A statistically significant, though not intimate, correlation was observed between weight at housing and persistency.

6. Maximum body weight gave a statistically significant negative correlation with persistency, but the constant was of small magnitude.

7. There was a consistent decline in mortality in the laying houses as the weight of pullets at housing increased.

8. Groups of pullets having an increase in weight of 1½ lb. between housing and March 1st had the lowest subsequent mortality. Removal of lightweight pullets on March 1st, therefore, offers an effective means of reducing subsequent mortality.

9. Mature body weight showed a statistically significant negative correlation with annual egg production. The absolute magnitude was so small, however, as to indicate only a remote association.

10. Pullets increasing 1 lb. in weight during the first laying year gave the most satisfactory egg record. Birds losing weight or with unchanged weight gave unsatisfactory egg records.

11. Considerable parallelism was observed between monthly body weight and monthly egg production. The highest level of egg production occurred when body weight was at its maximum in March and April.

12. In general, body weight offers a valuable guide to the breeder, particularly from the standpoint of egg size and laying-house mortality.

Physiologic and Genetic Studies of Crooked Keels in Chickens. D. C. Warren. Kansas Station Technical Bulletin, No. 44, 1937.

After six generations of selection for and against crooked keel bones in White Leghorns, the proportions of crooked-keel birds were increased and decreased in different lines. However, both types were still produced in both high and low crooked-keel-bone strains. The results showed that although the condition was inherited, its occurrence was influenced by the sharpness of perches, the age of starting the birds to roost, and amount of time spent on the perches. Under normal roosting conditions, the crooked-keeled strain showed an incidence of from 60 to 80 per cent. of crooked keels, and the straight-keeled strain an incidence of less than 10 per cent. The crooked-keeled condition usually developed between 6 and 12 weeks of age. The ash content of the breast bones of crooked-keeled birds was less than that of normals in the same groups and strains, but there was no difference in the ash content of the leg bones. However, affected birds were not more susceptible to rickets on a deficient diet than straight-keeled birds. Males showed a higher incidence of deformity than females. Season had no influence. This condition clearly shows the interaction between hereditary factors and environment in the characters expressed.

"Eclipse Plumage," possibly a Universal Factor in the Sequence of Moult in Ducks. E. F. Stead. Royal Society of New Zealand, Trans. and Proc., Vol. 68, 1938, p. 102. (Ref. Experiment Station Record, Vol. 80, 1939, p. 326.)

Attention is called to the so-called eclipse plumage as a stage in the double moult of many ducks.

Sexual Dimorphism in the Down-Colour and Adult Plumage of Geese. C. D. Gordon. Alabama Polytechnic Institute. Journal of Heredity, Vol. 29, 1938, p. 335.

Sex dimorphism was exhibited by a strain of geese common in Alabama in which adult males were white with only a few grey feathers and sky-blue eyes. The plumage of females was predominantly grey with dark-grey or brown iris colour. The down colour of goslings was lighter for males than for females.

Daily Light Ration and Gonadal Activity in the English Sparrow (Passer domesticus). A. R. Ringoen and A. Kirschbaum. University of Minnesota. Minnesota Acad. Sci. Proc., Vol. 5, 1937, p. 32.

Testes were stimulated to sperm production in winter by lengthening the day by artificial light for 6 weeks. Females required about 10 weeks' treatment to cause enlargement of the ovary and oviduct. Capping the birds largely prevented the light effect.

Factors controlling the Diurnal Spermatogenic Cycle of the Male Sparrow (Passer domesticus). G. M. Riley. Iowa Acad. Sci. Proc., Vol. 43, 1936, p. 396.

Spermatogenesis in the sparrow, which normally occurs at from 2 to 4 a.m., could be induced during the day by inversion of the light period or by lowering the body temperature by feather clipping and exposing to a low temperature, and could be prevented at night by keeping the bird active and the temperature high. Injection of pregnant mare serum induced spermatogenesis in 5 hours, indicating that normally the darkness and quiet lowers body temperature, which is necessary to release the gonadotropic hormone from the pituitary.

Monthly Weight Changes of White Leghorn Pullets in Relation to Concurrent Egg Weight and Rations. E. W. Henderson. Growth, Vol. 2, 1938, p. 267.

For a period after laying commences, growth continues, while egg weight, which is correlated with body size, also increases. In this study it was observed that the protein content of the ration did not significantly affect either rate of increase in bodyweight or increase in egg weight, and the latter was not affected by the former. During the subsequent period, March to September, the only time at which the correlation between changes in bodyweight and changes in egg weight approached significance was in March and April.

Breed Variations in Egg Characters. G. O. Hall. Poultry Science, Vol. 18, 1939, p. 282.

A statistical analysis of various egg characters for the White Wyandotte, Barred Plymouth Rock, Rhode Island Red, and Single Comb White Leghorn revealed no significant breed differences in egg weight, weight of yolk, weight of total white, height of albumin, yolk index, percentage of total yolk, and percentage of total white. Compared with eggs of other breeds and with the average of all breeds, the Barred Plymouth Rocks were lower in weight of shell, percentage of shell, and weight and percentage of inner thin white, but had a greater amount and higher percentage of thick white. Similarly, eggs from Rhode Island Reds had a significantly higher percentage of inner thin white and eggs from White Leghorns a significantly higher percentage of outer thin white. The White Wyandottes differed significantly from the Rhode Island Reds and White Leghorns and from the mean of all breeds in observed score of condition of firm albumin. Meat spots were more numerous in eggs of Plymouth Rocks and Rhode Island Reds.

On the Measurement and Inheritance of Sexual Maturity in Turkeys (Meleagris gallopavo). V. S. Asmundson. University of California, Davis.

Summary :

Statistical analysis of the trapnest records of turkeys extending over 7 years shows that date of first egg is a better measure of sexual maturity in turkeys than age at first egg. Date of first egg is little influenced by variation in the time of hatch within the normal hatching season of almost 2 months, whereas age at first egg is influenced, the later-hatched birds starting to lay when younger than the earlier-hatched birds. Moreover, genetic differences in sexual maturity can more readily be demonstrated with date of first egg than with age at first egg.

Selection for early and late sexual maturity was effective in establishing lines that differed significantly in date of first egg. When these lines were crossed the results differed according to which way the cross was made. The progeny of *late* male x *early* female laid earlier than the birds in the late-maturing line but later than the progeny of the reciprocal cross. In at least one case, the progeny of the latter (early male x late female) laid just as early as the birds in the early-maturing line. It is concluded from this that sexual maturity in turkeys is determined by both sex-linked and autosomal genes. The bodyweight of turkeys at the time they lay their first egg is usually near the maximum first-year weight, whereas chickens start to lay 3 to 5 months before they reach maximum first-year bodyweight. It is suggested that physical maturity is a less important factor in determining the onset of egg production in turkeys than in chickens and that turkeys have a higher threshold of response to environmental stimuli than do chickens.

Eye Condition as a Reliable Guide to Poultry Health. T. Newman. Eggs, June 7th, 1939.

As a result of experimental work on the S.P.B.A. farm and careful observation author's conclusions are :—

1. Defective eyes, such as the split or running pupil, are inherited in a very high degree.
2. Green appears to be dominant to red. A green eye is not an unhealthy one ; the green eye, if it is structurally sound, is as healthy as the red.
3. The light eye is quite a different matter. Birds with light eyes are lacking in constitutional vigour. They are more often the result of parasitic infestation.
4. Pearly grey eyes author believes to be transmitted, the trouble appears to be increasing, particularly among Wyandottes. The pupil gradually contracts until it becomes a pin point and the bird is totally blind.

Birds in batteries will generally maintain their eye colour.

The Inheritance of Melanism in Pheasants. J. H. Bruckner. Cornell University. Journal of Heredity, Vol. 30, 1939, p. 45.

The melanistic mutant in pheasants is primarily black throughout, both in chick and adult plumage. Several crosses with ringnecks showed that the character was due to a single, dominant, autosomal gene M. The single homozygous melanistic male found produced 80 melanistic F_1s when crossed with ringneck females. The F_2 generation consisted of 136 melanistic and 41 ringneck birds, and the backcross produced almost equal numbers in more than 200 individuals. Evidently modifying genes were needed to induce the maximum expression of M. The possible relation of the melanistic mutant in pheasants to the *Phasianus versicolor* species is discussed.

Artificial Insemination of Chickens and Turkeys. W. H. Burrows and J. P. Quinn. U.S. Department of Agriculture, Circular No. 525.

Description of the technique of artificial insemination of chickens of turkeys.

This technique is valuable, in providing a means of obtaining fertile eggs from hens in laying batteries, in extending the usefulness of valuable males and females, and in effecting fertilisation when birds do not, or cannot, mate naturally.

Artificial Insemination of Domestic Fowl. R. O. Biltz. The Veterinary Journal, Vol. 95, 1939, p. 199.

Description of artificial insemination in turkeys.

Breeding for Egg Production. F. A. Hays and R. Sanborn. Agricultural Experiment Station, Amherst, Massachusetts, Bulletin No. 307, June, 1939.

During the last 25 years the Poultry Husbandry Department has conducted numerous investigations to determine the influence of various factors, controllable through breeding, on the egg-producing ability of Rhode Island Reds. This compilation of results obtained up to the present date is intended as a guide to assist the poultry breeder in directing his operations.

Factors affecting Egg Production in Turkeys. V. S. Asmundson. California Experiment Station. Journal of Agricultural Research, Vol. 58, No. 10.

Sexual maturity (date of first egg) was found to be the most important factor affecting turkey egg production from the beginning of egg production to the end of April.

Length of pauses, date of last egg and net rate of production were other factors in the order of their importance, during this first part of the laying year. Egg production in May and June was influenced most by length of pauses and date of last egg. Persistency had by far the greatest influence on production after June. Date of first egg and net spring rate had little or no effect on egg production during this period.

Factors of greatest practical importance in selecting breeders for improved egg production during the breeding season are, in the order of their importance, sexual maturity, length and number of all broody and non-broody pauses and net spring rate.

Iris Pigmentation in Domestic Pigeons. W. F. Hollander and R. D. Owen. Genetica (Netherlands), Vol. 21, 1939, p. 408.

A simple autosomal recessive factor is responsible for the pearl condition as opposed to the normal orange of wild-type *Columbia livia*. The symbol tr for the pearl factor, as proposed by Bessonertnaja (1928), will be retained.

A very similar colour to pearl, but faintly yellow, is shown to accompany the factor for chocolate plumage colour.

No evidence for linkage of tr with the factors S, C, or o has been detected.

Unlike the chicken iris, the pigeon iris contains no carotenoid pigments. According to chemical tests it also contains no flavines of flavones, and the yellow pigment is not xanthine. The pigment substances are probably melanin-like.

Iris colour is a poor index of breed relationships in pigeons.

The Value of Periodical Trap-nesting. M. W. Olsen. Poultry Science, Vol. 18, 1939, p. 232.

An analysis of first-year trap-nest records of 500 White Leghorn and 390 Rhode Island Red pullets gave evidence that the use of 1 day-a-week records would permit an estimation of actual production with a high degree of efficiency, the standard error of estimates being 18·6 in the case of White Leghorns and 19·4 in the case of Rhode Island Reds. Testing this method

against the actual records of 100 pullets (not used in developing the equations), it was found that 44 per cent. of the calculated records were within 10 eggs, 58 per cent. within 15 eggs, and 85 per cent. within 25 eggs of the actual production. Using 1 day-a-week records through August 31 plus daily records for the remainder of the laying year only slightly improved the accuracy of estimation. The plan of trap-nesting 1 day a week is proposed as a serviceable basis for selecting the most prolific layers for practical poultrymen and progressive farm flock owners.

Relative Influence of the Various Factors that affect Egg Production of Turkeys during different Parts of the First Laying Year. V. S. Amundson. California Agricultural Experiment Station. Journal of Agricultural Research, Vol. 58, 1939, p. 747.

The first laying year of turkey hens trap-nested in 1934, 1935, and 1936 was arbitrarily divided into three periods ; (*a*) From beginning of egg production to the end of April ; (*b*) May and June ; and (*c*) after June. Egg production in each of these periods was correlated with various factors.

Sexual maturity (date of first egg) was found to be the most important factor influencing egg production to the end of April, the other factors in the order of their importance being length of pauses, date of last egg (persistency), and net rate.

Egg production in May and June was influenced most by length of pauses and date of last egg, whereas date of first egg and net spring rate had less influence on egg production in this period.

Persistency had by far the greatest influence on egg production after June while the coefficients for egg production with the length of pauses were low. Date of first egg and net spring rate had little or no influence on egg production in this period.

Persistency has little influence on egg production early in the year ; hence the factors of greatest practical importance in selecting for improved egg production during the breeding season are, in the order of their importance, sexual maturity (date of first egg), length and number of all broody and non-broody pauses, and net spring rate.

The Activity of the Catalase and Peroxidase in the Blood of Embryos in Dependence on External Factors. Yu. M. Ogorodniy. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

1. The activity of both the catalase and the peroxidase of the embryo's blood increases with its age, but this growth proceeds unevenly, by leaps and bounds. A particularly sharp rise in the activity of the catalase begins from the 12th day of development. This is connected with the embryos increased expenditure of fat as a source of energy.

2. Both the external conditions of embryonic development and the combination of physical factors can considerably alter the activity of the catalase, not only in quantity, but also in respect to the direction of the processes. As compared with artificial incubation natural incubation gives an entirely different picture in regard to the alteration in the activity of the catalase.

3. Particularly sharp and specific changes in the activity of the catalase are produced by high temperature maintained for a long time. In this case the activity of the catalase becomes particularly strong by the 16th-17th days

of development and the presence or the absence of this growth can serve as means for incubational control and diagnostics since it is very characteristic.

4. The activity of the peroxidase hardly depends on temperature and its sensibility to temperature reduces with the age of the embryo.

5. A sharp cooling of the embryo leads to a decrease in the activity of both ferments, but in certain stages of development, depending on its conditions, the activity of the ferments may rise.

6. The growth in the activity of the catalase and the peroxidase between the 12th and the 18th days of development are opposite as to their direction. This enables us to presume that the oxidising processes as well, as reflected by each of the ferments, are to a certain extent opposite to each other. The decrease of one of them leads to the increased activity of the other.

The State of the Oxidising System of the Blood in a Chicken Embryo under Various Conditions of Development. Yu. M. Ogorodniy. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

1. In our work we have shown the variations in the amount of haemoglobin, erythrocytes, iron, acid capacity and sugar in the blood of a chicken embryo during the second half of its development, depending on the age of the embryo and the conditions of its development.

2. With the exception of the sugar contents of the blood the factors which we have studied and which reflect the condition of the oxidising system of the blood, were found to depend to a greater degree on the physical factors of development, which can considerably change them both in quantity and by disturbing their normal force and correlation.

This circumstance proves that the physical factors of incubation represent quite a powerful regulator of the oxidation and respiratory function of bird embryos.

3. With the increase in the age of the embryo and in proportion to the growth in it of the properties of a warm-blooded animal, there is observed an increase in the strength and stability of the oxidising system of the blood, expressed in the increase in the quantity of haemoglobin, erythrocytes and the total amount of iron in the blood as well as the extent of the blood's acid capacity and in the decrease of their variability under the influence of the physical factors of incubation.

4. The study of the above-mentioned factors has confirmed the existence (during the second part of embryonic development) of two critical points : less pronounced on the 14th day and most outstanding on the 17th-18th days during which time there is observed a slackening up in the development of one group of factors and a strengthening of the other ; also an intensified activity in the oxidising system, in general.

The unfavourable conditions of development strengthen this tension by different means in each case.

5. During the embryonic development there occurs a change in the nature of the oxidising system, in particular haemoglobin gradually loses some of its iron contents. In the earlier stages haemoglobin is found to be richer in iron, which is in accordance with other data.

6. The intense activity of the oxidation and respiratory processes due to aggravated conditions of the embryo, cause certain changes of a compensatory and protective nature in the blood of the embryo. These amount to the following :—

(*a*) The change in the colour indices of the blood ;

(*b*) An increase in the iron content of haemoglobin ;

(*c*) An increase in the absolute quantity of haemoglobin.

Combination of compensatory changes and the specific gravity of each of them may vary according to the nature of the stimulus and the stage of development.

7. The level content of sugar in the blood of the embryo is extremely stable both in respect to the changes in the embryos age and in regard to the influence of the physical factors of development.

8. Haemoglobin, iron and the acid capacity of the embryo's blood may be made use of as incubational-diagnostic indices, due to their lability in regard to the physical factors of incubation, and to the characteristic features of the changes evoked by the latter in their force and absolute quantity. The amount of haemoglobin and iron in the blood, as well as their proportion may in principle be used to diagnose the chronic overheating and only partially underheating ; the acid capacity of the blood may be made use of exclusively in diagnosing both the acute and chronic cases of underheating.

Changes in the Blood Indices and Physical Properties of Embryonic Fluids of Duck Embryos. M. I. Fetischeva. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

1. The nature of the development of duck embryos comes very close to that of the chicken embryos. Just as in the case of chickens, the percentage of growth decreases in proportion to the development, but this decrease is uneven, and during the second part of development there are observed three periods of increased growth between the 14th and the 16th days and by the 20th-24th days.

2. Glutinosity of the allantois hardly changes throughout the process of development of the duck embryos. Glutinosity of the amnion grows sharply between the 20th and the 22nd days. This should be taken into account when drawing up diagnostic indices. Following this period a tendency is observed towards the decrease in glutinosity similar to the chicken embryos. The maximum amount of amniotic fluid was observed on the 16th day and the allantoic on the 18th.

3. In the haemopoetic function of the embryo there is observed in the course of the development several critical periods expressed in the decrease in the number of erythrocytes, and the amount of haemoglobin. During these periods (16th and 20th days) the decrease in the ability of the blood to consume oxygen is compensated by an increased amount of iron in the blood. By the 26th day the quantity of haemoglobin decreases while the number of erythrocytes increases. This led to comparative hypochromia accompanied by an increase in the iron content of the blood.

4. The catalase of the blood grows up to the 20th day, following which it grows less, remaining at this level up to the moment of hatching.

Calorimetric Investigations of the Embryonic Development of Chickens under Various Conditions of Incubation. E. E. Penionschkevitsch and L. I. Schechtman. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

1. The caloric content of 1 gramme of the dry matter of embryos increases in proportion to their age. Until the sixth day of incubation the caloric content is higher in those groups which developed more rapidly. With further development this tendency disappears.

2. The caloric content of embryos increases as they grow, not only because the organic matter increases at the expense of the inorganic, but also as a result of an increase in the caloric content of the organic matter itself.

3. The total number of calories in embryos depends directly on the degree of their development. Embryos which develop under high temperature and whose development proceeds more rapidly have a greater caloric content, while those which develop under increased moisture (with the development proceeding more slowly) have the least number of calories.

4. The caloric content of both the albumen and the yolk also depends on the conditions of incubation. Under lower temperature the number of calories in 1 gramme of albumen hardly alters throughout the entire period of incubation. Under higher temperature, at the end of the incubation period (18th day), there are considerably less calories in 1 gramme of the yolk than at the beginning (the 6th day).

Disturbance of the Water and Mineral Metabolism in the Embryo in Cases of Chondrodystrophy and with a Varying Percentage of Humidity in the Air during Incubation.

Yu. M. Ogorodniy. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

1. The embryonic mineral metabolism is strongly disturbed under the influence of chondrodystrophy, lack of vitamin B_2 and proteinogenic toxicosis. This results in the fixation of chlorine by the tissues, an increase in the amount of phosphorus in the embryo—the calcium content remaining constant—and an extension in the proportion of Ca to P. The quantity of potassium and sodium in the tissues changes as well as their correlations.

2. Hypercalcaemia and hypophosphatemia is observed under conditions of proteinogenic toxicosis. A shortage in vitamin B_2 causes hypophosphatemia only ; no alteration was observed in the quantity of calcium in the blood.

3. An increase in the quantity of haemoglobin and erythrocytes in the blood as well as the occurrence of weak hyperglycaemia were observed when there was a shortage of vitamin B_2 and under the influence of toxicosis.

4. The fact that in our experiments chondrodystrophy has been found to accompany a shortage of vitamin B_2 allows us to presume the existence of a close connection between these two phenomena and that the shortage of vitamin B_2 and toxicosis along with the specific features of protein feeding of poultry play an important role in the etiology of chondrodystrophy.

5. A comparison between the disturbances of mineral metabolism as observed under the above-mentioned pathogenetic conditions and those described in literature as characteristic for the hypofunction of the thyroid gland point to their very close relation.

6. Both the excessive and insufficient humidity in the air during incubation lead to considerable disturbances in mineral metabolism in the embryo. Insufficient humidity shows unfavourable effects only by the 18th day of development.

The changes in mineral metabolism occurring under the influence of increased humidity are to a considerable degree similar to changes caused by ecological factors. Hence it follows that an excessive increase in the humidity of the air during incubation will help bring about the factors of chondrodystrophy and glutinosity and will increase them. On the other hand the proper regulation of humidity along with the other factors of incubation, may weaken the negative effect of chondrodystrophy and the phenomena connected with it.

Temperature and Relative Growth of Chick Embryo Leg Bones. I. M. Lerner and C. A. Gunns, University of California. Growth, Vol. 2, 1938, p. 261.

The experiment reported here tends to support the view that the general pattern of growth of the leg bones, as expressed by average allometric growth ratios, depends entirely on embryo weight, although instantaneous growth ratios show variations, which are unrelated to the weight of the embryo.

The Shape of the Chick Embryo Growth Curve. I. M. Lerner, University of California. Science, Vol. 89, 1939, No. 2297, p. 16.

Although in different sets of data the log of weight of chick embryos plotted against the log of age after 7 days has given a satisfactory fit to a straight line, sharp accelerations in growth rate have appeared between 13 and 17 days of age. Acceleration of growth at earlier ages in embryos incubated at 105° F. and distortion of the straight line in embryos incubated at 95° were observed in data from Henderson and Brody. It appears that the deviations from the straight line which occur at around the 15th day of incubation, though small, are significant.

The Position of Turkey, Chicken, Pheasant and Partridge Embryos that Failed to Hatch. V. S. Asmundson. University of California, Davis. Poultry Science, Vol. 17, 1938, p. 478.

Summary :

Over 5,000 embryos were examined. Of those considered old enough to classify according to position, there were 3,348 turkeys, 611 chickens, 388 Ringneck pheasants, 180 Mongolian pheasants, 203 Reeves pheasants, and 279 Chukar partridges. The positions of the dead turkey, pheasant, and partridge embryos (that failed to hatch) were comparable to those of chicken embryos that failed to hatch and the percentage of embryos in the various positions did not differ sufficiently to indicate that there are species differences in their incidence.

Embryos with head to the left or head between the thighs, whether in the large or the small end, rarely pipped the shell and presumably very seldom hatch. A relatively high percentage of the embryos with head to the right pipped the shell and presumably may hatch regardless of whether they have the head in the large or small end or whether the beak is over or under the wing or towards or away from the air cell.

Relatively more turkey embryos have the head in the small end of the egg when the eggs are incubated horizontally than when they are incubated with the large end up for the first 24 days. Such embryos, even when the head is turned to the right, are apparently handicapped by their position and, therefore, are less likely to hatch than those with the head in the large end.

The difference in the incidence of embryos with head to the left from different strains and hens indicates that hereditary factors are involved.

Observations on turkey embryos show that they change their position in the egg during the last three or four days prior to hatching. The changes in position are comparable to those that occur in the case of chicken embryos.

Relation of Interior Egg Quality to Hatchability. C. A. Wilhelm. Agricultural Experiment Station, Washington.

Eggs from White Leghorn pullets having an extremely high or low albumen index hatched equally well. Albumen index and albumen height were found to be closely associated with one another, but neither was found to be associated with hatchability. Both egg weight and shell thickness were closely related to percentage of hatch, but there was no association between shell thickness and 21-day mortality.

Control of Temperature and Humidity in the Incubator. A. L. Romanoff. Canadian Poultry Review, October, 1938.

In order to hatch every hatchable egg and to bring up the healthiest chicks, one must strive for better methods of hatching. Better hatching requires thorough study of the incubator, especially the study of the rate of air movement in relation to its type, size, principles of construction, and mechanical efficiency. From this study, one is able to make the most desired modifications in the control of temperature and humidity.

Specific Gravity of the Egg is a Measure of Hatchability. S. S. Munro. Canadian Poultry Review, October, 1939.

The specific gravity of the egg has been found to be a simple and accurate measure of per cent. shell. The specific gravity is easily determined by floating the egg in salt solutions of varying densities. Eggs of low specific gravity and thus of low per cent. shell, give distinctly poorer hatching results than those in the higher brackets. There is also a slight but distinct tendency for fertility to fall as the specific gravity decreases. The same hen lays eggs which vary from day to day in shell strength. The eggs must be measured when strictly fresh, *i.e.*, within 24 hours of being laid, and the salt solution should always be at the same temperature, about 70° F.

Changes in the Content of Total and Non-protein Arginine in the Egg during Embryonic Development and under the Influence of Certain Factors. E. Y. Rashba. Chemical Abstracts, Vol. 33, 1939, 4305[1]. (Ref. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 561.)

The total arginine content in developing hen eggs, beginning with the 3rd day of incubation, varies little and is somewhat lowered by introducing $MnSo_4$ and H_2SO_4 into the egg. The content of non-protein arginine is lowest on the 2nd and 3rd days of incubation (which is, evidently, the period of maximum arginase activity). The introduction of $MnSO_4$ lowers somewhat the arginine content on the 8th and 12th days. Injections of H_2SO_4 (pH : 4·7, corresponding to the pH of the injected $MnSO_4$ solution) cause a shift of the arginine content in the same direction. Thus, the inference that $MnSO_4$ has a specific action tending to activate the arginase of the developing egg is not justified, but the obvious disturbance in the protein metabolism under the influence of both $MnSO_4$ or H_2SO_4 is to be noted.

The Influence of Violent Jerks upon Hatching Results. Der Einfluss heftiger Erschütterungen auf die Brutfähigkeit des Hühnereies. Seck. Archiv. für Geflügelkunde, 1939, No. 12.

Summary :

1. Violent shaking by jerks which was applied to 1-, 2- and 3-days-old eggs for a time up to 6½ hours, did not in any way impair their hatchability. The eggs thus treated gave average hatches of 80 per cent. of the fertile eggs. The hatching quality of eggs on purpose packed carelessly and insufficiently and during 8 days driven in a small car over bad roads, cobbles, and so on, was also not injured by such treatment, 87 per cent. of the fertile eggs hatching.

2. The same treatment was applied to eggs after 6 and 11 days' incubation. In this case also the majority of the eggs did not materially suffer from being subjected to this considerable ill-treatment and hatched well. Only a small percentage of the eggs had to be eliminated on account of the yolk and the white getting mixed. Evidently the germ is more sensitive in its later stages of development ; future experiments will deal with this problem.

Factors Affecting the Post-natal Growth of Brown Leghorn Chickens. N. Galpin. Empire Journal of Experimental Agriculture, Vol. 7, 1939, p. 139.

In a study of Brown Leghorn chicks, it is shown that the weight at 6 weeks was highest in early hatched chicks and fell in later hatches to a minimum for those hatched in May and June. This seasonal variation is considered to be due mainly to some inherent factor carried over by the egg and not to external influences during rearing.

Some Observations on the Skeletal Development of Fowl to Six Weeks of Age. H. E. Le Masurier and H. D. Branion. Poultry Science, Vol. 18, 1939, p. 314.

Data are presented on the weekly growth rate of New Hampshire, Barred Plymouth Rock and White Leghorn chicks which indicated that both male and female chicks of each breed grew more rapidly and were heavier at 6 weeks of age when raised in batteries with 24-hour lighting than when raised on the floor. X-ray photographs of representative chicks from each lot indicated more extensive calcification of the skeletal tissue of the battery-reared chicks. However, this increased degree of calcification was not in relative proportion to the remainder of the body growth, resulting in a coarse heavy bone, whereas birds raised on the floor showed a very desirable skeletal growth in keeping with other body development, resulting at 6 weeks in a finely textured and finished bone. Certain questions are raised regarding the present criteria and standards for the measurements of calcification and skeletal growth.

Further Observations on Moult in the Duck Family. E. F. Stead. Royal Society of New Zealand, Trans. and Proc., Vol. 68, 1938, p. 105. (Ref. Expt. Sta. Record, Vol. 80, 1939, p. 326.)

Further observations suggested that probably all members of both sexes of the order of Anatiformes have double moults annually.

NUTRITION

VITAMINS

VITAMIN A

Condition of the Tissues as Determining Factor for Liability to Infection in Vitamin A Deficiency. Histological Investigations with Hens. Die geweblichen Gründlagen der Infektionsbereitschaft bei Vitamin A Mangel. Experimentell Histologische Untersuchungen bei Hühnern. O. Seifried. Berlin. Münch. tierärtzl. Wochenschr., No. 47, 1938, p. 720.

A discussion of the causes of liability to infection in vitamin A deficiency is illustrated by the results of the author's experimental observations on infection and vitamin A deficiency in hens.

Examination of Carotene. Carotinbestemmelse ved Hjaelp af Pulfrich-Fotometer. A. Lund. Kgl. Veterinaer-og Landbohojskoles landokonomische Forsogslaboratorium, Kopenhagen, 1939.

Summary :

After a short description of the principles, which can be used for quantitative measurements of carotene, and a short survey of the statements found in the literature concerning the extinction of carotene, a series of experiments are described, on the determination of the extinction-coefficient for β-carotene in benzene solution, measured on the Zeiss Pulfrich-Photometer. The extinction here measured shows a small deviation from Beer's law. As the extinction of the same solutions measured spectrographically follows Beer's law, the deviation must be due to the photometer, and is probably due to the fact that the photometer does not work with strict monochromatic light. The deviations from Beer's law are smaller when using the filter S.45 than when S.43 or S.47 are employed. When the extinctions are read between E = 0·5 and E = 1·0, the deviations are of no practical importance. The readings are sufficiently consistent with Lambert's law. The average value for $E\frac{1 \text{ per cent.}}{1 \text{ cm.}}$ are for filter S.43 = 2052, for filter S.45 = 2474 and for filter S.47 = 2373. The average of the spectrographical determinations is $E\frac{1 \text{ per cent.}}{1 \text{ cm. } 450 \text{ m}\mu} = 2715$.

The Evaluation of the Vitamin A Potency of Feeds. G. S. Fraps. Anal. Ed. Ind. and Eng. Chem., Vol. 10, 1938, p. 525. Agricultural Experiment Station, College Station, Brazos County, Texas, Circular No. 83, May, 1939.

The vitamin A potency of feeds is due almost entirely to betacarotene, except for cryptoxanthin in corn. Several methods for the estimation of

carotene in feeds have been proposed, and are being standardised and improved by the Associate Referee on Carotene of the A.O.A.C., and others. The yellow colouring matter extracted, purified and read as carotene, is not always pure, especially when derived from low-grade hays, silage, and animal excrements. Colorimetric reading against potassium bichromate offers a rapid method for carotene tests. Reading with a spectroscope should be more accurate and more satisfactory for research work. The use of a high-power photo-electric spectroscope may aid in estimating the quantity of carotene in solutions containing other colouring materials and provide factors to correct the results of the carotene estimation by other methods. The methods available at present for the estimation of carotene probably give more accurate comparative values for vitamin A potency in feeds than do biological methods.

Mortality in Poultry Flocks and the Vitamin A Content of the Livers of Pullets and Hens. D. F. Chichester, Walter C. Russell and C. B. Hudson. New Jersey Agricultural Experiment Station. Poultry Science, Vol. 17, 1938, p. 505.

Summary :

The number of Moore units of vitamin A per gramme of liver, determined colorimetrically in chickens which died from specific diseases, bears no significant relation to the causative agent, the mode of transmission of the disease or the physiological system involved. The number of units for diseases of the transmissible type was found to be greater than the value for the normal group in the case of some diseases but less for others.

A disproportionately large number of individuals of both the normal and disease groups showed low liver vitamin A values. The possibility that this was due to manipulative loss in analysis is excluded, and in the case of the normal group there was definite knowledge that the intake of the factor was adequate for the functional life of the pullet. It is concluded that among chickens a number of individuals exist in which vitamin A is utilised in such a way that it does not appear in the liver in appreciable amounts and that low liver vitamin A does not indicate an inadequate consumption of the factor.

The Stability of Carotene and Vitamin A in a Mixed Ration. Bethke, Record and Wilder. Agricultural Experiment Station, Wooster, Ohio, 56th Annual Report, 1938, Bulletin No. 592.

Experiments were conducted with chicks and rats to obtain information on the stability of the vitamin A in cod liver oil and the carotene in alfalfa leaf meal when these materials are incorporated in mixed rations and stored at near room temperature. Two different vitamin A-deficient rations were used. One ration consisted of white corn, wheat middlings, casein, irradiated yeast, and minerals ; the other was similar to it, but meat scraps and dried skim milk replaced the casein. Dehydrated alfalfa leaf meal and Reference cod liver oil were incorporated in each of the two rations to supply 75, 150 and 225 units of vitamin A per 100 grammes of ration.

The mixed rations were fed to chicks and rats when first mixed and again after storage periods of 3 and 6 months. The results showed that there was a loss of vitamin A from cod liver oil and carotene from alfalfa leaf meal on both rations, but that the loss was much greater in the meat scraps-dried milk ration than in the casein ration. The loss of vitamin A or carotene was, however, not complete even after a storage of 6 months.

Stability of Carotene in Green Grasses and Alfalfa stored at Five Degrees Fahrenheit. D. W. Bolin. Idaho Experiment Station, Journal of Dairy Science, Vol. 22, 1939, p. 111.

Samples of green alfalfa, Kentucky bluegrass, orchard grass, meadow fescue, and bromegrass collected at intervals during the month of July were analysed for carotene in the fresh state and after storage in the dark at 5° for 10 months. The alfalfa showed a pronounced loss of carotene during storage (average loss 62·7 per cent. in one and 70 per cent. in another), while the grasses stored under like conditions lost little or no carotene, suggesting that a carotene-destroying factor active at 5° was present in alfalfa but not in the grasses.

The Effect of Different Methods of Drying on the Biological Value and Digestibility of the Proteins and on the Carotene Content of Grass. S. Bartlett, K. M. Henry, S. K. Kon, L. W. Osborne, S. Y. Thompson, and J. Tinsley. Biochemical Journal, Vol. 32, 1938, p. 2024.

In an experiment at the National Institute for Research in Dairying, the biological value and true digestibility were determined for the proteins of respectively, artificially dried grass (300°) as 67 and 66, for artificially dried grass (170°) 62 and 65, and for sun-cured grass 52 and 64. The differences in the biological value of proteins from artificially dried grasses and hay were highly significant, while other differences were not. Samples of the grass artificially dried at high temperature, at low temperature, and in a current of hot air, sun-cured, and dried without sun at air temperature contained 86·7, 78·1, 89·4, 25 and 31·5 per cent., respectively, as much carotene as found in the fresh grass.

Loss, during Storage, of Vitamin A from Alfalfa Leaf Meals Fed to Chickens. B. W. Heywang and R. B. Morgan. U.S. Department Agriculture, Technical Bulletin, No. 632, 1939.

In a series of trials at the Southwest Poultry Experiment Station, Glendale, Arizona, the vitamin A potency of artificially dehydrated and sun-cured alfalfa meals stored in paper-lined burlap bags for periods of 1, 4, 7, 14 and 24 months was determined. The various meals were fed at 0·5-, 1- and 2-per cent. levels as supplements to a vitamin A-deficient basal diet, the relative vitamin A potencies being measured in terms of viability, rate of growth, and efficiency of feed utilisation of chicks over 70-day experimental periods. The meals showed only a slight loss in vitamin A content after being stored from 7 to 9 months, while a marked loss occurred after 14- to 16-month periods, and very pronounced losses were evident after from 24 to 26 months' storage. The artificially dehydrated meal (dried at 1,100° F.) declined in vitamin A content more rapidly than the sun-cured meals, the former having approximately the same potency after 14 months' as the latter after 24 months' storage.

Destruction of Vitamin A by Rancid Fats. E. J. and J. G. Lease, J. Weber, and H. Steenbock. Wisconsin Experiment Station. Journal of Nutrition, Vol. 16, 1938, p. 571.

The extent of destruction of vitamin A and carotene as present in halibut liver oil, egg yolk, and alfalfa by various degrees of rancidity produced by heating, aeration and ozonisation, and by admixture with various decomposition products was tested by an indirect method involving the feeding of the preparation to rats during a 5-week period and determining colorimetrically the vitamin A content of their livers at the end of the period.

Pronounced destruction of vitamin A took place with definitely rancid fats but not with fresh fats. Fats heated in air destroyed vitamin A in proportion to the duration and time of heat treatment. Lard heated in an open pan for 5 minutes at 240° C. had no effect on vitamin A, but heating at the same temperature for 30 or 90 minutes completely destroyed the vitamin. Similar heating in nitrogen prevented the subsequent destruction of the vitamin. Various oxidising compounds which might occur in rancid fats, including palmitic peroxide, ozonised lard, oxidised oleic acid, and oxidised fatty acids of lard, destroyed the vitamin, but oleic acid fed as 10 per cent. of the ration had no effect. The destructive effect of certain fats was quite out of proportion to the peroxide value. Other possible constituents of rancid fats tested included chemically pure, straight-chain aldehydes and methyl ketones containing from 7 to 12 carbon atoms, oxidised glycerol, glyceric acid and aldehyde, allyl alcohol, acrolein, acrylic acid, pyruvic acid, and propyl aldehyde. None of these proved effective. The components of rancid fats which caused destruction of vitamin A were not removed by distillation with steam or extraction with alcohol, but were rendered inert to a certain extent by heat. The addition of various antioxidants, such as ascorbic acid, hydroquinone, gallic acid, and ethyl gallate, did not prevent the destruction. Vitamin A was not destroyed when given to rats on an empty stomach even when they were maintained on a ration rich in rancid fat, but was destroyed when mixed with rancid fat in the stomach.

Monthly Variations in Carotene Content of Two Important Range Grasses, Sporobolus flexuosus and Boutelona eriopoda. W. E. Watkins. Journal of Agricultural Research, Vol. 58, 1939, p. 695.

The monthly carotene content of two important southern New Mexico range grasses, black grama and mesa dropseed, has been presented. Both grasses are moderately high in carotene during the growing season. The mesa dropseed loses all of its carotene soon after the fall freezes end the growing season. The black grama grass, whose upright stems remain green for a distance of from 4 to 6 inches of their base throughout the winter, contain an amount of carotene that seems to be ample to satisfy the vitamin A requirements of range cattle.

Digestibility of Carotene by Rats and Chickens. A. R. Kemmerer and G. S. Fraps, Journal Nutrition, Vol. 16, 1938, p. 309 ; Agricultural Experiment Station, College Station, Texas, Circular No. 83, May, 1939.

Yellow pigments were found in the excrement of rats and chickens which had received feed containing practically no carotene. These colouring materials could not be separated from the carotene by the usual chemical procedure for carotene. The absorption curves of these pigments were different from that of carotene even though they absorbed some light in the same region of the spectrum. Corrections were made for these pigments in estimating the digestibility of carotene.

The percentage of carotene digested depended on the quantity fed, on the nature of the material in which it was contained, and on the kind of animal

to which it was fed. When carotene, in the form of dehydrated alfalfa leaf meal was fed at the level of 20 parts per million, the rats digested 18 to 23 per cent. of it and the chickens 29 per cent. When 1 part per million was fed the rats digested 43 per cent. and the chickens 69 per cent. When carotene in Wesson oil was fed at the level of 10·5 parts per million of the feed the rats digested 51·2 per cent. as compared with 22·4 per cent. when an equal amount of carotene was fed as dehydrated alfalfa leaf meal.

The Determination of Vitamin A in the Hen's Egg. C. A. Baumann, J. Semb, C. E. Holmes, and J. G. Halpin. Wisconsin Experiment Station. Poultry Science. Vol. 18, 1939, p. 48.

Vitamin A was determined in eggs from White Leghorns which had received varying amounts of sardine or cod liver oils as supplements to a standard poultry ration for 7 months. Spectrophotometric determinations on egg yolks indicated a range from 5·4 μg. of vitamin A per gramme for those birds on a sardine oil diet to 9·2 μg. for those birds on a diet containing 2 per cent. cod liver oil. Eggs from birds receiving 1 per cent. sardine oil and 0·5 and 2 per cent. cod liver oil were incubated, and the newly hatched chicks were assayed colorimetrically or placed on a low vitamin A diet and allowed to succumb to the effect of the deficiency. The vitamin A content of the chicks, as well as the period of their survival, varied with the amount of vitamin A in the yolk, satisfactory agreement being obtained for the three technics. Four μg. of vitamin A in the yolk extended the life of the chick for 1 day.

Vitamin A Requirements of Growing Chicks : A Review of Experimental Work. A. E. Tepper and R. C. Durgin. New Hampshire Station Bulletin, No. 310, 1938.

Experimental results obtained over a 6-year period are summarised. The various objectives in this series of investigations included the effect of various levels of cod liver oil for growing chicks, the effect of changing chicks from an adequate vitamin A ration to a deficient vitamin A ration at an early age, the effect of increasing cod liver oil levels as chicks advanced in age, the relative value of the New England College Conference ration with and without cod liver oil, the vitamin A potency of sardine oil and the relative efficiency of sardine and cod liver oils, and the optimum number of vitamin A units required by growing chicks to 6 weeks of age.

The chicks showed a relatively high requirement for vitamin A for rapid growth and normal storage, amounting to approximately 135 International Units per 100 grammes of feed during the first 5 weeks and, thereafter, increasing to approximately 400 I.U. per 100 grammes of feed. When chicks were changed from a vitamin A-adequate to a deficient diet at 4 or 8 weeks of age, the stored vitamin A was not sufficient to meet their requirements for more than 2 weeks of deficiency feeding. Kidney injury and the presence of urinary crystals in the faeces and scrapings from the large intestine accompanied avitaminosis A. An increased vitamin A consumption, but too high a content of cod liver oil in the feed tended to decrease livability of the chicks. Adding 0·5 or 1 per cent. of either cod liver oil or sardine oil to a vitamin A-deficient basal diet prevented the occurrence of avitaminosis A, with the cod liver oil groups showing somewhat more rapid growth. Increasing the level of vitamin A intake beyond that supplied by 1 per cent. of good cod liver oil was not warranted. The New England College Conference ration contained sufficient vitamin A to prevent ophthalmia and to support normal growth without additional vitamin A supplement.

Vitamin A Requirements of Laying Hens. H. J. Almquist and E. Mecchi. University of California. Poultry Science, Vol. 18, 1939, p. 129.

Six groups of hens of tested egg-producing ability were maintained on experiment for 1 year (July 9th to July 9th). The basal ration for the various groups was supplemented as follows: 1, check; 2, 3 and 4, carotene in oil to supply 1,800, 3,600 and 7,200 International Units of vitamin A; and 5 and 6, shark liver oil to supply 1,800 and 3,600 I.U. of vitamin A per lb. of ration, respectively. Data are reported on the feed consumption, percentage mortality, egg production, hatchability of fertile eggs, vitamin A storage in the livers of hens at the end of the trial and the growth rate and survival of chicks for the six groups. The lower level of carotene feeding proved inadequate for satisfactory hatchability, while an equal level of vitamin A units supplied by shark liver oil allowed satisfactory hatchability. Rat assays at the end of the trial indicated that the carotene supplement had lost approximately one-third of its original vitamin A activity. A ration containing the lower level of shark liver oil calculated to contain 2,027 I.U. of vitamin A per lb. of feed appeared to represent about the minimum dietary level of vitamin A, which was satisfactory for all purposes. These results, along with recent findings of other investigators, led to the conclusion that about 2,500 I.U. of vitamin A per lb. of feed may be considered as a minimum practical recommendation for poultry feeding.

Observations on the Vitamin A Requirements of Laying Birds. Record, Bethke, Wilder and Chamberlin. Agricultural Experiment Station, Wooster, Ohio, 56th Annual Report, 1938, Bulletin No. 592.

In a continuation of the studies on the vitamin A requirements of laying birds, eight groups of White Leghorn pullets were used. Four of these groups were reared on range and four, in confinement, receiving known amounts of carotene (200, 400, 800 or 1,600 microgrammes per 100 grammes of feed) in their ration from date of hatching. A basal ration of white corn, wheat middlings, wheat bran, ground whole oats, meat scraps, dried skimmed milk, irradiated yeast, and minerals was used, to which dehydrated alfalfa leaf meal was added to supply 200, 400, 800 or 1,600 microgrammes of carotene per 100 grammes of feed.

The results of this trial indicate that a minimum of approximately 400 microgrammes of carotene from alfalfa leaf meal was required per 100 grammes of feed for good egg production and hatchability.

Vitamin A Deficiency in Commercial Poultry Flocks. M. Rubin, H. R. Bird, and H. M. DeVolt. University of Maryland. Poultry Science, Vol. 18, 1939, p. 410.

Vitamin A reserves are stored by the chick in its liver. Hence, generally speaking, the more vitamin A and provitamin A is provided in the feed, the greater are the amounts stored in the chick's liver. Nine out of 24 flocks had at least one chick which had no vitamin A reserves in its liver. Although liver storage of vitamin A is generally assumed to be governed by the vitamin A content of the feed, the authors take cognisance of the well-known phenomenon of secondary vitamin deficiency, because even on an adequately fortified diet, there is the possibility that vitamin A liver storage may be affected by environmental conditions other than the ration fed and by pathological conditions which have as yet been undetected.

Estimating Vitamin A in Grain Feeds. A. V. Pletner. Journal of Physiology, Vol. 23, 1937, p. 797; Chemical Abstracts, Vol. 33, 1939, 769[2].

The amount of vitamin A in "chick units" in oats, barley, wheat, yellow corn and millet is 0·0, 0·3, 0·0, more than 3·0 and more than 3·0, respectively, as determined by photo-orientation of chicks to red and blue filters.

Cod Liver Oil in War-Time Poultry Feeding. Economy and Efficiency. R. G. Booth. Poultry Industry, October, 1939.

If ½ to 1 pint of a good reliable cod liver oil per cwt. of food is used in a well-balanced practical diet there will be sufficient both of vitamin A and D to meet all practical needs.

VITAMIN B

A New Colour Reaction of Vitamin B_1 (Thiamin). H. W. Raybin. Science, Vol. 88, 1938, No. 2271, p. 35.

The author reports that vitamin B_1 reacts with 2·6-dibromoquinone-chloro-imide to give orange solutions of which the colour is extractable by immiscible solvents such as chloroform. It appears that only the thiazole portion of the thiamine reacts to give the colour with the reagent.

The B Vitamins and Fat Metabolism. 2. The Effect of Thiamine upon the Synthesis of Body Fat in Pigeons. E. W. McHenry and G. Gavin. Journal of Biological Chemistry, Vol. 128, 1939, p. 45.

The total fatty acids in the bodies of pigeons suffering from polyneuritis when maintained on a diet of polished rice constituted 3 per cent. of the bodyweight, while in normal birds or birds fed for 18 days on polished rice but not yet exhibiting symptoms of polyneuritis, they amounted to about 8 per cent. of the bodyweight. Control birds receiving polished rice and 60 gamma of thiamine (vitamin B_1) daily showed about double the amount of fat found in normal birds; the fat constituted 16 per cent. of the bodyweight, though the fat content of the rice could only account for one-thirtieth of this. After 18 days on the unsupplemented polished rice diet the bodyweight fell considerably, while the total amount of fat present was unchanged; administration of vitamin B_1 after this period led to a considerable increase in weight, 56 per cent. of which was due to fat deposition.

Action of Acetylcholine on the Small Intestine of Pigeons with B_1 Avitaminosis. Influence of Vitamin B_1 (Aneurin, Thiamine) on the Action of Acetylcholine. Das Verhalten des Dünndarmes von an den Folgen der B_1-Avitaminosis leidenden Tauben gegenüber Acetylcholin. Einfluss von Vitamin B_1 (Aneurin, Thiamin) auf die Acetylcholinwirkung. E. Abderhalden and R. Abderhalden. Pflüg. Archiv. ges. Physiol., Vol. 240, 1938, p. 388.

The authors found that the small intestine of pigeons on a diet of polished rice (deficient in vitamin B_1) had lost the capacity for contraction on

dosing with acetylcholine which always occurred in that of pigeons on a normal diet. A recovery of the acetylcholine tone was obtained by the administration of aneurin to the test pigeons. Aneurin itself has no stimulating action on the intestine.

Is the Enlargement of the Suprarenals (of Pigeons) in inanition Conditioned by Vitamin B Deficiency? M. Chiba. Tohoku Journal of Experimental Medicine. Vol. 33, 1938, 85. Chemical Extracts 32, 1938, 7531.

The suprarenals of fasting pigeons enlarge slightly with inanition ; the adrenaline content is somewhat increased ; and hypertrophy frequently occurs in the medullary cells along with the well-known abundant hypertrophy and hyperplasia of the cortical cells accompanied by regressive changes. None of these suprarenal changes is influenced by vitamin B.

Testis and Ovary during Experimental Beriberi in Birds. G. Solarino. Arch. Ist. Biochim. Ital., Vol. 10, 1938, p. 325. (Ref. Nutrition Abstracts, Vol. 9, 1939, p. 69.)

The conclusion of Dulzetto and Cannavà, that the lesions arising in testis and ovary during avian vitamin B_1 depletion are not due solely to underfeeding, is questioned.

Castration and Experimental Beriberi of Pigeons. Castrazione e Beri-beri sperimentale nei Colombi. V. Capraro. Atti R. Acad. Lincei, Vol. 27, 1938, s. vi, p. 419. (Ref. Nutrition Abstracts, Vol. 8, 1939, p. 926.)

From a study of the beriberi quotient of Amantea in castrated pigeons it is concluded that in the first 5 to 7 months after castration either the reserves of vitamin B_1 are increased, or the amount used is diminished, or both these possibilities are realised.

Breed Differences in Resistance to a Deficiency of Vitamin B_1 in the Fowl. W. F. Lamoreux and F. B. Hutt. New York, Cornell Experiment Station. Journal of Agricultural Research, Vol. 58, 1939, p. 307.

In each of four experiments comparing chicks of the White Leghorn and Rhode Island Red breeds, the former showed a greater ability to survive on diets deficient or lacking in vitamin B_1 than the latter. Chicks of the White Leghorn and Rhode Island Red breeds survived an average of 12·9 and 10·8 days, respectively, when fed the deficient basal diet from hatching, 22·1 and 16·9 days when similarly treated except that they received an adequate diet on the 3rd day only, and 34·1 and 29 days, respectively when fed a normal diet to 2 weeks of age and the deficient diet thereafter. When chicks were fed a normal diet to 3 weeks of age and a deficient diet thereafter the percentages of chicks surviving to 13 weeks of age were 32, 20·5 and 8 for the White Leghorns, Rhode Island Reds, and Barred Plymouth Rocks, respectively. The superior resistance of the Leghorns to this deficiency was shown to be independent of body size and was not caused by differential mortality from other causes than polyneuritis. F_1 progeny of a Leghorn male x Rhode Island Red females were intermediate between the parent stran ins iresistance to this vitamin deficiency.

The Lack of Nerve Degeneration in Uncomplicated Vitamin B_1 Deficiency in the Chick and the Rat. R. W. Engel and P. H. Phillips. Wisconsin Experiment Station. Journal of Nutrition, Vol. 16, 1938, p. 585.

When chicks were fed a vitamin B_1-deficient diet or a normal diet at restricted levels, myelin sheath degeneration in the sciatic nerve occurred in a high percentage of cases. However, the administration of vitamin A concentrate in the form of β-carotene or percomorph oil, together with riboflavin, removed all evidence of pathology in the peripheral nerves when such diets were fed. Histological observations on a large number of rats indicated that neuropathology seldom occurred when the animals received a vitamin B_1-deficient but otherwise adequate diet. A histologic change indicative of fatty degeneration of the liver was observed when vitamin B_1-deficient symptoms in the rat were cured by the administration of crystalline vitamin B_1. These findings led to the conclusion that uncomplicated beriberi is not accompanied by peripheral nerve degeneration.

Effect of Diets producing Vitamin B Deficiency or Mineral Imbalance on the Composition of Pigeon Muscle. Influence de régimes producteurs d'avitaminose B totale ou de déséquilibre minéral sur la composition du muscle de pigeon. R. Lecoq and R. Duffau. Comptes Rendus Acad. Sciences, Vol. 207, 1938, p. 1013.

Variations in the chemical composition of muscle tissues were examined in pigeons receiving three different rations deficient in B vitamins to which dried brewer's yeast could be added in varying amounts as a separate daily supplement. The first diet contained 66 per cent. glucose, the second 66 per cent. saccharose, and the third 61 per cent. saccharose and 5 per cent. sodium sulphate which produced a severe mineral imbalance. With a 2 gramme dose of dried yeast daily, the birds survived 5 to 7 months without symptoms on the first two diets, but larger yeast doses up to 4 grammes daily were required to compensate for the mineral imbalance of the third ration. Polyneuritic symptoms developed in 12 to 14 days on the unsupplemented glucose diet and in 17 to 19 days on the unsupplemented saccharose diets. The lactic acid and orthophosphate content of the muscles was somewhat greater in polyneuritic pigeons than in normal birds but other constituents showed no notable variations. There was a high content of reducing substances in muscles from pigeons receiving the ration with added sodium sulphate, whether the yeast dose given was adequate or not. The lactic acid values in the muscles of these birds were slightly lower than normal but the orthophosphate values showed very little change.

Effect of various forms of B_1 Avitaminosis on Oxidation-reduction Processes in Pigeon Muscles. M. F. Merejinsky. Bull. Biol. Méd. exp. U.R.S.S., Vol. 6, 1938, p. 288. (Ref. Nutrition Abstracts, Vol. 8, 1939, p. 923.)

In pigeons fed exclusively on autoclaved polished rice two types of deficiency symptoms were distinguished, spasmodic nervous affections with opisthotonus, or emaciation accompanied by paralysis of the leg muscles. In the latter condition the time of decolorisation of methylene blue by a suspension of the leg muscle tissue was greatly increased, and the effect of previous stimulation of the muscles to produce artificial fatigue was to increase the decolorisation time further. With leg muscle tissue from pigeons with

spasmodic symptoms, the time of decolorisation of methylene blue was 31 to 32 minutes as compared with 55 to 57 minutes for that from paralysed birds. Fatigue increased the time to 44 minutes for the former group and to 82 for the latter, indicating that in the spasmodic condition the oxidation processes in the muscles are less disturbed than in the paralytic stage.

The Influence of Polyneuritis on the Lactic Acid and Glycogen Content of the Muscles of Pigeons with various kinds of Fatigue. L. I. Palladina and L. A. Dubovtzeva. Ukrain Biochemical Journal, Vol. 12, 1938, p. 41. (Ref. Nutrition Abstracts, Vol. 8, 1939, p. 925.)

When the muscles of one leg of polyneuritic pigeons were subjected to rhythmic irritation by an electrical stimulation for 10 to 30 minutes, the birds killed and the lactic acid estimated in the muscles, the amount in the fatigued muscle was greater by 10 to 36 per cent., depending on the period of stimulation, than the amount in the muscle of the unstimulated leg. With continuous electrical stimulation producing tetanic contractions, the lactic acid content of the fatigued muscle decreased by 10 to 30 per cent. according to the time of stimulation. This decrease was less than that previously observed in normal pigeons. The glycogen content of the muscles was decreased by rhythmic as well as by tetanic contractions. The breast muscles of polyneuritic pigeons were also observed and after rhythmic contractions the lactic acid content was considerably increased, and the glycogen content decreased, to a greater extent than in normal birds. The glycogen content of the breast muscles was also greatly decreased by tetanic contractions.

Anti-dermatitis Factor varies with different Yeasts. W. H. Peterson and C. A. Elvehjem. University of Wisconsin, Journal of Nutrition, Vol. 18, No. 2 ; Poultry Digest, 1939, p. 470.

Yeast grown in grain wort gave protection when fed at a 2 per cent. level, molasses yeast at 7 per cent. and glucose-salts yeast at 6 per cent. commercial bakers' and brewers' yeasts also protected at the 2 per cent. level.

Pantothenic Acid and the Filtrate (Chick antidermatitis) Factor. T. H. Jukes. Journal of American Chemical Society, Vol. 61, 1939, p. 975.

Calcium pantothenate, in an amount of 10 mg. per 100 grammes of diet, was active in preventing dermatitis and promoting growth in chicks maintained on a heated grain diet. By comparison with a standard rice bran filtrate the salt was calculated to contain 8,400 chick filtrate factor " units " per gramme. This led to a ratio for the calcium pantothenate preparation of approximately 5 : 1 between the yeast growth promoting potency and the potency to prevent dermatitis in chicks. A similar ratio was found to exist between the potencies of the two factors in fresh liver.

Differentiation of the Rat Dermatitis Factor and the Chick Dermatitis Factor from Nicotinic Acid. W. J. Dann and Y. Subbarow. Journal of Nutrition, Vol. 16, 1938, p. 183 ; Chemical Abstracts, Vol. 32, 1938, 7969.

Nicotinic acid will not cure rat dermatitis or prevent chick dermatitis, and it is concluded that vitamin B_6 and the filtrate factor are both distinct from

nicotinic acid. Black tongue in dogs is successfully cured by the use of nicotinic acid. The vitamin B_2 complex contains the following four different, sharply characterised entities : riboflavin, nicotinic acid, vitamin B_6 and the filtrate factor.

The Antidermatosis Vitamin required for Reproduction in the Domestic Fowl. J. C. Bauernfeind and L. C. Norris. Science, Vol. 89, 1939, p. 416.

Four groups of hens were fed the following diets respectively : (1) a normal diet containing all the vitamins known to be required by the domestic fowl ; (2) the same diet, except that the cereal portion and the liver extract were heated to destroy the antidermatosis vitamin—this was designated the heated diet ; (3) the heated diet + 5 per cent. whey adsorbate which contained the new growth and reproduction vitamin and (4) the heated diet + 5 per cent. whey adsorbate + 5 per cent. antidermatosis vitamin. The results showed that the average hatchability of the eggs of the hens fed the normal diet was 60 per cent. while that of the eggs of the hens fed the heated diet was 2·8 per cent. No improvement in hatchability was obtained by addition of the whey adsorbate only to the heated diet, but the hatchability increased rapidly to 48 per cent. when 5 per cent. antidermatosis vitamin concentrate was also added. Observations on the development of dermatosis in chicks from the eggs of the hens in groups (1) and (2) showed that the eggs of hens fed the heated diet contained less of the antidermatosis vitamin than those of the hens fed the normal diet.

From the results it is concluded that the antidermatosis vitamin is required for hatchability or reproduction in the domestic fowl, but a lack of this vitamin did not affect egg production or mortality during the experimental period.

VITAMIN G

The Histopathology of Neuromalacia and "Curled Toe" Paralysis on the Chick fed low Riboflavin Diets. P. H. Phillips and R. W. Engel. Journal of Nutrition, Vol. 16, 1938, p. 451.

Young White Leghorn chicks reared on a diet deficient in riboflavin usually developed an acute paralysis characterised by neuromalacia, or the more slowly developing "curled toe paralysis." Both these syndromes could be prevented by the addition of riboflavin to the diet. When administered in an amount of 300 gamma per 100 grammes of food, however, riboflavin did not always prevent degenerative lesions of the spinal cord, although on histological section the sciatic nerves were always found to be normal in birds receiving this dosage. On the other hand, addition of a concentrate of the chick antidermatitis factor to the basal diet failed to protect against degeneration of the sciatic nerve, but appeared to exert a protective action against degenerative changes in the spinal cord.

The Riboflavin (Vitamin G) requirement of the Chicken. Hunt and Winter. Agricultural Experiment Station, Wooster, Ohio, 56th Annual Report, 1938, Bulletin No. 592.

This project is a continuation of the experiments reported in Bulletin No. 579 (Annual Report, 1935-1936) in co-operation with the Poultry Department of the Ohio State University. White Leghorn pullets raised on a ration of yellow corn, wheat, wheat bran, Argentine casein, minerals, and cod liver oil failed to lay; whereas normal range-reared pullets, when put on the same flavin-deficient ration, laid normally for a few months and then ceased. Eggs from these birds failed to hatch. When 5·0 per cent. of alfalfa leaf meal or 5·0 per cent. of dried skim milk was added to the above rations, egg production and hatchability were improved. However, for maximum results 10 per cent. of dried skim milk, or 5·0 per cent. of dried skim milk and 5·0 per cent. of alfalfa leaf meal were necessary. The above supplemental rations contained from 250 to 300 microgrammes of flavin per 100 grammes of feed, according to the rat assay method. Biological rat assays of the experimental rations show that there is a correlation between their riboflavin (vitamin G) content and growth, egg production, and hatchability.

Riboflavin (Vitamin G) essential in Poultry Nutrition. Bell and Kick. Agricultural Experiment Station, Wooster, Ohio, 56th Annual Report, 1938, Bulletin No. 592.

A continuation of the Station's studies on the function and importance of riboflavin in poultry nutrition has shown definitely that it is required in avian nutrition. Chicks on a ration deficient in riboflavin grow poorly, and a variable percentage develop a characteristic leg disorder. The feeding of 40 microgrammes or more of either a pure crystalline natural or a synthetic riboflavin daily per chick increased growth markedly and also prevented the occurrence of the leg disorder.

Experiments on hatchability also showed that riboflavin was essential in embryonic development. Hens on a ration deficient in flavin produced eggs of which only 4·2 per cent. of the fertile ones hatched. The feeding of 100 microgrammes of riboflavin per hen daily increased the hatchability of the fertile eggs to 53·3 per cent. When the flavin intake was increased to 200 microgrammes daily, 80·7 per cent. of the fertile eggs hatched. A further significant observation made was that the hatchability of the fertile eggs decreased from 80·7 per cent. below 5·0 per cent. in 2 weeks after flavin feeding was discontinued.

The Vitamin G Content of some Oil Press-Cake Meals and Related Products. F. W. Sherwood and Y. O. Halverson. Journal of Agricultural Research, Vol. 58, 1939, 787.

The term " vitamin G " is used to denote the undifferentiated complex which stimulates the growth of rats on a basal ration containing cornstarch and supplemented with an extract of rice polish but which is otherwise free of water-soluble vitamins. Riboflavin is probably the chief limiting factor in this diet.

Peanut meal, linseed meal, cottonseed meal, soybean meal, and soybeans are good sources of vitamin G, the values ranging from 2·5 to 5·9 Sherman-Bourquin units per gramme. They are as rich in this factor as are cheddar cheese and the green leafy vegetables.

The optimum length of the test period was about 7 weeks. The relation between gain in weight of each of the albino rats used in the experiment and their vitamin G intake (as dried brewers' yeast) was affected by the time of year in which the assay was made, and to a less extent by the initial weight of the rat and the gain in the depletion period.

A curve of reference with corrections for season, initial weight, and gain in the depletion period is given. This curve was found useful in interpreting the results although certain limitations to its general use are recognised.

Common Laying Rations without supplement may not be sufficient for Breeder Turkeys. H. S. Wilgus, Jr. Colorado Farm Bulletin, Colorado Station, 1939, p. 16.

Preliminary results of a study to determine the vitamin G requirements of breeding turkeys necessary to give optimum hatchability of eggs indicated that an ordinary poultry laying ration without milk was deficient in this factor and that hatchability was markedly improved by adding 2·5 or 5 per cent. of dried whey to the ration. Poorer results were obtained in a second trial than in the first, indicating that rations may vary from season to season and that under certain conditions 5 per cent. of dried whey fails to provide an adequate level of vitamin G. Similar results were obtained with pens of layers in confinement and on range. Electric lights to provide a 14-hour day proved effective in stimulating early egg production.

VITAMIN D

A new Vitamin D in Cod Liver Oil. C. E. Bills, O. N. Massengale, K. C. D. Hickman, and E. L. Gray. Journal of Biological Chemistry, Vol. 126, 1938, p. 241.

The most volatile of several vitamins D which occur in cod liver oil was assayed with rats and chickens. Per rat unit, it was from ½ to ¼ as effective for chickens as the total vitamin D of the oil. The assays substantiate the evidence, previously obtained from molecular distillations, that cod liver oil contains several vitamins D.

Studies on the Relative Efficiency of Vitamin D from several sources. I, II. J. T. Correll and E. C. Wise. Journal of Biological Chemistry, Vol. 126, 1938, p. 573.

The results of two studies are reported, dealing respectively with the influence of vitamin D of different origins on (1) bone ash and body weight and (2) on the serum phosphatase of the chicken.

Comparative tests in which chick rations were supplied with different levels of vitamin D from a number of commercial samples of tuna liver oil and cod liver oil indicated that, rat unit for rat unit, the tuna liver oil was only from 40 to 60 per cent. as effective as the cod liver oil for chicks as measured by bone ash content. The former sources of vitamin D were also much less efficient than the latter in promoting growth of chicks during the first few months of life.

The serum phosphatase concentration in 2-day-old chicks was found to be about 80 Bodansky units per 100 c.c. When adequate amounts of vitamin D were supplied the concentration of serum phosphatase rapidly declined, approaching a level of 20 units per 100 c.c. but in the absence of vitamin D the concentration increased to over 200 units per 100 c.c. in highly rachitic chicks. On a rat-unit basis supplements of cod liver oil proved more efficient than irradiated ergosterol or the tuna liver oils in reducing the phosphatase activity in the serum of growing chicks.

The Stability of Vitamins A and D in mixed Feed Ingredients. I, Vitamin D. F. D. Baird, A. T. Ringrose and M. J. MacMillan. Poultry Science, Vol. 18, 1939, p. 35.

When fortified cod liver oil was mixed in the chick ration and stored at summer room temperature, assays conducted after 2, 4, 8, 12, 16 and 32 weeks of storage failed to indicate any measurable destruction of vitamin D.

The Vitamin D requirement of Young Turkeys. T. H. Jukes and T. D. Sanford. University of California, Journal of Nutrition, Vol. 18, 1939, p. 71.

In a series of experiments to determine the vitamin D requirement of young turkeys, the bone ash content of the tibia at 4 weeks of age as influenced by various levels of vitamin D in the diet was measured. Maximum bone ash values approximated 50 per cent. U.S.P. reference cod liver oil and a fish oil blend were used as sources of vitamin D. The blend contained about 450 units of vitamin D per gramme as determined by chick assays based on the value of 95 units per gramme for the reference cod liver oil. The fish oil blend was more effective, chick unit for chick unit, than the cod liver oil as a source of vitamin D for poults, the efficacy ratio being about 1·4 : 1. Satisfactory growth and calcification in the complete absence of sunlight were produced when turkeys received 0·4 gramme of the fish oil blend per 100 grammes of diet, while significantly poorer calcification resulted when 0·3 gramme was used. Growth rate of poults was markedly influenced by the vitamin D content of the diet. While the vitamin D requirement of turkeys cannot be precisely stated in terms of A.O.A.C. chick units, the value of 200 chick units per 100 grammes of diet was approximately the amount required to support normal development of turkeys to 4 weeks of age.

Discovery of High Vitamin Content of Domestic Fish Livers creates new American industry. New England Poultryman, April 15th, 1939.

It was only 5 years ago that it was discovered that the livers of many domestic fish contained vitamins a hundred times more potent than the liver of cod.

Halibut was the first domestic fish from which vitamin-bearing oil was successfully extracted. But the number of these domestic fish whose livers are rich in vitamins has steadily increased and now include among others, tuna, swordfish, salmon, dogfish, barracuda, California mackerel and burbot.

The development of this domestic fish oil industry has benefited not only the American fisherman but the American farmer, as well as the chemical, feed and drug industries. It is estimated that the annual value of the fish liver oil sold in this country totals around $35,000,000.

Contrary to popular conception, baby chicks rather than human babies at present consume most of the vitamin-bearing fish oils produced in the United States.

The Limit of Accuracy of the A.O.A.C. Chick Assay for Vitamin D. B. L. Oser. Journal of the Association of Official Agricultural Chemists, Vol. 22, 1939, p. 445, (Ref. Nutrition Abstracts, Vol. 9, 1939, p. 297.)

The limits of error of the A.O.A.C. method for estimating vitamin D with chicks have been determined by a statistical examination of the results obtained in 14 different laboratories in the course of a collaborative test.

The weighted means of the value for the bone ash for each dose were found to fall on a straight line over the range of doses examined. The variation

within the groups was about the same for all doses. The standard deviation of individual bone ash values for all laboratories at all levels of dosage was found to be ca. 2·490. Most workers considered that the region of maximum sensitivity of the curve of response, relating bone ash to dose of vitamin D, was at about the dose of 15 I.U. and in this region the standard deviation was ± 3·056, and for a group of ten chicks the standard error was ± 0·966.

Vitamin D Deficiency in Chicks. Avitaminosis D hos kyllinger. O. Wanscher. Arnold Busck, Copenhagen, 1939, p. 169. (Ref. Nutrition Abstracts, Vol. 9, 1939, p. 300.)

The chicks were White Italians of uniform breeding and from hens kept under uniform conditions. The experiments started when the chicks were 3 days old. Groups of four in separate cages were used for Ca and P balance experiments, followed by X-ray and histological examination of leg bones, and estimation of the water and ash content of the tibia and femur. Other groups of from 5 to 15 chicks were similarly treated without determination of Ca and P balances. The routine experimental period was of 4 weeks. The basal ration was of ground yellow maize 42, wheat 20, barley 20, casein 10, dried autolysed yeast 5, arachis oil 2, and NaCl 1 per cent. The Ca content of this ration averaged 0·07 and the P content 0·53 per cent. Additions of $CaCO_3$ or $CaCl_2$ were made to bring the Ca content of the food to 0·5, 1, 2 or 4 per cent. in different experiments, the P content being unaltered. In other experiments in which the Ca was 0·5 per cent., the P was increased to 1·5 per cent. by addition of primary or secondary ammonium phosphate. In one experiment the Ca was brought to 2 and the P to 1·5 per cent. by addition of $CaCO_3$ and $CaHPO_4$.

In each experiment a similar number of chicks received the same diet but was irradiated for 10 minutes every 2nd day with a mercury quartz lamp at 100 cm.

All of the non-irradiated chicks showed some degree of rickets, none of the irradiated. In both irradiated and non-irradiated chicks the amount of food eaten and the growth varied with the mineral supplement. The retentions of Ca and P increased with the total amounts ingested, which varied with the percentage in, and the palatability of, the ration. Retentions were consistently higher in the irradiated chicks than in non-irradiated with the same total intake.

Experiments were also made with addition of vitamin D to the food. In these the effects were again assessed in 4-week periods by X-ray examination and analysis of bone. There were five chicks in each group. With a Ca : P ratio of 2 : 1 in the foods, 15 I.U. of vitamin D, as cod liver oil, per 100 g. ration, were not fully protective but 20 I.U. were. When the Ca : P ratio was 4 : 1, not less than 35 I.U. per 100 grammes ration were required. Comparison of cod, halibut and tunny liver oils, with a Ca : P ratio in the food of 2 : 1, indicated that 8 to 16 I.U. were protective with the first two but not with the third oil. When irradiated ergosterol was used 125 I.U. were required for full protection. With a Ca : P ratio of 4 : 1, the requirement was for cod liver oil 16 I.U. and for irradiated ergosterol at least 200 I.U. With international standard vitamin D solution, 75 I.U. were not protective but 150 I.U. gave full protection. Pure vitamin D_3 gave results in agreement with cod liver oil, namely 8 to 16 I.U. It was found that the relationships between the logarithm of the dose of vitamin D_3 and the percentage of ash or water in the bone could be represented as straight lines.

Balance experiments, each with two chicks, were made with 16 and 64 I.U. as cod liver oil, 125 and 500 I.U. as irradiated ergosterol and 16 and 64 I.U. as vitamin D_3, all with a Ca : P ratio in the food 2 : 1. There was no significant difference in retention of Ca between the groups or between these and irradiated chicks but the P retention was higher than in irradiated chicks.

VITAMIN E

A Study of Fowl Paralysis. C. W. Barber. Cornell Veterinarian, Vol. 29, 1939, p. 41.

The effect of vitamin E treatment was studied in fowls suffering from lymphomatosis gallinarum which was diagnosed by operative examination of the femoral nerve in paralysed birds. Of 21 cases treated with cold pressed wheat germ oil, 1 to 2 ml. daily, 15 showed no improvement, four made partial or temporary recovery and two apparently recovered completely from the paralysis though one of these died of a respiratory infection later. Of 14 paralysed fowls kept as controls one recovered, but no partial or temporary recoveries were seen. All treated and untreated paralysed birds showed similar nerve lesions at autopsy.

Anti-Encephalomalacia Activity of dl-a-Tocopherol. H. Dam, J. Glavind, O. Bernth and E. Hagens. Nature, London, Vol. 142, 1938, p. 1157.

Daily doses of dl-a-tocopherol, increasing proportionally to the weight of the animals in quantities of 0·0075 mg. per gramme bodyweight per day, completely protected chicks against encephalomalacia. In another experiment in which a basal diet containing less fat was used, it was observed that the growth of the chicks was stimulated by addition of dl-a-tocopherol. Several authors agree that there is a fat-soluble and a water-soluble form of the anti-encephalomalacia factor and from the experimental observations it seems that the fat-soluble form is either identical with, or may be substituted by, the synthetic vitamin E ; further it should be possible to standardise vitamin E in fats by means of the anti-encephalomalacia activity.

Nutritional Encephalomalacia in Chicks and certain related Disorders of Domestic Birds. Storrs Station Bulletin, No. 229, 1939, p. 121.

This monograph is a comprehensive presentation of accumulated facts which appear to establish nutritional encephalomalacia of chicks as a definite entity in the group of deficiency diseases.

The several chapters discuss the Clinical Picture, by A. M. Pappenheimer and M. Goettsch (pp. 9-14) ; Pathology, by A. M. Pappenheimer, A. Wolf and M. Goettsch (pp. 15-24) ; Brain Weight and Moisture Content, by M. Goettsch and A. M. Pappenheimer (pp. 25-30) ; Blood Volume, by A. M. Pappenheimer and S. Graff (pp. 31-37) ; Non-infectious Character of the Disease, by A. M. Pappenheimer (pp. 39-42) ; Comparison of Natural Foods Diets and Diet 108, by M. Goettsch (pp. 43-48) ; Protective Experiments With Natural Food Stuffs, by M. Goettsch and A. M. Pappenheimer (pp. 49-58) ; Preventive Effect of Vegetable Oils and Their Fractions, by M. Goettsch, H. B. Gillespie, and A. M. Pappenheimer (pp. 59-67) ; The Occurrence of Encephalomalacia in the Field, by E. Jungherr and K. C. Seeger (pp. 69-79) ; Nutritional Myopathy in Ducklings, by A. M. Pappenheimer and M. Goettsch (pp. 81-88) ; Nutritional Myopathy of the Gizzard in Turkeys, by E. Jungherr, K. C. Seeger, and A. M. Pappenheimer (pp. 89-96) ; and Various Forms of Leg Weakness in Chicks : Differential Diagnosis, by E. Jungherr and A. M. Pappenheimer (pp. 97-112).

The general discussion stresses the fact that chicks, ducks, and turkeys develop entirely different pathological symptoms when fed the same deficient diet, the lesions being confined to the brain in chicks, to the skeletal muscles in ducks, and to the smooth muscle of the gizzard in turkeys. Complete

protection against chick encephalomalacia is obtained by administering a vitamin E concentrate or alpha-tocopherol, thus indicating that only one factor is concerned in this disease. A bibliography of 130 references is appended.

VITAMIN K

Synthesis of the Antihemorrhagic Vitamin by Bacteria. H. J. Almquist, C. F. Pentler, and E. Mecchi. University of California, Soc. Expt. Biol. and Med. Proc., Vol. 38, 1938, p. 336.

Further experiments confirm previous findings that ether-extracted, vitamin K-free fish meal when allowed to putrefy through the action of micro-organisms developed an appreciable amount of antihemorrhagic activity as assayed with chicks. A sterile fish meal control gave no evidence of such activity. When an organism isolated from the putrid fish meal was grown on various liquid and solid media, the washed bacteria were found to be rich sources of the antihaemorrhagic factor. Several known species of the bacteria were grown in nutrient agar, suspended in saline, repeatedly washed, autoclaved, and added to the basal diet of chicks for assay. All but one of the species thus tested possessed definite antihaemorrhagic properties, indicating that this factor is a product of bacterial metabolism.

Estimation of the Antihaemorrhagic Vitamin. H. J. Almquist, E. Mecchi, and A. A. Klose. University of California. Biochemical Journal, Vol. 32, 1938, p. 1897.

Continuing this line of investigation, it was found that the blood clotting time of the chick varies with age, the vitamin K reserve of the chick, and the vitamin K content of the ration. It tended to reach a maximum at 2 weeks of age, while at 3 weeks of age the chick achieved a balance of blood clotting power with respect to the vitamin K content of the ration. The reciprocal of the blood clotting time was found to be a simple linear function of the logarithm of the vitamin K level in the ration, over a practical range of values. An improved assay technique for vitamin K based on these findings is described.

Failure of " Vitamin K " excess to Heal Encephalomalacia of Chicks. H. C. Mason. University of Illinois. Soc. Expt. Biol. and Med. Proc., Vol. 41, 1939, p. 50.

Experiments at the University of Illinois, in which healthy chicks were fed the Pappenheimer and Goettsch deficiency ration No. 108, gave evidence that nutritional encephalomalacia in chicks is not prevented by the administration of an excess of vitamin K.

SUNDRIES

Unsuitability of Blood Sugar Values of deprived Pigeons for Estimation of Vitamins. La curva glicemica dei colombi in avitaminosi non e'utilizzabile per la titolazione dei prodotti vitaminici. A. Allegri. Boll. Soc. ital. Biol. sper., Vol. 13, 1938, p. 1127. (Ref. Nutrition Abstracts, Vol. 8, 1939, p. 918.)

Although crystalline vitamin B_1 and the acid clay adsorbate previously used as the international standard for vitamin B_1 had some action in lowering the values for blood sugar in pigeons maintained on a diet of polished rice, no consistent quantitative relation could be detected between the magnitude of the dose and of the response, and it was not found possible to base a method of estimating vitamin B_1 on these observations.

The Ascorbic Acid Content of Chick Blood. A. D. Holmes, F. Tripp, and G. H. Satterfield. Journal of Nutrition, Vol. 16, 1938, p. 407.

Although it has not been shown that ascorbic acid is essential for normal development of the chick, simultaneous determinations were made of the vitamin C content of the blood plasma and of the food of a series of Rhode Island chicks. Both determinations were made by extraction in the presence of metaphosphoric acid followed by titration with indophenol. No consistent relationship could be found between sexes or amongst age groups tested. The average blood value was 2·04 mg. ascorbic acid per 100 ml. plasma.

The Ascorbic Acid Content of Blood Plasma of Laying Hens. A. D. Holmes, F. Tripp, and G. H. Satterfield. Poultry Science, Vol. 18, 1939, p. 192.

Following a similar study with chicks the ascorbic acid content of the blood plasma of laying hens was determined. Seven groups of birds were used, the assay on group 1 being made at the beginning of the trial (20 weeks of age); group 2 at 30 weeks of age (10 weeks' egg production); group 3 at 36 weeks (16 weeks' egg production); group 4, 5 and 6 at 72 weeks (1 year egg production); and group 7 at 86 weeks (66 weeks' egg production). The average ascorbic acid content of the plasma was 1·836, 1·129, 1·628, 1·061, 1·288, 1·073 and 1·906 mg. per cent. for groups 1 to 7, respectively. Individual birds varied widely to give a considerable range within each group. These data reveal very little correlation between the ascorbic acid of the plasma and the egg production, bodyweight, feed intake, or age of the birds.

Nutritional Gizzard Lesions in Chicks. W. B. Esselen, Jr. Massachusetts Experiment Station. Poultry Science, Vol. 18, 1939, p. 201.

A comparison of eight different diets with reference to their effect on the gizzard linings of young chicks showed that the unsupplemented basal diet of Almquist and Stokstad was most effective in producing nutritional gizzard lesions, the lesions being produced within 2 weeks when starting with day-old chicks. The Massachusetts State College chick ration (control) gave practically complete protection against this disorder. The addition of a mixture of 15 per cent. each of wheat bran, wheat middlings, and oat groats, and 4 per cent. of alfalfa leaf meal to the Almquist diet gave good protection against the lesions. There appeared to be little correlation between the rate of growth and the severity of the gizzard lesions. In curative trials, dried pork lung, alfalfa leaf meal, soybean meal, oat groats, and wheat middlings were all effective to some degree. Chicks fed an adequate diet for 1 or 2 weeks soon developed gizzard lesions when placed on the deficient basal diet, indicating that very little of the protective factor is stored by the chick. Turkey poults appeared either unsusceptible to this disorder or much more resistant to it than chicks.

MINERALS

Mineral Content of Feathers of Ducks with Osteomalacia. La minéralisation de la plume au cours de l'ostéomalacie. R. Salgues. Comptes Rendus Société Biologie, Paris, Vol. 129, 1938, p. 751.

From analyses of the ash of feathers of normal and osteomalacic ducks for Ca, P, Mg and CO_2 (carbonate) it was concluded that the principal Ca-P compound of feathers is not $Ca_3(PO_4)_2$ (as in bone) and that the composition of feather ash, moderately constant in normal birds, varies considerably during the course of the disease. Comparatively it would appear that the activity of the H_2PO_4'ion, in a biological medium, is greater than that of the PO_4'ion for normal birds, while the reverse holds true for osteomalacic subjects.

Excess Calcium and Perosis. H. S. Wilgus, A. R. Patton. Colorado Agricultural Experiment Station. Journal of Nutrition, Vol. 18, No. 1 ; Poultry Digest, 1939, p. 471.

The conclusion from experimental evidence is that the excess insoluble calcium phosphate tends to remove the manganese from solution in the intestine. This decrease in the manganese in the intestines of chicks was observed after feeding steamed bone meal.

Distribution of Phosphorus in the Leg Bones of Chickens. M. J. L. Dols, B. C. P. Jansen, G. J. Sizoo and G. J. van der Maas. Nature, London, Vol. 142, 1938, p. 953.

Solutions of radioactive phosphorus were intraperitoneally injected into both rachitic and normal chicks, and the distribution of phosphorus in the leg bones was studied 22 hours after injection. As expected, the phosphorus content of the dry matter in all parts of the bones of normal chicks was higher than in rachitic chicks. In both lots the total phosphorus content of the diaphysial part of the bone was higher than for the epiphysial part of the same bone. A greater concentration of the radioactive phosphorus was found in the bones of rachitic chicks than in normal ones, also a greater concentration in the epiphysial part than the diaphysial part of the same bone, thus indicating that phosphorus metabolism is more intense in the bones of rachitic chicks than in the bones of normal ones and also more intense in the epiphysial part than in the diaphysial part of the same bone.

Studies on Phosphorus Metabolism in Normal and Rachitic Chickens with a Radioactive Phosphorus Iostope. III. The distribution of the injected phosphorus in the organs, especially in the different parts of the leg bones. M. J. L. Dols, B. C. P. Jansen, G. J. Sizoo and G. J. van der Maas. Proceedings Kon. Akad. v. Wetenschappen, Amsterdam, Vol. 42, 1939, p. 499.

Experiments have been discussed in which particularly the distribution of phosphorus in the leg bones of chickens was investigated, with a radioactive phosphorus isotope as an indicator.

The figures obtained convincingly showed, that both in the normal and in the rachitic chickens the phosphorus metabolism is more intensive in the

epiphysis than in the diaphysis of the leg bones, whereas the phosphorus metabolism in the bones of the rachitic birds is more intensive than in the bones of the normal chickens.

Moreover a method has been published by which it is possible to photograph the distribution of the phosphorus in the leg bones of animals.

The Origin of the Phosphorus Compounds in the Embryo of the Chicken. G. C. Hevesy, H. B. Levi, and O. H. Rebbe. Biochemical Journal, Vol. 32, 1938, p. 2147.

In the phosphatides of embryos, from eggs incubated for 11, 16 and 18 days after injection of Na phosphate containing radio-P, considerable proportions of radio-P were found, although the yolk phosphatides contained scarcely any radio-P. Hence the embryo synthesises at least some of its phosphatides and does not derive them from the yolk. Only the inorganic P of the embryos is taken as such from the yolk or white. It was also found that the ratio in which the yolk radio-P atoms were incorporated into the various P compounds of the embryo was governed solely by probability considerations. When the radio-P was injected in the form of hexosemonophosphate, the hexosemonophosphate P of the embryos had about the same specific radioactivity as had the inorganic and phosphatide P indicating that probably inorganic phosphate radicals split off from hexosemonophosphate and other compounds of the yolk and white rather than that the whole hexosemonophosphate molecules of yolk and white are used in the synthesis of the P compounds of the embryo.

Cereals and Rickets. 9. The availability of phytin-P to the chick. J. T. Lowe, H. Steenbock and C. H. Krieger. Poultry Science, Vol. 18, 1939, p. 40.

A ration of yellow maize, wheat middlings, crude casein and NaCl in the ratio of 70 : 17 : 12 : 1 was fed to 13 chicks of which only three survived after 3 weeks. The ash content of the tibiae averaged 23·0 per cent. A supplement of $CaCO_3$ lengthened the survival time and raised the ash content of the tibiae to 26·3 per cent. after 3 weeks and to 30·4 per cent. after 5 weeks. Supplements of $CaCO_3$ and P were given, the latter being in the form of either phytin, prepared from wheat bran, or disodium-orthophosphate in equivalent amount. With the inorganic P supplement the ash content of the tibiae was 41·4 per cent. while with the phytin it was only 30·3 per cent. after 5 weeks. The Ca : P ratio in each case was 2·6 : 1. These data were obtained with and without suboptimal amounts of vitamin D as cod liver oil.

Fluctuations of Phosphatase and Inorganic Phosphorus in the Blood of the Laying Hen during the period of Egg Formation. W. J. Peterson and D. B. Parrish. Kansas Experiment Station. Poultry Science, Vol. 18, 1939, p. 54.

Blood samples from hens which had been laying for 9 months and from pullets which had just come into lay, collected immediately after and at approximately 12 and 26 hours after oviposition of the previous egg, were analysed for phosphatase and inorganic phosphorus. In the former group the average plasma phosphatase was 30 per cent. higher and the inorganic plasma phosphorus 15 per cent. higher at the time of active shell deposition than at the start of the 26-hour egg cycle. In the latter group there was an increase of 35 per

cent. in phosphatase and 39 per cent. in inorganic phosphorus at the period of active shell deposition. The possible role of phosphatase in eggshell formation was discussed.

Phosphatase and Inorganic Phosphorus in the Plasma and whole Blood of the Fowl. W. J. Peterson and D. B. Parrish. Kansas Experiment Station. Poultry Science, Vol. 18, 1939, p. 59.

The average plasma phosphatase values of 5-month-old cockerels and pullets were found to be 20 and 22·9 units, respectively, while corresponding values in the whole blood were 16·5 and 17·2 units. For birds of corresponding breed and sex at 16 weeks of age the plasma contained 8·8 and 9·7 units and the whole blood 7·8 and 10·4 units, respectively. There was no significant difference in the inorganic phosphorus content of the plasma and whole blood in either sex.

A study of Blood and Bone Phosphatase in Chick Perosis. A. C. Wiese, B. C. Johnson, C. A. Elvehjem, E. B. Hart, and J. G. Halpin. Wisconsin Experiment Station. Journal of Biological Chemistry, Vol. 127, 1939, p. 411.

In a further report a revised method for measuring the blood and bone phosphatase activity is described. It was found that the blood and bone phosphatase activity of chicks with perosis was definitely lower than that of non-perotic chicks. In a series of *in vitro* experiments to determine the effect of various ions on the activity of bone phosphatase it was found that manganese had an activating influence on the enzyme, while calcium and phosphorus ions depressed the activity. Magnesium, which caused some activation of the enzyme, failed to exert a curative effect against perosis in chicks.

Phosphorus Metabolism of Chicks afflicted with Perosis. A. C. Wiese, B. C. Johnson, C. A. Elvehjem, and E. B. Hart. University of Wisconsin. Science, Vol. 88, 1938, p. 383.

A study of the phosphorus distribution in chicks suffering from perosis and of normal chicks fed the same perosis-producing diet but protected by the feeding or injection of manganese showed that (1) the inorganic phosphorus of the blood remained constant at from 4·7 to 5·6 mg. per 100 c.c. of blood for both groups, (2) the ester phosphorus was from 26 to 30 mg. per 100 c.c. of blood for perosis chicks and from 32 to 44 mg. for normal chicks, (3) the phosphorus content of the blood was 2·1 to 3·1 units per 100 c.c. of blood and from 3·6 to 7·7 units per gramme of green bone for chicks on the perosis-producing diet and from 15·9 to 51·3 units per 100 c.c. of blood and from 8·5 to 10 units per gramme of green bone for chicks on the fortified diet. It is suggested that inositol may be concerned in the ester phosphorus increase in normal birds. In this connection chicks receiving the basal diet fortified with 20 p.p.m. of manganese and injected with 100 mg. of inositol per week were fully protected against perosis, while chicks similarly fed but receiving only 10 mg. of inositol or 100 mg. of glucose per week were not protected.

The amount of Manganese required to prevent Perosis in the Chick. W. D. Gallup and L. C. Norris. Cornell University. Poultry Science, Vol. 18, 1939, p. 76.

When New Hampshire chicks were reared on a low manganese basal diet, perosis developed in approximately 80 per cent. of the cases. When the

manganese content of the diet was increased to 50 p.p.m. by additions of chemically pure $MnCl_2$, $MnSO_4$, $KMnO_4$, $MnCO_3$, and MnO_2, the incidence of perosis was reduced to about 7 per cent., with evidence that these various salts were equally effective. In trials to determine the minimum amount of manganese required to prevent perosis, graded levels of manganese intake from 20 to 100 p.p.m. were provided by additions of $MnCO_2$. A level of 30 p.p.m. completely prevented perosis in White Leghorns, while 50 p.p.m. reduced perosis to 7 per cent. in a normal strain of New Hampshires and to 18 per cent. in a highly susceptible strain of New Hampshires, thus indicating breed differences. A diet containing 1,000 p.p.m. of manganese was fed over a period of 20 weeks with no toxic effect.

The Effect of a Deficiency of Manganese in the Diet of the Hen. W. D. Gallup and L. C. Norris. Cornell University. Poultry Science, Vol. 18, 1939, p. 83.

Groups of New Hampshire pullets were fed rations containing 13, 53, 200, 500 and 1,000 p.p.m. of manganese, respectively. As the manganese intake increased over this range the manganese content of the eggs progressively increased from 0·045 to 0·342 mg. per 100 grammes of dry yolk. The lower level of manganese intake resulted in low egg production and high mortality of embryos, with such deaths generally occurring late in the incubation period. Production was slightly lower, but hatchability was as good at the 53 p.p.m. level of intake as at the higher levels. The minimum manganese requirement of the developing embryo was found to be about 0·005 mg., which represented approximately 70 per cent. of the manganese in the egg. Chicks hatched from low-manganese eggs and having a low initial manganese reserve were no more susceptible to perosis than those hatched from high-manganese eggs.

Relative Effectiveness of Ingested and Injected Manganese in Preventing Perosis. C. D. Caskey and L. C. Norris. Proc. Soc. exp. Biol. N.Y., Vol. 40, 1939, p. 590.

The results of supplying Mn in the diet of Rhode Island Red chicks for a period of 6 weeks showed that a level of 1·5 mg. Mn per 100 grammes of a diet containing 1 per cent. Ca and 0·5 per cent. P was just as effective in preventing the development of perosis as a level of 14 mg. of Mn per 100 kg. of a diet containing 3 per cent. Ca and 1·5 per cent. P. As the Mn level in either the low Ca : P diet or the high Ca : P diet was increased, the final average weight of the chicks increased and the incidence of perosis decreased.

That injected Mn was much more effective than ingested was demonstrated by the fact that the intraperitoneal injection of 10 mg. of Mn per chick during the experimental period of 6 weeks completely prevented the development of perosis, even though the chicks received the high Ca : P diet, whereas an oral intake of 141·7 mg. was only partially effective in the prevention of perosis. The injection of 20 and 60 mg. of Mn during the experimental period also completely prevented perosis but retarded the growth considerably. It is concluded that Ca and P when present in the diet in excess amounts greatly reduce the availability of Mn in the intestinal tract.

The Availability of Manganese in Avian Digestion. H. S. Wilgus, Jr., and A. R. Patton. Colorado Experiment Station. Science, Vol. 89, 1939, p. 393.

A series of *in vitro* experiments which consisted of precipitating calcium phosphate from solutions containing calcium, phosphate, and manganous ions in known amounts approximating the concentration which produces perosis in

chicks gave evidence that the manganese was carried down quantitatively by the calcium phosphate precipitate. Similar results were obtained by precipitating ferric chloride solution containing manganous ions. These results were substantiated by *in vivo* experiments using White Leghorn pullets by showing that manganese in the digestive tract, in the excreta, and even in the feed was rendered markedly less diffusible by the use of excessive amounts of bone-meal. These findings support the hypothesis that the perosis-producing action of calcium phosphate and ferric citrate is at least partially due to the removal of manganese from solution in the intestinal tract either by adsorption or chemical combination.

The Need for Manganese in the Bone Development of the Chick. C. D. Caskey, W. D. Gallup and L. C. Norris. Journal of Nutrition, Vol. 17, 1939, p. 407.

Allowing for the retardation in growth which occurs when chicks are fed on a diet low in Mn, the leg bones of those birds were found to be shorter than those of birds adequately supplied. Wing bones were similarly affected although not to the same extent. It was also found that the ash content of the bones was lower in the case of chicks on the deficient diet than in the case of the controls. It is concluded that the abnormal shortening of the bones is probably the result of a disturbance in Ca and P metabolism in the absence of Mn.

The Effect of certain Mineral Salts on the amount and severity of Perosis. R. M. Sherwood. Texas Experiment Station. Poultry Science, Vol. 18, 1939, p. 165.

In a comparison of the effect of eight experimental rations on the incidence of perosis in chicks, it was found that the basal diet containing 9 p.p.m. of manganese, 420 p.p.m. of aluminium, 98 p.p.m. of iron, 1·41 per cent. of calcium, and 0·72 per cent. of phosphorus gave very poor protection against this disorder. Increasing the aluminium and iron content of the diet only slightly improved the degree of protection. Substituting 20 per cent. of wheat grey shorts for an equal amount of milo in the diet increased the total manganese to 21 p.p.m. and afforded almost complete protection, as did the addition of 37 p.p.m. of manganese to the basal diet. Adding the ash of 20 per cent. of wheat grey shorts to the diet was less effective than when this amount of shorts was incorporated in the diet.

Assimilation and Storage of Manganese in the Developing Embryo and Growing Chick. W. D Gallup and L. C. Norris. New York, Cornell Experiment Station. Poultry Science, Vol. 18, 1939, p. 99.

A study of the assimilation of manganese by the developing chick embryo revealed that approximately 75 per cent. of the manganese in the egg was taken up by the embryo during incubation. The greatest concentration of manganese per unit of dry weight occurred at the 9th day (0·613 mg. per 100 grammes), while the most rapid accumulation of manganese occurred between the 9th and 15th days of incubation. In growing chicks, both on the low-manganese and manganese-supplemented diets, the absolute amount of manganese increased during the first 5 days, but no further increases occurred until about the 24th day. There was considerable decrease in the manganese content of the livers of the former lot during the first 5 days, followed by a slight increase, while that of the latter group remained quite constant. Depletion of liver stores did not occur until the chicks were over 6 weeks of age,

after which the liver content was roughly in proportion to the manganese intake. The manganese content of the bones declined rather rapidly, particularly in the former group, indicating that the manganese requirement of the liver is met first and that of the bones second.

Some Effects of Manganese on Eggshell Quality. M. Lyons. Arkansas Station Bulletin, No. 374, 1939.

A detailed study was made of the eggshell quality of approximately 5,200 eggs produced by six pens of pullets receiving rations varying in amounts and sources of manganese and containing varying amounts of calcium and phosphorus. Pullets fed low manganese rations (7 p.p.m.) with either high or low levels of calcium and phosphorus produced eggs with distinctly different and inferior shell characteristics than those fed adequate amounts of manganese. When a number of pullets on the manganese-deficient diets were changed to manganese-adequate diets, a rapid and marked improvement in shell quality occurred, while pullets changed from adequate- to deficient-manganese levels showed an even more rapid decrease in eggshell quality. Rations containing 27 p.p.m. of manganese proved inadequate in some cases for the production of high quality eggshell, while 57 p.p.m. appeared entirely adequate. Manganese supplied in rice bran appeared equally as effective as manganese sulphate. Normal eggshells contained less than 0·00002 per cent. manganese.

Phytic Acid and Mineral Metabolism in Poultry. R. H. Common. Nature, London, Vol. 143, 1939, p. 379.

A preliminary report is given of mineral metabolism experiments with pullets in which it was found that the birds failed to hydrolyse a considerable proportion of the phytic acid present in the rations. Supplements of $CaCO_3$ appeared to lower the proportion hydrolysed.

Beryllium Rickets in Chickens. H. D. Branion, F. F. Tisdall, and T. G. H. Drake. Poultry Science, Vol. 18, 1939, p. 66.

Addition of 1·0 and 2·0 per cent. Be carbonate to the diet of two groups of Barred Plymouth Rock chicks fed on an otherwise normal ration from time of hatching to 10 weeks, causes definite rachitis lesions as evidenced by low levels of inorganic plasma P, subnormal percentage of ash in the leg bones, and a failure in calcification and bone developments shown by X-ray examination. Over the 10-week period, addition of 0·5 per cent. Be carbonate was without effect and it would appear that chickens are in general more resistant to Be rickets than rats although there were distinct individual variations.

The Influence of Basic and Acid Equivalents of the Mineral portion of the Diet of Geese on the Physico-chemical Changes in the Egg during Embryonic Development. I. N. M. Shklyar. Biochemical Journal, Ukraine, Vol. 12, 1938, p. 141-59 (in Russian, p. 159-61 ; in English, p. 161-2 ; Chemical Abstracts, Vol. 33, 1939, p. 5897[3].

The acid diet used had a Ca : P ratio of 1 : 1·44 ; the basic diet had a Ca : P ratio of 2·89 : 1. The eggs from the experimental geese were incubated and the alkaline reserve, the pH and the water content studied. The alkaline reserve of the albumin and yolk, from the eggs of geese fed on the basic ration, was higher in comparison to the acid group. Similarly the pH of all the com-

ponents of the egg were higher in the basic group. The changes in water content ordinarily observed in the albumin and yolk of the egg during incubation proceeded more rapidly in the acid group.

The Production of Goiter in Chickens. A. R. Patton, H. S. Wilgus, Jr., and G. S. Harshfield. Colorado Experiment Station, Science, Vol. 89, 1939, p. 162.

The production of experimental goiter in chicks by feeding a ration containing 0·145 mg. of iodine per kilo and the prevention of goiter by the addition of 5 mg. of iodine per kilo to the same ration are reported. Thyroid weights of chicks fed the basal diet were 130, 240 and 294 per cent. of those of the control group at 6, 12 and 18 weeks of age, respectively. The histopathological conditions of the enlarged thyroids are described.

CARBOHYDRATES

Feeding with Different Quantities of Grain. Die Herabsetzung der Körnergabe bei Hühnern. Fangauf and Haensel. Archiv für Geflügelkunde, 1939, No. 6.

Summary :

In an experiment with four groups of two males and 30 females White Leghorns each, the result was tried of giving different quantities of grain where the birds had free access to mash. The groups got 50, 40, 30 and 20 grammes of grain per head per day (mixture of wheat and oats).

They took 64, 66, 72 and 82 grammes of mash respectively, so that the total intake remained substantially equal, but was somewhat less where less grain was given. The groups with less grain consumed more proteid. No noticeable differences were seen between the groups. It seems therefore that, especially on the farms where record production is not aimed at, other food, such as potato flakes and sugarbeet flakes can be substituted for grain to a very large extent. The feeding of poultry becomes more elastic in this way and the saving of grain, which can be obtained by substituting other carbohydrates for grain is extraordinary.

Effect of Varying Levels of Wheat Bran on Age at Sexual Maturity. L. W. Taylor and I. M. Lerner. University of California, Berkeley, Poultry Science, Vol. 18, 1939, p. 323.

Inclusion of 15 or 25 per cent. of wheat bran in a mash composed of ground whole grains, fish meal, skimmed milk, alfalfa meal, green feeds, minerals and sardine oil resulted in more rapid growth, earlier sexual maturity and, as a result of the latter, lower egg weight at the beginning at laying. The annual production, March egg weight, and extent and character of pathology were not significally affected by such change in the ration.

The Ration as Affected by Free-Choice Feeding of Whole Grain and Mash. Kennard and Chamberlin. Agricultural Experiment Station, Wooster, Ohio. 56th Annual Report, 1938, Bulletin No. 592.

The free choice feeding of whole grain and mash has become a popular method of feeding. A frequent question in connection with free-choice feeding

is whether layers can be depended upon to balance their own ration properly. Results of tests carried on at this station indicate that they can. Flocks varied greatly in the proportion of whole corn, wheat, or oats they consumed, but the proportion of total grain to mash was comparatively constant and in proportion to the protein content of the mash. To put it differently, the birds appeared to balance their ration pretty closely on the basis of protein content. When the birds received a mash with varying percentages of protein, (18 to 24 and 32) the percentages of mash consumed were 41 to 33 and 20 respectively ; on this basis the percentage of protein of the total feed intake was 14·6, 15·3 and 15·2. The rate of egg production affects mash consumption and, incidentally, the protein intake.

From the station's tests, free-choice feeding of whole grain and mash appears to be equally as satisfactory as all-mash or the usual grain and mash rations, provided the birds have ample opportunity to become accustomed to this method of feeding before they come into egg production.

Soaked Wheat Feeding Tests. Results of three years' experiments at Hawkesbury (Australia). Poultry, August 12th, 1939.

The results of the 3 years' experiments show that on the method adopted, neither group receiving the soaked wheat ration gave as satisfactory results as that fed on the ordinary ration. This conclusion appears to be confirmed by the fact that the majority of commercial poultry farmers who adopted the soaked wheat system of feeding reverted to ordinary rations even when price factors favoured the use of wheat.

There is evidence, however, to show that by the addition of pollard and bran to the soaked wheat the results could be improved, and there may be some advantage in adopting a modified system in times when the price of pollard and bran is high, or when there is a shortage of these commodities. Soaked wheat feeding might also have possibilities in wheat-growing districts where it is desired to run flocks of fowls, but judging by the results of the experiments under review, egg production would be definitely lower than where ordinary rations were fed.

It is of interest to note that over the full 3 years' tests the average annual return over cost of feed for the three groups was : No. 1, £11 2s. 8d. ; No. 2, £7 6s. 9d. ; No. 3, £10 15s. 2d.

Experiments on the Feeding of Ensiled Potatoes to Laying and Breeding Hens. Fütterungsversuch mit eingesäuerten Kartoffeln bei Lege- und Zuchthühnern. W. Liebscher. Biedermanns Zentralbl. (B), Tierernährung, Vol. 10, 1938, p. 385.

Satisfactory results were obtained if an adequate amount of protein of high biological value was included in the ration. The comparison was made with groups of 125 Rhode Island pullets. Along with 100 grammes steamed, ensiled potatoes the birds received, per head daily, 20 grammes of a mash consisting of 34 per cent. fish meal, 34 per cent. meat meal and 32 per cent. groundnut meal, with cracked maize as grain food. Over a period of 127 days the average egg production per bird was 60·3 in the control group and 61·5 in the experimental group. Percentage hatchability was 66 in the former and 77·6 in the latter group.

The Effect of Substituting an All-Mash and Pellet Ration for Grain, Mash and Pellets on Flock Production, Costs and

Returns. C. E. Lee, S. W. Hamilton, C. L. Henry and M. E. Callanan. Poultry Science, Vol. 18, 1939, p. 375.

An all-mash ration, even though supplemented by pellets, gave significantly lower egg production, higher feed cost per bird and per dozen eggs, and a materially lower return above feed cost per bird, among both Rhode Island Reds and White Leghorns, than a scratch grain and laying mash ration supplemented with pellets.

The investigators found that the average eggs per bird over a 10-months period for the combined groups of Rhode Island Reds and White Leghorns fed mash, grain and pellets was 169·69 eggs, compared with 157 eggs for the combined groups of Reds and Leghorns fed an all-mash ration supplemented with pellets.

Influence of Fattening Foodstuffs and Temperature on the Fowl's Body Fat. T. Takita. Bul. Sci. Fakult. Terkult., Kjusu Imp. Univ., Fukuoka, Japan, Vol. 8, 1938, p. 1. (Ref. Experiment Station Record, Vol. 81, 1939, p. 260.)

When one-half of the ration of fattening fowls was variously supplemented by ground Italian millet, ground corn, ground great millet, soybean hulls, wheat flour mixed feeds, and ground buckwheat over a 30-day fattening period, no significant differences were found in the physical or chemical characters of the body fat as a result of the ration. A comparison of fowls fattened in winter (average temperature 5° C.) and in summer (average temperature 27°) indicated that the body fat of the former contained only about one-fourth as much free fatty acid but more liquid fatty acid than of the latter. Reichert-Meissl, Polenske, iodine, and thiocyanogen values were all materially higher at the winter temperature. From these facts it is inferred that animals placed in a disadvantageous environment require relatively unstable compounds for their preservation.

Millet Feeding for Turkeys. G. P. Goodearl. North Dakota Station, Bimonthly Bulletin, No. 5, 1939.

Three years' experiments in which proso millet replaced one-half or all of the yellow corn in standard starting and growing rations for turkeys gave evidence that the millet rations were readily consumed by young, growing turkeys. The millet-fed groups consistently weighed more at marketing time than the corn-fed group, while on the average slightly more millet rations were consumed per lb. of gain. There was little difference in the rate of mortality in the various groups.

Feeding for Winter Egg Production. G. P. Goodearl. North Dakota Station, Bimonthly Bulletin, No. 1, 1938.

The relative value of whole grains *v.* a moist fleshing mash and whole grains as supplements to a well-balanced dry laying mash for laying pullets was determined in trials with groups of Rhode Island Red and White Leghorn pullets. There was little difference in the rate of egg production, percentage gain in weight, or mortality for either breed on the two types of rations. The use of the moist fleshing mash materially decreased the consumption of whole grains and decreased somewhat the consumption of dry mash. The feed cost

per dozen eggs was identical under the two systems of feeding for Rhode Island Reds, but White Leghorns showed a definite advantage in favour of the heavy feeding of whole grain.

PROTEINS

The Utilisation of Food Elements by Growing Chicks. VI. The influence of the Protein Level of the ration on the growth of chicks. VII. A comparison of Corn and Kalo in a ration for growing chicks. C. W. Ackerson, M. J. Blish and F. E. Mussehl. Agricultural Experiment Station, Lincoln, Nebraska, 1939. Bulletin, Nos. 108, 109.

Conclusions :

1. In two series of experiments chicks fed rations containing 22 per cent. of protein made greater gains on the same dry matter intake over the same period of time than chicks fed rations carrying 16 per cent. of protein.

2. The ratio of gain in weight to nitrogen fed was greater in the chicks fed 16 per cent. than in 22 per cent. protein lots.

3. The chicks on the 16 per cent. protein rations retained a higher percentage of the nitrogen fed, but the percentage of nitrogen in the gain was not as high as that in the chicks fed rations containing 22 per cent. of protein.

4. The slight differences in the percentage retentions of calcium and phosphorus can be ascribed to the differences in the percentage of those elements occurring in the rations as mixed.

5. The dilution of a complete ration with 30 parts of starch to yield a 16 per cent. ration resulted in uniform and definite evidence of depraved appetite including feather pulling and coprophagy. In addition the chicks fed the 16_1 ration were uniformly poorly feathered and had large nude areas.

1. The substitution of kalo for corn in an otherwise complete ration for growing chicks had no significant effect on the growth rate of chicks up to 6 weeks of age.

2. The retention of nitrogen, calcium and phosphorus was not significantly altered by the use of kalo in the ration.

3. Instances of cannibalism were confined to the kalo-fed lot.

Dry Skim Milk in Rations for Growing, Laying and Breeding Fowl. W. H. Ott, H. C. Knandel, R. V. Boucher. Pennsylvania Station Bulletin No. 381, 1939.

In three series of experiments eight all-mash rations varying in content of dried skimmed milk from 0 to 8·75 per cent., by 1·25 per cent. increments, were fed to groups of White Leghorn chickens from 1 day to 72 weeks of age. All groups received 16·9 per cent. protein starting rations to 12 weeks and 14·4 per cent. protein rations thereafter. The rate of growth during the first 2 weeks was directly related to the level of dried skimmed milk in the ration, and total feed consumption and total gain in body weight to 24 weeks increased with increasing levels of milk in the ration, although all groups grew at approximately equal rates from 10 to 24 weeks. The most efficient gains in bodyweight on the basis of dried skimmed milk intake were made by the chicks receiving the 1·25 and 2·5 per cent. levels. Age at sexual maturity decreased with increasing amounts of milk, while bodyweight at sexual maturity and percentage hatchability of fertile eggs increased with increasing milk levels. From the standpoint of egg production, egg weight, and hatchability the most efficient performance by laying pullets occurred at the 2·5 and 5 per cent. levels. Results at the 2·5 and 3·75 per cent. levels were essentially as satisfactory as the higher levels.

Protein requirements of Chickens at various stages of Growth and Development. A. E. Tepper, R. C. Durgin, and T. B. Charles. New Hampshire Station Bulletin No. 312, 1939.

In two extensive tests to determine the optimum levels and sources of protein intake for chickens during the various stages of growth and production, 12 rations were compared. Protein levels of 15, 17 and 19 per cent. were used with fish meal, meat scrap, and dried skim milk, each separately and the three in combination, constituting the main source of protein. As the percentage of protein increased a definite increase in body weight of the chicks occurred. Those groups receiving the protein mixture or fish meal alone were definitely heavier at 12 weeks than those on comparable protein levels supplied by meat scrap or dried skim milk. During the growing period (12 to 23 weeks) the groups on the lower protein levels were most efficient in feed utilisation. The groups receiving fish meal as the sole source of animal protein produced a greater number of eggs per bird, had the lowest feed cost per dozen eggs produced, and were earliest in sexual maturity as measured by average days to first egg. The percentage protein in the rations did not significantly influence age at sexual maturity nor size of egg laid. No significant relationship was observed between mortality and the source of animal protein fed. The maximum amount of protein which could be supplied by meat scrap or dried skim milk was definitely lower than in the case of fish meal. A ration containing 13 per cent. of fish meal (19 per cent. total protein) did not adversely affect the odour or flavour of either meat or eggs.

Comparative Values of various Protein Feeds for Growing Chicks. R. M. Sherwood and J. R. Couch. Texas Station Bulletin No. 569, 1939.

Five experiments, each with six lots of chicks, were conducted to determine the relative value of various combinations of protein-rich feeds, as measured by average live weight gains, feed requirement per unit of gain, and percentage mortality. Protein concentrates included sardine meal, dried skim milk, meat and bone scraps, cottonseed meal and soybean oil meal, three of these feeds being used in combination in each of the nine rations tested. In practically all cases, rations containing sardine meal, regardless of other constituents, produced larger gains and required less feed per unit of gain than rations not containing this ingredient. However, the sardine meal rations resulted in slightly higher mortality than when this ingredient was omitted, except in the case of the sardine meal-skim milk powder-soybean oil meal combination. Excessive mortality resulted when sardine meal was fed in combination with meat and bone scraps and soybean oil meal, but this high mortality did not occur when cottonseed meal replaced soybean oil meal in the mixture. In practically all cases, soybean oil meal and cottonseed could be used interchangeably and also dried skim milk and meat and bone scraps could be interchanged without appreciably affecting results. It appeared that, with the exception of the sardine meal-meat and bone scraps-soybean oil meal mixture, any of the combinations tested could be recommended to give satisfactory results, and that availability and cost per hundredweight should determine which one to use.

Expeller and Solvent-extracted Soybean Oil Meal Compared. R. M. Bethke and M. C. Sweet. Ohio Bi-Monthly Bulletin, July-August, 1939.

Toasted solvent extracted soybean oil meal was comparable to the expeller meal in feeding value for chicks.

In the ration where toasted solvent extracted soybean oil meal was the only source of supplemental protein, there was evidence of a vitamin K deficiency, the anti-haemorrhagic vitamin, in a few of the chicks.

The inclusion of 5 per cent. dried skim milk in the ration resulted in significant increases in growth, and further replacement of part of the soybean oil meal with meat scraps and fish meal gave additional growth increases.

A Comparison of Dry Milk, Meat and Bone Meal, and Combinations of both as Protein Supplements for Egg Production and a Critique of Methods. E. W. Henderson. Iowa Experiment Station. Poultry Science, Vol. 18, 1939, p. 106.

Employing the all-mash method of feeding, the influence of eight different protein supplements on the egg production of White Leghorn pullets and hens was measured by three different statistical procedures. The various supplements included dried milk at 15, 10 and 5 per cent. levels, meat-and-bone meal at 10 and 5 per cent. levels, and combinations of dried milk and meat-and-bone meal at 5 and 5, 9 and 5, and 5 and 8 per cent. levels. An analysis of variance of the average annual egg production (October 1st to September 30th) of pullets failed to show any significant differences between the various pens. However, when the October production records were omitted and the production records for the remaining 11 months were similarly analysed, significant differences appeared. When yearling hens were distributed among the pens with respect to the previous year's production, highly significant differences were obtained by the three methods of calculation. The average egg production (11 months) was 152, 139 and 121 eggs, and the percentage production per hen days was 45, 42 and 37 for the milk, the combination, and the meat-and-bone meal groups, respectively.

The Effects of Rations containing different amounts of Shrimp Meal on the Egg Production of Ducks. F. M. Fronda, L. Mencias and E. Basio. Philippine Agriculturist, Vol. 27, 1938, p. 278.

In order to produce the same number of eggs shrimp meal had to be fed at a higher level than fishmeal. The control group receiving 30 per cent. fish meal produced at the rate of 50·4 per cent. of the optimum. Other three lots receiving 20 per cent., 35 per cent. and 40 per cent. respectively of shrimp meal gave average productions of 43·7, 46·4 and 51·6 per cent. Mortality was lowest (13 per cent.) on 20 per cent. shrimp meal ; in the other groups it was over 20 per cent.

The Use of Copra Meal in Duck Rations for Egg Production. F. M. Fronda and E. Basio. Philippine Agriculturist, Vol. 27, 1938, p. 173.

Four groups of 30 ducks were fed as follows : group 1 control, 30 per cent. fish meal ; group 2, 20 per cent. fish meal and 10 per cent. copra meal ; group 3, 10 per cent. fish meal and 20 per cent. copra meal ; group 4, 30 per cent. copra meal. Egg production over a period of 73 days was 28 per cent. of the theoretical in the control group and only 3 per cent. in group 4. Groups 2 and 3 had a production of 21 and 17 per cent. respectively. Rather less food was consumed by group 4 than by the others but in no case did the health of the birds suffer.

The Growth-promoting Qualities of various Protein Concentrates for Leghorn Chickens. J. J. Bronkhorst. Onderstepoort Journal of Veterinary Science, Vol. 10, 1938, p. 481.

Comparable groups of baby chicks, given meat meal supplements from different sources, did not grow at the same rate, even though the diets were balanced to the same level of protein. The incidence of nutritional paralysis (curled toes) varied also with the meal used. As a protein supplement fish meal was very much inferior to meat meal and also to crayfish meal and whale meal. Growth promoting value of fish meal was greatly enhanced however, when it was combined with a small amount of brewer's yeast or casein. This improvement was most marked in the case of casein, but yeast apparently supplied some factor which prevented nutritional paralysis.

The Influence of the Protein Level of the Diet on the Growth, Egg Production, Egg Weight and Mortality of Single Comb White Leghorn Pullets. J. J. Bronkhorst. Onderstepoort Journal of Veterinary Science, Vol. 10, 1938, p. 469.

With a basal mash consisting of yellow maize and wheat by-products, 10 per cent. of meat meal was as satisfactory as 15 or 20 per cent. during the period from 9 weeks to maturity. Age at sexual maturity and subsequent egg yield were unaffected by the different amounts used, but size of egg was directly dependent on the level of meat meal.

On all three rations there was a high mortality, but it was much higher in the group receiving 10 per cent. than in those on higher levels. This was largely accounted for by the prevalence of prolapse on the low level of meat meal. Here there were 22 cases of prolapse compared with 13 and 3 in groups receiving 15 and 20 per cent. meat meal, respectively. Prolapse was frequently followed by cannibalism. The occurrence of this disorder did not appear to be influenced by egg size, egg yield or age at sexual maturity.

The Protein-minimum for Laying Hens. Weitere Beobachtungen über das Eiweissminimum bei Legehühnern. Fangauf and Haensel. Archiv für Geflügelkunde, Vol. 9, 1939.

Summary :

In this experiment six pens of 230 Leghorns each were fed increasing amounts of protein for a time of 9 months. In the first three pens the birds received 12, 9 or 6 grammes fish meal respectively per day, in the other three groups the birds received 100, 75 or 50 grammes skim milk instead. The difference between the amounts of mash consumed by the various groups was not significant and bears no relation to the protein level of the ration. There was, however, a marked influence of the feeding of milk the nutritive value of which had already been noted in former experiments, for, the amount of hard grain fed being equal, the pens fed fish meal consumed an average of 64 grammes of mash a day, but the pens fed milk only 53 grammes. There was a gradation of egg production in accordance with the protein level of the ration, yet the rate of difference was much less significant than it was in the doses of protein fed. This fact confirms our conclusion that the protein level usually employed is unnecessarily high and may be considerably reduced with the aim of a more economical utilisation of our limited stores of protein feeds. In the winter an amount of 7·5 grammes fish meal in the daily ration of a laying hen is sufficient, in summer 6 grammes. This means that a winter laying mash must contain 15 per cent. fish meal, and a summer laying mash 12 per cent. In the pens fed fish meal egg weight was decreasing in accordance with the decrease of the protein content of the ration.

At the protein levels tested no significant relation could be established between hatching results, body weight, or the physical condition of the birds and the amounts of protein given.

Experiments with Different Levels of Protein in the Rations of Laying Hens. Forsog med forskelligt proteinindhold i foderet til aeglaeggende honer. J. Baelum. Beretn. Kgl. Vet. Landbohojsk. landokon, Forsogslab Kobenhavn, Vol. 181, 1938, p. 173. (Ref. Nutrition Abstracts, Vol. 8, 1939, p. 1145.)

The experiments were made on birds of light and medium heavy breeds. The light birds, Brown Italian, require 10·5 to 11 per cent. digestible true protein. This is provided by a daily ration of 65 grammes grain with free access to a mixture containing 16 per cent. of digestible true protein.

The heavier breeds, Plymouth Rock, Rhode Island Red and Sussex, require slightly more total protein and so eat more of the free access food. No advantage is gained by feeding more protein than is provided in this way, but egg yield falls in proportion as the supply falls short of this level.

Studies are also reported of maintenance food requirement for non-laying hens. Reckoned as grain only, the lighter breed (1,600 to 1,700 grammes bodyweight) requires roughly 70 grammes per head daily and the heavier (2,050 to 2,700 grammes bodyweight) from 64 to 87 grammes according to bodyweight.

The Effect of the Level of Protein Intake on the Growth and Feed Utilisation of Turkeys. J. C. Hammond and S. J. Marsden. Poultry Science, Vol. 18, 1939, p. 11.

Seven lots of brown turkeys, totalling 1,379 individuals, were reared to 28 weeks of age on poor grass range with *ad libitum* feeding of both mash and grain. The mash rations varied in protein content about 18 to 30 per cent. by 2 per cent. increments. Mortality, malformation of legs or breastbones, and quantity of feed required per unit of gain were not significantly affected by either the protein content or calcium and phosphorus contents of the mash. During the first 16 weeks the average live weight of the lots was approximately in the same order as the quantity of protein fed. Birds fed the 28 per cent. mash weighed the most of all ages after 12 weeks, attaining an average weight of 15 lb. in 164 days, while birds receiving the 18 per cent. mash weighed the least at all ages and reached a 15 lb. average in 188 days. Under *ad libitum* feeding the birds ate more grain and less mash as the protein content of the mash increased, although the protein intake was not stabilised until the protein content of the mash reached 26 to 30 per cent. The birds receiving the 18 per cent. mash were the most efficient on the basis of total protein and of animal protein required per lb. of gain. Between 21 and 28 weeks of age the protein consumption of all groups was approximately the same, averaging about 16 per cent.

Role of Protein and Water Metabolism in the Pathogeny of Embryonic Stickiness in Chicks. Yu. M. Ogorodniy and E. E. Penionschkevitsch. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

In the course of the embryonic development of a chick, water passes from the albumen into the embryo and thence out of the egg in two ways. The first, prior to the closing up of the allantoic sac, is characterised by the transfer of water through the vascular system ; the water is passed directly from the albumen, the vascular system in the allantois and possibly by evaporation through the wall of the allantois. In the second period (after the allantois is closed up) the albumen together with the water it contains proceeds through the sero-amniotic channel in the amniotic cavity whence it is swallowed up by the embryo. Thus in this case the principal part of the water comes through the alimentary canal just as in post-embryonic development. The route of the water from the yolk through the vascular system loses its dominating significance. During this period water no longer evaporates from the albumen. The embryo begins to take part in regulating the process of the drying up of the egg.

Penetration of large amounts of albumen into the amniotic cavity during the period from the 14th to the 16th days leads to an increase in the volume of amniotic fluid in our control group, and to an increase in the protein contents in the fluid which results in heightened viscosity. By the end of the period of development, the embryo swallows up a considerably increased quantity of amniotic fluid due to which its volume rapidly decreases. At the same time viscosity also grows considerably less. During normal development there is practically no amniotic or allantoic fluid left at the moment of hatching.

Both the external and internal pathological conditions which we have studied serve to upset the natural process of accumulation and consumption of the amniotic fluid.

(*a*) They lead to a delay in the penetration of albumen into the amnion and to the increase in the quantity of albumen penetrating the latter. This results in an abnormal growth in the volume of the amnion and to an increase in its protein contents. By the time development is completed the egg still contains a certain amount of amniotic fluid with an abnormally high viscosity, due to a large content of protein which accounts for its glutinosity.

(*b*) Shortage of vitamin B_2, especially of flavin, leads to a delay in the consumption of the albumen, as a result of which an abnormally large amount of both water and protein penetrates into the amnion, thus leading to approximately the same results as in the case of increased moisture.

(*c*) A low amount of moisture accelerates the consumption of amniotic fluid, reduces it viscosity after the 16th day, but in the last period of incubation causes a delay in the consumption of the albumen, as compared with the control. This may lead to unfavourable results. If we compare the possible roles of the amniotic and the allantoic fluids in the pathogeny of glutinosity, we find that the allantoic fluid is not an important factor in this respect. It should be presumed that such an acute disturbance of water and protein metabolism as observed in the case of glutinosity is connected with other disturbances in the processes of embryonic metabolism, and by influencing them leads to a weakening of the organism. Therefore the lethal effect of glutinosity is not only the result of mechanical processes. On the basis of our investigations we arrived at the following conclusions.

1. " Stickiness " is the result of a disturbance in the water and protein metabolism due to a disturbance in the consumption of the albumen.

2. The occurrence of glutinosity results in the disturbance of the physical and chemical properties of the amniotic fluid and the process of its accumulation and consumption.

3. Changes in the above-mentioned properties have their own specific features which depend upon the action of some or other etiological factors, in particular the amount of moisture during incubation and the lack of vitamin B_2, as studied in our experiments. This makes it possible to make practical use of viscosity and the varying volume of amniotic fluid as compared with other factors, in incubational diagnostics.

4. The allantoic fluid plays no role in the formation of glutinosity.

5. The conditions and the process of the formation of glutinosity can to a certain degree be altered through the influence of external factors of incubation and particularly the humidity of the air.

6. The present investigation has proved that the stickiness of embryos is caused by high humidity of air and low quality of eggs due to a shortage of vitamins of group B in the feed or the incorrect protein feeding of the parent stocks. The combination of both these factors is particularly ruinous. Low temperature during incubation is another factor leading to the occurrence of glutinosity.

Therefore measures which could somewhat reduce glutinosity (particularly in the case of pathological eggs) are the stimulation of the development of embryos under favourable temperature conditions during incubation and a sufficiently strongly reduced percentage of humidity between the 10th and the 17th-18th days of incubation. The factor which prevents the tendency towards development of glutinosity in eggs is a sufficient supply of supplementary items in the feed of the hens, especially of vitamin B_2.

SUNDRIES

Observations on the Natural Food of the Young Chick of the Domestic Fowl. A. Brownlee. The Veterinary Journal, Vol. 95, 1939, p. 394.

The analysis of the contents of the crops of domestic fowl chicks kept under natural conditions and destroyed for examination at ages varying from 2 days to 36 days showed that under the conditions of the experiments the food consisted of a mixture of animal and vegetable material. The type of food picked up by these chickens appears to be governed largely by availability.

Grass blades and other green leaves were very rarely eaten by the chicks up to the time of the conclusion of the experiment.

The animal food consumed was more easily digested than the vegetable.

The Effect of Chondroitin Sulfuric Acid on Gizzard Erosion and Growth in Chicks. L. A. Crandall, Jr., F. F. Chesley, R. E. Gray, and H. E. Robinson. Journal of Nutrition, Vol. 17, 1939, p. 53.

A series of tests was conducted with chicks to determine the growth-promoting and gizzard-erosion-preventing activity of both commercial and purified chondroitin sulphuric acid when added at 3 per cent. levels to a commercial chick mash and to three different types of basal diets used by other investigators experimentally to produce gizzard erosions. No evidence was obtained to indicate that either preparation exerted any specific protective action against gizzard erosions. Under certain conditions they did exert a favourable effect on growth, leading to the suggestion that any slight influence upon gizzard erosion might be the result of a general nutritional improvement rather than the action of a specifically protective substance.

Effectiveness of Chondroitin in Preventing Gizzard Erosion in Chicks. H. R. Bird, J. J. Oleson, C. A. Elvehjem and E. B. Hart. Journal of Biological Chemistry, Vol. 126, 1938, p. 671.

The addition of 10 per cent. of cartilage, 3 to 5 per cent. of chondroitin, or of chondroitin sulphuric acid, or of calcium chondroitin sulphate to a diet

which produced gizzard erosion in chicks effectively prevented the gizzard lesions. The chondrosamine portion of the chondroitin molecule was inactive. Bile salts, cholic acid, or aldobionic acid from gum arabic also exhibited protective activity against gizzard erosion in chicks. The evidence for the activity of the glucuronic acid portion of the chondroitin molecule is discussed but further experimental data are required to establish the matter.

The Influence of Bile on Erosions of the Chick Gizzard Lining. H. J. Almquist and E. Mecchi. University of California. Journal of Biological Chemistry, Vol. 126, 1938, p. 407.

Extending these studies, it was established that cholic acid is an effective dietary supplement in the cure or prevention of erosions of the gizzard lining and that dehydrocholic acid is almost as effective, while desoxycholic acid is comparatively ineffective in this regard. A deficiency of bile or cholic acid in the chick leads to gizzard erosions.

Observations and Experiments on Gizzard Erosion in Poultry. W. P. Blount. The Veterinary Journal, Vol. 95, 1939, p. 301.

Conclusions :

1. That gizzard erosion is probably of widespread occurrence throughout Great Britain in numbers of intensively reared chicks, aged 2 to 8 weeks.
2. That the standard mash used successfully for the production of table poultry did not give protection against gizzard erosion when used intensively under the conditions of the experiment.
3. That a ration containing 20 per cent. bran, 12·5 per cent. alfalfa and 3 per cent. dried grass powder did not protect against gizzard erosion, somewhat contrary to the results of Almquist and Stokstad.
4. That dried yeast appeared to accentuate the condition.
5. That gizzard erosion is only one of the findings to be noted *post-mortem* associated with a deficiency of the nutritive factor concerned. Additional gizzard features are haemorrhages, " roughening," pigmentation, exfoliation and necrosis.
6. That the factor concerned appears necessary for the healthy functioning of the tubular glands in the tunica propria of the gizzard. If deficient the horny secretion will become disorganised, with or without haemorrhages in its substance.
7. That only a proportion of chicks in any given batch will be affected, presumably due to varying amounts of the anti-gizzard erosion factor having been inherited *via* the yolk sac.
8. That there is no correlation between body weight, gizzard weight, gizzard weight/body weight ratio and the number or degree of lesions observed.
9. That although some cases of erosion may be associated with mechanical causes and others related to fungous infections of the crop (thrush), the vast majority are due solely to an absence or inhibition of the specific nutritional gizzard erosion preventive factor.
10. That no evidence was obtained to show whether the gizzard lesions observed did effect the well-being of affected chicks relative to coccidiosis.
11. That the whole problem requires careful investigation to decide its importance and significance for the practical poultry farmer.

Feeding Chickens. H. J. Almquist, T. H. Jukes and W. E. Newlon. California Agricultural Extension Service Circular No. 108, August, 1938, p. 38.

This is a popular treatise on poultry feeding, which includes much recent information on the subject and is primarily intended for commercial poultry keepers.

A New Factor required for Growth and Reproduction in the Domestic Fowl. J. C. Bauernfeind, A. E. Schumacher, A. L. Hodson, L. C. Norris and G. F. Heuser. Society of Experimental Biology and Medicine Proceedings, Vol. 39, 1938, p. 108.

In trials with chicks involving the use of a heated diet adequate in all known vitamins except the antidermatosis factor and nicotinic acid, it became evident that supplementing this diet with the above factors resulted in a significantly slower rate of growth than was obtained by feeding the unheated diet. Similarly in trials with laying hens, feeding the heated diet supplemented with the antidermatosis factor or nicotinic acid resulted in very low hatchability of eggs as compared with the unheated diet. An unidentified factor which corrected the above-described deficiencies was provided in yeast, milk, and cereals. The factor was destroyed by heating in a dry atmosphere for 36 hours at 120° C. It appeared improbable that it was identical with the grass-juice factor or that it was of a protein nature.

The Feed Cost of Producing Eggs in New Jersey in 1938. L. M. Black. New Jersey Station. Hints to Poultrymen, Vol. 26, 1938, No. 1.

A summary of 14 individual flock records showed an average annual egg production of 181·2 and 136 eggs per pullet and per hen respectively, an average total feed consumption of 95·3 lb. per bird, and an average return above feed costs of $2·13 per bird, based on the average number of birds for the year. The percentage decrease in number of birds during the year was 48·8 and 45·7 for pullets and hens respectively.

The Utilisation of the Energy of Feed by Growing Chickens. G. S. Fraps and E. C. Carlyle. Texas Station Bulletin, No. 571, 1939.

Productive energy of a basal mixture of feed based on 11 experiments involving 256 chicks is reported. Representative chicks were analysed at the beginning of the test, and all chicks were analysed for protein and fat at the end of the test. The gains in energy of the chicks, the quantity of feed consumed, and the length of the feeding period gave data from which the maintenance requirement of the chicks and the productive energy of the feed were calculated. Individual chicks varied appreciably in their capacity to grow and to utilise feed. Maintenance requirements and productive energy, calculated on the assumption that maintenance requirement varied according to live weight, varied less and were in closer agreement with values reported by other investigators than when calculated on the assumption that maintenance requirement varied according to the surface area of the bird. The average maintenance requirements of chickens from 28 to 42 days old was 74·8 grammes of total feed, 63·3 grammes of effective organic constituents, 48·7 grammes of effective digestible nutrients, 134 calories of productive energy or 200 calories of metabolisable energy. The ration averaged 1·79 calories of productive energy per gramme of feed, 2·14 calories per gramme of effective organic constituents, and 2·77 calories per gramme of effective digestible nutrients, and 67·6 per

cent. of the calories of metabolisable energy over maintenance was used for productive purposes. An average of 25·8 per cent. of a limited (about one-half) ration and 42·1 per cent. of a full-fed ration was used for gain in weight.

Nettles in Poultry Feeding. L'ortica nell'alimentazione dei polli. R. Marracino. Quad. Nutrizone, Vol. 6, 1939, p. 1. (Ref. Nutrition Abstracts, Vol. 9, 1939, p. 499.)

Experiments conducted over considerable periods on White Leghorn hens, singly and in groups, showed that nettles, Urtica dioica, given as green fodder or as hay, were relished by the fowls, which maintained weight and improved laying capacity when the nettles were fed at a level of about 10 per cent. The hay is recommended as a valuable food for chickens. Analyses of the material are quoted. Detailed observations are reported on the physico-chemical action of nettles fed to fowls. There is a lengthy discussion of the therapeutic and nutritive values previously reported and poultry farmers are advised to use this cheap fodder.

Economic Aspects of Poultry Keeping in Canada with Special Reference to Egg Production. S. Bird and J. W. Sinclair. Scientific Agriculture, Vol. 19, 1939, p. 551.

A difference in egg weight of 10 grammes corresponded to 8·79 grammes of food consumed. Large birds at a given level of production utilised smaller percentages of the total food for eggs than smaller birds. Theoretically the smallest possible bird giving the highest possible production is the ideal unit for economy. To some extent this viewpoint was found to be supported in fact, but owing to the limitation of experimental data it was not possible to analyse how far down the scale of body size this holds. Under battery conditions total annual food consumption per bird for the White Leghorn (a small breed) was 69 lb. and for the Barred Plymouth Rock (a large breed) 97 lb. When similar birds were run in pens, their annual requirements were 82 and 106 lb. respectively.

A Study of the Energy Required for Maintenance, Egg Production, and Changes in Body Weight in the Domestic Hen. S. Bird and J. W. Sinclair. Division of Poultry Husbandry, Central Experimental Farm, Ottawa, Ontario. Scientific Agriculture, Vol. 19, 1939, p. 542.

1. Partial correlation coefficients show that, in the ratios indicated by the coefficients, the weight of ingested feed is positively and significantly correlated to weight of the body that is to be maintained, weight of egg material that is being produced, and to weight of change in body weight.

2. Requirements for maintenance decline from values indicative of the high immature metabolism to their lowest values during April and May. Through the remainder of the year there is again a steady rise in metabolism.

3. In the somatically immature bird the efficiency wherewith feed is utilised for purely egg production purposes is about 75 per cent. Through the remainder of the year subsequent to reaching somatic maturity this efficiency drops to about 60 per cent. which is of the same order as that reported in the literature for milk production in cows.

4. The partial correlations between change in body weight and egg production are negative in all instances. They are on the borderline of significance through periods in which losses in body weight occur, but highly significant and of practical value when gains in body weight obtain. Body

reserves are therefore drawn upon with little certainty in the support of egg production, whereas the storing up of such reserves actively inhibits the formation of eggs.

5. The partial correlation coefficients show that the total weight of the weekly egg production is independent of body size.

6. The relationships that have been demonstrated for one breed probably hold for most other breeds.

Home produced Feeds for Laying Hens. Forsok med Norskavlet for til verpehoner. I. Finne and T. B. Hesthamar. Second Report from the State Training School for Teachers to Smallholders, 1939, p. 42. (Ref. Nutrition Abstracts, Vol. 9, 1939, p. 499.)

In the first report published in 1937 it was found that laying pullets could consume about 15 per cent. of their food requirement as boiled potatoes. Further experiments showed the beneficial effect of sour skimmed milk, as 15 to 18 per cent. of the total food requirement, on egg production and hatchability of eggs.

In the second report the results of further experiments are given confirming those already found. Potatoes and skimmed milk were excellent foods for laying hens and may profitably be given combined in a ration of grains and a mixed dry mash. The potatoes seemed to counteract the tendency of the milk to give a somewhat loose and liquid egg white. Small sized birds (Leghorns) should be restricted to 50 to 60 grammes potatoes and 80 to 100 grammes skimmed milk per bird per day.

A.I.V. silage may be given to laying hens. There were no adverse effects on the quality of the eggs produced when 30 grammes kohlrabi were replaced by 20 grammes A.I.V. silage.

Methods of Feeding Laying Hens. E. T. Robertson, J. S. Carver, and J. W. Cook. State College, Pullman, Washington. Bulletin No. 381, July, 1939.

Five methods of feeding laying hens were compared, using 340 White Leghorn pullets in five duplicate lots for nine 28-day periods. The methods of feeding studied were : (1) all-mash, adjusted for the amount of grain usually consumed by birds ; (2) a basal mash with grain fed in litter ; (3) a basal mash with grain fed in hoppers ; (4) a basal mash with grain in litter and supplementary feeding of pellets ; (5) free choice of grains and a high protein concentrate. Egg production and variation in yolk colour were greatest in lots with free choice of concentrates and grain. Egg production was lowest in lots fed the all-mash ration.

When grain was restricted to 7 lb. per 100 birds per day, the birds in this experiment consumed a ration containing approximately 70 per cent. mash and 30 per cent. grain. Where supplemental pellets were fed, a reduction in the mash consumption resulted. Hens with a free choice of a high-protein concentrate and cracked corn, wheat and oats, consumed 58 per cent. wheat ; 21 concentrate ; 12 corn, and 9 oats. Feed cost per dozen eggs was lowest (8.6 cents per dozen) with birds on free choice of feeds, and highest (10.8 cents per dozen) on all-mash ration. It required 6·3 lb. of an all-mash ration to produce a dozen eggs, as compared to 4·9 lb. of feed in the free choice lots. Supplemental pellet feeding showed no advantage in egg production when the feed cost per dozen was considered.

Mortality apparently was not influenced by the methods of feeding, but resulted from the manifestation of the leukosis complex.

As a result of this experiment it would appear that any of the methods of feeding laying hens used with the exception of the all-mash method gave equally good results in egg production.

Advances in Poultry Nutrition. L. C. Norris. Cornell University. Floor and Feed, 1939, p. 8.

A summary, with particular reference to the quantitative requirements for calcium, phosphorus, manganese, the vitamins A, B, D and G (riboflavin) and the antidermatitis factor.

An Individual Chick Cage for use in Poultry Nutrition Studies. A. E. Tepper. University, New Hampshire. Poultry Science, Vol. 17, 1938, p. 451.

An individual chick cage which has proved very satisfactory in nutrition studies is described and illustrated.

The Response of Laying Hens to Sudden Feed Changes. G. R. Sipe and H. D. Polk. State College, Missouri. Poultry Science, Vol. 18, 1939, p. 394.

Suddenly changing the feed of layers did not reduce egg production during the first month after the change, nor did it cause the birds to moult.

The 15 hens averaged 157·7 eggs each. Four pens of birds comparable except for feed changes averaged 136·25 eggs each. The annual average egg production of birds subjected to four changes of feed was higher than that of four comparable lots with feed unchanged.

Feeding Systems for Laying Hens. M. O. North. University, Wyoming. Agricultural Experiment Station. Bulletin No. 230, November, 1938, p. 15.

In a comparison of various feeding methods over a 3-year period, the all-mash method gave slightly the best results. The usual system of feeding mash *ad lib.* with a limited grain allowance fed twice daily was almost as good. Various modifications of the latter method, involving, for example, the feeding of both mash and grain to appetite or the feeding of mash to appetite with a single feed of grain each day, were also quite satisfactory.

The Cannibalism-preventing Properties of Oat Hulls. M. W. Miller and G. E. Bearse. Poultry Science, Vol. 17, 1938, p. 466.

This attempt to determine the constituent of oats which prevents cannibalism showed that oat hulls and oat mill feed were as useful as oats themselves, whereas manganese sulphate, the ash of oat hulls, or the ash of whole oats were valueless. Cannibalism appeared to be somewhat less severe when the basal diet free from oats, was supplemented with spruce sawdust.

The Cannibalism Preventing Properties of the Fibre Fraction of Oat Hulls. G. E. Bearse, V. L. Miller and C. F. McClary. West Washington Experiment Station. Poultry Science, Vol. 18, 1939, p. 401.

Oat hulls and oat hull fibre tend to reduce the severity and incidence of feather picking and cannibalism.

Effect of Fibre and Bulk in the Diet of Chickens on their Growth and on the Prevention of Feather Picking and Cannibalism. E. J. Sheehy. University College, Dublin, Eire. 7th World's Poultry Congress, Cleveland, 1939.

A feed mixture which, in addition to being complete, contains the proper amount of bulk and fibre, *i.e.*, is satisfactory from the mechanical aspect, controls feather picking.

Poultry Feeding Tests. Results at Werribee. W. O. Frederick and A. G. Clark, Journal Department of Agriculture, Victoria, Vol. 36, 1938, p. 500.

Hens allowed soaked grain and meatmeal consumed considerably less food than those fed dry mash and grain, but their egg yield was also rather lower. Those receiving wheat as the only soaked grain laid more eggs than those fed a mixture of grains. With wheat, however, meat meal was consumed in greater quantity.

Poultry-Feeding Experiment. Relative merits for egg-production. W. J. Jourdain. New Zealand Journal of Agriculture, Vol. 57, 1938, p. 519.

The following methods of feeding were compared : (1) a mash of bran, pollard and meat meal with wheat, maize and barley as grain ; (2) same as (1) but with meat meal also fed from a hopper ; (3) a mash mixture of bran, meat meal and linseed meal in combination with soaked wheat ; (4) a more complicated dry mash combined with wheat as a grain feed ; (5) similar mash to (3) but with soaked barley substituted for soaked wheat. Egg yield and net profit over food cost were in the above order. Soaked barley was unsatisfactory owing to fermentation.

Feeding Tests at Parafield Poultry Station.

A new series of feeding tests was commenced at Parafield Poultry Station on April 1st, 1937. Five tests have been arranged each of 50 White Leghorn pullets. The principal object of these tests is to collect some accurate data concerning the results obtained from the soaked grain method of feeding in different ways, also the production of the birds under the various methods of feeding. The following is a list of the tests that have been arranged.

A. Morning—Soaked wheat at rate of 8 lb. grain per 100 birds, meat meal ½ lb. per 100 birds, greenfeed same quantity as dry grain. Afternoon—Same as morning, but meat meal ¼ lb. per 100 birds.

B. Morning—Soaked wheat at rate of 8 lb. per 100 birds, ¼ lb. meat meal per 100 birds, ¼ lb. linseed meal per 100 birds, greenfeed same as No. 1 test. Afternoon—Same as morning, but without the ¼ lb. linseed meal.

C. Morning—Soaked wheat once a day at rate of 8 lb. per 100 birds, meat meal ¾ lb. per 100 birds. Afternoon—Dry wheat at rate of 1¼ oz. per bird.

D. Morning—Soaked barley twice a day at rate of 8 lb. per 100 birds, greenfeed same quantity as dry grain, meat meal ¼ lb. per 100 birds. Afternoon—Greenfeed same quantity as dry grain, meat meal ¼ lb. per 100 birds.

E. Morning—Soaked wheat and barley at rate of 4 lb. wheat and 4 lb. barley per 100 birds, greenfeed same bulk as dry grain, meat meal ½ lb. per 100 birds, linseed meal ¼ lb. per 100 birds. Afternoon—Dry grain at rate of ¾ oz. wheat per bird and ¾ oz. barley per bird.

The quantities of foodstuffs as stated in the tests are given as a basis, but are liable to slight variations from time to time, according to seasonal conditions, and the requirements of the birds.

Test.	Total Eggs Laid from April 1st, 1937, to March 31st, 1939.
A	12,740
B	13,967
C	13,817
D	11,894
E	13,161

Digestion of Food by the Pigeon. Die Verdaulichkeit der Futtermittel bei der Taube. E. Mangold and A. Hock. Archiv für Geflügelkunde, Vol. 12, 1938, p. 334.

Results are summarised from a large series of digestibility trials with carrier pigeons. Proteins and starch were well digested, but not the non-starch components of the N-free extract. The average digestibility co-efficients for protein and fat were rather higher, and those for N-free extract and fibre rather lower, than in the case of the fowl.

Feeding Homing Pigeons. Versuche über Haltung und Aufzucht von Brieftauben bei einfacher Fütterung. Mangold and Damköhler. Archiv für Geflügelkunde, 1939, Nos. 4-5.

Summary :

To find out whether homing pigeons can be fed with home-grown foodstuffs, one group of pigeons was kept on beans and vetches, and one group on barley and oats exclusively.

The main difference in the two diets was one in the proportion of albumen. This was 1 : 1·2 for diet No. I and 1 : 5·8 in diets No. II.

Exactly the same result was obtained in both groups, Group I averaging 5·44 eggs and 2·6 adult young per pair, Group II gave 5·45 eggs and 2·9 young.

The young pigeons were kept on the same food, and those in Group I averaged 411 grammes for males, and 373 grammes in females, whereas the pigeons in Group II weighed 383 and 348 grammes. The differences were not significant.

No significant differences in weight were found in the adult pigeons of the two groups.

The methods are fully discussed, and new experiments are planned.

Feeding and Confinement Rearing Experiment with Turkeys during 1937 (Third Report). F. N. Barrett, C. G. Card, and A. Berridge. Michigan Station. Quarterly Bulletin No. 21, 1938, p. 79.

The third year's results in this series of trials essentially confirmed previous findings. A 27 per cent. protein mash ration containing ground corn and ground oats as the principal grains, and meat scrap, soybean oil meal, and dried skim milk as the principal sources of protein, with corn as a scratch grain, continued to produce thrifty turkeys with smooth, lustrous plumage and of

excellent market quality and is recommended as an excellent all-purpose mash. Substituting barley for corn in both the mash and grain rations gave practically as good results and may be safely recommended. A 25 per cent. protein mash in which corn gluten meal replaced the dried skim milk failed to give satisfactory development and is not recommended. There was little, if any, economy or advantage in substituting an 18 per cent. protein mash for the 27 per cent. protein mash after turkeys were from 8 to 12 weeks of age. Turkeys on the lower protein mashes consumed more mash and less grain than those on the higher protein mashes. All turkeys consumed a greater proportion of grain and a lower proportion of mash as they approached maturity.

A cobblestone turkey yard satisfactorily employed during the 1937 season is described.

Finishing Rations for Turkeys. E. I. Robertson, J. S. Carver, and J. W. Cook. Washington Agricultural Experiment Station. Bulletin No. 372, March, 1939.

Summary :

Very slight differences were noted in the body weight of turkeys at 20 weeks of age when fed different methods. The average weight of the toms at 20 weeks was 17·5 lb. and of the hens 11·9 lb.

Equally as good results were secured in hopper feeding of grain as hand feeding of grain to turkeys from 6 weeks on. At 28 weeks of age there was very little difference between live body weights of the various lots of hens or toms fed different finishing rations plus alfalfa. The average gain for the toms was 8·4 lb. as compared with 4·0 lb. for the hens for the 8-week finishing period.

The turkeys consumed approximately 48 per cent. of their total feed during the 2-month finishing period. When the scratch grain contained a high percentage of corn, the turkey consumed a higher percentage of grain than when fed a low corn mixture.

Hens showed approximately 2 weeks earlier feathering and fleshing than the cocks as measured by scored observations. Feather picking occurred only on the toms, and was restricted to the new main tail feathers. The shrinkage between the live weight before killing and the dressed weight was 9 per cent. after 24 hours starvation period on wire floors.

There was little difference in the dressed body weights of the same sex turkeys in various lots. All lots showed a high percentage of top U.S. grade of turkeys. Hens graded higher than toms—95·8 per cent. prime hens or better, and 83·1 per cent. prime toms or better.

The ration showed practically no difference in average returns per turkey over feed cost, with a range of $2.19 to $2.35.

All finishing rations used in this experiment gave good results in growth, feathering and fleshing. The high corn ration gave more colour and greater gains to the turkeys than the lower corn rations. Hens had more colour than toms.

The Food of Partridge Chicks (Perdix perdix) in Great Britain. J. Ford, H. Chitty and A. D. Middleton. J. Animal Ecol., Vol. 7, 1938, p. 251. (Ref. Nutrition Abstracts, Vol. 8, 1939, p. 1147.)

The results are tabulated of the detailed analyses of the crop contents of 69 partridge chicks mostly from grass, clover and lucerne habitats. During the first 2 weeks after hatching the food was chiefly animal, during the 3rd week a change occurred and from 3 weeks onward the food was almost entirely vegetable. It is considered that feeding on insects is probably a random process since the species most abundantly eaten were those most numerous or

most easily available in the bird's habitat. The most important insect forms eaten were clover weevil larvae. Lepidotera larvae, springtail (*Sminthurus viridis*), Aphididae and ants.

Turkey Feeding Experiments. T. H. Jukes. California. Turkey News, August, 1938.

A comparison was made of three types of finishing mashes for fattening turkeys from 18 to 30 weeks of age. One contained 32 per cent. of protein and the other two 20 per cent. of protein, with one of the latter containing 3 per cent. of dehydrated molasses and the other none. Each was supplemented with whole scratch grains (wheat 70, barley 60). All rations produced satisfactory gains, the average gain in 12 weeks ranging from 9·5 to 10 lb. for males and approximately 5 lb. for females. The consumption of scratch grain was relatively much higher with the high protein mash so that the protein content of the total feed consumed was 18·2 as compared with approximately 16 per cent. on the lower protein mashes. The feed required per unit of gain and feed cost per lb. of gain was very similar for the three rations.

ANATOMY AND PHYSIOLOGY

ANATOMY

Notes on Cross-beak in Fowl. W. Landauer. Connecticut. Storrs Experiment Station. Journal of Genetics, Vol. 37, 1938, p. 51.

Four types of cross break in fowls are noted. One type was associated with eye defects; one occurred in homozygous creepers; and two types, one present at hatching and on developing later, were hereditary and had a complex mode of inheritance. Cross break was not a true lethal, but mortality was heavy after hatching. Crossing of the upper beak toward one side or the other seemed more frequent in certain types, but the breeding data did not bear out its hereditary nature. A fifth type of cross beak involving a short but straight upper beak at hatching which later became crossed was also noted.

The Blood Picture at Birth in the Chick. W. P. Blount. The Veterinary Journal, Vol. 95, 1939, p. 193.

Description of the blood picture at birth in the chick with a table of the normal blood picture of the domestic hen.

Thrombocyte Formation in the Domestic Hen. The Veterinary Journal, Vol. 95, 1939, p. 195.

Description of the thrombocytes in the hen and thrombocytopoiesis.

The Respiratory System of the Chicken. W. M. McLeod and R. P. Wagers. Journal of American Veterinary Medical Association, Vol. 95, 1939, p. 59.

Description with illustrations of Nasal Cavity; Infraorbital Sinus; Pharynx; Larynx; Trachea; Syrinx; Thorax; Diaphragm; Thoracic Content; Lungs; Structure of the Lung; Air Sacs.

The Carotenoid Nature of Yellow Pigment in the Chicken Iris. W. F. Hollander, R. D. Owen. University of Wisconsin. Poultry Science, Vol. 17, 1939, p. 385.

The yellow pigment of the chicken is composed of carotene and xanthophyll, according to the solubility tests employed. No carotenoids were found in the iris of the pigeon.

On the Histogenesis of the Pars Hepatica of Chicken Embryos. E. F. Penionchkevitsch. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

1. The above brief paper gives preliminary information on the changes in the correlations between glandular tissue and the lumens of blood vessels, depending upon the conditions of embryonic development.

2. The greatest delay in the development of liver is observed under conditions of increased moisture and lower temperature.

3. In addition to the changes which occur with age as a result of development under high temperature, pathological deviations were also observed in the development of liver.

4. The changes described in our paper in the development of the liver due to different conditions of incubation can be made use of to analyse the causes of certain embryonic pathologies. At the same time it is necessary to continue these investigations of various combinations of temperature and moisture, which have not yet been studied in our experiment.

A Study of the Cell Content of the Blood of Normal Chickens, with special reference to Comparative Differential Leucocyte Counts made with Supravital and Wright's Staining Technics. N. M. Twisselmann. Division of Veterinary Science, University of California, Berkeley. Poultry Science, Vol. 18, 1939, p. 151.

The wide variations found in the successive differential blood counts of the same individual demonstrate that results from a few observations could easily give a very misleading conception of the blood picture of a normal chicken. The variability of results given by different methods of making blood counts might also contribute to the conflicting reports. It is likely that these factors are responsible for much of the divergence in the blood count figures previously reported in the literature.

Forkner (1929) and Cook and Dearstyne (1934), using supravital staining technic, obtained average values for their differential counts, which agree quite closely with those reported in this paper.

Biely and Palmer (1935), reporting on 100 birds, and Emmel (1935) have given total leucocyte counts comparable to those we have obtained, but those reported by the latter showed much less fluctuation between individual counts. Biely and Palmer (1935) also reported total erythocyte counts which were in close agreement with those reported here.

A great fluctuation was found in differential leucocyte counts for the same individual when either the supravital or the Wright's technic was employed. However, the average values of the differential counts on different individuals show much less variation. Changes in the blood picture could not be correlated with age.

Supravitally stained preparations regularly showed greater percentages of polynuclear cells containing rods or granules, of basophiles, and of monocytes, but fewer lymphocytes than corresponding Wright's stained cover-slip preparations. It is believed that this difference may be due largely to the presence of unidentifiable disintegrated cell types in Wright's stained films and to the definiteness with which monocytes can be identified and differentiated from lymphocytes with supravital staining.

For differential counts, preparations stained by the supravital technic seem superior to those stained by Wright's technic because (1) there are no unidentifiable, degenerated cells present; (2) the monocytes can be unmistakably differentiated; and (3) the staining of the cells is always of the same intensity. One disadvantage of supravitally stained preparations is that they do not afford a permanent record—they must be examined within 15 to 30 minutes. Furthermore, until one is familiar with supravitally stained blood films, care must be taken not to overlook lymphocytes. The mean values, standard deviations, and the range of variability within normal limits were established for total erythrocyte and total leucocyte counts and for differential leucocyte counts for the 21 chickens used in these studies. It is not concluded, however, that the values given would apply to other normal chickens kept under different environmental conditions.

PHYSIOLOGY

Cytological Studies on Spermatogenesis in the House Sparrow (Passer domesticus). G. M. Riley. Cytologia, Vol. 9, 1938, p. 165.

Progressive cytological changes in the testes of sparrows are described and associated with the changes in the size of the gonads occurring in the different seasons. The larger chromosomes were paired into 13 groups, but the smaller chromosomes varied from 28 to 34, making a total count of from 54 to 60. One large chromosome was unpaired in female embryos.

Differential Gradient Functions in the Feather Germ. R. M. Fraps. Physiological Zoology, Vol. 11, 1938, p. 187.

"Three orders of pigmentation induced in feathers of the Brown Leghorn male or capon with increasing hormone concentration are described. These are, in terms of loci in the collar of the developing germ, (a) the dorsoventral order previously described in detail by Lillie and Juhn; (b) the ventrodorsal order, which is completely the reverse of (a); and (c) a complex order, proceeding from a medial point in the collar toward both ventral and dorsal collar limits. These orders of pigmentation are interrupted in terms of differential gradient functions, that is, in terms of secondary gradients in the limiting reaction potentials for alternative pigmentation processes. Each of these secondary gradients or gradient functions, is assumed to vary by differing proportionalities with a given change in primary gradient differentials, which are assumed to remain always the same in direction although varying in absolute values in collar limbs of different germs."

Composition of the Uterine Secretion of the Domestic Fowl. B. W. Beadle, R. M. Conrad, and H. M. Scott. Kansas Experiment Station. Poultry Science, Vol. 17, 1938, p. 498.

About 50 samples of the uterine secretion of actively laying hens were obtained either by catheterisation of normal hens or by surgery from anaesthetised birds. Analyses of these samples revealed that this secretion was essentially a mineral solution consisting mainly of sodium, calcium, and potassium present as chlorides and bicarbonates. The small amount of protein present was apparently due to diffusion from the formed egg. A comparison of the analysis of 35 uterine eggs with that of 35 laid eggs from the same hens indicated that the principal additions to the egg during the formation of the outer thin white were water, potassium, and bicarbonate ions with smaller amounts of sodium and chloride ions. The potassium concentration of the uterine solution was approximately ten times that of normal blood serum. The possible significance of this phenomenon is discussed.

Cytochrome of Pigeon-Breast Muscle. K. Laki. Zts. f. Physiologische Chemie, Vol. 254, 1938, 27 ; Chemical Abstracts, Vol. 32, 1938, 7932.

Pigeon-muscle extract contains cytochrome *a, b* and *c*. They are reduced by various agents, as ascorbic acid, in the order *a, c* and *b*. Quinhydrone reduces *c* in these extracts only at alkaline reactions, 0·5 reduction occurring at pH 7·4. Isolated cytochrome *c* is not reduced by quinhydrone. Cytochrome *c* bound to the cell structure is more positive than the isolated substance.

Respiratory Inhibition by Carbon Dioxide Stimulation on the Lungs of Young Ducks. W. F. Windle and D. Nelson. Journal of Cellular and Comparative Physiology, Vol. 11, 1938, p. 325; Chemical Abstracts, Vol. 32, 1938, 6709.

With the vagus nerves intact inspired CO_2 produces slowing and inhibition of respiration of ducks 1 to 10 days old. With the vagus nerves divided high in the neck, CO_2 relieves the dyspnoea which follows the operation and causes deep rhythmic breathing. CO_2 activates inhibitory receptors in the lower respiratory passages. Oxygen-lack due to use of 5 to 7·5 per cent. O in N causes a marked acceleration of respiration.

Metabolism Body Size and Age in Baby Chicks. M. Kleiber. University of California. Society of Experimental Biology and Medicine Proceedings, Vol. 38, 1938, p. 793, Ref. Experimental Station Record., Vol. 89, 1939, p. 383.)

Two series of respiration trials were conducted on fasting baby chicks from 5 to 20 days of age. A steady increase in metabolic rate with increasing age was noted. Based on the extrapolated rate of birth this amounted to from 0·2 to 1 per cent. per day per unit of body weight, 2 per cent. per day per kilogramme$^{\frac{2}{3}}$, and 3 per cent. per unit of surface area. Evidently baby chicks deviated from the general rule which is valid for the relation of body size and metabolism in mature homeotherms.

The Influence of Bile on Erosions of the Chick Gizzard Lining. H. J. Almquist and E. Mecchi. Journal of Biological Chemistry, Vol. 126, 1938, p. 407.

Cholic and dehydrocholic acid were almost equally effective as agents in the prevention of the erosions and the cholic acid content of the lining increased when this acid was given as dietary supplement. Deoxycholic acid had little preventive action. Dehydrocholic acid was more effective in the diet than when given by intramuscular injection. Deficiency of bile or of cholic acid led to erosions of the lining.

Distribution of Phosphorus in the Leg Bones of Chickens. M. J. L. Dols, B. C. P. Jansen, G. J. Sizoo, and G. J. van den Maas. Nature, Vol. 142, 1938, p. 953.

X-ray photographs and determination of the radio-P content of the leg bones of healthy and rachitic chickens 22 hours after injection of Na phosphate containing radio-P have shown that metabolism is more intense in the bones of rachitic than in those of healthy chickens and also more intense in the epiphyseal than in the diaphyseal part of the same bone.

Erythrocyte Number in Young Pigeons and its Relation to Heredity, Growth and Metabolism. O. Riddle and G. E. Cauthen. American Journal of Physiology, Vol. 122, 1938, p. 480.

The authors studied the fluctuations in red blood cell values in pigeons for 100 days after hatching. In the first three days after hatching the number of red blood cells from 1,275,200 to 1,078,000 per c.mm. of blood. At about the 27th day of post-natal life the maximum value of 3,409,700 red blood cells was

reached, and this was maintained for about 30 days. This reduction of red blood cells in early post-natal life has also been observed in rats, rabbits and human beings.

The red blood cell level is closely associated with growth capacity in the first three days. Only the early period (about one-third) of red blood cell increase is associated with an increased basal metabolic rate. After the end of the third or fourth month the red blood cell level and the basal metabolic rate slowly diminish throughout life.

A Note on the Action of Atropine in the Bird. J. D. P. Graham. Journal of Physiology, Vol. 93, 1938, p. 56P.

The author has found from experiments conducted with the duck that the effect of atropine on the bird is not identical with its effect on the mammal. "While the absence of pupillary dilatation is explained by differences in histological structure, the dissimilarity in regard to heart and respiration cannot be explained on this basis. The reaction of the gut to adrenaline is noted with interest."

The Effect of X-rays on the Embryonic Development of Hens' Eggs. M. D. Tarnavs'kii. Akad. Nauk. U.R.S.R., Inst. Zool. i Biol., Zbir. Prac. Genet. (Acad. Sci. Ukrain. S.S.R., Inst. Zool. and Biol., Mem. Genet.), No. 2, 1938, pp. 91-107, figs. 3; Russ., Eng. abs., pp. 103-107. (Ref. Exp. Station Record, Vol. 80, 1939, p. 608.)

X-raying eggs with different doses increased the mortality in proportion to the dose from the earliest stages to six days of incubation and retarded growth after hatching when the heaviest doses were employed. Various monsters also appeared in the X-rayed groups.

Regeneration of Testis in the Fowl, and its Bearing on Germ-cell Theory. C. W. Hooker and B. Cunningham. Anatomical Record, Vol. 72, 1938, p. 371.

A small fragment of the testicle inadvertently left after castration causes the resumption of growth of the comb and head furnishings within one month, but in five cases among approximately 500 capons resumption of comb growth was delayed for more than six months. Evidence, including the testicular tissue removed from three of the five animals and histological study of the testicular tissue present, suggested the regeneration of testicular tissue resembling autoplastic testes grafts, but full spermatogenesis was not observed. However, this evidence is taken to indicate that somatic (peritoneal) cells can be transformed into germ cells.

Influence of Diet on Gonad Activity of English Sparrow (Passer domesticus (Linnaeus)). J. C. Perry. Society of Experimental Biology and Medicine Proceedings, Vol. 38, 1938, p. 716.

Development in the testes and ovaries of English sparrows and darkening of the beaks of males were induced during the nonbreeding season by feeding wheat exposed for over 250 hours to ultraviolet irradiation. The induced spermatogenesis and increased size of the ovaries were similar to that resulting from direct irradiation of the birds.

Some Observations on the Semen Production of the Male Fowl. W. H. Burrows and H. W. Titus. Poultry Science, Vol. 18, 1939, p. 8.

Studies of the semen production by 22 crossbred cockerels and 10 crossbred cocks about 1·5 years of age showed that the average yield per collection was about 19 per cent. greater if collections were made on alternate days as contrasted with daily collections. Full semen production of about 1 cc. per collection was reached at about 275 days of age and maintained throughout the experiment (579 days of age) except during February. On analysis after post mortem, approximately 61 per cent. of the variation in semen production of the individuals was related to testis size. Size of the comb and wattles and other characters including libido were not correlated with semen production.

The Physiology of Development of Feathers, I, II. F. R. Lillie and M. Juhn. Physiological Zoology, Vol. 5, 1938, p. 434.

These papers deal with the fundamentals of the physiology, development and growth of feathers. Part 1 deals with the Growth Rate and Pattern in the Individual Feather and Part 2 with the General Principles of Development with Special Reference to the After-Feather.

Experimentally Induced Mutations in Chickens through X-rays. I. M. Krajevij. Akad. Nauk. U.R.S.R., Inst. Zool. i Biol., Zbir. Prac. Genet. (Acad. Sci. Ukrain. S.S.R., Inst. Zool. and Biol., Mem. Genet.), No. 2, 1938, p. 109 ; Russ., Eng. abs., p. 153. (Ref. Experiment Station Record, Vol. 80, 1939, p. 751.

Irradiation with X-rays of sperm used in artificial insemination of hens reduced the percentage of fertile eggs produced from 54·2 to 30·9 per cent.; increased the production of various forms of head, tail and leg abnormalities, monsters and lethals; lengthened the incubation period slightly; and increased the weight of the chicks hatched alive. Females were more subject than males to the occurrence of both lethal and viable monstrosities.

Feather Characterization as Studied in Host-graft Combinations between Chick Embryos of Different Breeds. B. H. Willier and M. E. Rawles. National Academy of Scientific Proceedings, Vol. 24, 1938, p. 446. (Ref. Experiment Station Record, Vol. 80, 1939, p. 754.)

A further analysis is reported of the role of host and donor in feather characterisation in the graft area. Both skin ectoderm with some mesenchyme attached and pure limb bud mesoderm were used as implants. Down feather pigmentation in skin grafts usually followed that of the donor except in certain White Leghorn grafts in which no white feathers appeared in the graft area. When the juvenile feathers appeared, some showed donor colour; the distal portion of others was the colour of the donor, and the proximal portion was host coloured. The form, rate of growth, and arrangement of feathers were similar to those of the host. Juvenile plumage was generally the colour of the host, and adult plumage was completely so. Both the host and donor play a part in feather characterisation in the graft area. The feather structure is the product of host feather germs, but the colour is controlled by the grafted tissue. Different results with White Leghorn

transplants occurred in that they produced white feathers on Minorcas, but with Barred Plymouth Rock and Rhode Island Red breeds the host feather colour is expressed. The controlling factors are concluded to reside in the skin and are not blood borne.

Reactions of Avian Muscle to Acetylcholine and Eserine. G. L. Brown and A. M. Harvey. Journal of Physiology, Vol. 94, 1938, p. 101.

The responses of normal and denervated avian muscle to acetylcholine and eserine have been studied by the method of close arterial injection. The differences betwen avian and mammalian muscle may be accounted for by assuming that the amount of acetylcholine, liberated by a single impulse at a motor nerve ending in avian muscle, only just reaches the threshold level in the case of most fibres, and is subliminal for some.

Utilisation of Lactose by Poultry. Beitrag zur Verwertung des Milchzuckers beim Geflügel. W. Lenkeit and M. Becker. Ztschr. Tierernährung und Futtermittelkunde, Vol. 2, 1939, p. 15.

An appreciable increase in blood sugar followed consumption of glucose and galactose; laevulose and sucrose had only a small effect, if any; lactose did not effect any change. In the hen glycogen is either not produced from lactose or is produced only in minimal amounts, more than one-half of the lactose being excreted unchanged. The rest of the lactose is disposed of by the enhanced bacterial fermentation, being mainly converted to lactic acid. The use of products rich in lactose for poultry feeding is deprecated.

A Study of Blood and Bone Phosphatase in Chick Perosis. A. C. Wiese, B. C. Johnson, C. A. Elvehjem, E. B. Hart, and J. G. Halpin. Journal of Biological Chemistry, Vol. 127, 1939, p. 411.

A new modification is described of the method of determining blood and bone phosphatase by the hydrolysis of disodium phenylphosphate with subsequent estimation of phenol, a photo-electric colorimeter being used.

Day-old chicks receiving diets containing large amounts of $Ca_3(PO_4)_2$, $CaCO_3$ or Ca lactate developed perosis. If traces of Mn were added to the diet perosis did not occur. Blood and bone phosphatase values fell rapidly during the first two weeks on the diets in both groups but the reduction was greater in the group receiving no added Mn. The greater reduction preceded the development of perosis. In vitro experiments showed that Mn activated, while Ca and Po_4 inhibited, phosphatase action. It is believed that the diminished phosphatase activity of the skeleton is a contributory factor in perosis.

Phosphatase and Inorganic Phosphorus in the Plasma and whole Blood of the Fowl. W. J. Peterson and D. B. Parrish. Poultry Science, Vol. 18, 1939, p. 59.

The average plasma phosphatase values for 27 5-month-old cockerels and nine pullets of the same age were 20·0 and 22·9 Bodansky units, respectively. These values were 21 and 33 per cent. higher than the average values obtained on whole blood, but similar comparisons of 16-month-old birds showed no significant difference between plasma and whole blood. Considerably higher values in both plasma and whole blood phosphates were obtained from younger birds than from older birds of corresponding breed and sex. The inorganic P values for plasma

and whole blood were not significantly different but cockerels at five months had a considerably higher plasma inorganic P than 16-month-old laying pullets; the difference between 5-month and 16-month pullets was much less.

The Physiology of the Reproductive System of the Fowl. E. A. Hewitt. State College, Ames, Iowa. Journal of American Veterinary Medical Association, Vol. 95, 1939, p. 201.

Contents: Descriptions of the reproductive organs of the male and female birds; Acquisition of albumin by the egg; The hen's egg; General aspects of the hen's reproductive system; Abnormal eggs.

The Determination of the Urea in Chicken Blood. S. F. Howell. Journal of Biological Chemistry, Vol. 128, 1939, p. 573.

The values published for the urea N content of normal chicken blood are generally too high owing to erroneous methods of analysis. The average value is 0·7 mg. per 100 c.c. The amount may increase owing to disease. The urea was determind by hydrolysis with crystalline ureas and the NH_3N content was also estimated to obtain corrected values for the urea N.

The Non-fermentable Reducing Substance of Chicken Blood. J. W. Cavett. Poultry Science, Vol. 18, 1939, p. 150.

To ascertain whether the relatively high normal blood sugar level in chickens was primarily due to glucose or partially to non-sugar-reducing material, the non-fermentable-reducing substance in the whole blood, plasma, and cells of 21 chickens was determined. The data presented indicate that the high blood sugar was not due to the latter substance.

Variability of Body Temperature in the Normal Chick. W. F. Lamoreux and F. B. Hutt. Cornell University. Poultry Science, Vol. 18, 1939, p. 70.

A pronounced rise occurred in the body temperature of chicks during the first week after hatching, particularly during the first four days, although no significant differences were noted between average temperatures at 4 and 5 days of age. White Leghorns had a significantly higher body temperature than Rhode Island Reds at 7 to 10 days of age. No consistent relationships were found between temperature and sex or temperature and body weight. Diurnal variations, temperature gradient and differences in the ability of the attendants to record temperatures were other major causes of variation. The necessity of carefully standardised technics for recording temperature and caution in comparing results from the different experiments are stressed.

Factors Responsible for the Sexual Cycle in the English Sparrow (Passer domesticus (Linnaeus)). Ocular stimulation and spermatogenesis; effect of increased light ration on ovarian development. A. R. Ringoen and A. Kirschbaum. University of Minnesota. Journal of Experimental Zoology, Vol. 80, 1939, p. 173.

Studies of the influence of additional light supplied to sparrows during the non-breeding season (with and without blindfolding) on the germ cell development showed that light on non-blindfolded birds greatly stimulated testicular growth

and to a lesser extent ovarian development and enlargement in most cases. These effects were prevented in most birds by blindfolding during the period when the extra light was supplied. Theelin injections particularly duplicated the oviduct enlargement in light-treated females but inhibited the ovarian development. A recent publication by Rowan has indicated that the effect of light in activating the pituitary is to stimulate general activity of the bird.

HORMONES

Comparative Effects of Light Stimulation and Administration of Gonadotropic Hormones on Female Sparrows. G. M. Riley and E. Witschi. Endocrinology, Vol. 23, 1938, p. 618.

Lengthened daily light periods induced only a moderate degree of ovarian development in sparrows. Female sparrows were partially refractory to injections of gonadotropic substances in September and October but less so later in the winter and not at all after February.

Ambisexuality in the Female Starling. E. Witschi and R. A. Miller. Journal of Experimental Zoology, Vol. 79, 1938, p. 475.

The colour of the bill of starlings of both sexes turns yellow during the breeding season, but the bills of gonadodectomised birds remain black. The administration of androgens caused the bills of castrated animals of both sexes to turn yellow, but oestrogens had no effect. This result, together with the effects of the internal secondary sex organs, is taken to indicate the production and release of androgens by the ovary, as well as testis, during the breeding season.

A Pseudogynandromorph in the Fowl. W. F. Lamoreux. Cornell University, Ithaca, New York. The Journal of Heredity, Vol. 30, 1939, p. 79.

The pseudogynandromorph illustrated in this article was produced to demonstrate in a striking manner the effect of female sex hormone upon both the colour and structure of the fowl's plumage.

Egg Shell Puzzle Solved. Dr. M. Altmann and Dr. F. B. Hutt. Cornell University. Poultry Digest, August, 1939.

Apparently a hormone produced by the ovary is accumulated in the developing egg yolks and when it reaches a certain concentration it stimulates the parathyroid glands into activity. When active they produce a powerful hormonal secretion which causes the blood to hold much more calcium than it could without that hormone.

The same effect was provided artificially by injecting egg yolk into non-laying birds. This effect was also induced by injecting purified ovarian hormone without any egg yolk.

Skeletal Changes and Blood Serum Calcium Level in Pigeons receiving Estrogens. C. A. Pfeiffer and W. U. Gardner. Endocrinology, Vol. 23, 1938, p. 485.

In studies at Yale University, daily injections of 1,000 International units of oestrogen into pigeons caused a rise in serum calcium from a normal of 8 to 8·8 mg. per 100 c.c. of serum to values ranging from 13·12 to 21·65 mg. Hypercalcification of the marrow-containing bones began about two weeks after such injections were started and reached a maximum after five weeks. Most of the new bone was endosteal.

Hypercalcification, -Calcemia and -Lipemia in Chickens following administration of Estrogens. W. Landauer, C. A. Pfeiffer, W. U. Gardner, and E. B. Man. Society of Experimental Biology and Medicine Proceedings, Vol. 41, 1939, p. 80.

In further studies, full-grown sexually mature cocks received daily injections of oestrogen ranging from 1,700 to 30,000 International units. After three weeks' injection at the lower level a thin layer of newly-deposited calcium was found on the endosteal surface of the bones. Higher levels resulted in more extreme bone changes and also a marked increase in serum calcium and serum lipids. Extreme lipemia occurred at the highest levels of injection.

The Effect of Sex Hormones on the Combs of Castrated and Normal Cocks. Direct effect of folliculin on the cock's comb. J. Morató-Manaro and A. Albrieux. Endocrinology, Vol. 24, 1939, p. 518.

Neutralising effects of male hormone and folliculin when mixed in vitro prior to application in comb tests were verified. By dividing the combs of capons into anterior and posterior portions and treating one with folliculin it was found that the decreased size resulting was much greater in the half to which the hormone was directly applied than in the other half. A similar local effect was noted in increased comb growth induced by testosterone applied to a portion of the comb even though considerable testicular changes were induced. Assays of female or male hormone must be made on materials freed of the hormone of the opposite sex.

Variations in the Reaction of Chicks to Different Methods of administering Androgens. W. R. Breneman. Endocrinology, Vol. 24, 1939, p. 55.

Studies were made of the comparative comb-growth effects induced in capons by different methods of administering Oreton (testosterone propionate) and Oreton-B (dihydroandrosterone benzoate). Both substances were more effective by subcutaneous than by intraperitoneal injection, but Oreton proved less effective than Oreton-B. There was increased comb response from the administration of the two hormones simultaneously. Birds were induced to crow in seven days after hatching by the administration of Oreton-B and Oreton, but in five days with Oreton-B alone.

The Comb of the Baby Chick as a Test for the Male Sex Hormone. R. T. Frank, E. Klempner, and F. Hollander. Society of Experimental Biology and Medicine Proceedings, Vol. 38, 1938, p. 853.

The chick comb test for assaying the male hormone was made more sensitive and found to give more uniform results with chicks 3 days of age injected for seven days with doses up to 50 gamma of androsterone in 0·05 c.c. of sesame oil than previously when chicks 6 days of age were injected for ten days with up to 500

gamma of androsterone in 0·1 c.c. of oil. Comb weights plotted against dose had the same slope for males and females, with a slightly higher intercept for males.

The Effect of Testis Hormone on the Preservation of Sperm Life in the Vas Deferens of the Fowl. S. S. Munro. Journal of Experimental Biology, Vol. 15, 1938, p. 186.

In a study with mature young cockerels the length of sperm life in the vas deferens under conditions of vas isolation (ligature of the vas deferens at both proximal and distal ends) without castration and accompanied by castration were compared. The mature sperms in the isolated ductus deferens retained the capacity for movement in physiological saline for an average of from 26 to 28 days in each instance, thus indicating that the testis hormone is not directly concerned with the maintenance of sperm life in the excurrent reproductive ducts of the fowl.

The Effect of Temperature on the Response of Bantam Capons to Androsterone. A. M. Hain. Quart. Jour. Expt. Physiol. and Cog. Med. Sci., Vol. 28, 1938, p. 353. (Ref. Experiment Station Record, Vol. 81, 1939, p. 500.)

Comb growth as determined by increase in the length and height in capon Bantams was found to be related to the dose of androsterone administered on five successive days. With 0·25 mg. of androsterone the average growth at a temperature of from 40° to 48° F. was 3·4 mm. as compared with 10 mm. with doses of 1·5 mg. at the same temperature. Temperature also had an important influence, as doses of 0·5 mg. of androsterone caused comb growth of 5·75, 3·3, and about 2·5 mm. when the temperatures of the house ranged from 40° to 48°, 50° to 64°, and 58° to 74°, respectively.

Comb Atrophy after Adult Castration (Bantam Cocks). A. M. Hain. Quart. Jour. Expt. Physiol. and Cog. Med. Sci., Vol. 28, 1938, p. 349. (Ref. Experiment Station Record, Vol. 81, 1939, p. 500.)

Data are reported on the regression in height and length of the combs of 100 Bantams following adult castration. Regression in the length was close to 40 per cent., but the regression in height varied with the initial size. The heights to which the combs of adults regressed were much greater than the heights of the combs of immature castrates.

Maximum Growth Rate of Capon Comb. C. W. Emmens. Journal of Physiology, Vol. 93, 1938, p. 413.

Massive prolonged dosage of Brown Leghorn capons was obtained by the intramuscular implantation of tablets of compressed testosterone propionate. By this method the maximum growth rate of which the comb is capable was determined, the combs attaining a size equal to that of normal cocks in a little over 40 days.

On a Differential Sensitivity of the somatic Tissues to the Male Sex Hormone in two Brown Leghorn X Rhode Island Hens. C. J. Bond. Journal of Genetics, Vol. 36, 1938, p. 367.

Two Brown Leghorn × Rhode Island Red hens which exhibited comb and wattles of the masculine type and sex in difference are described. Small encapsulated

bodies were found in quiescent ovaries. The response of the head furnishings and of feather and other characteristics to the masculine hormone is taken to indicate differential sensitivity of somatic tissues to hormone influence.

The Influence of Testis on Sexual Plumage in the Domestic Fowl. A. W. Greenwood and J. S. S. Blyth. Journal of Genetics, Vol. 36, 1938, p. 501.

Based on the hypothesis that hen feathering in the male is dependent on the sensitivity of the epidermal tissue and the amount of hormone stimulus applied, hen feathering was induced in a Brown Leghorn male by the introduction into the abdominal cavity at 10 weeks of age of testes from six other birds. Observations on two males exhibiting some female characteristics in their plumage gave support to the hypothesis that female feathering in males was attributed to the state of activity of the testes and the sensitivity of the epidermis to hormone stimulation.

Female Hormones and Growth in Chicks and Pullets. F. Vacek. Brno. Annales de Médicine Vétérinaire, February, 1937, p. 78.

The administration of female hormones over long periods (22-26 weeks) in variable doses markedly affects the growth of chicks. Ovarian extract, folliculin, and estrin were used on chicks, beginning at the age of six weeks. The growth and development of chicks given small doses of female hormone in the form of ovarian extract was tardy while large doses of pure hormone favoured growth. The ovaries of those receiving small doses in the form of extract were small and their oviducts short and thin, while these organs in those receiving large doses were well developed —in fact, better than normal ovaries, and the comb, wattles, and plumage were favourably influenced.

The period of laying was retarded in those receiving the small doses. In the group receiving large doses of ovarian extract mixed with the mash, development was much better.

The conclusion drawn from the experiment was that the administration of female hormone to chicks during a long period stimulates growth and the development of the sexual organs. In small doses and in a form not pure, however, hormones employed in the manner mentioned retard growth and sexual development.

The Young Chick as Test for the Thyrotropic Hormone. C. L. Cope, Journal of Physiology, Vol. 94, 1938, p. 358.

Smelser's claim (*Endocrinology* 23 (1938) 429-38) that chicks are convenient test animals for the thyrotropic hormone is confirmed. Thyrotropic substances can readily be assayed by the weight increase of the chick thyroid. This weight is approximately doubled by ⅓ of a Parkes unit of hormone. The behaviour of anti-thyrotropic serum in inhibiting the action of the thyrotropic hormone may also be studied in the chick.

Chick Thyroid as a Basis for Thyrotropic Hormone Assay. G. K. Smelser. Endocrinology, Vol. 23, 1938, p. 429 ; Chemical Abstracts, Vol. 32, 1938, 9227[9].

The chick thyroid is an exceedingly sensitive test for thyrotropic extract. It reacts to one-tenth the amount required to affect the weight of guinea-pig thyroids. Chick thyroid weight increases with the amount of hormone injected over a wide range of dosages. The response is consistent. Crude non-pituitary extracts, urine and blood serum do not affect chick thyroid weight. Histological response is elicited by amounts of extract too small to produce hypertrophy.

The Influence of various Organ Extracts and Hormones on the Development of Chicken-embryo Heart-ventricle Tissue in Tissue Cultures. S. Nisibayasi. Z. klin. Path. Hamatol. (Japan) Vol. 6, 1937, p. 95 ; Nagoya Journal of Medical Science, Vol. 12 ; Abstracts (in German) Vol. 80, 1938 ; Chemical Abstracts, Vol. 33, 1939, 5056[1].

High concentrations of chicken-embryo heart, liver or skeletal muscle extracts favoured tissue growth; low concentrations were unfavourable. The commercial preparations Lacarnol, Romuna Hormone, and Kallikrein inhibited growth in proportion to the concentration.

Substances of the Auxin Type found in the Incubated Hen's Egg and in the Adult Bird. Sur les substances du type "auxines" qui peuvent se révéler dans l'oeuf incubé de poule et chez l'oiseau adulte.
Substances of the auxin type found in the chick embryo. A propos des substances du type " auxines " décelées dans l'ebryon de poulet. H. Berrier. Comptes Rendus Société Biologie, Vol. 131, 1939, pp. 941, 943.

1. No plant growth factors of the auxin type could be isolated from fertilised hen's eggs until after the twelfth day of incubation when they were found not only in the embryo but in the liquor and allantois. In adult birds auxins were identified in the excretory organs but not in liver, heart or muscles.

2. Very small amounts of auxins were extracted by acid hydrolysis from chick embryos at earlier stages than the 12th day of incubation.

Influence of Thyroid on Egg Production. C. F. Winchester. Endocrinology, Vol. 24, 1939, p. 697.

Egg laying of fowls is affected in the same way as the milk yield of cows by thyroidectomy and thyroxine administration. Following thyroidectomy eggs production in a group of seven hens decreased from 3·77 to 0·42 per hen per week. Production of a control group during the same period remained high. Weekly ingestion of 0·93 mg. thyroxine increased production of a thyroidectomised group to 40 per cent. of that of normal fowls and later to 60 per cent. when the dose of thyroxine was doubled.

DISEASES

INFECTIOUS DISEASES

PULLORUM

Use of the Rapid Whole-Blood Test for Pullorum Disease. H. Bunyea. U.S. Dept. Agric. Misc. Pub., 349, 1939.

A practical account with explicit information concerning the qualifications of a pullorum testing agent, including the details of technique and equipment necessary for the work.

Localized Pullorum Infection in the Ovary of a Duck. F. R. Beaudette. Agricultural Experiment Station, New Brunswick, New York. American Veterinary Medical Association, Vol. 92, 1939, p. 100.

Description of a case which appears to be the first record of pullorum infection in an adult duck.

Eighteenth Annual Report on Eradication of Pullorum Disease in Massachusetts. H. Van Roekel et al. Massachusetts Station. Control Service Bulletin No. 93, 1938.

In continuation during 1937-38 of the control work with pullorum disease, a steady progress was made in its eradication. There was a marked increase over the previous season in the number tested, 480,227 birds in 308 flocks, of which 0·17 per cent. reacted, indicating infection, as compared with 448,519 birds in 307 flocks tested the preceding year with 0·37 per cent. reactors.

The First Cases of Pullorum Disease in Turkeys in Italy. Richerche sul primo focolaio di pullorosi nei tacchini riscontrato in Italia. E. Barboni. Clinica veterinaria, Milano, Vol. 60, 1937, p. 597.

Fifteen turkeys, 5 to 10 days old, died after an illness of 3 to 4 days, and a type of *Salmonella pullorum* was isolated. It was found that the eggs of infected turkeys were also infected.

Imminence of Pullorum. The occurrence of Salmonella pullorum in species other than the Chicken. H. Bunyea. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 562.

This is a review of the known facts concerning the occurrence of *S. pullorum* infections in species other than the chicken.

Within the last year it has become evident that pullorum disease is beginning to adapt itself to turkeys in certain important turkey-raising areas.

Cases of pullorum disease in the duck have also been discovered. Pullorum bacilli have been recovered from sparrows, bullfinches, quails, geese, pheasants, pigeons, bitterns, rabbits and guinea fowl.

Comparative Studies of Salmonella pullorum and Salmonella gallinarum. J. A. Dumaresq. Australian Journal of Experimental Biology and Medical Science, Vol. 16, 1938, p. 361.

In comparative cultural studies of four strains of *S. gallinarum* and eight strains of *S. pullorum*, the strains of both could be differentiated by the fermentation of maltose, dulcitol, sodium mucate, and sodium potassium tartrate by *S. gallinarum* and not by *S. pullorum*. They could also be differentiated by their reactions in litmus milk and brom-thymol blue agar. No significant serological differences could be detected by cross agglutination or agglutinin absorption. No VI antigen could be detected in a single strain examined from each species.

PARATYPHOID AND CHOLERA

On the Epidemiology of Salmonella typhi-murium. Ein Beitrag zur Epidemiologie des Bact. ent. Breslau. H. Stenert. Tierärztliche Rundschau, Vol. 44, 1938, p. 565.

An attack of enteritis in a bull found to be due to *S. typhi-murium* was traced to its origin in ducks and geese ; the blood of three out of the 85 geese, of one out of the 26 ducks, and of two horses, and eight calves that shared the pasture contained agglutinins for the organism. It was recovered from mixed samples of faeces of the geese and ducks, and from those of the eight calves on the same pasture. The owner had often lost birds, and on at least one occasion *S. typhi-murium* had been recovered from the carcase. One of the calves was found to be a constant carrier of the organism, but none of them had specific agglutinins in the blood. In view of the evidence given by S. it seems that the calves were just as likely to have been the source of infection as the waterfowl.

Paratyphoid in Ducks. Over Salmonella-agglutinaties bij Woerden en Eenden tijdens de ontwikkeling van Kuikentot volwassen dier. Dr. J. Jansen and W. H. van Haselen. Tijdschrift voor Diergeneeskunde, Vol. 66, 1939, p. 439.

Summary :

Fifty 5-day-old ducks were placed in one run with the water supply outside.

Forty-nine young drakes bred at the same farm were placed in one run with the water supply inside.

In both runs ducks died spontaneously from *S. enteritidis* var. *essen* infection, five in the first run and six in the second. Both sexes are therefore very susceptible to " *essen* " infection. The agglutination tests of the surviving ducks in both groups were negative during the first months. Testing by agglutination before puberty is therefore without value. During and after puberty the number of positive reactions is much larger in ducks than in drakes. A full-fledged duck is therefore more susceptible to " *essen* " infection than a full-fledged drake.

This corresponds with the results obtained in practice ; out of 23·157 ducks 34·8 per cent. reacted positively, out of 4,190 drakes 11·9 per cent. As negative ducks can give a positive reaction in a short time it is necessary to examine the ducks directly before breeding the eggs.

A Note on a Mortality due to Salmonella typhi-murium Infection among Ducks. D. F. Stewart. The Australian Veterinary Journal, April, 1939, p. 67.

Description of a case where 2,000 ducks from 2½ to 6 weeks of age out of a total of some 10,000 ducks had died within several weeks. In the blood and tissues of dead birds *S. typhi-murium* was found.

Salmonella Infections of Ducks and Ducklings. J. S. Garside. Harper Adams 23rd Annual Poultry Conference, August, 1939.

The cause of the disease is one or other of the following organisms : *Salmonella typhi-murium* or *S. aertrycke*, *S. enteritidis* (Gaertner) or *S. anatum*. *S. pullorum* has been obtained on a number of occasions from ducklings. The persistence of infection on premises may be due to the agency of rats and mice acting as reservoirs of infection. Regular testing of the breeding flock is of little use when, immediately after being pronounced free of infection, ducks at any time of their lives may become re-infected from organisms disseminated by vermin or any other of the animals or birds capable of harbouring and transmitting the infective agent.

Serologic Types of Salmonella Isolated from Paratyphoid in Chicks. E. Jungherr and C. F. Clancy. Journal of Infectious Diseases, Vol. 64, 1939, p. 1-17.

In a routine examination of 1·241 chicks under 3 weeks old, the authors found 15 cases of infection with the paratyphoid bacteria mentioned below. Ten of these were from pullorum-free stock. Of the 14 strains studied serologically four were classified as *Salmonella typhi-murium* according to the Kaufman-White Scheme. Two were classified as *S. typhi-murium* var. *binns*, one as *S. bareilly*, two as *S. oranienburg*, three as *S. montevideo*, one as *S. anatum* and one as *S. london*. So far as the authors are aware *S. bareilly*, *S. montevideo* and *S. london* have not been recorded before as occurring in man or animals in the U.S.A. Analysis of the antigenic structure of *S. montevideo* confirmed its inclusion in the vi, vii group, and that it is monophasic. The specific phase was found to contain m t g o s of which g o s was deficient in absorbing capacity.

Two new Salmonella types isolated from Fowls. P. R. Edwards and D. W. Bruner. Kentucky Experiment Station. Journal of Hygiene, London, Vol. 38, 1938, p. 716.

Studies of cultures of Salmonella led to recognition of the two species here described as new. The first of these was isolated from a 3-weeks-old poult which came from a turkey farm in Minnesota and is named *S. minnesota*. Its antigenic formula is XXI : 1 ⇌ enx. The second species to which the name *S. worthington* is given, was isolated from a young turkey which came from a hatchery at Worthington, Minn. (hence the specific name), and also from a chick, the origin of which is unknown. Its antigenic formula is I XIII XXIII : lw ⇌ z.

Fowl Typhoid. A brief résumé of the literature. C. Ram. The Indian Veterinary Journal, Vol. 16, 1939, p. 174.

Contents :

Distribution ; Etiology ; Susceptibility ; Dissemination ; Symptoms ; *Post-mortem* Appearances ; Mortality ; Differential Diagnosis ; Treatment and Control.

Paratyphoid Infection of Turkeys. B. S. Pomeroy and R. Fenstermacher. Minnesota Experiment Station. Journal of American Veterinary Medical Association, Vol. 94, 1939, p. 90.

In studies commenced in Minnesota in 1935, it has been found that *Salmonella aertrycke* may produce an acute disease of young poults up to 5 weeks of age. This organisation was isolated from infertile eggs and dead-in-the-shell embryos during the second, third and fourth weeks of incubation and from the ovary and oviduct of three of ten naturally infected birds. It was shown that in addition to *S. aertrycke*, *S. anatum*, *S. newington*, *S. montevideo*, *S. derby*, *S. senftenberg*, *S. bareilly*, and *S. bredeney* may produce losses among baby poults.

Paratyphoid and Trichomonas Infection in Pigeons. W. E. Niemeyer. Journal of American Veterinary Medical Association, Vol. 94, 1939, p. 434.

The author records the isolation of *Trichomonas columbae* and *Salmonella typhi-murium*—Type IV variant—from diseased pigeons in southern California.

The Detection of Carriers of Fowl Cholera, and its Control, by Means of a Stained-antigen, Rapid, Whole-blood Test. W. B. Shook and H. Bunyea. Poultry Science, Vol. 18, 1939, p. 146.

Report is made of an outbreak of fowl cholera due to a carrier condition of several years' standing that was controlled by use of a stained-antigen, rapid whole-blood agglutination test of the flock, followed by removal of the reactors. The stained-antigen test agreed with the tube agglutination test on 133 reactor birds, with negative controls. The stained antigen for the rapid, whole-blood test was made from 24 hours agar growths of an autogenous blue type culture of *Pasteurella avicida* washed off with physiological saline containing 1 per cent. of formalin. The suspension was adjusted to a turbidity of 75 × 1 of the McFarland nephalometer scale and stained with 0·1 per cent. of crystal violet. The antigen was set aside for several days at room temperature before use.

TUBERCULOSIS

Incidence of Fowl Tuberculosis in Small Holdings. Adatok a baromfigümökór elterjedtségéhez a népies tenyésztésben. A. Nemes Mihaly. Thesis, Budapest, p. 14.

The intradermal tuberculin test was carried out on 4,934 hens from 208 farms in the same district ; 358 hens (7·3 per cent.) coming from 33 farms (15·9 per cent.) were shown to be infected. Infection of the wattle, due to *Pasteurella aviseptica* infection, developed in some of the birds after the injection of the tuberculin. The author discusses this point ; it is impossible to draw any conclusions concerning the tuberculin reaction in the birds so affected.

Differential Characteristics of Acid-Fast Bacilli isolated from healthy Guinea Pigs and Avirulent Avian Tubercle Bacilli. Caractères différentiels des bacilles isolés du cobaye neuf et des bacilles aviares avirulents. A. Saenz. Comptes Rendus Société Biologie, Paris, Vol. 128, 1938, p. 594.

Two groups of 12 guinea-pigs, 45 days after an intramuscular injection of smooth strains of acid-fast bacilli from healthy g. pigs in the case of one group, and of a smooth strain of avirulent avian tubercle bacilli in the case of the other, received 0·0001 mg. of rough virulent human tubercle bacilli intramuscularly. Culture on Löwenstein's medium of the spleen and sublumbar lymph nodes of guinea-pigs from each group, killed at intervals after the eighth day, showed that the human bacilli spread less rapidly in the first than in the second group of guinea-pigs. Subdural injection of eight rabbits with acid-fast bacilli from healthy guinea pigs caused death with paralytic symptoms in 16 to 30 days, while 17 rabbits survived a similar dose of avirulent avian tubercle bacilli by the same route. Rabbits surviving intravenous injection with the guinea-pig strains of acid-fast bacilli showed no lesions at autopsy after 4 to 6 months. Rabbits injected (intraven.) with avirulent avian tubercle bacilli showed osteo-arthritic lesions P.M. after 5 to 7 months.

Experiments on the Premunition of Rabbits against Avian Type Tubercle Bacilli with Homologus heat-killed Bacilli. Nouvelles expériences de prémunition de lapins vis-à-vis de bacilles tuberculeux aviaries, au moyen de bacilles homologues, tués par chauffage. F. van Deinse. Comptes Rendus Société Biologie, Paris, Vol. 129, 1938, p. 649.

Thirty-six rabbits received one to three intravenous injections of 1 mg. of heat-killed avian tubercle bacilli suspended in 1 c.c. of normal saline. Of the 26 rabbits that survived, 23 received an intravenous dose of 0·1 mg. of live bacilli 5 to 73 days after vaccination, and three 206 days after vaccination. Four rabbits, tested 11 to 59 days after vaccination, died in 7 to 12 days with a P.M. picture similar to that found in the seven control rabbits, which died of the acute Yersin type of tuberculosis in 15 to 30 days and did not show macroscopic caseous lesions. Eight rabbits, tested 5 to 56 days after vaccination, died after the usual interval for the benign Yersin type of TB., while 13 died after 46 to 158 days, the period of survival increasing with the interval between vaccination and infection. The Yersin type of TB. (toxic infection) could not be produced by the test dose in rabbits 60 days after vaccination. In the author's opinion, vaccination with dead avian bacilli produced an allergic state followed by a gradual desensitisation, rather than a true immunity.

The Role of the avian Tubercle Bacillus in the Sensitization of Cattle to Tuberculin. W. H. Feldman. The Mayo Foundation, Rochester, Minn. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 152.

From a summary of the facts reviewed concerning the ability of the avian tubercle bacillus to infect cattle and to sensitise bovine animals to tuberculin, the following conclusions may be drawn :—

1. The avian tubercle bacillus has a limited pathogenicity for cattle. When lesions occur they are in the majority of instances small, localised and non-progressive. Instances in which the disease was generalised have not been reported.

2. Under conditions of natural exposure the lymph nodes of the alimentary canal are the sites of predilection for the avian type of infection in cattle.

3. Lymph nodes that appear grossly to be without morbid changes may, by suitable laboratory procedures, yield avian tubercle bacilli.

4. Following natural or experimental exposure to avian tubercle bacilli, most cattle develop sensitivity to avian tuberculin. In cases of natural exposure this sensitivity is usually transitory and eventually disappears if the animals are moved to a non-infected environment.

5. Occasionally, cattle sensitised under natural conditions will react rather typically to mammalian tuberculin. Plum's observations suggest that a definite reaction, but of substandard dimensions, occurs in the majority of cattle that harbour avian tubercle bacilli.

6. It seems not unlikely that in the United States the avian tubercle bacillus sensitises more cattle to mammalian tuberculin than is generally recognised, and the possibility is suggested that at least some of the so-called non-visible lesion reactors react to mammalian tuberculin as a consequence of sensitivity induced by avian tubercle bacilli.

7. In areas where tuberculosis of fowl is prevalent and the infective agent exists in excessive concentration, sensitivity due to the avian tubercle bacillus should be seriously considered in reacting cattle from herds in which it is reasonably certain that infection with bovine tubercle bacilli has not occurred.

Avian Tuberculosis in the Cow. J. F. Timoney. The Veterinary Record, Vol. 51, 1939, p. 239.

1. Implantation experiments with cultures of the isolated organism were performed on the udders (lactating and non-lactating) of two non-tuberculin reacting cows without the production of any clinical evidence of mastitis.

2. The lactating cow as judged by the intradermal tuberculin test had cleansed itself of infection within 107 days whereas the non-lactating animal gave a positive response to avian and bovine tuberculosis when tested 107, 215 and 314 days following artificial infection. The response was much more marked with the avian or homologous product than with the bovine or heterologous product.

3. Biological tests of individual udder quarter secretion samples during life failed to demonstrate infection with the tubercle bacillus in any quarter other than the inoculated one.

4. *Post-mortem* examination of the infected cow 440 days after experimental infection revealed no macroscopic evidence of tuberculosis of the udder or of any other organ.

5. Tubercle bacilli possessing avian cultural characters were demonstrated by biological test to be present in the colostrum of the inoculated udder quarter of the cow at the time of slaughter, the remaining colostrum samples and retromammary lymph nodes proving negative.

6. It was also shown that the passaged organism still retained its pathogenicity for the fowl.

The Relative Susceptibility of the Field-vole to the Bovine, Human, and Avian Types of Tubercle Bacilli and to the Vole Strain of Acid-fast Bacillus (Wells, 1937). A. S. Griffith. Journal of Hygiene, London, Vol. 39, 1939, p. 244.

Report is made of an epizootic disease among field voles (*Microtus agrestis*) in England resembling tuberculosis in its anatomical features but due

o an acidfast bacillus different from the tubercle bacilli found in other species of warm-blooded animals. The study has led to the following conclusions: "(1) The vole is susceptible to infection with all the four types of acidfast bacilli used. (2) The bovine tubercle bacillus is the most virulent, and when injected parenterally or introduced by feeding gives rise to generalised progressive tuberculosis which runs a rapid course and is characterised by caseation of the lesions, especially the glandular, and great multiplication of the bacilli. (3) The human tubercle bacillus can multiply in the tissues of the vole and cause death but does not, except locally and occasionally elsewhere, provoke tuberculous tissue changes leading to the formation of visible lesions. (4) The avian bacillus acts in much the same way as the human bacillus, having little tendency to produce macroscopic lesions. (5) The vole strain of bacillus can infect the vole through abrasions in the skin, or when taken with the food, or injected parenterally. The generalised disease produced experimentally by the vole bacillus is distinguished from that set up by bovine bacilli by its more chronic course and by the occurrence in the areolar tissues of masses of necrotic or caseous substance largely composed of acidfast bacilli. (6) The vole appears to react in a characteristic manner (general lymph-gland caseation) to all strains of bovine tubercle bacilli, whether these are fully virulent for the rabbit or so reduced in virulence for that animal as not to be clearly distinguishable by the rabbit test from tubercle bacilli of the human type. (7) These results suggest that the vole may prove of great value in ordinary typing of tubercle bacilli and for testing strains which, though culturally bovine, have given equivocal results in rabbits."

Avian Tuberculosis Infections. W. H. Feldman. Baltimore: Williams and Wilkins Co., 1938, pp. ix+483.

Following an introductory discussion, the several chapters of this work consider the biologic characters of *Mycobacterium tuberculosis avium*; isolation and culture; diagnosis in chickens, laboratory procedures for demonstrating tuberculous infections in mammals and fowl; the pathologic anatomy of tuberculosis in chickens; experimental tuberculosis in chickens; pathogenicity of avian tubercle bacilli for fowl other than chickens, certain mammals other than man, cattle, swine and human beings; tuberculin and the tuberculin test; and dissemination and control of avian tuberculosis. Lists of references to the literature accompany the several chapters.

Multiple Focal Epithelial Hyperplasia of the Esophagus of a Chicken. W. H. Feldman. Journal of American Veterinary Medical Association, Vol. 93, 1938.

In the course of a *post-mortem* examination of a tuberculous chicken, benign epithelial hyperplasia was observed in multiple foci of the anterior portion of the oesophagus. The lesions resembled those described by Seifried as occurring in vitamin A deficiency in chickens.

Reactions of the Chorio-Allantoic Membrane of the Chicken Embryo to Bovine Tubercle Bacilli. Réactions de la membrane chorio-allantoïde de l'embryon de poulet aux bacilles tuberculeux bovins. F. Bloch and L. Costil. Comptes Rendus Société Biologie, Paris, Vol. 128, p. 849.

On the third day after inoculation the membrane was oedematous and thickened. Microscopically there was considerable leucocytic infiltration of the mesoderm, and perivascular histiocytic nodules containing numerous

bacilli were observed. By the 5th day the bacilli were penetrating to the ectodermal surface. On the 7th day, white opaque nodules were just visible: the bacilli were very numerous and clumped together in the centre of the nodules. Similar changes were observed after the inoculation of human tubercle bacilli.

Differentiation of Avian Tubercle Bacilli from other Acid-fast Bacilli, after Growth in Liquid Medium. Gelingt es, Tuberkelbazillen des Typus gallinaceus nach Wachstum in flüssiger Kultur von anderen Säurefesten sicher zu unterscheiden? G. Chiti. Zentralblatt Bakteriologie, I, Orig., Vol. 142, 1938, p. 313.

C. does not consider that the nature of growth in fluid medium constitutes a reliable criterion for distinguishing the avian from the other types of acidfast bacilli, and states that " S " forms cannot be relied upon to behave characteristically in this respect.

PEST

Variability of Fowl Pest Virus. Variabiliteit van Hoenderpestvirus. F. C. Kraneveld and A. Nasoetion. Nederlandsch Indische Bladen voor Diergeneeskunde, Vol. 51, 1939, p. 104.

Summary :

The virus of fowl-pest (strain Brescia) proved to be transmissible from mouse to mouse with absolute certainty by intracerebral injection. After such an infection the virus spread out through the entire body.

In the course of 100 intracerebral passages through mice—covering over a year—the virulence for mice was increased (Table I) and the virus was so modified that it was also possible to infect mice by subcutaneous injection, which was not possible with the original strain nor with virus that in the course of the experiments had been passed exclusively through chickens. This modification took place rather quickly (Table II). The modified virus could also be changed back in the reverse direction. By passing the hundredth mouse-passage strain through chickens, it was found that after 60 passages it was no longer possible to infect mice by subcutaneous injection (Table III), while when this chicken-passage virus was injected intracerebrally into mice the time it took for them to die had again become longer and had again begun to show wider differences per group, as had also been observed with the original strain (Table IV).

The pathogenicity for chickens was reduced somewhat by intracerebral passages through mice, but not greatly (Table V). When the hundredth mouse-passage strain was again passed through chickens (Table VI), it rapidly regained its original virulence for the latter (after 15 passages).

A Case of Pseudofowlpest. Dr. F. C. Kraneveld. Nederlandsch Indische Bladen voor Diergeneeskunde, 1939, p. 243.

Description with photographs of a case of pseudofowl-pest with nervous symptoms.

The Status of Philippine Avian Pest in the past Ten Years. A. B. Coronel. Philippine Journal of Animal Industry, Vol. 6, 1939, p. 43.

An account of avian pest, considered to be the most destructive disease of the avian family in the Philippines, where it has been established for 10 years.

FOWL POX

Action of Caustic Soda, Caporit and Formalin on the Virus of Fowl-pox. O djelovanju natrijeve luvine, kaporita i formalina na virus difterije i boginja peradi. S. Knajtner. Jugoslav. vet. Glasn., Vol. 18, 1938, p. 61. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 308.)

K. concluded that filtered fowl-pox virus was killed by a 0·1 per cent. solution of caporit in 5 minutes, and unfiltered virus in 30 minutes. When exposed to a 0·1 per cent. solution of formalin, the former was destroyed in 5 minutes, and the latter in 1 hour. Filtered virus became inactive in contact with a 1 per cent. solution of NaOH within 5 minutes, but when unfiltered it remained alive even after 2 hours. Hence he considers that both caporit and formalin are preferable to caustic soda as disinfectants for fowl-pox virus.

Immunisation of Birds against Fowl-pox and Pigeon-pox, respectively, with Viruses propagated on the Chori-allantoic Membrane of the Developing Egg. R. E. Glover. Journal of Comparative Pathology and Therapeutics, Vol. 52, 1939, p. 29.

Report is made of work conducted with a strain of pigeon-pox virus that has been maintained on the chorio-allantoic membrane of the hen's egg for 50 generations. " The virus has become slightly attenuated for the pigeon but induces good dermal lesions in the fowl. It shows no signs of enhanced virulence for poultry. Similarly, a fully virulent fowl-pox strain has been carried through 38 generations. It still fails to induce lesions in the pigeon and shows some evidence of attenuation for the fowl. Membranes infected with pigeon virus can be stored in broth at a temperature of 0° to 4° C. There is a gradual loss in infectivity, but lesions are still obtainable in the egg and in the pigeon after 380 days. Fowl virus is also relatively stable under similar conditions. Pigeons which have received a single dose of egg membrane virus by the intradermal, intraperitoneal or intravenous routes show a fairly durable immunity which can be reinforced by a second dose of virus. The subcutaneous route is less effective. In fowls the intradermal application of the egg virus appears to be as satisfactory as natural virus for the immunisation of the fowl, but the immunity shows signs of waning after about 6 months. The immunity can be reinforced by a second injection of pigeon or fowl virus given intravenously or intraperitoneally. There is a slight indication that fowl virus is the more effective."

Studies in certain Filterable Viruses. II. Immunisation against Fowl-pox with Fowl- and Pigeon-pox Viruses cultivated in vivo and in vitro. C. A. Brandly and G. L. Dunlap. Research Poultry Laboratory, U.S. Depart-

ment of Agriculture, East Lancing, Michigan ; Journal of American Veterinary Medical Association, Vol. 95, 1939, p. 340.

1. In these experiments bacteria-free egg-propagated and tissue-cultured as well as skin-lesion (bacteria-carrying) fowl and pigeon viruses were employed to determine their value for immunisation of chickens against fowl-pox. The former appear to possess several points of superiority.

2. The chorio-allantoic membranes of 12-day eggs were found to be more susceptible to infection with fowl and pigeon-virus than was the skin of chickens 6 to 12 weeks old. Furthermore, the egg-propagated virus material (chorioallantoic membrane lesions) almost invariably was found to be richer in virus than the tissue-cultured and the skin-lesion virus material tested.

3. Large intramuscular doses of the bacteria-free forms of virus appeared to show less tendency to cause undesirable constitutional reactions in vigorous 8- to 12-week-old chickens than did the bacteria-contaminated skin-lesion virus material.

4. As compared with the lesions produced in the chorio-allantoic membranes of 12-day chicken eggs by fowl-pox virus the pigeon virus lesions showed much greater cellular proliferation and much less tendency to necrosis and secondary metastatic foci.

5. Passage of one strain of fowl-pox virus through 68 series of developing eggs over a period of about two-years did not appear to bring about any significant change in virulence for chickens or the chorio-allantoic membrane of developing eggs.

The Effects of hard X-rays and Ultra-violet Light upon Fowl-pox Virus. R. Graham, C. A. Brandly, N. D. Levine. The Cornell Veterinarian, Vol. 29, 1939, p. 383.

Suspensions of fowl-pox virus grown in the chorio-allantoic membranes of developing chicken eggs were irradiated with X-rays and ultra-violet light. Dosages up to 888 R. units of hard X-rays were used, with no effect which could definitely be attributed to the X-rays. The virus was inactivated by ultra-violet light from a mercury vapour lamp in 2 hours at 20 cm. and attenuated by irradiations of from 15 to 90 minutes. A concentration of 1 to 50,000 methylene blue added to the virus suspension reduced the irradiation time necessary for inactivation to 5 minutes, while a 2½ minute irradiation markedly attenuated the virus.

LARYNGO-TRACHEITIS

The Viability and Immunizing Value of Egg-propagated Laryngo-tracheitis Virus. F. R. Beaudette and C. B. Hudson. Agriculture Experiment Station, New Brunswick, New York. Journal of American Veterinary Medical Association, Vol. 95, 1939, p. 333.

Tenth generation egg virus dried and held *in vacuo* under refrigeration maintained its potency and immunising power in laboratory experiments over a period of 421 days, even when used at the rate of 1 mg. per c.c. of diluent. This virus also gave equally good results in field trials when used at the rate of 20 mg. per c.c.

Twenty-fifth generation virus retained its immunising power, but in the experiments the smaller doses employed gave inconsistent results.

Preventive Vaccination against Laryngo-tracheitis. F. G. Hungerford and L. Hart. The Australian Veterinary Journal, Vol. 15, 1939, p. 140.

Summary and Conclusions :

Vaccinations have been carried out on approximately 10,000 birds on 13 properties with 26 separate vaccines. Of the vaccines prepared from material from naturally infected birds in the outbreaks, eight were used in a dilution of 1 in 20 and one in 1 in 30 ; of those made from material from birds infected artificially with homologous strains, three were used in a dilution of 1 in 20, two in 1 in 50 and one in 1 in 100. Two were 1 in 50 dilutions of exudate from birds infected artificially with heterologous strains. All vaccines were used within a few hours of preparation. Vaccination as carried out has prevented the spread of infection to birds so treated. On occasion, as in Outbreak No. 4, birds may contract the disease immediately following vaccination, apparently deriving the infection from the vaccine. Vaccine such as that employed in these trials should be used the day on which it is prepared, and if prepared from natural cases, birds in the peracute stage of the disease should be selected and the exudate diluted 1 part in from 20 to 50 of glycerine saline. All birds on the property, except the infected birds, should be vaccinated, and any failing to show " takes " on the 5th day should be revaccinated from those showing strongly positive reactions.

Where the disease occurs annually, the new season's stock should be vaccinated at 2 to 3 months of age, unless it is possible to isolate them completely from the survivors of previous outbreaks. Vaccination for fowl-pox and laryngo-tracheitis may be carried out simultaneously, and since in many instances outbreaks of laryngo-tracheitis have occurred following vaccination for fowl-pox, this procedure would be desirable where carriers of laryngo-tracheitis exist on the property. Vaccines prepared from natural cases in the outbreak, or those using homologous strains, have been used mainly in the outbreaks here recorded, but as all strains of laryngo-tracheitis so far examined in New South Wales are immunologically identical, any strain should produce a suitable vaccine.

Differential diagnosis between infectious laryngo-tracheitis, infectious catarrh and coryza is sometimes difficult. Hence the practice of using vaccines prepared from natural cases in each outbreak has the advantage of excluding the risk of introducing infectious laryngo-tracheitis into a flock affected with another disease which may resemble it.

INFECTIOUS DISEASES—SUNDRIES

Avian Piroplasmosis in French West Africa. Notes sur la piroplasmose aviaire en A.O.F. G. Curasson. Bull. Serv. zootech, Epiz. A.O.F., Vol. 1, 1938, p. 33, No. 2. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 308.)

Curasson notes the frequency of the occurrence of avian piroplasmosis in French West Africa. He discusses the pathogenicity of *Aegyptianella pullorum* for various domestic and wild birds, giving a brief historical review of the work done on the nature of the parasite. The curative value of several drugs is compared. Two intramuscular injections of gonacrine gave the best results.

The Common Duck as a convenient Experimental Host for Avian Plasmodium. F. Wolfson. American Journal of Hygiene, Vol. 28, 1938, p. 317.

Experiments in which a total of ten ducks and six canaries were used have led to the conclusion that the duck may serve as a convenient host for experiments on bird malaria and that it possibly may enable the study of certain morphological and physiological changes of *Plasmodium* due to residence in a foreign host.

* *Resistance to Trypanosoma evansi of Fowls on good or Avitaminotic Diets. Sulla refrattarieta' verso il Trypanosoma evansi di alcuni uccelli domestic ad alimentazione normale ed a regime avitaminico.* L. Cardona. Nuova Veterinario, Vol. 15, 1937, p. 103.

The object of these experiments was first, to test the alleged immunity of birds to *Tryp. evansi*, and secondly to find whether this immunity was affected by keeping the birds on an avitaminotic diet. C. used two hens, two pigeons, and two turtle-doves, inoculating them with blood taken from an infected guinea-pig. The birds remained in good health and repeated tests failed to detect a single trypanosome in the blood stream. An attempt to infect healthy g. pigs from the blood of the experimental birds also failed. He then put all the birds on an avitaminotic diet, but even when the birds sickened from the diet he was unable to infect them with trypanosomes, and found no trace of the parasites in any of the birds on *post-mortem* examination.

* *Experimental Trypanosoma equiperdum Infection in Fowls and Pigeons. Sul comportamento sperimentale dei volatili verso il Trypanosoma equiperdum.* I. Kujumgieff. G. Batt. Imm., Vol. 19, 1937, p. 383. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 306.)

Attempts to infect fowls and pigeons by subcutaneous or intravenous injections of *Tryp. equiperdum* gave negative results.

Factors influencing the Asexual Periodicity of Avian Malarias. L. A. Stauber. Journal of Parasitology, Vol. 25, 1939, p. 95.

1. A study of the experimental modification of the asexual periodicity of avian malaria was conducted on three strains of *P. cathemerium* (" C," " D " and " N ") and on one strain of *P. relictum* var. *matutinum* (" R "). One of the strains (" N ") was obtained by single-parasite isolation.

2. The synchronous periodicity of reproduction of avian malaria is affected by alternate 12-hour periods of high and low temperature.

3. It is affected by light itself—active through the eyes and not through the body surface—if of sufficient intensity to cause the host to be active.

4. As a corollary to (2), it is associated with rest or sleep which seem to be important orienting factors.

5. It is not affected by host feeding of the type devised in these experiments.

6. It is considered possible that the host may furnish a set of critical temperature conditions which orients the time of segmentation. In such an hypothesis, the period of rest becomes important in that it makes possible the temperature differential necessary for the appearance of the critical value.

Detection of Fowl Spirochaetes and Leptospira by Examination of Organs. Spirochätennachweiss aus Organen (durchgeführt mit Geflügelspirochäten und Leptospiren). W. Krestan. Wiener tierärztl. Monatschr., Vol. 23, 1936, p. 569.

It is not always possible to demonstrate spirochaetes in the blood and organs of infected animals. The most suitable method in K.'s opinion, is histological examination using Levaditi's silver staining method. If the organs are pulped and emulsified at a concentration of 1 : 10 in physiological saline, the emulsion filtered through a coarse filter, and the filtrate centrifuged, leptospira in the sediment may be revealed by dark-ground illumination. This enrichment technique is only applicable to living leptospira, as dead organisms decompose during centrifugation.

Clostridium Infection in Turkeys. R. Fenstermacher and B. S. Pomeroy. Minnesota Experiment Station. Cornell Veterinarian, Vol. 29, 1939, p. 25.

Report is made of an outbreak of disease in a flock of approximately 1,000 turkey hens in which there was a mortality of 2 per cent. Losses occurred at the beginning of the breeding season. The atrium of infection was probably wounds that occurred at the time of breeding. The anaerobic infection produced subcutaneous emphysema and edema around the head and thigh. *C. septicum, C. welchii,* and *C. sordellii,* and a Gram-positive coccus were isolated from the internal organs and subcutaneous tissue of two turkey hens.

Equine Encephalomyelitis Virus (Eastern Type) isolated from Ring-necked Pheasant. H. van Roekel and M. K. Clarke. Agriculture Experiment Station, Amherst, Massachusetts. Journal of the American Veterinary Medical Association, Vol. 94, 1939, p. 466.

The occurrence of equine encephalomyelitis virus (Eastern type) among pheasants in New Jersey has been observed and identified. The English sparrow (*Passer domesticus*) was found highly susceptible to this infective agent through experimental inoculation, and should be added to the list of hosts which may contract the disease. Other suspicious outbreaks among pheasants were reported in Massachusetts and Rhode Island at the time the disease manifested itself in man and horses in this area.

Inherited Immunity of Fowl Spirochaetosis. Ueber die ererbte Immunität bei der Hühnerspirochätose. H. Kroo and J. G. Orbaneja. Z. Immunitäts forschung, Vol. 86, 1935, p. 224.

Persistence of Fowl Spirochaetes in the Brain. Notiz über die Persistenz von Hühnerspirochäten im Gehirn. H. Kroo and J. G. Orbaneja. Ibid., 1935, p. 229.

Both the white and the yolk of eggs laid by fowls which had been infected experimentally with spirochaetes were able to destroy the infectivity of comparatively large numbers of spirochaetes. The blood serum from chicks

newly hatched from similar eggs also showed a similar capacity for inactivating these organisms, whilst immune birds actually inoculated intracerebrally with spirochaetes were able to resist infection. These facts indicate that a strong heritable immunity can be built up. On the other hand, infected chicks treated with neosalvarsan and apparently cured still harboured spirochaetes in the brain.

Spirochaetosis or Tick Fever of Poultry. Anon. J. Dept. Agric. Vict., Vol. 36, 1938, p. 339.

This is a general discussion of the life-cycles, pathogenic effects and control of *Argas persicus* and *Dermanyssus gallinae*. The epidemiology, symptoms and control of spirochaetosis are briefly outlined.

On a New Leucocytozoon, L. galli, n. sp. Its Parasitic Destructive Action, and its Multiplication by Schizogony in the Red Blood Corpuscles and Internal Organs of the Common Fowl. Parazitski razoracki rad i mnozenje multiplom deobom (shizogonijom) jednoga Leucocytozoona (Leucocytozoon galli spec. nov.) u crvenim krvnim zrncima i unutrasnjim organima domace kokosi (Gallus domesticus L). M. Ivanic. Arhiv. Minist. Poljopriv. Belgrade, Vol. 4, 1937, No. 9, p. 3. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 696.)

The author describes the life-cycle of a new pathogenic species of Leucocytozoon (*L. galli*) and gives details of its multiplication by schizogony in the red blood corpuscles and internal organs (especially in the spleen) of the common fowl.

Preliminary Note on the Occurrence of Leucocytozoon smithi Laveran and Lucet (1905) in Turkeys in the South-eastern United States. B. V. Travis, M. H. Goodwin and E. Gambrell. Journal of Parasitology, Vol. 25, 1939, p. 278.

A survey conducted following the finding of *L. smithi* in blood smears from a sick domestic turkey on a plantation near Newton, Georgia, revealed the presence of this disease among domestic turkeys in Alabama, Georgia, South Carolina and Florida, in addition to Virginia, previously reported by Johnson *et al.* It was also found in wild turkeys in Missouri. Of ten wild turkeys examined, five of which were from Georgia and five from Florida, all were found infected with this parasite. Of 447 adult domestic turkeys examined, 369 were infected. Chickens, pea fowls, guinea hens and ducks were examined on farms where there were infected turkeys, but no leucocytozoa were found in these fowls. Although sufficient data were not obtained in the survey to indicate definitely which species of insect were responsible for the transmission of the disease in the south-east, it was noted that in low areas in Georgia and Florida where wooded marshes and ponds were numerous nearly 100 per cent. of the adult turkeys were infected with *L. smithi*. This suggests that some aquatic breeding insect is involved. Although recorded by Johnson *et al.* from captive wild turkeys in Virginia, it has not previously been reported from turkeys in the wild.

A Pathogenic Trichomonas from the Upper Digestive Tract of Chickens. N. D. Levine and C. A. Brandly. University of Illinois. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 77.

A description is given of an affection of the upper digestive tract of chickens associated with *Trichomonas*. The gross pathological lesions observed in naturally affected chickens resemble the trichomonad lesions encountered in pigeons and turkeys. The morphology of and preliminary animal exposure experiments conducted with the causative *Trichomonas* indicate that it may be a strain of *T. columbae*.

Growth of the Fowl Coryza Bodies in Tissue Culture and in Blood Agar. J. B. Nelson. Journal of Experimental Medicine, Vol. 69, 1939, p. 199.

N. describes the nature and growth requirements of small coccobacilliform bodies in nasal exudate resulting from fowl coryza, and prefers to use this descriptive term rather than to designate a new bacterial genus at present. The culture medium generally used was that previously described, in which a faint turbidity, unreliable as evidence of growth, was sometimes noted at 24 hours. Living tissue cells were not essential for growth, but better results were obtained with them. Experiments showed that factors of a diffusible nature, and derived from tissue cells, allowed growth, and that tissue cells gradually lost this factor after storage at 10° C. Increase of this growth factor in the supernatant of culture media was proportionate to the length of storage up to 5 days. The growth factor was inactivated at pH 6·0, but withstood a temperature of 100° C. for 1 hour.

The results of culture in post embryonic tissue (liver, spleen and blood) media are detailed. After artificial tissue culture for 80 generations the organisms survived on blood agar slopes and multiplied slightly after the 120th generation, but the virulence of one strain was lost on blood agar at the 83rd subculture. Tissue cultures survived storage at 10° C. for 2 weeks and, after desiccation, the period of survival appeared to be connected with the amount of subculture previous to desiccation.

Deaths in Young Ducks, due to Infection by Bacterium alcaligenes. Epizootia mortifera em patos novos, devida a Alcaligenes Faecalis. A. L. Valle, A. Braga and A. Wey. Bol. Soc. brasil. Med. vet., Vol. 8, 1938, p. 15. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 376.)

The authors describe an epizootic disease, in ducks 2 to 3 weeks old, characterised by diarrhoea, weakness and death in 24 hours. The mortality was about 100 per cent. Older ducks were not affected. The lesions were those of a septicaemic disease. Blood culture showed a motile Gram-negative bacillus that was identified as *Bact. alcaligenes*.

Infection of a Peacock with Erysipelothrix rhusiopathiae, followed by a case of Human Erysipeloid. A. W. Greener. British Journal of Dermatology and Syphilis, Vol. 51, 1939, p. 372.

Description of a case of erysipelas in a turkey that had died suddenly. A veterinarian who examined the bird developed erysipeloid on the back of the hand.

A Report of Swine Erysipelas in Turkeys. A. S. Rosenwald and E. M. Dickinson. Oregon Experiment Station. Cornell Veterinarian, Vol. 29, 1939, p. 61.

A report is made of three outbreaks of swine erysipelas septicaemia, thought to be the first in Oregon turkeys, together with a preliminary report of the studies conducted. The possible connection with ovine polyarthritis, the seasonal occurrence, and the preponderance of males affected were noted. This affection of sheep is not known to exist in the section of Oregon where the turkey outbreaks occurred.

Erysipelothrix rhusiopathiae associated with a Fatal Disease in Ducks. R. Graham, N. Levine and H. R. Hester. Laboratory of Animal Pathology, University of Illinois, Urbana, Illinois. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 211.

On a farm in Illinois, approximately 10,000 ducklings succumbed to an acute septicaemic disease. *Erysipelothrix rhusiopathiae* or a culturally and serologically indistinguishable microorganism, was isolated from some of the ducks after death. The strains of *E. rhusiopathiae* isolated from ducks were pathogenic for pigeons, mice and ducks. Rabbits and guinea-pigs proved resistant to the subcutaneous injection of suspensions of agar cultures. Several healthy, mature birds inoculated with strains of the microorganism isolated from spontaneously affected ducks remained healthy, suggesting the possible significance of age as a factor in resistance. The influence of environmental factors was suggested by the high mortality in one house in which the birds were subject to draughts and temperature fluctuations. Attempts to protect ducklings (with erysipelas serum and bacterins) on contaminated premises and environmental conditions under which the spontaneous disease developed were not successful.

PARASITES

COCCIDIOSIS

The Influence of Dried Buttermilk in Rations on Fatality with Coccidiosis in Chicks. E. R. Becker and H. L. Wilcke. Iowa Experiment Station. Poultry Science, Vol. 17, 1938, p. 405.

The rates of mortality in four artificially inoculated lots of chicks receiving rations containing 0, 10, 40 and 40 per cent. of dried buttermilk respectively, were approximately 30, 72, 60 and 24 per cent. respectively. The " ordinary type " rations Nos. 2 and 3, containing dried butter-milk, resulted in high mortality but supported better growth than the No. 1 ration. The relatively low mortality on the No. 4 ration containing 40 per cent. of dried buttermilk but otherwise containing only corn, oats and bran indicated that the high mortality on rations Nos. 2 and 3 could not be attributed solely to the presence of the dried buttermilk in the ration.

Dried Skim Milk and other Supplements in the Ration during Caecal Coccidiosis of Chicks. E. R. Becker and P. C. Waters. Iowa Station College. Proceedings of the Society of Experimental Biology and Medicine, Vol. 40, 1939, p. 439.

Further evidence is supplied for the unfavourable effect of dry buttermilk in the ordinary type of growing ration when White Leghorn chicks become infected with sizable doses of *Eimeria tenella*. It is now shown that dry skim milk has an effect similar to that of dry buttermilk.

It made little difference when soy bean oilmeal (expeller process) was substituted for a considerable part of the meat element in meat scraps, or where a fine grade of low temperature sardine meal was substituted for dry milk.

Further, it was brought out in chicks on two different rations that there was no difference in mortality from infective inoculations of 100,000 and 200,000 oöcysts (Experiment 3).

The Effect of Sulfanilamide on the Course of Experimental Avian Coccidiosis. P. P. Levine. Veterinary College, Ithaca, New York. The Cornell Veterinarian, Vol. 29, 1939, p. 309.

1. An effective new technique is described for making oöcyst counts in chicken faeces.

2. Sulphanilamide fed at the rate of 0·3 grammes daily to chickens (weight 1½ lb.) had no effect on the course of infection with *E. tenella*. Similar treatment of birds infected with a mixture of *E. mitis*, *E. acervulina* and *E. necatrix* prevented the development of oöcysts of the two former species but had no effect on the latter species.

3. Sulphanilamide fed at the rate of 0·3 grammes daily to chickens (weight 1½ lb.) practically completely suppressed the discharge of oöcysts of *E. praecox*, *E. mitis*, *E. hagani* and *E. maxima*. A few days after the drug was discontinued, oöcysts appeared in the faeces and the oöcyst count reached a peak considerably below that of the controls.

4. Sulphanilamide when mixed in the mash in concentrations of 0·1, 0·2, 0·3, 0·4 and 0·5 per cent. by weight, prevented the normal weight gain of growing chickens.

5. Sulphanilamide in concentrations of 0·1 per cent. and 0·2 per cent. had no effect on the production and discharge of oöcysts of *E. hagani* and *E. praecox* respectively.

6. Sulphanilamide in the mash in concentrations of 0·3 per cent. by weight had a marked inhibitory effect on the oöcyst discharge of birds infected with *E. mitis*, *E. praecox* and *E. hagani*. This coccidiostatic effect was evidenced as long as the drug was fed. Cessation of sulphanilamide feeding was followed by an increase in the oöcyst counts not equalling (one exception) the counts of non-treated control birds.

Avian Hosts of Eimerian Coccidia. D. C. Boughton and J. J. Volk. University of Georgia. Bird-Banding, Vol. 9, 1938, p. 139.

The authors present a classified list of avian hosts with the respective species of the coccidian genus *Eimeria*. The host list includes 37 species of birds, which represent 31 genera, 13 families and eight orders. "For each of the 34 species of *Eimeria* which have been reported from these hosts brief notes are given on the following: Oöcyst characteristics, tissue stages, prevalence and geographical distribution, pathogenicity, host specificity and pertinent references. Of the 37 species of birds four are reported here for the first time as hosts of *Eimeria* sp. These are *Columba leucocephala*, *Zenaidura macroura carolinensis*, *Melopelia a* [*iatica*] *asiatica*, and *Oreopeleia chrysia*."

A bibliography of 42 titles is included.

The Efficiency of the Blow Lamp for the destruction of Coccidial Oöcysts in Poultry-houses. C. Horton-Smith and E. L. Taylor. Veterinary Record, Vol. 51, 1939, p. 839.

In the experiments reported the resistance of coccidial oöcysts to the blow lamp flame was found to be approximately the same as that of *Chromobacterium prodigiosum*. " One second's exposure to the blow lamp flame was found to be sufficient to kill both *C. prodigiosum* and coccidial oöcysts, but approximately 0·5 seconds on rough surfaces sometimes failed to kill both of these organisms. It was found to be necessary to spend more than 20 seconds in flaming a square foot of clean rough board in order to kill all *C. prodigiosum* that had been painted on to it. *C. prodigiosum* spread in a very thin film of faeces on to a square foot of rough board survived 70 seconds' flaming. It is necessary to spend more than 100 seconds in flaming a square foot of smooth wood, rough wood, zinc, or asbestos, if damp, in order to kill all *C. prodigiosum* present. The disinfection of the interior of a poultry house only 20 feet long and 12 feet wide by the blow lamp would, therefore, take from 2 to 16 hours to complete, and it must be concluded that the blow lamp is a very inefficient means of sterilising large surfaces. It is thought probable that these results also apply to coccidial oöcysts."

Coccidiosis of the Chicken with special reference to Species. W. T. Johnson. Oregon Agricultural Experiment Station Bulletin No. 358, December, 1938.

Summary :

1. Six species of coccidia infecting the chicken are described : *Eimeria tenella* Raillet and Lucet, *Eimeria maxima* Tyzzer, *Eimeria acervulina* Tyzzer, *Eimeria mitis* Tyzzer and two new species for which *Eimeria praecox* and *Eimeria necatrix* have been proposed.

2. The average measurements in microns of 50 sporulated oöcysts for each species were : 13·7 by 15·0, *E. mitis* ; 13·8 by 18·0, *E. acervulina* ; 17·5 by 23·7 *E. tenella* ; 20·6 by 23·8, *E. praecox* ; and 22·9 by 30·4, *E. maxima*.

3. The average measurements in microns of nine schizonts of *E. necatrix* selected from a large number were 49·2 by 63·1.

4. *E. tenella* proved pathogenic with 24 hours or less sporulation, *E. acervulina* in 18 to 24, *E. mitis* and *E. praecox* in 24 to 36, and *E. maxima* in 36 to 48.

5. The minimum prepatent period observed for *E. praecox*, *E. acervulina*, *E. mitis*, *E. maxima* and *E. tenella* was 4, 4, 5, 6 and 7 days, respectively.

6. Self-limitation of infection occurred with *E. mitis*, *E. acervulina*, *E. praecox*, *E. maxima* and *E. tenella*.

7. Immunity or a high degree of resistance was established against *E. mitis*, *E. acervulina*, *E. praecox*, *E. maxima* and *E. tenella*.

8. Distinct susceptibility was demonstrated to *E. tenella*, *E. maxima*, *E. praecox*, *E. acervulina* and *E. mitis* in the same fowl, inoculated in the order named. A second fowl, inoculated in reverse order, showed distinct susceptibility to all except *E. tenella*, which was probably due to previous accidental infection with this species.

9. With large dosage, *E. necatrix* and *E. tenella* showed extensive haemorrhage from the small intestine and caeca respectively ; *E. maxima* showed slight haemorrhage and considerable viscid mucus from the small intestine ; *E. mitis* and *E. praecox* showed slight and moderate amounts, respectively, of viscid mucus from the small intestine.

10. Laboratory-reared fowls, between 2 and 3 years of age, were distinctly susceptible to *E. mitis*, *E. acervulina*, *E. praecox*, *E. maxima* and *E. tenella*.

Infection was accompanied by loss of appetite and markedly abnormal small-intestine faeces when inoculated with *E. acervulina* and *E. maxima*.

11. The data offer discouragement to the practice of raising fowls to maturity free of coccidiosis.

Studies on the Effect of X-rays on the Pathogenicity of Eimeria tenella. A. A. Albanese and H. Smetana. American Journal of Hygiene, Vol. 26, 1937, p. 27.

Studies conducted with a view of determining the therapeutic effect of X-rays on oöcysts of *E. tenella in vitro* and the consequent influence on the course of the disease in chicks due to such radiated organisms are reported. It was found that experimental infection with oöcysts of *E. tenella* irradiated with X-rays of 9,000 r-units at 75 r. per minute was much less severe than that produced in controls. " Exposure of oöcysts of *E. tenella* to X-rays of 13,500 or more r-units at 75 r. per minute rendered the organisms ineffective for experimental infection ; 13,500 r-units at 75 r. per minute constitutes the minimum prophylactic dosage under the given experimental conditions. Experimental infection with oöcysts exposed to X-rays of from 2,250 to 4,500 r-units at 75 r. per minute caused an increased production of organisms during the patent period, suggesting a stimulating action of these sublethal doses on the oöcysts. Experimental infection with oöcysts irradiated with low intensity X-rays of 4,500 or more r-units at 75 r. per minute was followed by a definite shortening of the patent period and a slight prolongation of the prepatent period. Infection with oöcysts exposed to 2,250 r-units was characterised by a normal prepatent period and a prolonged patent period. Irradiation with high intensity X-rays of 104 r-units per minute was much more effective in damaging the oöcysts of *E. tenella in vitro* than X-rays of low intensity. Non-sporulated oöcysts were found to be 15 times more sensitive to X-rays than sporulated oöcysts. *In vitro* excystation of oöcysts irradiated with X-rays was greatly reduced as compared to that of non-irradiated controls."

BLACKHEADS

Blackhead in a Black Cock. " Schwarzkopfkrankheit " auch beim Birkwild. S. Salhoff. Berliner Tierärztl. Wochenschrift, January 28th, 1938, p. 49.

Blackhead was diagnosed in a wild black cock. The findings at autopsy were typical ; the caecum was very much swollen and distended, and there were flat or sharply circumscribed circular ulcers in the mucous membrane, which had led to perforation of the intestinal wall. The changes in the liver were not clearly marked.

Blood Alterations in Typhlohepatitis of Turkeys, with Notes on the Disease. E. P. Johnson and C. J. Lange. Virginia Experiment Station. Journal of Parasitology, Vol. 25, 1939, p. 157.

The authors have found *Histomonas meleagridis* in caecal discharges of carrier chicks to be extremely pathogenic, as compared to this protozoan in other material and to other channels of administration when introduced into the rectum of turkeys held in a suspended position. " The average differential leucocyte count of normal turkeys maintained under the conditions of this experiment is as follows : Heterophiles 43·4, eosinophiles 0·9, basophiles 3·2, lymphocytes 50·6, and monocytes 1·9 per cent. Experimental blackhead

disease of turkeys results in a marked disturbance in the blood picture which is characterised by (1) a marked heterophilia of from 8 to 21 per cent. within 24 hours of receiving the infective material, (2) a persistence of the heterophilia until death, (3) an irregular monocytosis in some cases, especially in those receiving subcutaneous implantations of infective material [and] (4) myelocytosis and anaemia usually preceding the fatal termination. The sudden marked heterophilia following introduction of infective material indicates that the histomonads penetrate the caecal epithelium and establish themselves in some parenteral position where toxic material results within 24 hours. Natural cases of typhlohepatitis were found to have very similar leucocyte disturbances to those found in the experimentally infected birds. An extensive lesion in the proventriculus due to the administration of *H. meleagridis* by way of the mouth is described and illustrated. In no case could intravascular protozoan forms be demonstrated in the experimentally infected birds. The rounded forms are interpreted as macrogamete stages of a blood protozoan resembling *L[eucocytozoon] smithi* and are not related to *H. meleagridis*."

Histomonas meleagridis in Domestic Fowls. (Gallus gallus.) Cultivation and Experimental Infection. A. Bishop. Parasitology, Vol. 30, 1938, p. 181.

Turkeys bred from " sterilised " eggs were fed with bacteria-free cultures of *H.m.* in order to establish that this organism is the cause of " blackhead." Although cultures (Strain CL) were obtained from the liver of a hen and subcultured for a year, B. failed to obtain a pure culture. The media used are described. The pH of cultures less than 3 days old was 7·0 to 6·5, but fell later. If it was less than 4·0 all the organisms died. The optimum temperature was 36·5° to 37° C. ; the organisms died rapidly at room temperature or lower temperatures. Strain CL was not markedly virulent for chicks, but infectivity was high, 11 out of 12 chickens being infected although only caecal lesions were set up. The strain showed great amoeboid activity at 37° C. and normally possessed a hair-like flagellum. In fixed stained preparations the size was 8-19 micron (average 10-14) ; living forms were larger. The nucleus was spherical or pear-shaped, with a well-defined nuclear membrane and a globular, siderophilic karyosome. A flagellum arose from a single blepharoplast, which was sometimes opposed to the nuclear membrane and otherwise attached to it by two fine rhizoplasts, and ending in the cytoplasm at the opposite end of the body was sometimes seen. Multiple fibrils as described by Tyzzer in tissue sections were not seen. Parasites having 2-4 nuclei, each of the latter with a flagellum, are described ; the flagella disappeared during division. No resistant phase was observed in cultures.

WORMS

Observations in the Life History of Raillietina echinobothrida and of R. tetragona (Cestoda). M. W. Horsfall. Journal of Parasitology, Vol. 24, 1938, p. 409.

The two common poultry tapeworms of economic importance (*R. echinobothrida* and *R. tetragona*), which injure the host by destroying the tissue by burying their heads deep in the intestinal wall and even through the muscularis mucosae and by causing the formation of intestinal nodules, are dealt with. Both the pavement ant and *Pheidole vinelandica* have been shown by Jones and the author to serve as intermediate hosts of these cestode species. In the course of laboratory tests individuals of the pavement ant were infected with *R. echinobothrida*. Under natural outdoor conditions the two cestodes were present throughout the year in chickens. The ants were active from

March 15th through December, but were only found naturally infected from approximately June 1st through December in 1935 and 1936.

Studies on the Life History and Biology of the Fowl Tapeworm Raillietina cesticillus (Molin). W. M. Reid, J. E. Ackert, and A. A. Case. Transactions American Microscopical Society, Vol. 57, 1938, p. 65 ; Biological Abstracts, Vol. 12, 1938, No. 7, 11873.

The life history of this cestode was restudied. Physiological experiments involving 300 chickens and 570 beetles gave much new information. Most of the gravid proglottids are voided by the chickens in the afternoon and evening. This periodicity is apparently associated with feeding and digestion in the chicken and with absorption and assimilation in the tapeworm. Detached gravid proglottids are very motile in the intestine, and while warm they remain motile for some time after leaving the host : one warm proglottid moved 8 inches on moist filter paper. They migrate to the outside of the faecal mass in which they are evacuated, but they are not tropistically activated by light, heat or gravity. The onchospheres of *R. c.* can be distinguished from those of other species of fowl tapeworms by two funnel-like structures in the membranes which surround the hexacanth embryo. Two genera and 12 species of Carabidae which previously have not been reported can act as intermediate hosts for the tapeworm : *Pterostichus torvus*, *P. permundus*, *P.* (*Anaferonia*) near *constrictus*, *Amara obesa*, *A. latocolis*, *A. muscula*, *A. fallax*, *A. basilaris*, *Anisotarsus subvirens*, *Chlaenius tomentosus*, *Anisodactylus rusticus*, and *Harpalus pennsylvanicus*. Nearly all species of *Amara* which have been tested have proved to be intermediate hosts of *R. c.*, but in the genera *Pterostichus* and *Harpalus* some species can be while others cannot. 626 cysticercoids were produced by one beetle which had been fed four proglottids. The size of the cysticercoids is partly dependent on the number of cysticercoids in a beetle and on the species of beetle. Cysticercoids usually develop into adult tapeworms in about two weeks, although tapeworms with gravid proglottids were produced in 11 days after the fowl had swallowed cysticercoids. Techniques were developed which facilitated the infection of beetles with onchospheres, the rearing of infected beetles and the feeding of the fully developed cysticercoids to chickens, thus making possible critical studies of host-parasite relationships.

Age Resistance of Chickens to the Cestode Raillietina cesticillus (Molin). J. E. Ackert and R. M. Reid. Journal of Parasitology, 1937, p. 558.

The authors administered about 50 infective cysticercoids of *Raillietina cesticillus* to 15 chickens 20 to 51 days old, which resulted in an average parasitism of 4·87 worms per bird, each worm averaging 94·91 segments. A similar experiment with 27 birds of the same flock, but 71 to 150 days old, resulted in an average of 3·22 worms (averaging 79·3 segments) per bird.

The differences in the number of worms and their size, as judged by the average number of segments, in the two age groups were submitted to critical analysis and found in each case to be five times as great as the probable error. These results demonstrate that chickens about 9 to 20 weeks old may be much more resistant to the existence and growth of *R. cesticillus* than are younger birds (about 4 to 8 weeks old) in the same flock.

Reproductive Cycles of Raillietina cesticillus of the Fowl. P. D. Harwood. Livro Jubilar Prof. L. Travassos, 1938, p. 213. Rio de Janeiro (Veterinary Bulletin, Vol. 9, 1939, p. 860.)

H. carried out experiments on the rate of shedding of strobilae by tapeworms. *R. cesticillus* was fed to laboratory-raised chickens, in one of which infestation was observed for over 18 months. At the beginning of a cycle the segments were large and numerous, and well filled with eggs ; the segments gradually became smaller, contained fewer eggs and a few sterile segments were excreted. The decline in segment elimination was not regular but was marked by periods in which no segments or only relatively few, were eliminated. Chains of unripe proglottides followed, and for a time or no segments were excreted. This period of diminished excretion was often of very short duration, but sometimes lasted several weeks.

The Influence of Infections with the Tapeworm, Raillietina cesticillus, on the Growth Rate of Chickens. P. D. Harwood and G. W. Luttermoser. Proceedings of the Helminth Society of Washington, Vol. 5, 1938, p. 60. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 400.)

The author paired off chickens 2 to 4 weeks old according to weight and gave one of each of 41 pairs various numbers of infective cysticercoids of *R. cesticillus* (obtained from *Aphodius* spp. and *Tribolium* spp. of beetles) the other chick in each pair serving as a control.

The diet fed to the first experimental birds was low in available manganese and resulted in one case of perosis, but the diet was adjusted for the remaining experiments.

The weights of the chicks were recorded at weekly intervals and the greater increase in each experiment was in the control birds. In spite of perosis, the control bird in the first experiment gained weight more quickly than its infested mate.

The number of cysts fed varied from 40 to 0·1,000 and the most tapeworms found in any bird 6 weeks after dosage was 155 (1,000 cysts fed).

Critical analysis of the results indicated that the infestation had an injurious effect, proportionate to the degree of infestation, on the growth rate of chicks fed adequate rations, this effect being enhanced when the diet was deficient in manganese.

The Effect of Infection with Davainea proglottina on the Weights of Growing Chickens. P. P. Levine. Journal of Parasitology, Vol. 24, 1938, p. 550.

A group of 7-weeks-old chickens was experimentally infected with *D. proglottina*. From the 35th day until the end of the experiment on the 136th day after infection, they showed a lower weight increase than the non-parasitised control birds, although the food intake of both groups was practically identical.

T. fissispina : A New Fowl Parasite in Madagascar. Un parasite des poules nouveau pour Madagascar. G. Buck. Bull. Soc. Path. exot., Vol. 32, 1939, p. 447. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 785.)

The parasite was found singly or in association with another parasite, *Acuaria spiralis*, in the proventriculus of various breeds of poultry. In heavy infestations the walls of the stomach was thickened, the mucous membrane was congested and the birds were emaciated.

Observations on the Biology of the Poultry Cestode Davainea proglottina in the Intestine of the Host. P. P. Levine. Journal of Parasitology, Vol. 24, 1938, p. 423.

Observations of the biology of *D. proglottina* are reported, with the details given in tables.

Studies on the Control of the Poultry Cestode Davainea proglottina (Dav.). P. P. Levine. Cornell Veterinarian, Vol. 28, 1938, p. 220.

Report is made of the treatment of tapeworm (*D. proglottina*) infected chickens with some 20 anthelmintics, none of which was effective. Tobacco dust in the proportion of 2 per cent. of the mash by weight did not prevent infection with *D. proglottina*, neither did copper sulphate in the drinking water in the proportion of 1:500. Cysticercoid-bearing slugs (*Agriolimax agrestis*) survived the severe winter of 1935-36 under field conditions. They survived 8 days at 3° to 5° C. and proved to be infective to chickens. Subsequent exposure to —1° for 24 hours was lethal for the slugs and the cysticercoids.

An Improved Critical Test for Poultry Taeniacides. P. D. Harwood and A. C. Jerstad. Poultry Science, Vol. 17, 1938, p. 295.

Tests made of a method for determining the maximum efficiency of a taeniacide for removal of *Raillietina cesticillus* of chickens are reported. "A mixture of drugs containing kamala was given to six chicks, each of which had been artificially infected with a single tapeworm. At necropsy 1 week after treatment each of five of the experimentally infected chicks was infested with a single specimen of *R. cesticillus*. The fate of a single tapeworm in one chick is not satisfactorily explained by the data presented."

Observations on Capillaria contorta in Turkeys. M. W. Emmel. Florida Experiment Station. Journal of the American Veterinary Medical Association, Vol. 94, 1939, p. 612.

A report is made of observations on three flocks of turkeys infested with *C. contorta*, consisting of 800, 1,200 and 500 birds, respectively, which showed that the characteristic symptoms were indisposition, weakness, droopiness, emaciation, frequent swallowing, and a penguin-like position of the body. " Macroscopic lesions consisted of catarrhal and haemorrhagic inflammation, thickening, necrosis, and sloughing of the mucosa of the oesophagus and crop. Microscopic lesions consisted of areas of hyperplasia, hypertrophy, necrosis and haemorrhage in the layers of epithelium. *C. contorta* did not penetrate deeper than the basement membrane. A satisfactory treatment consisted of feeding the flocks 5 per cent. of sulphur in the regular mash for a period of 3 weeks."

Ants are Intermediate Hosts to some Tapeworms. Jones and Horsfall. Journal of Parasitology, Vol. 21, p. 442; Science, Vol. 83, p. 303.

The role of ants as intermediate hosts for some tapeworms has long been suspected. Authors have produced definite evidence at least as regards two species of tapeworms, including the one causing " nodular disease," a condition affecting the intestinal tract and sometimes mistaken for tuberculosis.

The Land-Snail an Intermediate Host of the Cecae Fluke of Poultry. J. E. Alicata. Science, Vol. 88, 1938), p. 129.

Experiments conducted during the past year on the life history of *Postharmostomum gallinum* have shown the land snail (*Eulota similaris*) to be the common carrier of this fluke under natural conditions in Hawaii. Snails collected in fluke-endemic poultry farms near Honolulu were found heavily infected with larval flukes (adolescercariae), the largest of which measured 0·87 mm. long and 0·39 mm. wide and possessed well-developed suckers and caeca closely resembling those of the adult fluke.

The Life History of Hymenolepis exigua, a Cestode of Poultry in Hawaii. J. E. Alicata and E. Chang. Hawaii Experiment Station. Journal of Parasitology, Vol. 25, 1939, p. 121.

A report is made of an experimental study of the development of the tapeworm, *H. exigua* in the intermediate host (*Amphipod, orchestia platensis*), and in the final host, which is the chicken. " Eggs of this parasite, when ingested by amphipods, were found to develop during a period of about 12 days to the cysticercoid stage capable of infecting chicks. Cysticercoids fed to week-old chicks developed to maturity in the duodenum and eggs passed in the dropping of the birds 9 to 10 days after experimental infection. Sowbugs (*Porcellio laevis*), beetles (*Tenebroides nana*), houseflies (*Musca* sp.), and undetermined species of earthworms which were exposed to infection with eggs of *H. exigua* failed to become infected."

Preliminary Note on the Life History of Subulura brumpti, a common Cecal Nematode of Poultry in Hawaii. J. E. Alicata. University of Hawaii. Journal of Parasitology, Vol. 25, 1939, p. 179.

In studies on caecal worms parasititising chickens in Hawaii, *S. brumpti* was found in 42 out of 50 sets of caeca examined from birds obtained in Honolulu markets. The following five species of insects collected in poultry farms were found naturally infected with encysted larvae of *S. brumpti*, namely, " (Coleoptera) *Dermestes vulpinus*, *Gonocephalum seriatum*, *Ammophorus insularis*, *Alphitobius diaperinus*, and (Dermaptera) *Euborellia annulipes*. An examination of 20 specimens of insects collected in one poultry farm near Honolulu revealed the following incidence of infection : *A. diaperinus* 75 per cent., *A. insularis* 90 per cent., *E. annulipes* 70 per cent. Encysted larvae of *S. brumpti* were also found in grasshoppers, *Conocephalus saltator*, 15 days after they were experimentally fed embryonated eggs of this parasite."

Use of Iodine for Gapeworms in Pheasants. J. P. Delaplane and H. O. Stuart. Rhodes Island Experiment Station. Journal of the American Veterinary Medical Association, Vol. 94, 1939, p. 538.

The treatment of some 20 gapeworm-infested pheasants in a large flock by instillation of a few drops of iodine vermicide in the trachea with a pipette or eyedropper is said to have relieved the symptoms of respiratory distress after a few days. No losses from gapeworm occurred in the flock following this treatment. In two gapeworm-infested pheasants showing paralytic symptoms that were treated by the authors, the symptoms of respiratory distress disappeared after 4 or 5 days. Autopsies of the two birds later failed to reveal any gapeworms indicating the effectiveness of this form of treatment.

Barium Antimonyl Tartrate as a Remedy for the Removal of Gapeworms from Chickens. E. E. Wehr, P. D. Harwood, and J. M. Schaffer. Poultry Science, Vol. 18, 1939, p. 63.

In the experiments here reported barium antimonyl tartrate was the best of the several substances tested for the removal of gapeworms of chickens and was very effective for this purpose. It was dusted over the birds and inhaled by them.

A Study of the Cellular Elements and Haemoglobin in the Blood of Chickens experimentally infected with Capillaria columbae (Rud.). C. Olson and P. P. Levine. Cornell University. Poultry Science, Vol. 18, 1939, p. 3.

Observations of the blood cells and haemoglobin of two groups of chickens, one of which was experimentally parasitised with *C. columbae*, are reported upon, the details being given in table form. A leucocytosis of the heterophils and eosinophils and a slight anaemia was detected in the infected chickens during the period when clinical symptoms of the infection were manifest. A list is given of ten references to the subject.

Observations on the Development of the Poultry Gapeworm Syngamus trachea. E. E. Wehr. Trans. Amer. micr. Soc., Vol. 56, 1937, p. 72. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 324.)

According to the observations made by Wehr, the embryo of *Syngamus trachea* moults twice in the egg and hatches as a third stage larva which is infective for chicks or earthworms, developing to an adult in the chick, and persisting as an infective third stage larva in the earthworm. The first moult in the egg takes place on the 5th day and the second moult on the 7th day, in cultures incubated at a temperature ranging from 24° to 30° C.

Wehr fed chicks with embryonated eggs (containing third stage larvae) or with infected earthworms and examined them after various intervals.

Third stage larvae were found in the liver and lungs of one bird, and fourth stage larvae in the lungs of others. It was also observed, in further experiments that young adult worms appeared in the lungs and copulated there before migrating to the trachea.

The six stages of the life-cycle are described and illustrated.

The Diagnosis and Treatment of Hymenolepidosis H. lanceolata Infestation of Geese. Diagnostika i terapija gimenolepidoza (Hymenolepis lanceolata) gusei. V. A. Potemkina. Papers on Helminthology, Commemorating 30 Year Jubilee of Prof. K. I. Skrjabin, 1937, p. 529. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 802.)

The authors carried out experiments to assess the value of arecoline, a product spoken of as " philotselene," male fern extract, kamala and copper sulphate for the treatment of hymenolepis infestation in geese. Arecoline was found to be the most effective ; it was given in doses of 0·002 to 0·0025 grammes per kilo. body weight after fasting. " Philitselene " and male fern

extract also gave good results but they are very toxic, and have to be followed by a saline purgative. Diagnosis of infestation was made by examining the faeces for ova.

Susceptibility of domestic Birds to Infestation by Trematodes of the Family Heterophyidae. Recherches expérimentales sur la réceptivité des oiseaux domestiques à l'infestation par les trématodes de la famille "Heterophyidae." I. Ciurea. Mém. Prof. Jean Cantacuzene, 1934, p. 169. The Veterinary Bulletin, Vol. 9, 1939, p. 631.

Experiments to determine the receptivity of domestic birds to trematodes from fish were carried out on hens, guinea-fowl, turkeys, ducks, geese and pigeons. The fish used came from the Danube, the Dniester and the Black Sea, and the birds were infested by giving them small, whole fish of their various organs to eat, or by force-feeding them. The number of metacercariae in fish were not estimated before feeding them to the birds.

Results showed that pigeons could be infested by all the trematodes fed to them, *viz.*: *Metagonimus romanicus*, *Apophallus muhlingi*, *Rossicotrema donicum*; *Cryptocotyle concavum*, and *Pygidiopsis genata*. Hens and turkeys could be infested with *Cryptocotyle concavum*, but only for a few days. Guinea-fowl could be infested with *Cryptocotyle concavum*, *Pygidiopsis genata* and *Parascocotyle sinoecum*, and ducks and geese with *Cryptocotyle concavum* and *Pygidiopsis genata*. It is suggested that receptivity or non-receptivity to infestation should not be considered as being due to immunity or resistance to infection, but rather to the chemical metabolism of the digestive tract which may vary in different species of birds.

The trematodes from the Danube fish were most often found in the posterior third of the intestine of the birds, those from the Black Sea fish were most often found in the anterior and middle thirds.

Some Observations on Manson's Eyeworm of Poultry in Antigua, B.W.I., and a suggested Method of Control. L. R. Hutson. Tropical Agriculture, Vol. 15, 1938, p. 66. Veterinary Bulletin, Vol. 9, 1939, p. 634.

Removal of the membrana nictitans of chickens as a method of control of *Oxyspirura mansoni* has given promising results. Membranectomised and control birds were infected by placing larvae in the eyes, or feeding with larvae or infested cockroaches. Adult worms were received from all of the controls but the membranectomised birds remained uninfected. Mature adult worms set up considerable irritation in the eyes of the treated birds, but disappeared within 24 hours.

Disease in Turkeys due to Prosthogonimus macrorchis. R. W. Macy. Journal of the American Veterinary Medical Association, Vol. 94, 1939, p. 537.

Infestation experiments indicate that the turkey is poorly adjusted to the fluke *P. macrorchis* and that this fowl is an unnatural host. "Turkeys eagerly devour dragonflies and flocks in the vicinity of lakes may easily become exposed to the infection. Therefore, during the period of maximum dragonfly emergence, May 20th to June 20th, the birds should be kept some distance from the lakes."

On the Nutrition of the Fowl Nematode Ascaridia lineata (Schneider). J. E. Ackert. Kansas Experiment Station. American Microscopical Society Transactions, Vol. 57, 1938, p. 218. (Ref. Experiment Station Record, Vol. 80, 1939, p. 547.)

Immature worms grown in their normal habitat, the duodenum of chickens, were transferred into the body cavities of other chickens to see if the nematodes could feed upon tissue or lymph. " Of a total of 142 live *A. lineata* transferred into the body cavities of 31 chickens, 81 of the nematodes were recovered ; of these only 16 worms remained viable for from 1 to 4 days. Nearly all of the worms recovered were phagocytosed, encapsulated or walled off by some portion of the fowl's body. The worms were unable to thrive outside the lumen of the intestine. The occasional occurrence of *A. lineata* in the hen's egg obviously is due to migration of the adult worm through the lumina of the large intestine, cloaca, and oviduct rather than to the entrance through the oviducal infundibulum of a migrating larva grown to maturity in the body cavity."

Some Trematode Parasites of Ducks and Geese in Eastern Canada. D. G. Cannon. Canadian Journal of Research, Vol. 16, 1938, p. 268.

Further knowledge of the distribution of trematode parasites encountered in ducks and geese obtained through the collections made in eastern Canada during the general survey work is reported. Of the eight species found, *Stephanoprora mergi*, taken from the caeca of an American merganser duck, is described as new, and *Echinoparyphium elegans* (Looss, 1899) and *Psilochasmus longicirratus* Skrj, 1913, both from the small intestine of the black duck, are recorded for the first time in America. Other specimens recorded are *Echinostoma revolutum* (Fröhlich, 1802), *Hypoderaeum conoideum* (Bloch, 1782), *Zygocotyle lunata* (Dies., 1836), *Apatemon gracilis* (Rud., 1819) and *Notocotylus attentuatus* (Rud., 1809).

On the Nematode, Tropisurus fissispinus and its Transmission to Chickens in Formosa. M. Sugimoto and S. Nishiyama. Journal of Japanese Society of Veterinary Science, Vol. 16, 1937, p. 305.

Investigations in Formosa have shown that the grasshoppers *Pternoscirta sauteri*, *Heteropternis respondens*, *Gastrimargus transversus*, and *Atractomorpha bedeli*, the cockroaches *Periplaneta americana* and *P. australasiae*, and the earthworms *Perichaeta candida* and *Allolobophora foetida*, must now be regarded as additional intermediate hosts for *Tropisurus fissispinus* in chickens and ducks.

Grasshoppers, cockroaches and earthworms reared under experimental conditions were fed chicken droppings containing embryonated eggs of the nematode. Infestation was readily acquired and the larvae became infective in 9 to 28 days.

The infective larva is 1·5 to 2 mm. long. The head end is blunt and simple, but the tail end has a circle of 12 equal papillae. The muscular portion of the oesophagus averages 182μ and the glandular portion 448μ. Distinct cross striations may be observed in the cuticle.

Ingestion of the intermediate host sets the larvae free in the proventriculus, where they enter the glands of Lieberkühn and become mature in about 90 days.

Alterations in the Blood of Fowls Infested Experimentally with Heterakis. Le alterazioni del sangue nei poli infestati sperimentalmente con ascaridi. (Heterakis Papillosa ed Inflexa.) I. Bacci. Nuova Veterinaria, Vol. 17, 1939, p. 95.

Eight fowls were used for this experiment and two were kept as controls. The examination of the blood was begun when eggs began to be recovered from the faeces. The number of red blood corpuscles was reduced from 3,231,500 the normal figure, to 2,280,000 and even to 2,000,000. This decrease was accompanied by anisocytosis, poikilocytosis and polychromatophilia. The most important variation in the leucocytic ratio was an intense eosinophilic leucocytosis with the occurrence of eosinophile and pre-eosinophile myelocytes. Cells resembling Rieder cells were also often seen. There was also intense thrombocytosis.

The following are the proportions after 150 days from the beginning of the infestation: red blood corpuscles per c.mm., 2,280,000, haemoglobin 44 per cent., white blood corpuscles per c.mm. 38,600, lymphocytes 29 per cent., giant mononuclear leucocytes 6 per cent., immature forms 1 per cent., Rieder cells 7 per cent., polynuclear neutrophiles 16 per cent., eosinophiles 30 to 5 per cent., pseudo-eosinophiles 10 per cent. and basophiles 0·5 per cent. For every 100 leucocytes there were 401 thrombocytes.

Acuaria hamulose Infestation in Fowls. L'acuariosi (o disfaragosi) dei polli in Umbria. R. Coppini. Nuova Veterinaria, Vol. 16, 1938, p. 312.

Infestation with *Acuaria hamulose* has been observed in fowls, pigeons, peacocks, geese, ducks, and swans. The larvae develop in the muscular tunic of the gizzard. Symptoms are lassitude, increasing emaciation and general cachexia in spite of a good appetite; death follows in 5 or 6 weeks. Diagnosis is difficult in the living subject, but easy on *post-mortem* examination. Affected birds can be treated with essence of turpentine in gelatine capsules. Coppini found that there were usually no lesions except in the digestive organs, especially the gizzard, but in the case of one fowl he found the liver and spleen seriously diseased.

Nematode Resistance in Poultry. Kansas Experiment Station. Journal of Heredity, Vol. 29, 1938, p. 53.

Differences in the resistance of breeds and strains of poultry to the nematode *Ascaridia lineata* are noted.

Studies on Helminths of Fowls. I. On the second intermediate hosts of Metorchis orientalis and M. taiwanesis, liver flukes of Ducks.

II. Some Trematodes of Fowls in Tsing-kiangpu, Kiangsu, China.

H. F. Hsu and C. Y. Chow. Chinese Medical Journal Supplement 2, 1938, pp. 441, 443. Biological Abstracts, Vol. 12, 1938, No. 7, 11856, 12421.

I. These hosts were the fish, *Pseudogobio rivularis* and *Pseudorasbora parva*. Eggs of *M. taiwanensis* appeared in faeces of ducklings 11 days after feeding cysts, and eggs of *M. orientalis* in 16 days.

II. Species reported are: *Prosthogonimus japonicus*, *Metorchis orientalis*, *M. taiwanensis*, *Opisthorchis tsingkiangpuensis*, *Hypoderaeum conoideum*, *Philophthalmus sinensu*, *Psilochasmus longicirratus* and *Harmostomum gallinum*.

Two important Diseases of Ducks in Quebec. W. E. Swales. Journal of Agriculture, Quebec, Vol. 39, 1936, p. 40.

Swales discusses duck malaria and the duck stomach worm *Tetrameres crami*). Duck malaria due to *Leucocytozoon anatis* is common in Quebec, being carried by *Simulium venustus*. It strikes suddenly, infected ducklings dying within a day of the appearance of symptoms. Control depends on the removal of nesting ducks from the vicinity of running water, and isolating them in a screened outhouse from May to July. The stomach worm is carried by fresh-water amphipods, and does considerable local damage. No curative treatment is known, and the keeping of fish is suggested as a means of removing the carriers and so preventing disease.

The Life History of the Gizzard-Worm (Cheilospirura hamulosa) and its Mode of Transmission to Chickens, with Special Reference to Hawaiian Conditions. J. E. Alicata. Livro Jubilar Prof. L. Travassos, 1938, p. 11.

The extent of gizzard-worm infestation in birds in various poultry farms in Hawaii is described. Experiments showed that grasshoppers under natural conditions harbour infective larvae of the parasite and sandhoppers, weevils and beetles may serve as carriers.

Control measures suggested include the keeping down of weeds in poultry yards and removal of droppings. Alicata found that small amounts of copper sulphate would kill sandhoppers. A 1 c.c. dose of carbon tetrachloride did not cure six infested chickens. No drugs are thus far known which will affect these parasites *in situ* in the tissues.

Studies on the Development of the Pigeon capillarid Capillaria columbae. E. E. Wehr. U.S. Department of Agriculture, Technical Bulletin, No. 679, 1939.

The results of experiments conducted to determine the transmissibility of the pigeon capillarid to chickens and turkeys under natural conditions are reported, together with an account of control measures applicable. The eggs of *C. columbae* were found to develop to the infective stage within 6 to 8 days when kept at room temperature. " Cultures of nonembryonated and embryonated eggs of *C. columbae* suspended in a small quantity of water were found to be very resistant to low temperatures. Nonembryonated eggs were found to be viable and to complete embryonation after an exposure of 35 days to a temperature of 5·6° to 9·4° C. when subsequently exposed to room temperature. Embryonated eggs were found to be infective to pigeons after an exposure of 14 days to a temperature of 6·7° to 12·2°. Drying for 24 hours at room temperature destroyed the vitality of partly embryonated eggs. . . .

" The life history of *C. columbae* was shown to be of the direct type. The unhatched embryo has not been observed to molt within the egg. The first-stage larva molts and becomes a second-stage larva early in the second week of infection. The second-stage larva completes its development and molts to the third stage before the 14th day after infection. The transition from the third to the fourth stage occurs betwen the 2nd and 3rd weeks of infection, and mature worms may be recovered from the small intestines of experimentally

infected birds as early as 19 days after infection. Eggs have been found in the faeces of the birds 26 days after infection. In experimental studies pigeons necropsied 7 months after infection were still infested with *C. columbae*. All stages of the worm penetrate more or less deeply in the intestinal mucosa, the larvae being found somewhat deeper than the adults. Necropsies of many birds have shown that most of the worms usually occur in the middle portion of the small intestine. Heavily infested birds showed symptoms of emaciation, diarrhoea and listlessness ; food and water were consumed sparingly ; and death was usually the termination of severe infestations. For several days prior to death, infested birds spent considerable time in a huddled position on the ground. The feathers were ruffled and those around the vent were usually soiled with faecal material. As observed by the writer, pigeons naturally infested with *C. columbae* showed on *post-mortem* examination extensive destruction of the mucosa, frequently with complete sloughing of the mucous membrane. The intestines contained large quantities of fluid. Control of this parasite should be directed toward prevention by thorough sanitation and selection of well-drained areas for permanent lofts. Chickens, turkeys and pigeons should be raised separately, since all three types of birds are susceptible to *C. columbae* infection."

A list is given of 17 references to the literature cited.

SUNDRIES

On a New Feather Mite Parasitic on the Indian domestic Fowl (Gallus Bankiva Murghi). M. Ab-dussalam. Veterinary Journal, Vol. 95, 1939, p. 39.

The mites were found hidden under the epidermal scales that were being cast off from the healthy skin under the wings. On examination, they were found to be a new species of the genus *Rivoltasia lauestrim*, 1894.

Leeches (Protoclepsis tesselata) as a Cause of Conjunctivitis in Geese and Ducks. Igler (Protoclepsis tesselata O. F. Müller) som Aarsag til Sygdom, bl. a Konjunktivitis, hos Gaes og Aender. M. Christiansen. Moanedsskr. Dyrlaeg., Vol. 50, 1938, p. 409 ; Zeitschrift für Infektionskrankheiten, Vol. 55, 1939, p. 75.

A flock of young geese, which had free access to a muddy pond, were observed in June to July to be affected with severe conjunctivitis with mucopurulent discharge from the eyes. The cause of the trouble was a heavy infestation of the conjunctiva with immature forms of the leech *P. tesselata* : 37 were found in one young goose. From the right and left nasal cavities 29 and 20 leeches respectively were gathered and a further four from the moth cavity. On another goose a large number of leeches were attached to the featherless skin covering the top of the head as well as to the conjunctiva.

The flock quickly recovered when removed from the pond. On a transitory inspection in September of the pond and the brook from which it was supplied, no species of *P. tesselata* was found, According to zoological records *P. tesselata* is not very frequently found in Denmark. The heavy infestation registered in this case is, therefore, most unusual.

The literature on *P. tesselata* as a parasite is reviewed and a survey is given on the morphological structure and life-history.

A False Fowl Myiasis Caused by Larvae of Lucilea eximia. Sur une fausse myiase des poules produite par la larve de la Lucilia eximia Wied. (Dipt.-Calliphoridae). H. de S. Lopes. Comptes Rendus Société Biologie, Paris, Vol. 129, 1938, p. 426.

Two larvae of the fly *Lucilia eximia* were found on the legs of a chicken severely infested with the sarcoptic mite, *Cnemidocoptes mutans*. The larvae are believed to have been feeding only on the epithelial detritus resulting from the infestation with mites, and to be of no pathogenic significance.

The Northern Fowl Mite (Liponyssus sylviarum C. and F., 1877). Investigations at Macdonald College, Quebec, with a Summary of Previous Work. D. Cameron. Canadian Journal of Research, Section D., Vol. 16, 1938, p. 230.

Cameron reviews the literature on the northern fowl mite (*Liponyssus sylviarum*). Twenty bird hosts and two mammals (man and the lemming) are recorded, and the morphology and bionomics of the mite are discussed in detail. He recommends the isolation of infested birds, the clearing of roosts, floor-boards and boxes in frosty weather, and the painting of roosts and their supports, and the lower front edges of nest boxes, with nicotine sulphate 20 minutes before the bird roosts (a single treatment). The birds come in contact with the nicotine and so rid themselves of mites ; 2 oz. is sufficient for 50 birds, but all should be treated on the same evening. Single birds may be hand-treated.

The Presence and Distribution of Hexamita sp. in Turkeys in California. W. R. Hinshaw, E. McNeil and C. A. Kofoid. Journal of the American Veterinary Medical Association, Vol. 93, 1938, p. 160.

The authors report having found a diplozoic flagellate of the genus Hexamita in turkeys suffering from enteritis that is similar to and probably the same as the infection described by Gierke and Hinshaw and Hinshaw. In the acute stage of the disease the flagellate was present in large numbers throughout the small intestine and in fewer numbers in the caeca. " It is usually also found in the bursa of Fabricius, and in poults killed after they reached a comatose condition it was found in a few instances in the abdominal cavity and in the liver. In the convalescent stages there seems to be a tendency toward a diminution in numbers in the duodenum and a persistence of large numbers in the lower jejunum, ileum, and bursa of Fabricius. It has been found in the bursa in turkeys up to 5 months of age." A list is given of 13 references to the literature.

Trichomonas gallinae (Rivolta, 1878). The Correct Name for the Flagellate in the Mouth, Crop and Liver of the Pigeon. R. M. Stabler. Journal of Parasitology, Vol. 24, 1938, p. 553.

A review of the literature on the Trichomonas from the upper digestive tract and liver of the pigeon reveals much confusion regarding its correct name. Since only one flagellate has actually been described from these sites, the names, *Cercomonas gallinae*, *C. hepaticum*, and *T. columbae* of various authors thus become synonyms of *Trichomonas gallinae*.

NEUROLYMPHOMATOSIS

Proposal for Experiments on Fowl Paralysis on an International Basis. Prof. Beller. World's Poultry Congress, Cleveland, 1939.

Fowl paralysis has become one of the most serious diseases of chickens menacing the poultry industry in many countries. Much experimental work has been done on this disease. Its results, however, have been very contradictory and far from convincing.

The cause of fowl paralysis is still unknown. Many regard it as an infectious disease probably caused by a filtrable virus, while others believe that it is due to a constitutional ailment brought about by intensive breeding for egg-production. Still others attribute it to environmental factors, excessive feeding of protein, or line breeding.

Most of the experiments on the transmission of the disease have been faulty in some respects. In many cases, the number of experimental animals used was so small that the results obtained were inconclusive when analysed statistically. Moreover, such animals often came from flocks not proven to be absolutely free from the disease. Another requirement neglected in many cases is the proper isolation of the experimental birds. Finally, the diagnosis of " fowl paralysis " has been made by some investigators on the basis of visceral and ocular lesions in the absence of marked nervous involvement which, in our opinion, is the only pathognostic sign of the disease.

It is advisable, therefore, to resume the experiments, omitting the mistakes previously made, and to provide sufficient funds to carry them out on a large scale and with the necessary precautions regarding the isolation of the experimental animals.

We propose the following principles for future work on the experimental transmission of the disease.

1. To secure experimental material (preferably fertilised eggs) from a variety of carefully controlled flocks free from fowl paralysis and leucotic diseases. The absence of these diseases from the flocks should be substantiated by preceding histological examination of a number of fowls of different ages.
2. Careful incubation of the eggs in sterilised incubators under uniform conditions.
3. To divide the chicks from the same parents after hatching into two equal groups, one to be inoculated by different methods at different ages, the other to remain uninjected as controls. This procedure should be repeated with each lot of chicks from the same parents. Hereditary factors that might influence the result of the experiment can be controlled in this manner.
4. The experimental animals should all be of the same sex to prevent possible infection by mating.
5. Both groups should be raised and fed in the same manner with coops and pens as equal as possible.

Is Paralysis of Fowls, as manifested by Iritis, transmitted through the Egg? C. F. McClary and C. W. Upp. Louisiana Station University. Poultry Science, Vol. 18, 1939, p. 210.

Observations of 227 chickens hatched and grown in isolation from the parent stock revealed approximately 20 per cent. incidence of iritis, strongly suggesting transmission of the disease through the egg. High incidence of fowl paralysis in the control group of birds indicated spread by contact.

The incidence of iritis in the progeny of parents with iritis was found to be greater than it was in those from parents with normal eyes. Slight cases of iritis did not greatly decrease the mean body weight of individuals so affected. Coccidiosis and parasitic infection apparently played no part in the incidence of iritis in this test. Dipping hatching eggs in chlorine water had no ill-effect on hatchability.

A bibliography of 30 titles is included.

PARALYSIS

The Nature of Fowl Paralysis (Neurolymphomatosis). F. Blakemore. Journal of Comparative Pathology and Therapeutics, Vol. 52, 1939, p. 144.

By inbreeding, fowl paralysis (neurolymphomatosis) was eliminated from a strain of fowls derived from badly affected stock.

The progeny were still highly susceptible as shown by the occurrence of the disease following injection of tissues from natural cases and exposure to natural infection.

In addition to the occurrence of typical lesions of neurolymphomatosis, the injected and exposed fowls became unthrifty and developed atypical lesions in the viscera, especially the liver and heart.

Passage experiments from the atypically affected fowls were carried out in the course of which the infective agent became raised in virulence and gave rise to an acute disease.

The early lesions in the heart and liver were inflammatory in character, and in some of the survivors a true lymphomatous response was found.

A study of the lesions in all stages of the infection indicates that in all probability the disease, popularly termed fowl paralysis or neurolymphomatosis, is the chronic stage of an acute infection.

The nature of the infecting agent is now being studied. The results of the investigation are in keeping with observations made in naturally occurring outbreaks of fowl paralysis and leave little doubt concerning the infective nature of the disease.

An Experimental Attempt to Produce Lymphomatosis in Chickens by Injections with Salmonella aertrycke and Lymphomatous Nerve Tissue, with Observations on the Blood Pictures of the Chickens. J. R. Beach and N. M. Twisselmann. University of California. Poultry Science, Vol. 18, 1939, p. 160.

The results of the experiment here reported failed to show that intravenous inoculation of young chickens with lymphomatous nerve tissue or the repeated oral administration of cultures of *Salmonella aertrycke*, either alone or in combination, caused the development of lymphomatosis or produced a haemocytoblastosis or other changes in the blood pictures of the chickens. " Several types of abnormalities of blood pictures were found in 12 or 13 chickens with lymphomatosis. These, however, did not conform to any particular trend as to their nature nor with respect to the type of lymphomatosis with which the chickens were affected. Their appearance was nearly coincident with the development of paralytic symptoms in the case of neurolymphomatosis and shortly before death in the case of visceral lymphomatosis. They are regarded as a doubtful or valueless diagnostic aid."

Is Fowl Paralysis Infectious? A. H. Fraser. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 106.

Studies conducted at the Rowett Research Institute in Great Britain led to the conclusion that some infective factor which isolation tends to exclude, not worms and probably not coccidia, increases the incidence of fowl paralysis among poultry when other conditions are equalised. While the precise nature of the infective factor remains unknown, the results of 3 years' work on this disease indicate that fowl paralysis is infectious in nature.

Transmission of Avian Leucosis : A Note on Beach's Experiments. R. K. Cole. Cornell University. Poultry Science, Vol. 17, 1938, p. 417.

An application of the usual methods of statistical analysis has led the author to conclude that in the experiments of Beach, the transmission of avian lymphomatosis by inoculation was accomplished.

Failure of Wheat Germ Oil to Prevent Lymphomatosis in Chickens. L. W. Taylor and K. B. DeOme. University of California. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 73.

Data presented, the details of which are given in tables, are considered to show clearly that under the conditions of the experiment the feeding of wheat-germ oil had no appreciable effect on the incidence, type, or age of onset of lymphomatosis. " In this experiment the genetic constitution of the stock was responsible for the differences observed in the incidence of lymphomatosis. This conclusion is in agreement with previous work on this flock, wherein the principal indentifiable variable associated with the disease was of genetic nature." A list is given of 11 references to the literature.

Studies on Fowl Paralysis. 3. A Condition resembling Osteopetrosis (Marble Bone) in the Common Fowl. E. Jungherr and W. Landauer. Bulletin of Storrs Agricultural Experiment Station, No. 222, 1938, p. 34.

An outbreak of osteopetrosis is described in a breeding flock of 2,000 birds kept for purposes of genetic research. About 30 birds were affected in 1933, and 40 in 1934. Males and females appeared to be equally susceptible. The symptoms, gross pathology and histopathology are described in detail. The disease could be transmitted by inoculating chicks under a week old with heparinised whole blood or suspensions of bone-marrow from certain affected cases.

Practically all the natural cases of osteopetrosis had also lesions of lymphomatosis, and osteopetrosis could be set up by inoculating lymphocytic tumour material from them. The gross deformities seen in spontaneous cases of osteopetrosis were never reproduced experimentally. Lymphomatosis occurred in 47·5 per cent. of the inoculated chicks, compared with 2·5 per cent. in the controls. It was impossible to obtain a strain of osteopetrosis which did not also produce lymphomatosis, and the authors concluded that the. transmissible agent embodies both osteogenetic and lymphogenetic properties. This agent, which was ultramicroscopic and cell-free, could withstand desiccation for 105 days.

A review of the literature on avian osteopathies is included.

Paralysed Birds Recover. Feathered World, March 29th, 1940.

Two pullets received at the East Anglian Institute of Agriculture by Mr. Ernest Gray were hopelessly paralysed. Two injections of a 10 per cent. solution of potassium iodide, given a day apart, caused complete recovery within a week. They are now in lay.

LEUCAEMIA

Leucosis of Chickens caused by the Carcinogen 1, 2, 5, 6-dibenzanthracene. N. D. Yudina. J. Méd. Ukrain, Vol. 7, 1937, p. 819 ; Chemical Abstracts, Vol. 32, 1938, 7993.

Of 45 chickens given weekly subcutaneous injections of 0·5 per cent. dibenzanthracene in chicken fat during 5 months, one developed leucaemia, three aleucaemic myelosis, one of which also developed sarcoma and one had uncomplicated sarcoma.

On the Nature of the Agent causing Leucosis in Fowls. K. G. Stern and A. Kirschbaum. Science, Vol. 89, 1939, p. 610.

The studies of the virus of fowl leucosis here reported upon have led to the conclusion that with respect to its chemical and physical properties the material described resembles the causative agent of the Rous chicken tumour I, reported upon by K. G. Stern and F. Duran-Reynals, and also the macromolecular material isolated by A. Claude from normal chick embryos. In contrast to the virus proteins isolated by Stanley and others from plants, these materials do not represent pure nucleoproteins but much more complex chemical structures of the type encountered in the analysis of protoplasm.

Fowl Leucosis : The Recognition of a Transmissible Myelogenous and Erythroleucotic Form in New Zealand. L. W. N. Fitch. New Zealand J. Sci. Tech., Vol. 20, 1938, p. 40a. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 414.)

F. described a naturally occurring case of fowl leucosis. The liver and spleen were greatly enlarged and the peritoneum covered with flattened, greyish-white nodules. Histologically the tumours and affected organs showed chiefly undifferentiated myeloblasts, which were so named because many cells failed to exhibit any indication that they would develop into granulocytes.

The disease was transmitted to 6 week old chicks by intraperitoneal inoculation of liver and spleen emulsions. The presence of erythroleucosis was also demonstrated in the inoculated birds.

The Reactivation of the Fowl-Leukosis Agent after Inactivation by Oxydization. O. Frederiksen and J. Englebreth-Holm. Acta path. microbiol. scand. Suppl., Vol. 38, 1938, p. 49. ; Veterinary Bulletin, Vol. 9, 1939, p. 643.

This is a summary of material presented at the Scandinavian Pathological Congress in 1938. The authors state that infective plasma can be rendered inactive by subjecting it to oxidation and can be reactivated by subjecting it to reduction. They state that their findings may be of importance in relation to the question as to whether tumour viruses are to be considered as living micro-organisms or as chemical substances.

Fowl Leukosis. IV. Symptoms and Pathology. V. Transmission Experiments. C. D. Lee and H. L. Wilcke. Iowa Experiment Station. Poultry Science, Vol. 18, 1939, p. 244.

In the conclusion drawn from this series of studies it is pointed out that the term fowl leucosis is used to include the group of transmissible leucaemic, aleucaemic, and leucaemiclike diseases of fowls. "The disease in all expressions may be transitted to healthy chicks by injection of tissue suspensions of affected organs, by injection of cell-free filtrates, by pen contact exposure, or by contact with contaminated soil or litter. The evidence indicates that fowl leucosis is an infectious disease and transmitted by a filtrable virus. The incubation period of the disease is rather long, with a majority of cases occurring between 4 and 8 months. The clinical course is variable, extending over a period of weeks or months in some cases, while in others it is comparatively short. No recoveries have been observed, but temporary respites do occur. In the light of our present knowledge it seems rather important that a complete histopathological examination be made of all birds before a definite diagnosis is made. The injection of a suspension made from one type produces all the various manifestations considered to be expressions of this disease. Different suspensions experimentally produce similar results. Neurolymphomatosis associated with iritis, haemocytoblastosis, lymphoid, erythroid, and myeloid types of leucosis are different expressions of the same disease, and all are transmitted by a common etiologic agent. There seems to be a definite inherent difference of susceptibility and resistance in different birds and birds of different strains. The most important methods of control are careful culling, sanitation, and use of breeding stock from resistant sources."

Lymphoblastoma in Young Chicks. Poultry Tribune, March, 1937.

Using normal feed mixtures which had been treated with ferric chloride in ether solution in order to destroy vitamin E, Dr. F. B. Adamstone, University of Illinois, has obtained some interesting results in chicks. Microscopic examination of various tissues—chiefly heart, liver and gizzard—has shown a peculiar type of neoplasm or tumor which is malignant in character.

There is a progressive destruction of normal tissues by the new growth, accompanied by diversion of food material from the normal tissues and frequent haemorrhage when the new growth invades the blood vessels. There is extremely rapid increase in the number of cells in the affected tissues, and a marked similarity in type of new tissue growth regardless of the particular organ affected.

Considerable significance is attached to the fact that it has been possible to set up dietary conditions which bring about the development of excessive tissue growths, and cause changes in the character of certain cells so that they assume a destructive relation to their neighbouring cells. Especially interesting is the similarity between the conditions brought about by these experimental procedures and the conditions occurring naturally in leucemia. No general conclusions can be drawn, but the possibility exists that this type of study may ultimately help to explain the exact nature of leucaemia.

TUMOURS

Concentration and Purification of Chicken Tumor I Agent. A. Claude. Science, Vol. 87, 1938, p. 467.

A purified fraction (*I*) of chicken tumour *I* agent was prepared by extension of frozen tumours and purification in a high-speed centrifuge. *I* in concentrations of $5{\cdot}2 \times 10^{-12}$ produced vigorous tumours in hens. *I* is soluble in water and neutral, dilute buffer solutions. It is insoluble in abstracts EtOH, Me_2CO, Et_2O, $CHCL_3$ and C_2H_6. *I* is inactivated but not coagulated by heat (20 minutes at 54°). About 24 per cent. of *I* is soluble in Et_2O. *I* contains 9·0 per cent. N and 0·5 per cent. P, and gives positive pentonse, biuret and Millon tests.

The Occasional Neutralization of the Active Agent of Filterable Fowl Tumors by Fluid Media from Tissue Cultures. R. J. Ludford. American Journal of Cancer, Vol. 35, 1939, p. 63 ; Chemical Abstracts, Vol. 33, 1939, 2999[6].

A substance of unknown composition, capable of inactivating a filtrate of Fujinami sarcoma, is occasionally found in tissue culture flasks containing a plasma clot composed of fowl plasma and embryo extract.

Effect of Fatty Acids Structure on Inhibition of Growth of Chicken Sarcoma. O. M. Helmer and G. H. A. Clowes. American Journal of Cancer, Vol. 30, 1937, p. 553.

The authors found that an unsaturated fatty acid fraction of pig pancreatic juice had a strong inhibitory effect on the growth of the active agent of chicken tumour *I*, and oleic acid was found to have a comparable inhibitory effect. The biological properties of the fatty acids and their soaps were shown to be related to their structure. The authors then attempted to discover the relationship of the chemical configuration of a series of fatty acids to their inhibitory effect on the active agent of chicken tumour *I*.

Fatty acids dissolved in di-sodium acid phosphate were added to an aqueous extract of desiccated tumour *I* prior to injection into Plymouth Rock hens. It was shown that the straight chain unsaturated fatty acids with 18 carbon atoms had a greater inhibitory effect than a comparable saturated fatty acid. Increase in the degree of un-saturation greater than that of oleic acid did not increase this inhibitory effect, which was shown to be lessened when the acids were oxidised or reduced.

The presence of the hydroxyl group lessened the inhibitory action, which varied with the length of chain, the higher members of the series showing a much higher inhibitory action than the lower members. The inhibitory effect could only be seen when the fatty acid was in the form of a soap or in the free state.

SUNDRIES

Poultry Sanitation and Disease Control. B. F. Kaupp and R. C. Surface. Chicago : Authors, 1939.

This work, intended to be a complete guide to sanitation and treatment of diseases of poultry, is presented in 21 chapters.

Preliminary Notes on a Hitherto Undescribed Poultry Disease. Y. S. Grasovsky. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 71.

A description is given of a disease which appeared among young Rhode Island Red pullets and occasionally hens of the same breed on a large poultry farm in Palestine. While resembling the infectious purulent enteroproventriculitis studied at the North Carolina Experiment Station by Kaupp and his associates, well-defined differences were detected.

Zinc Poisoning among Poultry. O. Grini. Norway. Nordisk. Fjäderfätidskrift, No. 2, August, 1939.

It is especially emphasised in this article that caution must be observed in the use of galvanised containers for food for animals. A couple of instances are mentioned of zinc poisoning among poultry occasioned (1) by feeding from galvanised vessels and (2) through the fowl having eaten paint that contained zinc. It must be remembered that zinc is attacked even by inorganic acids.

A Study of Glycine Toxicity. A. R. Patton. University of Arkansas. Poultry Science, Vol. 18, 1939, p. 31.

Glycine proved toxic to chickens when the level of ingestion reached a certain point, 1 gramme per day being fed for an extended period without symptoms of toxicity, while 4 grammes per bird daily caused toxicosis within a few days. When 25 grammes of glycine suspended in water was introduced into the crop of a hen, coma and frequently death resulted within 24 hours. Glycine toxicity was not due to high intake of soluble organic matter or soluble nitrogen, as evidenced by the fact that 30 grammes of either glucose or urea were easily tolerated. Other qualitative tests indicated that it was not due to oxalic acid, methylamine, acidosis, alkalosis, or increased glycine in the blood. The probable cause was an excessive intake of soluble amino nitrogen, since identical toxicity was observed when similar amounts of *dl*-alanine were administered. Symptoms of toxicosis were accompanied by a marked increase in urinary nitrogen, a pronounced decrease in liquid excretion, an increase in concentration of purines, and an increase in size of kidneys with accompanying damage.

The Veterinary Profession and the Poultry Industry. Anon. Veterinary Record, Vol. 50, 1938, p. 1499.

An editorial article concerning the report of the Poultry Technical Committee, established by the Minister of Agriculture, England and Wales, and the Secretary of State for Scotland.

Uropygitis in Domestic Fowls. M. Mokey-Dean. Veterinary Journal, Vol. 95, 1939, p. 45.

This oil gland disease is a non-contagious, chronic inflammatory condition of the rump sebaceous gland. The tip of the gland becomes pointed like a sharp cone.

Description of history, occurrence, aetiology and causes, symptoms and treatment.

Contributions on Avian Pathology. Poultry Science, Vol. 17, 1938, p. 435.

Abstracts of contributions presented at the annual meeting of the Poultry Science Association held at Pullman, Washington, in August, 1938, include : Is Paralysis of Fowls, as Manifested by Iritis, Transmitted Through the Egg ? by C. F. McClary and C. W. Upp (Louisana State University) ; The Protective

Effect of Sulphur Against Artificial Infection with *Eimeria acervulina* and *Eimeria tenella*, by E. M. Dickinson and R. H. Scofield, and Erysipelas of Turkeys, by H. A. Hoffman and W. R. Hinshaw (both University of California *et al.*); Transmission of Leukemia in Young Chickens, by C. M. Hamilton and C. E. Sawyer (Washington Experiment Station); Fowl Paralysis, Leukemia, and Allied Conditions in the Fowl, by M. W. Emmel (Florida); An Experimental Attempt to Produce Lymphomatosis in Chickens by Injections With *Salmonella aertrycke* and Lymphomatous Nerve Tissue, With Observations on the Blood Pictures of the Chickens, by J. R. Beach and N. M. Twisselmann (University of California); An Important Factor Influencing the Development of Fowl Paralysis, Leukemia, and Chronic Hemocytoblastosis in the Hen-Battery Plant, by M. W. Emmel (Florida); and Fowl Leukosis, by C. D. Lee and H. L. Wilcke (Iowa State College).

Bibliography of Poultry Diseases. Vol. 4, No. 1, April, 1939. Issued semi-annually at New Jersey Agricultural Experimental Station and Rutgers University, New Brunswick. E. Jungherr, H. van Roekel, F. R. Beaudette.

Contents:

Virus Diseases; Bacterial Diseases; Mycotic Diseases; Protozoan Diseases; Parasitic Diseases; Miscellaneous; Deficiency Diseases; Egg Composition; Embryology; Endocrinology; Genetics; Miscellaneous; Nutrition; Physiology; Toxicology.

Poisons. Two Fowl Post-mortems. G. Mayall. The Veterinary Journal, Vol. 95, 1939, p. 145.

I. Corn Cockle Poisoning.—The oesophagus was inflamed, the liver jaundiced, there was pericarditis and a number of soft eggs in the oviduct.

II. Carbide Poisoning.—On *post-mortem* examination, the proventriculus was brown and dry and eroded and the contents smelt lightly of acetylene.

Work in Animal Pathology by the Massachusetts Station. Massachusetts Station Bulletin, No. 355, 1939.

The work of the year briefly reported upon includes pullorum disease eradication, infectious bronchitis immunisation of poultry, pullorum disease in turkeys and viability of *Salmonella pullorum*, all by H. Van Roekel, K. L. Bullis, O. S. Flint, and M. K. Clarke; and studies of neoplastic and neoplastic-like diseases by C. Olson, Jr.

Work in Animal Pathology and Parasitology by the Wyoming Station. Wyoming Station Report, 1938.

Work with coryza (roup) in chickens and transmission experiments with avian coccidiosis are briefly considered in this report.

The Control of Turkey Diseases. K. D. Downham. Harper Adams 23rd Annual Poultry Conference, August, 1939.

Experiments appeared to indicate that diet and management have considerable influence on the development of blackhead. There is some evidence to suggest that the practice of treating turkeys with Stabilarsan Veterinary (arsphenamine diglucoside) at the age of 6 to 8 weeks is of value in checking blackhead.

Lymphomatosis has been reported in turkeys on several occasions. Occasionally neurolymphomatosis with paralysis is found.

Elements resembling Balfour Bodies in Blood Cells of Fowls. Présence dans les hématies de poulets d'éléments rappelant les corps de Balfour. C. Henry. Bull. Soc. Path. exot., Vol. 32, 1939, p. 145. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 842.)

This is a description of cell inclusions found within the cytoplasm of the erythrocytes of fowls which were used for experiments with *Plasmodium gallinaceum*. In smears stained with May-Grünwald-Giemsa the inclusions appeared as red granular bodies, 0-5-2-5μ in diameter, surrounded by a halo and apparently showing evidence of binary and multiple fission. They were found in both diseased and healthy fowls.

The morphology of the bodies suggests their relationship to *Aegyptianella pullorum* (Balfour bodies) or to the parasite described by Coles in 1937, in New York and Philadelphia States. Further work on these inclusions is in progress.

Poultry Diseases. J. R. Beach. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 613.

Contents :

Descriptions of Paratyphoid Infection in Chickens and Turkeys ; Pullorum Disease ; Equine Encephalomyelitis in Birds ; Avian Lymphomatosis ; Differentiation of Respiratory Diseases ; Infection Catarrhal Enteritis of Turkeys ; Poultry Disease Nomenclature ; Explanation of Check Lists of Virus Diseases.

Infectious Catarrhal Enteritis of Young Turkeys. W. R. Hinshaw and E. McNeil. California Experiment Station. Nulaid News, Vol. 16, 1939, p. 25.

In reporting on the catarrhal enteritis of young turkeys due to a diploxoic flaggelate of the genus Hexamita, previously noted, the following measures are recommended as a means of prevention : (1) Selling all breeding birds at least 2 weeks before any poults are hatched ; (2) complete isolation of the breeding unit from the brooding quarters ; (3) separate attendants for the breeding flock and young poults ; (4) use of cement yards, and wire pens ; and (5) arrangement of feeding and watering equipment so that the attendant does not need to enter the pens.

Report of the Special Committee on Poultry Diseases. Journal of the American Veterinary Medical Association, Vol. 94, 1939, p. 311.

The committee stresses the chaotic methods and varied personnel dealing with poultry diseases in U.S.A. It recommends the formation of a special committee to study this problem and, especially, what responsibility the veterinary profession should undertake. It emphasises that live poultry should be inspected by veterinarians under the Bureau of Agricultural Economics' scheme, and also recommends an amendment of the Meat Inspection Act so as to include poultry.

In view of continuing outbreaks of infection with *Erysipelothrix rhusiopathiae* (the bacillus of swine erysipelas) which have occurred in turkeys since 1935, and its spread to several states, an attempt to determine the source of infection (sheep and fish-meal are suspected) is advised. The geographic and host distribution of poultry parasites, including blood parasites, require

investigation. Because wild birds may act as reservoirs of infection for common poultry, examinations of all species of birds, especially game birds, are recommended in order to acquire all the information possible. The importance of correct differential diagnosis of tumours histologically and by transmission tests is stressed, and the standardisation of examination methods for the diagnosis of respiratory diseases is advised.

General criticism of the United States National Poultry Improvement Plan is directed chiefly against certain provisions relating to control of *Salmonella pullorum* infection, such as (*a*) if only 10 per cent. reactors are found the flock is classed as " United States pullorum-tested breeding chickens," (*b*) only breeding stock need be tested, and (*c*) the test need not be under supervision by a proper Live Stock Sanitary Officer. In the opinion of the committee these provisions are all contrary to successful eradication principles. Finally, the committee recommends that a revised nomenclature of poultry diseases be included in its forthcoming report to the next annal meeting of the Association.

Poultry Mortality. L. E. Boley, R. Graham. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 545.

Mortality studies were made on one flock of approximately 1,500 hens and pullets over a period of 4 years. Sick and dead birds were autopsied daily with microscopic, histopathological and bacteriological examinations supplementing some of the autopsies. Losses on the flock were recorded (figures = per cent.), 1934-35, 37·87 ; 1935-36, 22·2 ; 1936-37, 27·04 ; and 1937-38, 47·099. In the flock studied, it appears that leucaemia and internal parasites are the important factors in the mortality. The incidence of leucaemia as observed at autopsy increased from 25 per cent. in 1934-35 to 53·1 per cent. in 1937-38.

Seventy-eight per cent. of the total mortality occurred in the pullets of the flock during the year 1937-38, while 79 per cent. of the lesions of leucaemia were observed in the pullets.

A classification of the disease entities diagnosed in 15,234 poultry specimens submitted to the division of animal pathology and hygiene, University of Illinois, over a period of 7½ years is recorded.

Toxic Algae in Colorado. A. W. Deem and F. Thorp. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 542.

While it is believed that the death of the ducks and the wild birds found around the lake were due to the effect of the toxic algae, the cause of the deaths of the fish and reptiles is only speculative. It was first believed that they might have died of suffocation, due to the fact that the water was stagnant. Carp, however, are probably rather resistant to suffocation, and the lake was no more stagnant than before the fish began to die.

The experimental work has shown that the algae were toxic to rabbits, guinea-pigs and chickens. The poison was not neutralised by botulinus antitoxin A, B or C. The water filtered from the algae was toxic to guinea-pigs. The symptoms and rapid death of the experimental animals following the administration of the algae corresponded to the description given by Fitch *et al.* and was not characteristic of botulinus poisoning.

The ground-up emulsion of dead fish, either filtered or unfiltered, was not toxic to guinea-pigs.

Clostridium botulinum was not isolated from the fish or one of the dead birds by suitable anaerobic methods.

A Genetic Approach to the Control of Adult Mortality in the Fowl. C. D. Carpenter and J. H. Martin. University of Kentucky. Poultry Science, Vol. 18, 1939, p. 168.

Citing evidence of progress in reducing mortality by selection for resistance to pullorum disease reported by Roberts and Card and to fowl typhoid reported by Lambert and Knox, the authors suggest controlling adult mortality genetically through line-breeding from large families of proved viability and finally by crossing superior lines to restore vigour lost through inbreeding.

Relation of Body Weight at Housing to Mortality. F. A. Hays. Massachusetts Agricultural Experiment Station. Bulletin No. 364.

Mortality in the laying houses decreased as the weight of pullets at housing time increased. This observation was made after a study of body weights of 2,283 Rhode Island Red pullets.

Pullets gaining 1½ lb. from housing time to March 1st had the lowest mortality during the remainder of the year, indicating that removal of light-weight birds about March 1st offers an effective way of cutting subsequent laying house losses.

From the standpoint of the number of eggs and the size of eggs produced, Hays found that an increase in body weight of about 1½ lb. during the first laying year was most desirable in this flock of Rhode Island Reds. Birds losing weight or showing no change in body weight during their first laying year gave unsatisfactory egg records.

Report of the Poultry Pathology Laboratory for the Fiscal Year ending March 31st, 1937. Canada. Rep. Vet. Dir. Gen. Dept. Agric. Can., 1936-37.

The report is a review of Poultry Conferences attended, of routine diagnostic services and of research in progress. One of the accompanying tables shows 20 diseased conditions identified, with their seasonal distribution. It is of interest to note that infectious laryngotracheitis and infectious bronchitis may be accurately differentiated and that their seasonal occurrence is quite different. The other table indicates the source and seasonal distribution of blood samples submitted to agglutination tests for *Salmonella pullorum* infection. Research was continued on the mortality in adult laying fowls and on coccidiosis.

The Enhancing Effect of Azoproteins on the Lesions produced by Vaccine Virus, the Shope Fibroma Virus, and the Agent Transmitting Chicken Tumour. A. Claude. Journal of Experimental Medicine, Vol. 69, 1939, p. 641. (Ref. Veterinary Bulletin, Vol. 9, 1939, p. 771.)

It is known that azoprotein solutions, like testicular extracts, possess the property of causing particles to spread through the dermis. The present work shows that azoproteins exhibit, like testicular extract, the power to increase the size of virus lesions in the skin of rabbits, and the size of tumours in chickens. The results indicate that the extent of the lesion is roughly proportional to the spreading power of the solution. This suggests that the spread of the infective material, over a large area of skin, is directly responsible for the enhancing effect.

The production of extensive lesions by means of spreading agents may have a practical value when large amounts of working material are needed.

Vesicular Dermatitis in Chickens. H. A. Hoffman. Journal of the American Veterinary Medical Association, Vol. 95, 1939, p. 329.

An acute outbreak in hens of vesicular dermatitis that involved the unfeathered skin of the head, feet and shanks is reported. One attack of the disease failed to confer an immunity, as evidenced by the fact that the disease recurred in the same individuals approximately 5 weeks following the onset of the first symptoms. Cultural examinations of affected birds consistently yielded staphylococci from lesions on the head and feet and, in one instance, from the liver of affected birds. Other types of organisms, apparently contaminated, were found in some of the cultures.

Exudate from the lesions on affected birds, as well as cultures of the staphylococcus, when rubbed into scarified skin of healthy birds resulted in vesicle formations in 12 out of 20 inoculations made.

Pen contact, feeding tests and subcutaneous inoculations were negative. The mild type of lesions produced by inoculation tests and the failure of these lesions to spread after the manner observed in natural cases preclude definite conclusions with respect to the etiological significance of the organisms studied.

Comparative studies were made with staphylococci obtained from cases of arthritis in chickens and from a case of impetigo in man. Inoculations with these cultures into scarified skin of healthy chickens resulted in lesions indistinguishable from those obtained with cultures from the acute vesicular dermatitis case.

Nutritional Encephalomalacia in Chicks and certain related Disorders of Domestic Birds. A. M. Pappenheimer, M. Goettsch and E. Jungherr. Storrs (Connecticut) Agricultural Experiment Station Bulletin, No. 229, January, 1939, p. 121, 20 plates.

Summary :

1. A synthetic diet containing all the factors known to be necessary for normal rat nutrition except vitamin E produces in young chicks a severe disorder of the brain. The term *nutritional encephalomalacia* is proposed for this previously unrecognised disease.

2. The essential pathological change is an ischemic necrosis of cerebellum, cerebrum, mid-brain *a* or medulla. Optic lobes, spinal cord and peripheral nerves are not affected. No constant visceral lesions have been noted.

3. The disease is not transmissible by inoculation and there are no reasons for regarding it as infectious in origin.

4. It is not accompanied by changes in blood volume or cell plasma ratio.

5. Acute lesions are associated with increased moisture content of the affected brain tissue.

6. Disease occurs during the period of active brain growth.

7. A protective factor is present in various vegetable oils and has been concentrated from soy bean oil by extraction with 95 per cent. alochol.

8. The protective factor in the natural oil resists autoclaving and aeration.

9. It is present in the non-saponifiable fraction, if due precaution is taken against oxidation during saponification and proper solvents are used for extraction. The fatty acid and water-soluble fractions are inert.

10. The active fraction can be further concentrated by the removal of sterols by freezing and precipitation with digitonin.

11. Preliminary experiments indicate that the chicks are protected by *a*-tocopherol (vitamin E) from vegetable oils and by synthetic *dl-a*-tocopherol acetate.

12. Ducks do not develop nutritional encephalomalacia upon the same diet, but there is produced widespread degeneration of the skeletal muscles. It is not known whether the duck disease is due to the same factors that induce encephalomalacia, but there are indications that vegetable oil contains a protective factor against the duck disease.

13. For turkeys, the same diet brings about selective necrosis of the smooth muscle of the gizzard.

14. Diseases having identical symptoms and pathology occur in chicks, ducklings and turkeys under field conditions.

Respiratory Diseases of Poultry: Their Prevention and Control. J. P. Delaplane. Rhode Island Station. Misc. Res. Pub., Vol. 4, 1939.

A practical summary of information on respiratory diseases of poultry.

A Study of Fowl Paralysis. Part I. Ante-mortem Diagnosis. C. W. Barber. The Cornell Veterinarian, Vol. 29, 1939, p. 41.

Description of a method for ante-mortem macroscopic examination of the sciatic nerve. Of 21 with wheat germ oil treated birds, 15 showed no improvement. Four birds made partial or temporary recoveries. Of the remaining two, one died of a respiratory infection and showed no lesions of paralysis while the other one has walked normally for about 7 months.

Of 14 paralysed birds maintained as controls, one recovered. Partial and temporary recoveries were not seen in this group.

Further Observations on Fowl Paralysis. E. Gray. East Anglian Institute of Agriculture, Chelmsford, Essex. The Veterinary Record, Vol. 51, 1939, p. 754.

Observations of author support the findings of Emmel, which have hitherto not been confirmed in England. It is possible that the organisms isolated from the nerves (*Streptococcus viridans*, *Staphylococcus aureus*, *Bacillus pyogenes*) are of no special significance. The curious association of parasitism with lymphomatosis or paralysis is, however, of interest in view of the findings of other workers.

New Light on Paralysis. E. Gray. East Anglian Institute of Agriculture, Chelmsford, Essex. Feathered World, April 28th, 1939.

In May, 1938, the writer found that certain organisms could be isolated from the nerve trunks of paralysed birds. These germs were of three types, but in over 90 per cent. of cases only one was found, namely, the *Streptococcus viridans*, which is suspected of being one cause of rheumatism in man.

In a pen of birds receiving in their mash and drinking water worm eggs, coccidial oocysts and cultures of the original organisms isolated after several weeks one bird abruptly went down with paralysis of both legs. The nerves were found inflamed, coccoid organisms were isolated from them and a lymphoid tumour was found in the ovary.

The role of the parasites is merely to blast a road into the body through which the bacteria can travel.

The disease can be controlled by breeding from sound stock and rearing chicks under the best hygienic conditions with plenty of fresh air, green stuff, exercise, and rations of good quality.

Observations on the Etiology and Control of Fowl Paralysis. J. W. Johnston and J. E. Wilson. The Veterinary Journal, Vol. 95, 1939, p. 474.

These experiments are concerned with the influence of environmental factors on the incidence of fowl paralysis.

When newly hatched chicks were taken from the original plant, where the disease was prevalent and reared on fields where poultry had not previously been kept, the mortality was very much lower than in the case of closely related birds reared in the original plant.

The disease appeared in birds hatched from eggs obtained from a stock free from disease but reared in the original plant.

Isolation, though proved by the appearance of coccidia to be incomplete, was effective in reducing the incidence of the disease and postponing the onset of symptoms.

The results obtained suggests that the disease is infectious and can be controlled by methods of management specially designed for that end.

Sulphured Soil for Poultry Yards. M. W. Emmel. Florida Experiment Station. Journal of the American Veterinary Medical Association, Vol. 94, 1939, p. 409.

The findings in experiments on various uses of sulphur in connection with poultry raising, conducted during the past three years, have shown sulphured soil to be of assistance in the control of diseases met with on premises in which birds must be confined in the same yards continuously. Commercial flour sulphur, consisting of ground run-of-mine sulphur grading 90 per cent. through 80-mesh screen, obtainable at about half the price of commercial flowers of sulphur, was used. It was broadcast over the surface of the soil at the rate of 800 lb. per acre and mixed with top soil by the use of a rake. The action of soil bacteria on sulphur produces sulphuric acid, which renders the soil acid in reaction, tests having shown that approximately 2 to 2½ months are required for the maximum acidity of a pH of 2·0 to 2·2 to be reached in surface soil. Soils sulphured to a depth of 6 inches remain at the maximum acidity for 1 year at the end of which free sulphur could still be found. The increased acidity results in the disappearance of all of the intermediate hosts of poultry tapeworms, including snails, slugs, earthworms, etc., whose life cycle definitely is associated with the soil. The life cycle of the common round-worm, whose egg must undergo incubation over a period of time on the ground, apparently is retarded. Pathogenic bacteria probably do not remain viable as long as the pH values of sulphured soil as in cases in which the soil is not so treated.

Experimental Treatment of Helminth Parasitic Infection of Poultry with Colloidal Iodine or Iodine Vermicide. S. K. Acharya. The Indian Veterinary Journal, Vol. 16, 1939, p. 83.

Summary and Conclusions :

1. Seventy birds with gross helminthic infection were experimented upon with colloidal iodine or iodine vermicide.

2. Colloidal iodine was found to possess vermicidal action both against nematode and cestode infections.

3. The success of treatment with colloidal iodine or iodine vermicide with regard to vermicidal actions on the experimental birds was found to be 89·4 per cent.

South African Helminths. Part III. Some Mammalian and Avian Cestodes. R. J. Ortlepp. Onderstepoort Journal of Veterinary Science, Vol. 11, 1938, p. 23.

The writer here describes eight new species of cestodes, three from mammals and five from birds ; the mammalian species are *Inermicapsifer leporis* sp. n. from a hare, *Catenotaenia geosciuri* sp. n. from a suricat. The avian species are *Raillietina* (*Skrjabinia*) *deweti* sp. n. from a guinea fowl, *Schistometra korhaani* sp. n. from a bustard, *Onderstepoortia taeniaeformis* gen. and sp. n. from a stone curlew, *Cladotaemia freani* sp. n. and *Cladotaenia vulturi* from birds of prey.

Part IV. Cestodes from Columbiformes, p. 51.

The writer records the following species from four species of South African pigeons : *Raillietina* (*Fuhrmanetta*) *crassula* (Rud. 1819) from *Columba livia domestica* and *Stigmatopelia senegalensis aequatorialis*. *Raillietina* (*Raillietina*) *columbiella* sp. nov. from *Columba livia domestica ; Raillietina* (*Raillietina*) *vinagoi*, sp. nov., *Raillietina* (*Raillietina*) *delalandei* sp. nov. and *Raillietina* (*Raillietina*) *vogeli* Hilmy, 1936, from *Vinago delalandei delalandei* ; and *Hymenolepis oenai* sp. nov. from *Oena capensis*.

Part V. Some Avian and Mammalian Helminths, p. 63.

In the preceding pages the writer discusses 20 species of helminths of which 14 are described as new. These are *Hymenolepis cormoranti* sp. nov. and *Contracaecum carlislei* sp. nov., from Reed Cormorants : *Idiogenes kori* sp. nov., *I. kolbei* sp. nov. *Subulura otidis* sp. nov., *Acuaria semei* sp. nov., and *Histiocephalus choriotidis* sp. nov. from a Giant Bustard ; *Habronema numidae* sp. nov. from a guinea fowl ; *Habronema ficheuri* var. *elanii* nov. from a Black-shouldered Kite ; *Porrocaecum spathulispiculum* sp. nov. from an unidentified bird ; *Raillietina* (*S.L.*) *thryonomysi* sp. nov. and *Trichuris vondwei* sp. nov. from Cane Rats ; *Cooperiodes hepaticae* sp. nov. from an Impala and *Trichonema* (*Cylicocyclus*) *gyalocephaloides* sp. nov. from a Zebra.

EGGS AND TABLE POULTRY

EGGS

Preserving Eggs. L. Mach. German Patent 676,896, June 14th, 1939 ; Chemical Abstracts, Vol. 33, 1939, 74269.

Eggs are impregnated *in vacuo* with a suspension of finely divided SiO_2 in a solution of F-free silicate.

Preserving Eggs. H. H. Stamper. U.S. Patent 2,160,604, May 30th, 1939 ; Chemical Abstracts, Vol. 33, 1939, 7426[8].

Eggs are immersed for about 10 to 20 minutes in a bath of water containing about 0·35 per cent. NaOH and maintained at a temperature of about 1° and are then placed in cold storage.

Table Composition of Foods. Imperial Bureau of Animal Nutrition, Great Britain. Technical Communication No. 10, 1938.

Data are given on the protein, carbohydrate, fat, Ca, P and Fe (total and available) contents of eggs, meats and various foods.

Egg Quality. A Literature Review. L. A. Wilhelm. Pullman, Washington. U.S. Egg and Poultry Magazine, November, 1939, p. 671.

The determination of egg quality by chemical means has been largely for the purpose of detecting storage eggs. In general, the egg undergoes no great chemical change until it has entered the inedible stage which is usually due to the presence of micro-organisms.

It appears that adequate methods are now available for the physical determination of broken out condition and colour of egg yolk and condition of the albumen, as well as the condition of the egg shell.

The colour of the egg yolk may be controlled by limiting the intake of the xanthophyll-bearing constituents of the hen's diet. The condition of the albumen does not seem to be influenced by the nutrition of the hen. The quality of the hen's egg shell is not affected by diet as long as her nutritive requirements are met.

It is generally accepted that the structure of the hen's eggs consists of (1) yolk, (2) four fractions of albumen, (3) shell, of which the important parts are : two shell membranes, two layers of calcareous material, a protein covering (the cuticle) and numerous pores.

There is a seasonal decline in the physical qualities of albumen and shell which apparently starts to lower in the spring and continues to late summer, irrespective of temperature changes.

To date, candling is the only rapid practical method of determining egg quality commercially.

It appears that candlers can determine the exterior quality factors and air cell size rather satisfactorily. However, yolk colour (or shadow) and

condition of the albumen do not seem to be conditions that can be accurately discerned before the candle for numerous reasons. Correlations between physical measurements of broken out appearance and quality as determined before the candle tend to indicate that perhaps our standards for eggs as determined by candling are formulated on false standards, since in many respects they do not guarantee the producer more money for a superior product or the consumer a better product. Candlers can fairly accurately determine the best and poorest eggs, but there is much confusion in the " in-between grades."

It is well established that high temperatures affect egg quality, and that even at 30° F. there is a gradual breaking down of the physical qualities of eggs. The effect of atmospheric humidity on eggs is so dependent on the accompanying temperature that the two must be considered together. Humidities for holding or storage of eggs should be 90 to 94 per cent., although mould growths frequently contaminate eggs if the relative humidity rises above 94 per cent. Air movement in storage or holding rooms is a necessity in the prevention of temperature and humidity gradients and the prevention of localised mould growths. The addition of carbon dioxide to the atmosphere of storage rooms or containers prevents storage flavours and odours, controls the breakdown of interior egg quality and retards the development of characteristic albumen discolouration due to storage.

Eggs should be properly cooled and humidified on the farm. This may be done in a number of ways cheaply and efficiently. Shell cleanliness is definitely an egg quality problem. Dirty eggs may be easily and safely cleaned without harmful effects.

The physiology of egg production is receiving increasing attention and some light is being shed upon its relation to egg quality. There appear to be some differences between breeds in respect to egg quality characters. It has been shown that a great many egg quality characters are individual characteristics of the hen and it has been shown that albumen quality and egg shell quality are inherited. Evidence has been presented and disputed that various egg quality characters are associated with or related to hatchability.

The problems of odours and flavours in both fresh and storage eggs have been presented. These seem to be due to (1) diet of the hen, (2) individuality of the hen, (3) action of micro-organisms, (4) natural chemical breakdown, and (5) absorption from environment. The relation of consumer preference to price was presented, and it was shown that season, place of production, size, shape, cleanliness, soundness of shell, shell colour, yolk colour, air cell size, condition of the albumen and nationality affect the relation between consumer preference and price.

Preserving Eggs. Societá Anon. Conservazione Sterilizzazione alimentati. French Patent, 838, 999, March 21st, 1939 ; Chemical Abstracts, Vol. 33, 1939, 6983[4].

The eggs are placed in a vessel the air of which is displaced by a mixture of CO_2 and N_2 circulated through the vessel. After about 5 days the operation is repeated to remove O_2 given off from the eggs.

This is repeated if necessary and when the vessel is free from O^2 it is hermetically sealed.

Report on Detection of Decomposition of Eggs. J. Callaway. Journal of Association of Official Agricultural Chemists, Vol. 22, 1939, p. 298 ; Chemical Abstracts, Vol. 33, 1939, 6975[3].

Further collaborative study of the Bandemer and Schaible method for ammonia N showed that it gives slightly higher results than does aeration;

the former method has the advantages of requiring less apparatus and less attention.

Tremulous Air Cells. James Gillanders, Ltd. Egg Review. The South African Poultry, Pigeon and Bird Magazine, Vol. 45, 1939, p. 293.

Eggs were candled before an " artificial " transpod vibration and without exception it was found that the air cells were tremulous and in many instances greatly deformed. In some instances even, a complete rupture had been effected resulting in a floating air cell. On testing the eggs, they had certainly—from a selling point of view—greatly deteriorated, but as the " experimental " journey only lasted a few hours, naturally no actual deterioration could have taken place, as the eggs to all intents and purposes were as fresh after the experiment as before. When the eggs were broken out, it was likewise noticed that changes had taken place. The firm, white layer of albumen surrounding the yolk, although not liquefied to any noticeable extent, had in many instances, weakened so much that the yolk was displaced, while the outer albumen showed decided signs of weakness. Altogether the viscosity was significantly lower than with eggs not so shaken. Even the yolks showed signs of change ; many showed lack of clearness, some of them appearing decidedly shadowy, and in some instances this shadow was so pronounced that, in candling, the eggs would have been condemned as " seconds." This pronounced increase in the yolk shadow was found, however, only where the firm white layer of albumen was ruptured, and although this may have been due to structural weakness of the albumen which was unable to hold the yolk in its central position, it is necessary to take this into account as it is impossible to avoid a certain percentage of weak eggs. In any case, it was obvious that the more vibration to which the eggs were subjected, the more easily was the inner albumen ruptured with the consequent apparent deterioration.

Sanitary Measures in the Egg Breaking Plant. J. S. Lagaevsky and P. O. Lutikova. Laboratory of Microbiology, the Institute of Poultry Industry, Moscow, 1939.

Summary :

1. Fresh laid eggs are resistant to bacteria penetration. This resistance is due to : (*a*) the presence in the white of eggs of lysozime, (*b*) the strength of under shell membranes inhibiting bacteria penetration.

2. Eggs are subject to bacteria contamination for the most part which by candling are graded as " undergrades." Eggs of the first, second and third grades, kept in cold storage or in a dry place at room temperature are, as a rule, sterile.

3. The bacteria penetration into the egg is to be referred partly to moulds. Growing on the surface of the egg shell, moulds penetrate within the under shell membranes and change the alkaline reaction of the egg white into neutral or low acid reaction, and in that way facilitate the bacterial penetration.

4. The germicidal power of the egg white is decreased, or sometimes disappears in cases of bursting the yolk membrane or adherence of the yolk to the shell, when the yolk in any way is mixed with the white.

That is why such kinds of spoiled eggs as " adherent yolk," or burst " yolk " are quickly contaminated by bacteria and moulds.

5. The adherence of the yolk to the egg shell and the bursting of vitelline membrane is dependent on the temperature and humidity of the environment. An unreasonable packing or careless handling of the eggs cause the bursting of the chalazae sustaining the yolk at the centre of the egg.

6. The bacterial contamination of eggs is attributed to insanitary conditions of the storage room.

Dirt and moisture when combined with high temperature of the storage room make it possible for organisms to enter the egg and cause decay.

7. Soiling of the egg shell by droppings, dirt, etc., is the main cause of egg spoilage, and in liquid egg production that is the main source of egg contamination.

8. To prevent contamination of good eggs by spoiled ones it is necessary to remove all spoiled, cracked and dirty eggs from the lot received. Then all clean eggs are to be graded, separating the first, second and third grades from the undergrades.

9. The undergrades, cracked and dirty eggs should be used immediately for breaking and freezing.

10. According to the increased amount of undergrades among the eggs reserved for breaking, the bacteria infection of liquid egg-mass increases.

11. By removing all undergraded eggs the bacterial content of frozen eggs is decreased many thousand times.

12. Liquid eggs produced from undergraded and dirty eggs have usually several millions of bacteria per 1 c.c. The titre of various bacteria of such liquid egg mass, amounts to 0·000001 and the coli titre to 0·0001. At the same time liquid eggs produced from first, second and third grade clean eggs are slowly contaminated mainly with cocci.

13. Experiments conducted on a large scale with about 6 millions of eggs showed that liquid egg mass from eggs of the first, second and third grades is nearly free from bacteria (20 to 60 bacteria per 1 c.c. of liquid eggs) if following rules are observed :—

(*a*) Disinfection of egg shells in a chlorine solution.

(*b*) Using automatic lids for cups and other containers.

(*c*) Changing pails, knives and cups after 40 minutes of work, with disinfected ones, replacing filters and pipes after 15 minutes.

(*d*) Egg-breaking girls have to wash hands in 0·5 per cent. chlorine solution after breaking a case of eggs.

(*e*) Disinfection of floor and walls with 1 per cent. chlorine solution once a day.

(*f*) Using hot water at the egg breaking plant freely.

(*g*) Better egg-grading by the way of premium payment to the breakers and graders.

(*l*) Daily bacteriological inspection of liquid egg-mass and all utensils.

(*k*) A strong fulfilment of sanitation rules by all workers of the egg-breaking plant.

14. The disinfection of egg shell in a chlorine solution has no influence upon the quality of eggs in shell or frozen eggs.

15. Under condition of hermetically closed disinfection bath, proper ventilation and chlorine neutralisation with 10 per cent. solution of hyposulphite of soda, the chlorine concentration in the room does not exceed 0·001 milligrammes per litre of air.

16. All sanitary measures in the egg breaking industry are effective only when applied together.

Not one of them is to be omitted or else the effectiveness of other measures may be brought to naught.

Microbiology in the Preservation of the Hen's Egg. Food Investigation Special Report, No. 47, 1939. The Secretary, Department of Scientific and Industrial Research, 16, Old Queen Street, London, S.W.1.

It is stated that the opinion is generally held in the trade that " rots " are more numerous with eggs from old hens than from younger ones, and that fertilised eggs decompose more rapidly than unfertilised eggs. According to this report, the experimental evidence for both these opinions is indecisive.

Hay and straw should be kept out of contact with eggs as far as possible, the white of really fresh eggs has a weaker germicidal action than that of older eggs. Rotting is caused by a fungus. When the fungus penetrates as far as the yolk, the membranes of the latter may be ruptured and once the yolk is reached, luxuriant growth of the fungus occurs.

The report described the commonest deleterious flavours or odours in stored eggs as " mustiness," " fishiness " and " cabbage-water " in the white and a " strong " flavour in the yolk.

Precautions to be taken are given.

The Storage Temperature and Keeping of Eggs in Transport. V. K. Laine, Finland. Nordisk Fjäderfätidskrift, No. 2, August, 1939.

During storage regard must be paid to the temperature of the room. On transport it is found that eggs which are 3 days old show the best power of resistance. New-laid eggs proved to be more sensitive in this respect, which is probably due to the white not yet having attained the necessary firmness. The transportation in this case took place by motor-coach for a distance of 26 kilometres. The quality percentage after transportation was 92·50 for 1-day-old eggs and 97·50 for 3-day-old eggs of the first class.

Green Rot in Eggs. Dr. A. E. Platt and C. F. Anderson. Department of Agriculture, Adelaide. Journal of Agriculture, 1939, p. 1040.

Description of a case of green rot in eggs with coloured photos. Green rot is due to an infection of the egg with species belonging to the genus Pseudomonas. It is most likely to be eonfused with the condition known as green white. In the first type of green white, pseudomonas has been incriminated as the aetiological agent. The second type of green white may not be due to an infection.

Effects of High Temperatures for Short Periods on the Quality of Infertile Eggs. M. W. Olsen. Poultry Science, Vol. 18, 1939, p. 123.

Three comparable lots of infertile eggs were incubated at 90° F. for 24 hours, incubated at 100° for 18 hours and unincubated respectively, and then stored at 35°.

At the end of 7 days the loss in weight and the percentage of thick and thin albumen were determined for each lot. Only slight differences occurred in percentage moisture loss for the different lots.

The eggs contained an average of 53, 52 and 61·5 per cent. of thick albumen respectively after storage, but aside from this variable condition, the incubated eggs kept as well in storage as did the control eggs.

The Anatomy, Physiology and Pathology of the Egg. M. A. C. Stidston. Parafield Egg Investigation Laboratory. Journal of the Department of Agriculture of South Australia, 1939, p. 1045.

1. Anatomy of the Egg. Description of the Shell, the White, the Yolk, with Tables of: Composition of shell, white and yolk. Also a list of references.

The Anatomy, Physiology and Pathology of the Egg. II. M. A. C. Stidston. Journal of Agriculture, Australia, August, 1939.

Contents :

The Physiology of the Egg ; The Colour of the Yolk ; The Biochemistry of the Egg Shell ; The Biochemistry of the Yolk and the White ; Mineral Content of the Egg ; The Influence of Climate and Soil on Egg Quality ; Changes which take place in the Egg with increasing age ; Candling the Egg ; Characteristics influenced by Heredity ; References.

Effect of Temperature on Size of Eggs from Pullets in Different Latitudes. D. C. Warren. Journal of Agricultural Research, Vol. 59, 1939, p. 441.

Summary :

Data were secured on egg size from 11 localities in latitudes extending from the Equator to as far north as Scotland. Curves showing mean daily egg weights together with the daily maximum temperatures for each locality were drawn for the pullet laying year. A comparison of the various curves of annual egg size showed that temperature was a very important factor in determining the shape of the curve. In most instances egg size increased rapidly for the first few months as a result of approaching physiological maturity. Following this, egg size was found to bear a close relationship to the temperatures prevailing. Excessively low temperatures seemed to have no effect on egg size, but after the daily maximum temperatures exceeded 70° F. for a period of a few days or more, egg size fluctuations usually showed a close correlation with those of temperature. Where the maximum temperature seldom exceeded 70° egg size increased throughout the entire pullet year, with the rate of increase relatively slow in the last half of the year. In localities where summer temperatures were high, the summer egg size was greatly depressed, and the bird was prevented from expressing its maximum potentialities for egg size unless the temperature dropped below 70° at the end of the laying year. If this decline in temperature occurred, the egg size increased rapidly thus indicating that the summer decline was not the result of any fatiguing effect of a long period of production.

Market Egg Grades as Affected by Humidity of Farm Egg Storage Rooms. D. C. Kennard and V. D. Chamberlin. Ohio Agricultural Experiment Station. Bi-monthly Bulletin, July-August, 1939.

It is obvious that U.S. Extras or U.S. Standards were produced at will, irrespective of normal temperature ranges by manipulating the amount of dampness in the station's egg room. During the period of addition of supplemental moisture, the relative humidity averaged 38·6 per cent. greater, and all cases inspected were graded as U.S. Extras, compared with the grading of 92 per cent. U.S. Standards during the previous period without supplemental moisture. Seldom can the dollars and cents value of a practical, inexpensive procedure be demonstrated so positively.

The Formation of the Egg of the Domestic Fowl. R. M. Conrad and H. M. Scott. Physiological Review, Vol. 18, 1938, p. 481.

This article reviews the work on ovum growth, ovulation and formation of albumen and shell. It also includes some hitherto unpublished results. The

mechanism of yolk formation is as yet obscure. Large amounts of lipoids are transported from the blood to the yolk, fat soluble compounds such as xanthophylls and Sudan III being deposited in the ovum from the food, but how this transport is effected is not known. The presence of a lymph space between the follicular epithelium and the vitelline membrane has been postulated. Ovulation is under very definite control, probably of an endocrine nature. The time spent by the ovum in passing through the sections of the oviduct has been determined as follows: funnel, 18 minutes; albumin secreting portion, 3 hours; isthmus, 1 hour; uterus, 20 to 24 hours. Work of much interest concerning the formation of the four layers of albumin is discussed in detail. The shell membranes are formed in the isthmus and consist of a network of keratin fibres. In the uterus, approximately 5 grammes $CaCO_3$ are deposited as shell. This comes mainly from the food, but bone Ca is also frequently utilised. It appears probable that the pores of the shell are formed by fibres from the shell membrane which project through the shell. When the latter dries, these shrink, leaving minute openings. There are 65 references given.

High Quality Eggs for Illinois Markets. H. H. Alp. Illinois Station. Circular No. 494, 1939.

Suggestions for the production, holding, packaging and marketing of eggs. Principal topics of discussion are the chief causes of small and light eggs; the effect of rations on shell quality; problems concerning egg white, egg yolk, off-flavour, and other common defects; measurement of egg quality; candling technique; farm storage rooms and coolers; grading and packing eggs for market; and ways of preserving market quality.

The Measurement of Freshness of Unbroken Eggs. R. H. Carr. Indiana Experiment Station. Poultry Science, Vol. 18, 1939, p. 225.

A test for freshness of whole eggs based on the difference in buoyancy weight of fresh and stale eggs is reported. A special adaptation of the Jolly balance for determining difference in buoyancy weight and the significance of the "Jolly" egg number are fully described. The Jolly number of normal fresh eggs ranging from 50 to 70 grammes was found to be dependent on the dry weight of the yolk and the shell and membrane. The condition of the thick white had a very important effect on the Jolly number. Normal-size eggs having a Jolly number of only from 25 to 45 are probably old eggs, with evidence that eggs undergo loss of about one Jolly number per day.

Storage of Shell Eggs. T. L. Swenson. Food Research, Vol. 3, 1938, p. 599.

A study was made of the effect of oil-treating eggs on their keeping quality. Eggs which were oiled under reduced air pressure showed a marked reduction in permeability (CO_2 evolution), and also markedly less decrease in percentage of thick white and less change in pH during storage as compared with untreated eggs. A large-scale experiment was conducted in which four lots of 200 eggs each were treated as follows: (1) No treatment, (2) oiled in an open immersion pan, (3) oiled as in (2) in oil charged with CO_2, and (4) oiled by the vacuum-CO_2 method. Half of each lot was put in cold storage immediately, while the other half was transported a considerable distance and then placed in cold storage. The decrease in grade during storage was very high in the untreated lots, considerably lower in lots 2 and 3, and markedly lower in lot 4, over two-thirds of the eggs in the latter group remaining in the two top grades.

The Occurrence of Mold on Egg Containers in Storage at a Chicago Plant. E. Toop. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 397.

An examination of 349 cars of eggs held at 31° F. and 87 per cent. relative humidity for an average of 8 months, showed that approximately 49 per cent. of these cars had some mould development, while the remaining 51 per cent. showed no evidence of mould. Only 6 per cent. of the cases were affected by mould at various stages of development. A similar inspection of 50 cars held at 31·5° and 86 per cent. relative humdity showed 14 per cent. of all cases attacked by mould. In no case was mould growth noted until after 5 months of storage. The variety of wood used in the construction of egg cases was an important factor in this regard, Sitka spruce proving most resistant to mould, while cottonwood was moderately resistant, and tupelo gum quite susceptible. The handling of egg cases prior to placement in storage and actual storage conditions were important considerations.

Growth of the Hen's Ovum. D. C. Warren and R. M. Conrad. Kansas Experiment Station. Journal of Agricultual Research, Vol. 58, 1939, p. 875.

Ovum growth rate was studied by intravenous injections of Sudan III into Single Comb White Leghorns and Rhode Island Reds, and observations were made on 367 eggs laid. From the dye bands growth rate was ascertained and the comparative influences of rate of laying, clutch position and other factors were determined. Growth was relatively constant as measured by radius increments from the 9th to the 7th day before ovulation but decreased rapidly thereafter, although some growth was detectable within an hour of ovulation. The first egg of the clutch may continue its growth slightly longer than successive eggs, but variations in yolk size and rate of ovulation were not conditioned by rate of ovum growth. The physiological basis for this is probably associated with factors controlling the initiation of the final stage of accelerated growth. Feeding excessive amounts of egg yolk stimulated rate of yolk secretion and increased the size of the mature ovum, but kamala feeding disturbed and checked the process of yolk secretion and thereby affected egg size.

Comparative nutritive value of firm and watery egg albumen. N. B. Guerrant and W. J. Rudy. Pennsylvania Experiment Station. Soc. Expt. Biol. and Med. Proc. Vol. 40. 1939. p. 166.

Two series of rat feeding tests, in which dried whole eggs containing varying proportions of firm and watery albumen plus calcium carbonate *ad libitum* constituted the sole diet, gave evidence that there is no significant difference in the nutritional value of firm and watery egg albumen.

A study of the effect of green feed upon interior egg quality. R. C. Ringrose and C. L. Morgan. South Carolina Experiment Station. Poultry Science. Vol. 18. 1939. p. 125.

A determination of the height of firm albumen, percentage of firm albumen, and yolk index of eggs produced by comparable pens of White Leghorn pullets confined and allowed access to green feed, respectively, indicated that the presence of green feed in the ration did not affect the quality of the egg.

The Effect of Temperature and Time on the Interior Quality of Eggs. L. A. Wilhelm and V. Heiman. Washington Experiment Station. U.S. Egg and Poultry Magazine, Vol. 44, 1938, p. 661.

Eggs from White Leghorn pullets which had been classified for their individual albumen index were used in this study. Seven lots of eggs were stored at temperatures of 30°, 50°, 70° and 90° F., each lot containing groups of eggs of high, medium, and low initial albumen index. These eggs were removed from storage after periods ranging from one-eighth of a day to 192 days, and the albumen index was determined for each egg.

The eggs of varying initial quality stood up under storage conditions in proportion to their original score, the percentage loss being approximately the same for each group. At 30° storage temperature eggs lost about 30 per cent. in albumen score in 48 days and about 44 per cent. in 192 days. At 50°, 70° and 90° loss in score occurred at increasingly rapid rates, those at 70° and 90° declining 71·7 per cent. in albumen index in 32 and 8 days respectively.

Egg Composition.—I. The Effect of Diet and Storage on the Chemical Composition of Eggs. R. Reder. Oklohama Experiment Station. Poultry Science, Vol. 18, 1939, p. 19.

Six groups of White Leghorn pullets were fed diets of varying composition, three groups receiving all-mash rations containing 13, 16 and 25 per cent. protein, respectively, and the three remaining groups receiving mash and grain rations of varying composition and constituents. Composite samples of eggs from each group were analysed while fresh and after storage periods of from 9 to 236 days. No significant differences were found in the composition of the fresh eggs produced on the different diets and the changes in composition which occurred during storage were practically the same for all groups. In general, the moisture content of the yolks increased and that of the whites decreased during storage. The loss in total egg weight during storage was greatest in eggs produced on the high protein diet.

A Review of Investigations on the Nutritive Value of Eggs. M. S. Rose and E. M. Vahlteich. Journal of the American Dietetic Association, Vol. 14, 1938, p. 593.

The results of studies on the nutritive value of eggs in the diets of experimental rats are discussed and information is given on the composition of the egg, the digestibility and utilisation of the various components, the mineral and vitamin contents, the sensitivity of humans to eggs, and the contributions of the egg to the diet. The bibliography lists 94 references.

A Serological Investigation of Bird Eggs, with Special Reference to the Possibility of Differentiating Species of Birds. O. Sievers. Acta Path. et Microbiol. Scand., Vol. 16, 1939, p. 44.

Differences in the serological reactions of different birds are noted.

Green Range and Egg Quality. Poultry Tribune, May, 1939.

Recent experiments have shown that there is some falling off in egg quality during the summer months in comparison with the average quality of eggs laid

from November to March. Some persons have suggested that the change is caused largely by higher air temperatures in summer, and others have thought that more liberal supplies of fresh green forage might furnish the true explanation.

A test carried out at the South Carolina Agricultural Experiment Station was designed to measure the effect of green range, as opposed to strict confinement on interior egg quality.

A flock of pedigreed White Leghorn pullets was divided into two groups which were made as near equal as possible on the basis of egg quality measurements taken during the months of January and February. One group was kept in confinement and the other allowed access to green forage from March 1st to June 30th.

On the basis of three different quality measurements, height of firm white, percentage of firm white and yolk index, there was no demonstrable difference in interior quality of eggs laid by the two groups of hens.

Determination of Egg Quality by a Sampling Method. S. R. Hoover. Jour. Assoc. Off. Agr. Chem., Vol. 21, 1938, p. 496.

The significance of an observed logarithmic relationship between the area of thick white and the " broken-out quality " of eggs is pointed out and the method of its determination simplified.

Egg Deterioration Due to Ingestion by Hens of Malvaceous Materials. F. W. Lorenz. Poultry Science, Vol. 18, 1939, p. 295.

In a study of factors responsible for olive yolk and pink-egg types of egg deterioration, nine groups of birds received supplements of (1) petroleum ether extract of raw cottonseed, equivalent to 5 per cent. cottonseed ; (2) purified gossypol, 0·35 grammes per bird fed by capsule in six doses of from 0·05 to 0·06 grammes each ; (3) mother liquor (tar) from gossypol preparation, equivalent to 15 per cent. cottonseed ; (4) completely extracted cottonseed, 5 per cent. of the ration ; (5) raw decorticated cottonseed, 5 per cent. ; (6) petroleum ether extract of *Malva parviflora* seeds, equivalent to 10 per cent. raw seeds ; (7) ethyl ether extract of the above-extracted seeds, 10 per cent. equivalent ; (8) completely extracted *M. parviflora* seeds, 10 per cent. ; and (9) young green *M. parviflora* leaves *ad libitum*. Two distinct substances were found to be present in cottonseed or cottonseed meal. Gossypol gave the yolk an olive-green colour and a gelatinous consistency, while the other substance, which is either identical or closely associated with the substance responsible for the Halphen reaction, caused an abnormal enlargement of the yolk and a reddish colour of yolk and albumin to develop in storage. Eggs from hens fed cottonseed developed a combination of these abnormalities. The Halphen substance was contained in other members of the plant family Malvaceae, and eggs from hens fed such plants developed only the second group of defects.

The Effect of Resecting the so-called " Chalaziferous Region " of the Hen's Oviduct on the Formation of Subsequent Eggs. B. R. Burmester and L. E. Card. University of Illinois. Poultry Science, Vol. 18, 1939, p. 138.

In an effort to obtain additional information on the mechanism of chalaza formation in eggs, 31 hens were surgically altered by the removal of sections of the oviduct from 2 to 7 cm. long from the chalaziferous region of the infundibulum. Of the 25 hens surviving the operation, 12 laid normal eggs,

and dwarf or yolkless eggs were laid by 19. Some laid nothing but yolkless eggs, others laid dwarf eggs alternately with normal eggs and seven laid one or more yolkless eggs when first coming into production and only normal eggs thereafter. With nine hens laying a sufficient number of normal eggs after the operation to allow a comparison of pre- and post-operative eggs, there was no significant change in the weight of the chalaza, total egg weight, or proportions of the egg white layers, even though the percentage of the chalaziferous region removed ranged from 44 to 88. A normal-appearing chalaza in the inner thin white surrounded by a thick, firm white layer was found in most of the dwarf eggs. The correlation between the weight of the chalaza and that of the inner thin white was lower in the yolkless eggs than in the normal ones.

The Antigenic Properties of the Products of the Alkaline Hydrolysis of Egg Albumin and their Nitrogen Derivatives. A. P. Konikov and T. L. Gerrin. Arch. Sci. Biol. (U.S.S.R.), Vol. 44, 1936, p. 147. Chemical Abstracts, Vol. 33, 1939, 6428[5].

The hydrolysis of egg albumen (I) (1 gramme NaOH to 10 grammes of I) in a thermostat for 3 weeks yields after neutralisation a portion insoluble in 7 to 8 volumes of 95 per cent. EtOH, and a soluble portion which is isolated as a syrup by concentration. Both fractions showed a loss in antigenic properties. The condensation of I and of the EtOH insoluble fraction with benzenearsonic acid (II) results in the formation of antigens with a new specificity characteristic of II. Condensation of the EtOH soluble fraction with II results in a product with weak antigenic properties which can be detected by means of an anaphylactic reaction in guinea-pigs, although it shows no reaction in the precipitin test.

Factors Affecting Prices at two Connecticut egg auctions. E. A. Perregaux, B. C. Wright and R. G. Bressler. Agricultural Experiment Station, Storrs. Bulletin No. 225, May, 1938.

The object of this study was to measure the relative importance of the different factors influencing the prices of eggs at the Hartford and Hamden, Connecticut, co-operative auction markets. The analysis was based on the information available to the buyers, including gross weight per case, grade designation, colour, number of cases per lot, and the producer's number.

Inheritance of Eggshell Thickness in White Leghorn Pullets L. W. Taylor and I. M. Lerner. Journal of Agricultural Research, Vol. 58, 1939, p. 383.

A selection of hens producing thin- and thick-shelled eggs, respectively, and a subsequent breeding programme of mating with closely related males were effective in establishing two lines of chickens producing significantly different types of egg shell.

Continued selection of this type was ineffective in further differentiation of the two lines or in decreasing the variability of expression of egg shell characters in subsequent generations.

Analysis of the data indicated that heritable factors were involved in the determination of the amount, thickness, and percentage of egg shell characteristic of individual hens. In several matings the dams seemed to have relatively more influence in determining the character of shell produced by the daughters than the sires.

The females of the thick-shelled line maintained the ability to produce eggs with relatively little or no decrease in shell percentage from clutch positions one to two. The pullets of the thin-shelled line, however, showed a greater tendency toward lower shell percentages in eggs in position two. Individual variations in this respect were found in both lines.

The possible relation between hereditary factors and the nutritional requirements and physiological efficiency of laying hens with respect to calcium metabolism and balance is pointed out.

In the treatment of data on the populations available for this study, the percentage of total egg weight represented by egg shell was found to be as accurate an expression of individual variation as more cumbersome formulas which take into account the effect of differences in total egg weight upon shell weight.

Grass as a Foreign Body in Eggs. A. S. Canham. Journal of the South African Veterinary Medical Association, Vol. 10, 1939, p. 136.

Description with photo of an egg with a piece of broad green grass inside. The hens lay in boxes lined with grass. The only probable explanation is that during laying, suction or a form of reversed peristalsis took place in the oviduct, drawing the grass far up into this organ, where it became part of the egg. Within a few days there have been laid, on this farm, three eggs containing grass.

The Semi-quantitative Estimation of Mineral Oil in the Shells of Processed Eggs. S. R. Hoover. U.S. Egg and Poultry Magazine, Vol. 45, No. 3, 1939, p. 162.

The simple method described for the rapid estimation of the oil contents of the shells of processed eggs essentially consists in measuring the turbidity produced when the shell is boiled with alcoholic sodium hydroxide and then diluted with water. Application of this method revealed a wide variation in the oil content of individual processed eggs, suggesting that this condition may account for some inconsistent results of processing encountered in commercial practice.

Artificially Coloring Hen Eggs by Feeding Sudan Dyes and the Influence of the Deposited Dye on Germination. A Asshoff. Zeitschrift für Untersuchung der Lebensmittel, Vol. 77, 1939, p. 578.

Six hens and one cock were fed 100 mg. of Sudan Red -β, in 2 c.c. of peanut oil each morning. The hens became emaciated and stopped laying. The dye appeared in the eggs 3 days after the first feeding, thereafter it seemed to be deposited in layers, a coloured layer alternating with a normal layer of yolk. On incubation the germs died after 12 to 48 hours growth.

A Practical Method of Determining Color in Fresh and Frozen Egg Yolks. A. W. Turner and V. Conquest. U.S. Egg and Poultry Magazine, November, 1939, p. 668.

The increasing demand for commercially packed egg yolk of a definite colour designation has brought about the need for a rapid method of determining quantitatively the amount of pigment present in any given sample of egg yolk. The colour paddles and colour mixtures being used to classify fresh yolk colour are unsatisfactory from many points of view.

Authors give direction for a new method. Acetone extracts of yolk are compared with standard potassium dichromate solutions against a pure white background.

The Relationship between Egg Shell Thickness and Strength. W. A. Lund, V. Heiman, and L. A. Wilhelm. Washington Experiment Station. Poultry Science, Vol. 17, 1938, p. 372.

An apparatus for measuring the resistance of egg shells to a crushing and puncturing force is described. The average force required to crush the eggs used in this study was 4·73 and 5·57 kg. for the large and small ends respectively. The coefficient of correlation between shell thickness and the crushing resistance of the eggs was $0{\cdot}633 \pm 0{\cdot}021$ and between shell thickness and resistance to puncturing $0{\cdot}835 \pm 0{\cdot}011$.

The Fat Acids in the Lecithin and Glyceride Fractions of Egg Yolk. R. W. Riemenschneider, N. R. Ellis and H. W. Titus. Journal of Biological Chemistry, Vol. 126, 1938, p. 255.

Lecithin and glyceride fractions, in a highly purified state, were prepared from fresh yolks of eggs from hens kept on a representative diet of known composition and high nutritive value. Palmitic and stearic acids were the only saturated acids identified in both of these fractions although there was evidence of a small amount of a lower saturated acid in the glyceride fraction. In both fractions oleic, linoleic and clupanodonic acids were found and 9 : 10 hexadecenoic acid was isolated from the glycerides. Quantitative data are given and the results compared with those of earlier workers.

Cold Storage of Eggs in Shell. The " Superfusion " Method. Monthly Bulletin of Agricultural Science and Practice, Rome. Vol. 30, 1939, p. 443.

It is possible to reduce the temperature of eggs several degrees below freezing point without solidification, provided that the eggs are not submitted to mechanical shocks.

Follows description of a new technique, the preservation of eggs in a state of superfusion by J. Foulon, Director of the Belgian State Refrigeration Services.

TABLE POULTRY

Comparative Growth and Feed Consumption of Roasters, Capons, and Pullets. G. E. Annin and J. G. Halpin. Wisconsin Experiment Station. Poultry Science, Vol. 17, 1938, p. 419.

Two years' trials with purebred and crossbred cockerels and capons indicated that there was no significant difference in the rate of growth or feed consumption between the cockerels and capons or between the purebreds and crossbreds. The feed required per unit of gain constantly increased with advancing age, particularly after 24 weeks of age, indicating the desirability of marketing capons as soon as they would command the usual premium over

heavy roasters. It proved profitable to hold late-hatched pullets for winter egg production and then sell them for meat in the spring when poultry meat prices are generally highest.

Meat Production in Chickens. F. P. Jeffrey. New Jersey Stations Bulletin No. 656, 1938.

The results of three lines of investigation are reported. A comparison of Rhode Island Red, Barred Plymouth Rock, and a first-generation cross of Rhode Island Red males by Barred Plymouth Rock female chicks indicated that the crossbred chicks of both sexes were heavier at 10 and at 20 weeks of age, had a lower percentage of mortality to 20 weeks, and required slightly less feed per unit of gain than the corresponding sexes of either purebred group, particularly the Rhode Island Reds. The superiority of the hybrids in rate of gain was most pronounced during the first 10 weeks. A comparison of the relative value of corn and oats in the ration under pen-fattening conditions showed little difference in the average weight of all chicks in the two lots at either 8, 12, 20, or 24 weeks of age, and, further, pen-fattening as practised in these experiments did not produce significantly more gain in weight than did no fattening. However, pen fattening of roasters did improve their eating quality. A comparison of the corn- and oat-fed groups indicated that corn was superior in improving eating quality, although the oat-fed groups were superior in desirability of flavour of fat. A study of the economy of meat production with White Leghorn capons indicated that they may be utilised economically as fryers or light roasters, but production costs were too high to warrant carrying them to the 5-lb. or heavier stage.

Some Observations on Methods of Fattening Chickens. A. J. G. and W. A. Maw. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 332.

The results of two trials at Macdonald College comparing the rate and efficiency of gain of Rhode Island Red cockerels over fattening periods of 7, 10, 14 and 21 days when fed two, three and five times per day are presented. Two feeds per day gave definitely smaller average gains than three or five feeds and also the groups getting the larger number of feeds per day showed a slight advantage in gain per unit of feed consumed. There was a high variability in amount of daily gain by individuals which is at least partially attributed to various uncontrolled environmental factors.

Canadian Studies on Electrical Methods of Killing Poultry. D. C. Rose. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 270.

The results of preliminary studies at the Canadian National Research Laboratories on the applicability of electrical methods for killing poultry are reported. The electrical circuits and types of electrodes used in these studies are illustrated. By a proper regulation of voltage and resistance in the circuit and proper application of the electrodes good feather release could be obtained, and the bleeding after electrical stunning was satisfactory.

Inspected Poultry. U.S. Egg and Poultry Magazine, October, 1939.

When federal inspection was started in 1928, it was confined to dressed poultry for use by canners of poultry and food products. During the past 5 or 6 years, however, it has been expanded to include an increasing quantity of poultry intended for sale in the raw state.

Nearly 43,000,000 lb. of federally inspected dressed poultry was sold to consumers last year by dealers in fresh and frozen poultry and by canners. More than this quantity was federally inspected. Between 1 and 2 per cent. of the total was condemned as " inedible."

Fishy Flavor in Turkey Meat caused by Feeding Menhaden Fish Meal. R. L. Bryant and G. T. Stevenson. Virginia Station Bulletin, No. 321, 1939.

Four groups of bronze turkey poults were fed rations containing 20 per cent. of flame-dried menhaden fish meal, 20 per cent. of steam-dried fish meal, 20 per cent. of meat scrap, and a combination of 10 per cent. each of fishmeal and meal scrap respectively, to 21 weeks of age, at which time all the fishmeal in the rations was replaced by an equivalent amount of meat scrap. Representative birds from each group were killed, roasted and scored for flavour at 21 weeks of age and at 2 week intervals thereafter until all traces of fishy flavour were eliminated from the cooked carcases. Fishy flavour was detected in the roasted carcases of turkeys receiving 10 per cent. or more of fishmeal. Fishy flavour was eliminated within 7 weeks after the 10 per cent. level of fish-meal feeding was discontinued and within 8 weeks after the 20 per cent. level was discontinued. The drippings had a more pronounced fishy flavour than did the meat, and male birds exhibited a slightly stronger fishy flavour than females. There was no marked difference in intensity of fishy flavour between the lots receiving the flame-dried and steam-dried meals.

Factors Influencing Market Quality and Consumer Value in Poultry Meat Stock. W. A. Maw. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 204.

In studies at MacDonald College, analysis of carcases of different breeds of chickens and of the different sex and weight classes within breeds gave evidence that significant differences occur in the edible portion of the carcase within these various groups. Significant differences also existed in the relation of amount of body fat to edible meat, the percentage waste in dressing and drawing, and losses in cooking, all of which affect the use of the carcases in the home for cooking and serving purposes.

Effect of Initial Weight, Range Feeding and Fattening on Gain and Edible Portion in Barred Plymouth Rock Cockerels. W. A. Maw and A. J. G. Maw. Scientific Agriculture, Vol. 19, 1939, p. 657.

The live weight gain of a chicken during the fattening period and the percentage of edible flesh is related to the initial weight or stage of body development when placed in the fattening crate. Smaller birds made relatively higher gains in weight with smaller quantities of feed consumed per lb. gain.

The birds in the 4 and 5 lb. weight class did not gain appreciably more when fattened than birds of similar weight left on range for the same period of time.

Bacteria and Other Biological Factors in Relation to Frozen Foods. J. O. Sealey. U.S. Egg and Poultry Magazine, 1939, p. 355.

1. Spoilage changes occur in frozen foods, similar to those in fresh foods—only much more slowly.

2. Frozen foods are not sterile. Bacteria decrease in number, but many survive; especially spore formers and micrococci. These are sufficient to cause spoilage in a very few hours at room temperature. Hence, frozen foods should be stored at temperatures around 0° F. (18° C.).

3. The natural or autolytic enzymes of frozen foods are important in bringing about certain spoilage changes in such foods.

4. Frozen foods are not necessarily preserved until the container is opened, especially if the temperature is allowed to rise subsequently to the freezing treatment. It should be emphasised that they differ from canned foods in this respect.

5. Frozen foods may dry out (dehydrate) unless protected by a film of oil or ice or packed in tins or moistureproof wrappers.

6. Oxidation may occur, especially in frozen foods containing fats and oils; and aromatic substances which impart flavours and odours to foods may disappear, unless they are packed in air-tight packages.

7. " Quick freezing " helps conserve the vitamin content of foods, thus helping to maintain their quality.

8. Freezing cannot be expected to improve the quality of foods, with the possible exception of meats.

9. Bacterical toxins, if allowed to develop in or enter the foods at any stage of their handling, will not be destroyed by freezing.

10. From a health or sanitation standpoint, it would perhaps help most to emphasise the fact that frozen foods are still essentially fresh foods and should be subjected to at least the same care in sanitation, storage and preparation as fresh foods of the same class.

The Substitution of Wheat Offals (Screenings) for Whole Grain in Fattening Poultry. A. N. Aleinikov. Transactions of All-Union Institute of Poultry Industry, Moscow, Vol. 3, 1938, No. 2.

Screenings consisting of 37·6 per cent. wheat, 5·9 per cent. other grains, 22·1 per cent. weed seeds (58 species) and 34·4 per cent. of non-edible parts such as hulls, chaff and dust, were given in amounts varying from 13 to 49 per cent. No injurious effect on gains, food utilisation or heath of the birds was noted, provided the amounts of poisonous weeds present in the screenings did not exceed certain minimum levels.

Cross-breeding Poultry for Meat Production including a Feeding Test of Taro Waste and Poi. C. M. Bice and B. A. Tower. Hawaii Agricultural Experiment Station Bulletin, No. 81, January, 1939. (Ref. Nutrition Abstracts, Vol. 9, 1939, p. 237.)

When taro waste was substituted for 40 per cent. maize meal, live weight increases were greater though more food was consumed per unit of gain. The taro waste, however, served to reduce the cost. Poi, in comparison, proved uneconomical as a substitute.

Physiological Studies on Poultry. 3. The dressing percentages of male and female Los Banos Cantonese Fowls. F. M. Fronda and A. S. Marcelo. Philippine Agriculturist, Vol. 27, 1939, p. 775.

The weight after removal of blood and feathers as a percentage of starved live weight is taken as dressing percentage. This did not vary appreciably

with sex or age. The only significant difference between sexes was at 2 months when females had a dressing weight 1·29 per cent. higher than males. The edible portion, including meat and giblets, was slightly greater in females than in males and seemed to increase somewhat at maturity.

Cooking Studies with Frozen Poultry. Iowa State College. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 156.

This and the following paper report a continuation by K. Hoffman of poultry cookery research under the direction of B. M. Lowe. The objectives of the present study were comparisons of the quality of the poultry, both uncooked and roasted, which had been chilled overnight before freezing with properly matched birds frozen within 2 hours after killing and of birds drawn before freezing with those frozen before drawing. The carcases frozen before drawing were stored for periods of 10, 30 and 90 days, after which they were defrosted, drawn and refrozen. The drawn birds were also stored for the same periods of time. A total of 56 birds of two breeds, Buff Orpingtons and White Rocks, held under the same conditions before killing, was used in the eight treatments involved in the comparison. The tests included for the raw supplies odour, fatness, condition of the skin and flesh, and colour and for the roasted samples scoring by a modified score card based on that developed by the Cooking Committee of the Co-operative Meat Investigations.

The odour of the uncooked birds became somewhat undesirable on prolonged storage before drawing. After cooking the differences in odour between the drawn and not-drawn birds were still significant for the Buff Orpingtons but not significant for the White Rocks. It is suggested that part of the undesirable odours may have volatilised during cooking. The cooking times per lb. were practically the same for all groups and the cooking losses were not affected by the time in storage before drawing or by the chilling treatment. Chilling before freezing gave no more palatable product except for tenderness than freezing within 2 hours after killing. Juiciness was not affected by storage before drawing or by the chilling treatment, but storage in general resulted in some degree of deterioration of all of the birds regardless of treatment. Tenderness of the muscles, as judged by the score card, was not affected by length of storage after freezing nor by chilling overnight before freezing for the Buff Orpingtons. For the White Rocks the birds chilled overnight before freezing were more tender than those frozen 2 hours after killing. Shear test readings also indicated increased tenderness as a result of chilling before freezing.

More Palatability Studies with Poultry. Iowa State College. U.S. Egg and Poultry Magazine, Vol. 45, 1939, p. 212.

This paper reports a comparison of the effects on the quality of poultry of washing the internal cavity with a stream of water after drawing with simply wiping the cavity with a cloth. The carcases were tested unfrozen and frozen.

In the unfrozen carcases the differences were insignificant for the two treatments in the condition of the flesh, cooking losses, aroma and flavour on cooking, juiciness, tenderness, and pH (uncooked meat), but the carcases which were washed scored significantly higher than those which had been wiped in the appearance of the skin. In the comparison of unfrozen with frozen carcases, the unfrozen tended to be more flabby than the frozen, particularly with long storage, showed considerably smaller losses on cooking, and were more juicy, but had less desirable odour and flavour, particularly as the time of storage increased. The pH values of the uncooked meat of the unfrozen carcases were significantly lower than those of the frozen carcases immediately before cooking, but the values of the cooked birds were not significantly different.

Causes of Condemnation by Meat Inspectors of Fowls of the "Old Hen" Class. E. J. White and A. A. B. Ellis. The Veterinary Record, Vol. 51, 1939, p. 471.

An analysis is given of the causes of confiscation of 250 fowls of the "old hen" class, derived from consignments from the United Kingdom and Eire. In 145 birds, the cause of condemnation was tuberculosis and the distribution of the lesions in these cases is discussed. Palpation of the "neck glands," which in reality represents the thymus, is of little value in the detection of tuberculosis since lesions are found in this situation in only 20 per cent. of cases.

The condition known as "fatty liver" was found more commonly in birds from Eire. It is not in itself sufficient to warrant confiscation.

The other pathological conditions met with are briefly discussed and the need for a uniform system of inspection of fowls of the "old hen" class is stressed.

Thoughts on Meat Inspection suggested by Smithfield Experience. A. B. A. Grace. The Veterinary Record, Vol. 51, 1939, p. 478.

A serious attempt must be made to obtain some degree of uniformity in meat and food inspection practice throughout the country. Whether this be effected by a national system of meat and food inspection under the jurisdiction of a central body or by a general application, within the jurisdiction of local authorities, of sound systems already practised by a minority of authorities, is apparently debatable.

The better opinion would probably favour the former method, but if the latter be adhered to, as being less revolutionary, it would seem essential to group many of the smaller local authorities for the purpose. At least, it will be generally accepted that in fairness to public and trader alike, there is an urgent necessity for a system which will eliminate once and for all the many inequalities of treatment emanating from our present lack of system. Also the invidious position would thus be ended whereby local authorities, diligently executing their various duties under public health food legislation, are threatened with a migration of trade to less well-inspected areas

GENERAL

EGG LAYING TESTS

Parafield Egg-Laying Competition, 1938-39. M. W. Aird. Journal of Agriculture, South Australia, July, 1939.

Number of birds that completed test, 352. Average number of eggs per bird, 187·12. Average cost of food per bird, 5s. 6·8d. Average return per bird, 17s. 10·3d. Return over cost of feeding, 12s. 3·5d.

Total 51 deaths from the 403 birds competing = 12·6 per cent.

37th Hawkesbury College Egg-Laying Test, 1938-39. E. Hadlington. Poultry, March 25th, 1939.

The period of the test has been reduced to 50 weeks (April 1st, 1938, to March 16th, 1939).

Section A.—Light breeds : White Leghorns, 318.

Section B.—Heavy breeds : Australorps, 156 ; Langshans, 36 ; Rhode Island Reds, 30.

	1938-39	1937-38
General average	194	197
Average for—		
Leghorns	202	193
Australorps	181	200
Langshans	195	208
Rhode Islands	183	207

A total of 45 deaths occurred (9 per cent.).

13th Central Egg-Laying Test, Glen, South Africa, April 5th, 1938 ; March 6th, 1939. J. P. v. d. Merwe. Boerderij in Suid Afrika, Vol. 14, 1939, p. 416.

Pullets entered, 452. Average production, 210 eggs. Mortality, 8·5 per cent.

5th Cedara Laying Test, South Africa, 1938-1939.

Number of pullets entered, 76. Average egg production, 216·2. Mortality, 10 per cent.

Register of Records in Laying Trials recognised by the National Poultry Council. Vol. 12, 1937-38 Trials. Editor : Ian Macdougall, 73, Southampton Row, London, W.C.1.

Entries at the 1937-38 open, county and government-controlled laying trials, 18,187 ; casualties, 3,092 ; percentage, 16·79.

Register of Records in Laying Trials recognised by the National Poultry Council. Vol. 13, 1938-39 Trials. Editor : Ian Macdougall, 73, Southampton Row, London, W.C.1.

Contents :

Executive Committee ; National Poultry Council ; Laying Trials Committee. Preface. List of recognised laying Trials. Objects of National Poultry Council. Analysis of entries, casualties, copper and brass rings at recognised trials, 1937-38 and 1938-39. Laying averages and grade percentages (pullets and ducks). Table of general averages (pullets and ducks). The Crisis. Copper ring records. Open and county trials. Brass ring records. Advertising rates. Copper and brass rings records. Northern Ireland Trials and Scottish Trials. Index of competitors.

Entries at the 1938-39 open, county and government-controlled laying trials, 18,130. Casualties, 3,045. Percentage, 16·80. General average, 169·35.

County Egg-Laying Trials, 1937-1938. Ministry of Agriculture. London : 1938.

The results show that the mortality rate has more than doubled since that recorded in the years 1930-1931. The mortality rate in the chief four breeds represented varied from 15·09 to 20·93 per cent., the latter figure referring to the White Leghorn and the former to the Light Sussex varieties. Of the four principal breeds represented, the latter produced the smallest number of scoring eggs. The Rhode Island Reds had a mortality rate of 15·62 per cent. with an egg production superior to that of the White Leghorns. The chief causes of mortality are not indicated.

National Egg-Laying Test, 1936-1937. Journal of the Department of Agriculture, Eire, Vol. 25, 1938, p. 93.

This is a very full report of the National Egg Laying Test.

During the year 68 birds died (9·6 per cent. of the flock). The deaths were confined to a comparatively small number of pens. The chief causes of mortality were ovarian diseases, parasitic infestations, gout and tuberculosis. Attention is drawn to the increase in the incidence of worm infestations and coccidiosis, which together caused almost 30 per cent. of the deaths. In previous years these parasites were relatively unimportant.

A table giving detailed results of the *post-mortem* examinations and one giving the number and percentage of deaths for each breed are included.

National Egg-Laying Test, 1937-38, Munster Institute, Cork, Eire.

The test was held during a period of 46 weeks, a total of 113 pens, each consisting of six pullets, was accepted. Only pullets, non-reactors to the agglutination test for bacillary white diarrhoea were accepted.

The average number of eggs per pullet for which a record for the full 46-week period was available was 193·8. The mortality was 7·7 per cent. The deaths were confined to a small proportion of the pens, the deaths in ten pens being responsible for almost 58 per cent. of the total mortality. The increase in the incidence of tuberculosis was the most unsatisfactory feature in the mortality.

Lancashire Utility Poultry Society. International Egg-Laying Test, 1938-39.

No. of pullets entered, 1,252. Deaths, 187. Eggs average, 181·67. In the commercial laying section were entered 72 birds. Deaths, 16. Eggs average, 181·13. Number of ducks entered, 72. Deaths, 6. Eggs average, 194·69.

National Laying Test, 1938-39, England.

Average egg production : heavy breeds, 181·06 ; light breeds, 178·48. Number of birds entered, 3,708 ; percentage mortality, 16·18.

Final Report of the Scottish Egg-Laying Test, 1938-39. Department of Agriculture for Scotland, Edinburgh, November, 1939.

Entries : 63 pens of six birds and eleven pens of twelve birds. The average number of eggs laid per pullet was 175·05. Mortality, 19·41 per cent. of the whole flock.

Harper Adams 1938-39 Laying Trials. The Harper Adams Utility Poultry Journal, Vol. 24, No. 12.

Entries : 1,102 pullets. Average production, 160·8 eggs. Mortality. 18·17 per cent.

Six Years of Central and Western New York Official Egg-Laying Tests. R. C. Ogle. New York State College of Agriculture, Ithaca, New York. Bulletin No. 394, 1938.

Contents :

Development of the egg-laying tests. Service of the State laying tests. Administration of the tests. Entries. Yearly results. High-bird records. Six-year results. Egg size and production of four popular breeds. Bird weights. Housing plan. Feeding and management. Mortality.

ANNUAL REPORTS

Report of Work in Avian Pathology. Western Washington Station Report, 1938.

Reference is made to breeding experiments for disease resistance in chickens, by M. W. Miller, G. E. Bearse, and C. F. McClary ; the use of milk flush for the control of caecal coccidiosis in chickens, a pullorum disease transmission experiment, and control of fowl-pox through vaccination, all by C. E. Lawyer and C. M. Hamilton ; gizzard erosions in chickens, by Sawyer, Hamilton, and L. G. Nicholson ; wheat-germ oil for the treatment of fowl paralysis, by Sawyer and Nicholson ; tapeworm transmission by garden slugs ; transmission of leukemia ; and control of coccidiosis by sanitation.

Poultry Keeping in the Netherlands, 1939.

There are in the Netherlands 32,804,504 hens (29,645,816 in 1938). The production of eggs in 1938 was 2,160 million, plus 94 million ducks' eggs. Export of eggs in 1938 amounted to 1,150 million of which 1,077 millions were hens' eggs and 73 millions ducks' eggs. More than half of the production was exported. 60 per cent. of the exports were to Great Britain, 37 per cent. to Germany, 0·8 per cent. to Spain, 0·5 per cent. to Belgium and 1·7 per cent. to other countries.

The proportions of the different breeds of poultry kept in the Netherlands are: White Leghorns 80·9 per cent., Rhode Island Red 12·6 per cent., Barneveld 1·7 per cent., " Noord Hollandsche Blauwen " or North Holland Blue 2·2 per cent., other breeds 2·7 per cent.

In 1938, 1,716,673 live birds were exported and 2,930 tons (gross) of dead birds.

The majority of the live birds were sent to Germany and the majority of the dead birds to Great Britain.

Duck breeding an old industry in the Netherlands, has now two important centres, one very old one in Waterland (Landsmeer-Volendam) and a new centre in the Noord Veluwe (Harderwijk-Tonsel). The most common breed is the " Khaki Campbell " (99 per cent.). The industry is chiefly directed to the production of eggs.

Poultry Keeping in the Netherlands. Monthly Bulletin of Agricultural Science and Practice, International Institute of Agriculture, Vol. 30, 1939, p. 229.

The Netherlands have an area of 34,917 square kilometres and a population of 8·5 million inhabitants, the density being therefore 240 inhabitants per square kilometre. The aggregate value of agricultural production is estimated at 700 million florins yearly, poultry accounting for more than 10 per cent. of this amount.

The development of poultry-keeping dates mainly from the beginning of the present century, but more particularly from the end of the war.

At present, there are more than 28·5 million hens producing 3 billion eggs per annum, 40 per cent. of which are exported. Germany absorbs 70 per cent. of the exports, England 22 per cent. and the remainder is divided between Belgium, Switzerland and Spain.

The White Leghorn is the most popular breed, followed by the Rhode Island Red and since their introduction into the country, these two breeds have been the object of continuous selection, resulting in very high production. The Barneveld, Welsum and blue breeds in the northern part of the country are the result of crossbreeding between native and imported races. The two former breeds give fine large eggs (70 grammes in weight); the last-mentioned which is a rather early layer and easily fattened, produces especially young eating chickens.

Chicken rearing, with the chief centre in the north of the country, is also a very important branch of poultry production. Exports of live chickens amount to about 1·5 million head per annum, while 1,700 tons of dead poultry are exported mostly to England, France and Germany.

Duck rearing has for long been carried on in the Netherlands, especially in the west, and is now general throughout the country. The most common breed is the Khaki Campbell. The principal aim of duck breeding is egg production.

Northern Ireland Pedigree Poultry Breeding Station. Annual Report and Stud Book, Vol. 7, 1939. Agricultural Research Institute of Northern Ireland, Hillsborough.

Report of the 1939 breeding season and 1939 stud book.

Poultry Census, 1938, in England and Wales. June, 1938.

Few changes have taken place during the last year in the numbers of fowls in England and Wales. The respective totals, including ducks, geese and turkeys, are 56,246,000 against 56,274,000 in 1938, on holdings of an acre or more.

Lancashire retains its position as the pre-eminent poultry county.

Fowls over 6 months old, 23,092,000; fowls under 6 months old, 29,645,000.

Ducks, 2,233,000; geese, 582,000; turkeys, 693,000.

Poultry Research in Maryland. Maryland Station Report, 1938, p. 85.

Studies on the effect of brief incubation on egg quality and the relative vitamin. A potency of brown and white-shelled eggs are briefly noted.

Livestock Investigations in Utah. Utah Station Bulletin, No. 282, 1938.

Contents:

Incubation studies: factors affecting egg production; a comparison of grains and sources and levels of protein and calcium for laying hens; and turkey feeding investigations.

Poultry Investigations in Western Washington. Western Washington Station Report, 1938.

Information is presented on the influence of various cereals and oat hulls in chick rations on the incidence of cannibalism; the value of various supplements to breeding hen rations on hatchability, chick mortality, and chick growth; and the effect of packaging materials and treatments and humidity conditions during shipping on egg quality.

Livestock Investigations in Nebraska. Nebraska Station Report, 1938.

Reports of poultry investigations include the manganese requirements of growing poults, the value of complex mineral mixtures in a poultry ration, the optimum amount of salt for chicks, the value of grain sorghums for poultry, certain factors affecting the carotene content of poultry feeding stuffs, the effect of applying heat to poultry rations, and genetic differences existing in turkey flocks.

Livestock Investigations by the Nebraska Station. Nebraska Station Circular 60, 1939.

A brief résumé of poultry feeding and management studies.

Poultry Investigations in Michigan. Michigan Station Biennial Report, 1937-38.

Results are briefly presented on the value of artificial illumination for breeding turkeys; a comparison of ground oats, ground oat groats and wheat bran for starting rations for chicks; and the effect of cottonseed oil in the ration of laying hens on egg quality.

Wisconsin Station Bulletin No. 442, 1938.

Contents:

The role of manganese and rice bran in preventing slipped tendon in poultry; the ineffectiveness of nicotinic acid as a cure for chick pellagra;

condroitin as a preventive of gizzard lesions in chicks; histopathological changes occurring in curled toe paralysis, slipped tendon and vitamin B_4 deficiency of chicks.

Livestock Investigations in South Dakota. South Dakota Station Report, 1938.

Contents :

A comparison of high and lower grades of grain in poultry rations, and the relative values of the common grains and their effect on poultry carcass quality, the utilisation of corn, wheat, oats, and barley in turkey rations, factors affecting hatchability of turkey eggs, capon production, and the value of millet grains in growing and fattening rations.

Livestock Investigations in Washington. Washington Station Bulletin, No. 368, 1938.

Contents :

The protein requirements of laying hens and of chicks, the protein value of various concentrates, fresh byproducts in poultry rations, the nutritive requirements of turkeys, the vitamin requirements of poultry, the effect of heredity and environment on interior egg quality and the effect of storage conditions on egg quality, the pH of watery white in eggs and the light requirements of laying hens.

Livestock Investigations in West Virginia. West Virginia Station Bulletin, No. 290, 1938.

Results are reported on a comparison of the efficiency of various animal and plant proteins, singly and in combinations in poultry rations; the effect of the level of protein feeding on poultry mortality; natural feeds as a source of manganese in poultry rations; the maximum utilisation of home-grown grains for poultry, the effect of the diet on interior egg quality; the comparative market qualities of pure bred *v.* crossbred turkeys.

Livestock Investigations in Alabama. Alabama Station Report, 1937.

Results are briefly reported for the supplemental value of peanuts to the chick and laying ration.

Livestock Investigations in Iowa. Iowa Station Report, 1938.

Reports of poultry investigations under the leadership of E. W. Henderson, H. L. Wilcke, Thomas H. Giese, C. Murray, C. D. Lee, N. F. Waters and B. Lowe include the biological value of different levels of meat scraps and milk combinations for egg production and the influence of rations and management on egg quality and size, a comparison of avian embryonic growth rates as measured by nitrogen and ash content, the air requirements of poultry, the effect of levels and sources of proteins and inorganic elements in the ration on slipped tendon in chicks and poults, the biological efficiency of several protein fractions for numbers, size and quality of eggs, the relation of the viscosity index to the hatchability of eggs, the tolerance of poultry for fat in the ration, the comparative efficiency of some protein supplements for growth and nitrogen retention of chicks, factors in oats which affect growth and feathering in fowls, and the effect of the ration and the fattening period upon gains and quality of market poultry.

Experiments with Livestock by the Cornell Station. Cornell Station Report, 1938.

Reports of poultry investigations include the requirements of poultry for the components of the vitamin G complex, protein concentrates for laying hens, the role of manganese in poultry nutrition, the value of yeast in poultry feeding, the effect of controlled temperature and different light rays on breeding birds, and the early detection of infertile eggs.

Livestock Investigations in Oklahoma. Oklahoma Station Biennial Report, 1937-38.

From poultry investigations results are noted on the effect of cottonseed meal in the ration on egg quality, poor sanitation as related to egg quality, and the value of evaporation-type egg cooler, all by R. B. Thompson and C. A. Roberts; the optimum crude fibre level for chickens and turkeys, and the effect of all-night lighting of the flock during winter months, both by R. Penquite; the effect of protein level on egg production and size, growth rate, and viability of chicks, by Penquite and T. T. Milby; methods of preventing slipped tendon in chicks, by Penquite and Heller; the relation of body conformation (live bird measurements) to market quality of chicks and turkeys, by Penquite and R. G. Jaap; breed variations in body form, by Jaap; optimum protein levels for turkeys, the value of dried grasshoppers for poults, the range requirements of turkeys, and the value of all-night lighting for breeding turkeys, all by Milby; and a State-wide turkey grading programme (co-operative U.S.D.A.), by Roberts, R. B. Thompson, A. W. Jacob, H. G. Ware and L. Morris.

Experiments with Livestock in South Carolina. South Carolina Station Report, 1938.

Reports of poultry investigations include the effect of cottonseed meal and cottonseed oil in laying rations on the hatchability of eggs, the value of whole oats in laying rations and the influence of different components of the ration upon cannibalism in poultry.

Animal Husbandry Investigations in Texas. Texas Station Report, 1937.

Poultry studies by R. M. Sherwood, J. R. Couch and Fraps gave information on factors involved in the slipped tendon disease of chicks, and the quantitative requirements of the chick for vitamin A, vitamin D and calcium and phosphorus.

Investigations in Animal Production. U.S. Department of Agriculture Report, 1938.

Progress is reported in the vitamin requirements of poultry, increased effectiveness of the National Poultry Improvement Plan, the effect of fattening at different stages on the body composition of cockerels, the effects of various pigmented feeds on egg yolk colour, the effect of soybean meal in the diet of hens on hatchability of eggs, cod-liver oil *v.* irradiated ergosterol as sources of vitamin D for chickens, a comparison of methods for determining the digestibility of carbohydrates in feeds, and the vitamin B requirements of the rat. Much of the work reported was in co-operation with the State experiment stations.

Experiments with Livestock in Arkansas. Arkansas Station Bulletin, No. 368, 1938.

Progress reports are presented on the relation of dietary silicon to silicon content of wool and the intermediary metabolism of glycine in the fowl; the manganese metabolism of the laying hen and of the chick embryo, the value of rice byproducts in the laying ration.

Livestock Investigations in Colorado. Colorado Station Report, 1938.

Poultry investigations include the vitamin G requirements of turkey breeding stock, a comparison of native grasses for poultry range and the role of trace elements in poultry nutrition.

Livestock Investigations in Kansas. Kansas Station Biennial Report, 1937-38.

Poultry investigations gave information on the relation of hatching date to income from eggs, a comparison of dehydrated alfalfa *v.* immature oat plant meal and of green alfalfa *v.* young cereal grasses in chick rations, the value of grass silage for poultry; the stability of carotene in dehydrated alfalfa and oat plant meal and the factors influencing feathering in chicks; growth comparisons of Bronze and Narragansett turkeys and the relation of altitude and temperature to feathering of turkeys; factors influencing colour of egg yolks; the mechanism and chemistry of egg formation.

Hawaii Station Report, 1938.

From tests with poultry, results are noted on the use of cane molasses and algarroba bean meal in laying rations, the results of using a laying ration composed entirely of local feeding stuffs, breeding for high egg production and resistance to disease and temperature conditions in all-steel or semi-steel poultry houses, all by C. M. Bice.

Livestock Investigations in Idaho. Idaho Station Bulletin No. 229, 1939.

From poultry experiments results were noted on the carotene requirements of laying hens, the carotene content of commercial dehybrated alfalfa, the influence of various levels of carotene intake on the carotene content of egg yolks, the relative effectiveness for hens of vitamin A in natural cod liver oil and in cod liver oil concentrate, the value of soybean oil meal in turkey growing rations, and the possibility of decreasing mortality of poultry through selective breeding.

Livestock Investigations in Indiana. Indiana Station Report, 1938.

Reports of poultry investigations include the reduction of protein in rations for chicks, returns from fine, medium and coarse ground corn in chick rations, wheat as a substitute for corn in poultry rations, the use of soybean oil meal in broiler rations, by R. E. Roberts and C. W. Carrick; the response of Leghorn pullets to artificial lighting, and wheat *v.* corn with scratch grains for layers, both by Carrick; the effects of varying ventilation, heat, and humidity conditions in poultry houses, by Carrick and I. D. Mayer; breeding for a specific body size in turkeys, and genetic influence on rate of growth in chickens, both by E. E. Schnetzler and various phases of poultry management at the Moses Fell Annex Farm.

Experiments with Livestock in Kentucky. Kentucky Station Report, 1938.

Results are briefly reported on the relation of humidity during incubation to hatchability of turkey eggs ; manganese required for normal hatching of turkey eggs and for normal growth of poults ; breeding chickens for longevity and high life time production, and a comparison of free-choice *v.* all-mash feeding of chickens.

Livestock Investigations in Wisconsin. Wisconsin Station Bulletin, No. 443, 1939.

Studies for which results are reported include the value of wheat germ oil when used as a supplement to a good poultry ration, and the interrelationships of manganese and phosphorus in the slipped tendon disease of chicks, both by J. G. Halpin, C. E. Holmes and W. W. Cravens ; the vitamin requirements of mature hens, by Halpin and Holmes ; the effect of sulphur supplements in the diet on the production and hatchability of eggs, by Halpin, Holmes and C. A. Herrick ; the comparative vitamin D requirements of different breeds of chickens, by Halpin, Holmes and E. B. Hart ; the value of infertile eggs discarded by hatcheries in chick rations, by Halpin, Holmes and M. H. Meshew, and the protein requirements of capons, and improved rations for growing poults, both by Halpin, G. E. Annin and Holmes.

Livestock Investigations in Wyoming. Wyoming Station Report, 1938.

Investigations at the main and sub-stations, for which results are briefly reported, include the value of a comparison of methods of feeding grain to laying hens ; the effect of varying periods of artificial illumination for laying hens ; the isolation of a laxative principle in rye ; the inheritance of resistance to coryza ; elimination of crooked breastbones in turkeys by proper adjustment of roots ; a comparison of vitamin A supplements for laying hens, and the relative cost of raising pullets by different methods.

Poultry Investigations in Rhode Island. Rhode Island Station Report, 1938.

Progress results are noted on a study of the effect of varying levels of alfalfa leaf meal on hatchability, egg yolk colour and livability of adult birds.

Size of Poultry Flocks Reported. U.S. Department of Commerce Report on Chickens and Chicken Eggs by Size of Flock, 1939.

A report recently issued by the Bureau of the Census, Washington, D.C., contains a large amount of detailed information on the distribution of poultry flocks according to size at the time of the last Census of Agriculture, January 1st, 1935.

It is shown, for example, that 81 per cent. of the flocks in the entire United States consisted of fewer than 100 chickens. There were seven states in which over 95 per cent. of the flocks contained fewer than 100, and only six states in which less than 60 per cent. of the flocks contained fewer than 100 chickens. The extremes were Mississippi, with 99 per cent., and Iowa, with 38 per cent.

Nearly 3·5 million flocks, about 60 per cent. of the total number, contained fewer than 50 chickens each, and there were nearly two million flocks of fewer than 25 chickens.

In the entire country, there were only 11,172 flocks with as many as 1,000 chickens, and 7,101 of these flocks were in the five states of New York, New Jersey, Pennsylvania, Washington and California. California had 3,219 such flocks.

Of the two billion dozen of eggs produced in 1934, 37 per cent. came from flocks of fewer than 100 chickens and 40 per cent. from flocks numbering from 100 to 399. Only 23 per cent. of the total egg production came from flocks of commercial size, *i.e.*, containing 400 or more chickens, and only 8 per cent. from flocks of 1,000 or more.

SUNDRIES

Dropping Boards Eliminated from Many Poultry Houses. P. H. Gooding, Agricultural College, Clemson, South Carolina. Poultry Tribune, December, 1939.

Dropping boards are passing out of use in laying houses in some section of the country. The roosting poles are placed 12 inches above the floor. Wire is tacked beneath the poles to keep the hens out of the droppings. Many laying houses of this kind have been built in South Carolina, and have been found more satisfactory than houses with dropping boards. Most of these houses are being used by farmers who have used houses with dropping boards in the past.

The back of the house can be constructed so that it can be opened up in the summer the same as in the front. This opening is a big help in keeping the birds cool. Farmers who once had trouble with the pullets not eating nor developing as they should, because of the heat when first housed, now move their pullets in during the early fall and the birds never show any signs of consuming less feed. These farmers attribute this to the coolness of the house caused by the back opening.

The chief advantages of the house without the dropping boards are :—

1. Birds use roosting poles a lot more during the day which keeps the front of the house cleaner.
2. There is less injury from birds getting on and off the roosts.
3. The birds distribute themselves more evenly over the roosting space.
4. The house is easier to clean and cooler in the summer.

Layers Vary in Weight from Hour to Hour. E. Stevens. Poultry, May 23, 1939.

The figures are in connection with two pullets competing at the Bucks Laying Test. One was a Light Sussex and the other a Rhode, and both were weighed at the same times on the same day.

The former which produced a normal egg in the early afternoon, scaled 7 lb. ½ oz. at 7.30 a.m., 7 lb. 1½ oz. at 10.15 a.m., 7 lb. 2 oz. at 1.30 p.m., and 7 lb. 1 oz. at 5 p.m.

The weights of the Rhode pullet—which did not lay on that day—were 6 lb. 10 oz., 6 lb. 13 oz., 7 lb. 1 oz., and 7 lb. respectively. As will be seen, the Sussex varied only 1½ oz. during the day but the Rhode 7 oz.

Ranges for the Laying Flock. L. N. Berry. New Mexico Agricultural Experiment Station. Bulletin No. 255, 1938, p. 15.

A test extending over an entire laying year was conducted to compare the value of alfalfa range, a combination of winter wheat and Sudan grass range, fresh-cut alfalfa fed in dry lot, and a combination of cod liver oil, dried buttermilk, and alfalfa leaf meal without green food as supplements to the ration of laying pullets. The largest returns over feed cost were produced when alfalfa range was provided. Allowing birds free access to such range gave highest egg production and lowest mortality, but limiting access to the range to 2 hours daily markedly improved the quality of the eggs. Neither the wheat and Sudan grass range nor the cut alfalfa were as efficient as the alfalfa range. The group receiving cod liver oil, dried buttermilk and alfalfa leaf meal without green food gave almost as good an egg yield as that on alfalfa range. Mortality was slightly higher, however, and feed costs significantly higher.

Recent Work on Grass Turf for Poultry. D. H. Robinson. Scottish Journal of Agriculture, Vol. 22, 1939, p. 149.

This review of published work deals with four different aspects of the subject, *viz.*, seed mixtures, effect of birds on turf, chemical changes in turf and soil, and the disinfection of poultry runs. Under the second of these, it is observed, that the quantity of herbage consumed is greatest on a low protein diet, and that, according to a report from Finland, poultry can obtain only from 5·5 to 7·0 per cent. of their food requirements from pasture.

Poultry House Cooling. Poultry Tribune, May, 1939.

Since high summer temperatures are known to cause lowered egg production, decreased egg size and increased mortality, poultrymen may well ask whether artificial cooling of hen houses is justified. An experiment conducted at the California Agricultural Experiment Station has provided a partial answer.

A hen house, 16 × 18 feet, was equipped with an evaporator cooler capable of giving one air change a minute. A thermostat turned the cooler on whenever the house temperature rose to 85° F. and turned it off when the temperature fell to 80° F. or below. A non-cooled house of similar construction was used as a check.

Ninety full-hatched pullets were placed in each house on April 1st, and kept there until January 1st. Records were kept of egg production, mortality, body weight, weight of eggs, food consumption, air temperatures and electric current used.

The average egg production for the entire period was approximately the same in both houses, but its distribution was quite different. During July, August and September, production was higher in the cooled house than in the other, but during October, November and December, the reverse was true. The pullets in the cooled house were noticeably more comfortable during hot weather than were the check pullets, and the total mortality was lower in the cooled house.

Efficient use of evaporator types of coolers is limited to relatively dry sections of the country, and further experiments will be necessary to ascertain the extent to which such equipment can be used by poultrymen with profit.

A Successful Corn and Poultry Rotation. A. Bridges. Journal of the Ministry of Agriculture, Vol. 46, 1939, p. 163.

This article is concerned with a successful corn and poultry rotation on the arable farm of Sacrewell, Thornhaugh, near Peterborough.

Effect of Some Factors on the Body Temperature of Hens. B. W. Heywang. Poultry Science, Vol. 17, 1938, p. 317.

In this study at the Southwest Poultry Experiment Station, Glendale, Arizona, it was found that when air temperatures exceeded 86° F., an appreciable increase in the body temperature of hens taken between 3 and 5 p.m., accompanied further increases in air temperature, the increases in body temperature being greater in closely confined hens than in those in open pens. On very hot days the average body temperature between 8 and 10 a.m. tended to decrease as the body temperature between 3 and 5 p.m. increased, and this difference was greater in the closely confined hens. Laying hens tended to have slightly higher average body temperatures than poor or non-laying hens. However, good layers had approximately the same body temperature during laying and non-laying periods. A pronounced diurnal variation in body temperature of hens was observed, the lowest temperatures occurring about midnight and the highest temperatures at 4 p.m., with the most rapid change occurring between 6 and 8 p.m. Highest body temperatures correspond with highest air temperatures, but the lowest body temperature did not occur during the coolest hours of the day. The extremes of body temperature recorded for healthy non-broody hens were from 103·2° to 110·4°.

An Individual Chick Cage for Use in Poultry Nutrition Studies. A. E. Tepper. University of New Hampshire. Poultry Science, Vol. 17, 1938, p. 451.

Data given for construction of cage.

Manure Production of Adult Turkeys. S. J. Marsden. Poultry Science, Vol. 17, 1938, p. 423.

Summary :

The results of this test indicate that adult turkeys of medium size when mated in the proportion of one male to ten females produce about 2·4 lb. of fresh manure (or 0·6 lb. on a machine-dried basis) per bird per week. This amounts to approximately 1 lb. of fresh manure for each lb. of feed (grain and mash) consumed. The fresh manure was found to contain approximately 75 per cent. of water. In this instance, in the comparatively short days of October, 72·7 per cent. of the manure was deposited during the day time and 27·3 per cent. was produced while the turkeys were on the roosts at night.

Starting and Brooding Turkey Poults. F. E. Moore. Agricultural College, Fargo, North Dakota. Circular 166, February, 1939.

Contents :

Natural brooding ; Artificial brooding ; Brooder house construction ; Brooder house management ; Brooder stoves ; The solid floor guard ; Brooding temperature ; Placing poults in brooder house ; Feeds ; Feeder space ; Litter ; The sun porch ; Sanitation ; Crowding ; Pertinent poult pointers.

The Effect of Supplementary Heat on Egg Production, Feed Consumption, Amount of Litter required and Net Flock Income. C. E. Lee, S. W. Hamilton, C. L. Henry and M. E. Callanan. Poultry Science, Vol. 18, 1939, p. 359.

The use of supplementary heat in an insulated laying house under the climatic conditions of central New York State results in a lower annual egg production, a slightly lower feed consumption, occasionally a lower litter requirement, and a serious and consistent lowering of the net flock income.

This investigation demonstrates that where pen temperatures are kept in general, below 50° F. the use of artificial heat does not cause a decrease in the average egg weight.

Chinese Methods of Spaying and Caponising. W. Orr and Cheah Phee Phay. Veterinary Journal, Vol. 95, 1939, p. 64.

The technique in caponising fowls appears to be of remote antiquity in China. Description of technique and instruments.

Old Laying Houses can be Modernised. D. C. Kennard and V. D. Chamberlin. Ohio Agricultural Experiment Station. Bi-monthly Bulletin, May-June, 1939.

Suggestions given for the modernisation of old laying houses. In general, these are also applicable to the construction of new laying houses.

Livability and Egg Production of Pullet Layers as affected by their previous Management. Kennard and Chamberlin. Agricultural Experiment Station, Wooster, Ohio. 56th Annual Report, 1938, Bulletin No. 592.

Since the appearance of fowl paralysis and allied complications among the stations' flocks in 1928, the chief problem in the operation of the poultry plant has been the heavy losses of pullet layers. Numerous tests of different management procedures with chicks and growing pullets designed to prevent or reduce the losses of pullet layers (often reaching 50 to 60 per cent.) have been in continuous progress during the past 9 years. Among the procedures tested were fresh range, used range in the proximity of older birds, wire sun porch, and batteries. Regardless of the first methods of procedure, the mortality of pullet layers remained practically the same, although the fresh-range pullets consistently laid more eggs.

When the first management procedures failed it was supposed that the breeding stock was responsible. Accordingly, ready-to-lay pullets were purchased from two different sources. Both came through the year with a low rate of mortality and high egg production. Since it was believed that the superiority of the imported pullets was due to their breeding, hatching eggs were secured from one of the sources of imported pullets. The chicks and pullets from the imported hatching eggs were raised in the proximity of the Station's poultry plant. The pullet layers from these eggs proved even a worse failure than the Station's pullets, as did the pullets the following year from day-old chicks and hatching eggs from another source, supposedly free from the diseases affecting the Station's flocks. These 2 years' failure with outside stock made it plain that after all it must have been a management problem that began with the day-old chick and continued until the pullet was ready to lay. If so, it was obvious that the previous management tests had failed to meet the requirements. In order to eliminate the unforseeable chances for exposure of the chicks and pullets to diseases of older birds, day-old chicks were sent to the Miami and Clermont County Experiment Farms in 1935 and 1936. The pullets, when ready to lay, were returned to the Station for test purposes. Both groups yielded high egg production with a low rate of mortality

the first year. During the past year the pullets from the one farm repeated the good results of the previous year, but those from the other did not on account of an outbreak of coccidiosis, which, of course, was a management problem. During the year 1936-37, 1,500 chicks were raised on an isolated range near the Station's poultry plant where management precautions were taken that would generally be considered practicable by poultry raisers. Test groups of these pullets yielded an average of 29 per cent. more eggs with 30·6 per cent. (34 versus 49) less mortality than did the pullets raised without the special management precautions. Although the results were not as favourable as when the pullets were raised at the experiment farms entirely away from the poultry plant, repeated tests will be necessary before the merits of the modified procedure are determined.

In the eleven tests during a period of 3 years with pullet layers subjected to preventive management versus non-preventive management while chicks and growing pullets, the average mortality was 28 versus 59 per cent., and the eggs per bird were 182 versus 147.

Until more definite research information becomes available, preventive management procedures (particularly the isolation of chicks and growing pullets from older disease-carrying birds or the disposal of all chickens, depopulation, 4 to 6 weeks before bringing day-old chicks to the place and the use of hen breeders), uncertain as they may be, undoubtedly offer a poultry raiser coping with an acute disease and parasite (internal) situation the best promise for near future relief.

What is needed for the ultimate solution of the pullet mortality problem is more definite and comprehensive research information relative to the causes and means of transmission of diseases, including the role of " carriers " or " hosts " in the dissemination of diseases and internal parasites. With such information available, effective prevention and control measures (preventive management) could be more intelligently undertaken.

Egg Production and Livability of Pullets as affected by Management. D. C. Kennard and V. D. Chamberlin. Ohio Experiment Station. Poultry Science, Vol. 18, 1939, p. 318.

Five systems of management of chicks and growing pullets, with representatives from each group kept in floor pens and in laying cages during the laying year, were compared in this experiment. None of the management practices proved more than partially effective in reducing the mortality of pullet layers. Chicks having access to isolated range after 2 weeks proved superior, both in egg production and livability, to those confined to wire sun porches from 8 to 10 weeks before being placed on range. Egg production in floor pens averaged highest for those pullets reared on the isolated range. In practically all cases, livability and total egg production of pullet layers in laying batteries were better than similarly raised pullets kept in floor pens. Pullets brooded and reared in batteries generally proved unsatisfactory when placed in floor pens during the laying year, whereas they were generally satisfactory when continued in batteries during the laying periods.

The Care of Layers in Batteries. D. C. Kennard and V. D. Chamberlin. Ohio Station. Bi-monthly Bulletin No. 197, 1939.

Feeding and watering equipment for laying battery installation, rations for layers in batteries and methods of feeding are each briefly discussed. A comparison of the livability and egg production of pullet layers in batteries *v.*

similar pullets in floor pens (average 25 trials) indicated a lower percentage of mortality and an average of seven eggs per bird greater production in favour of those in batteries.

Laying Batteries versus Floor Pens for Layers. Kennard and Chamberlin. Agricultural Experiment Station, Wooster, Ohio. 56th Annual Report, 1938, Bulletin No. 592.

The first tests with caged layers at the Ohio station were begun in 1924, or just about as soon as it became known how to feed chickens so that they could live indoors. Numerous tests with caged layers have been in progress almost continuously during the past 14 years. Since 1933, when commercial equipment became available, tests of livability and egg production of layers in batteries versus similar layers in floor pens have been under way.

In 17 tests during the past 5 years, the layers in batteries averaged 148 eggs per bird against 150 from similar layers in floor pens. The rates of mortality were 35·8 and 49 per cent. respectively.

The birds were fed on a coarse, all-mash feed mixture. The principal difference in nutritive requirements was that the birds in batteries required more supplemental vitamin D (perhaps 50 to 75 per cent. more) than the floor birds. Batteries have their advantages and disadvantages as do floor pens.

Although laying batteries offer promising commercial possibilities, they must still be regarded as being in their experimental stage of development.

Bilateral Variation in the Weight and Composition of the Long Bones of some Experimental Animals. Ch. E. Weakley and R. B. Dustman. Journal of Agricultural Research, Vol. 58, 1939, p. 711.

Introduction

The literature dealing with bilateral variation in the bones of experimental animals and suitable for close comparisons is meagre and scattered. Investigators have sometimes used bones from one side of an animal for one type of determination and the corresponding bones from the other side for a different type of determination, with the tacit assumption that the bones from the two sides were identical in composition or other properties. Some years ago an investigation was begun at this laboratory to determine the composition of various skeletal parts of experimental animals. This afforded an opportunity for a study of bilateral variation in the long bones.

Summary and Conclusions

In a study of bilateral variation in the weight and composition of green bones of 20 rats, 20 chicks, 19 hogs and two dairy heifers, the following results were obtained :—

1. No significant differences in weight of green bone or in percentage of moisture, ash, and organic non-fat were found in bones from the right and left sides of the rat.

2. In the chick bones green weight and percentage of moisture were significantly higher on the left side while percentage of ash and organic non-fat were significantly higher on the right side.

3. In the hog bones green weight, percentage of moisture, and percentage of organic non-fat were significantly higher on the left side while percentage of ash was significantly higher on the right side.

4. The dairy heifers showed a tendency toward heavier bones on the right side.

5. In animals in which one side showed a tendency to dominate in weight of bone the same side tended to be higher in percentage of moisture and the opposite side to be higher in percentage of ash.

These results may be interpreted as suggesting (1) that certain species of lower animals may tend toward a dominance of one side over the other with respect to bone development, and (2) that bones from one side are not necessarily identical in composition or other properties with those from the other side, although in general the differences found in these experiments were quite small.

The Battery System of Housing Laying Stock. A. S. B. Wilson, Boghall. Agricultural Experiment Station Station of the Edinburgh College of Agriculture. The Scottish Journal of Agriculture, July, 1939, p. 266.

The cages should be stocked with pullets. Pullets retained after their moult could only attain 23 per cent. production. The moult is prolonged under this system of housing. The birds do well on an exclusive diet of dry mash.

Approximately 16 per cent. of the pullets are culled in their first year, exclusive of a mortality figure of 4 per cent. From the remaining birds, satisfactory egg yields have been recorded, 193 per bird in 1936-37 and 191 in 1937-38.

The mash consumption recorded over a 2-year period at Boghall was 112 lb. per bird per annum, and the total consumption of oyster-shell grit was 6½ lb. per annum.

The two main causes of death noted at Boghall were prolapsis and tuberculosis.

A Statistical Study of Winter Pause in White Leghorn Pullets. I. M. Lerner and L. W. Taylor. Division of Poultry Husbandry, California Agricultural Experiment Station. Journal of Agricultural Research, Vol. 59, 1939, p. 199.

Degree of winter pausing as defined here (percentage of hen-days from November to February spent in pauses of 7 days' duration or longer) is determined by the percentage of birds pausing in a population by the frequency of pauses, and by duration of pause.

Percentage of birds pausing is of major influence in determining the degree of pausing in a population.

In a population with 21·9 as the degree of pausing, duration of pause was significantly correlated with degree of pausing, while in a population with 11·4 as the degree of pause, frequency of pause was of greater importance than duration of pause.

Percentage of pausing birds in a family is suggested as a standard of selection in breeding against occurrence of winter pause.

Degree of pausing depends also on the genetic constitution of the birds (as shown by variance between sires), on the date of hatch, and on the season.

Intensive v. Battery Housing. J. Bennett. Eggs, August 25th, 1939.

Using White Leghorn × Rhode Island Red pullets, little difference was discernible between the results of stock housing in single bird batteries or intensively. All-mash feeding and lighting from 8 to 9.15 p.m. were part of the normal management.

Both egg weight and body size were significantly higher in the battery than on the floor. It was noticed, however, that slower maturing stock did better in cages than on the floor, while no advantage was gained by placing rapid-maturing birds in the battery.

While, for experimental reasons, culling was not practised the differences between the groups would have been substantially the same had management conformed to commercial standards. The ration employed was made up of bran 20, weatings 25, yellow maize meal 40, dried grass 5, fish meal 5, ex. soya bean meal 3½, salt ½, and cod liver oil 1.

	December hatched June, 1938 to May, 1939		May hatched October, 1938, to present time	
	Battery	Intensive	Battery	Intensive
Eggs per bird	201·6	196·1	167·9	162·3
Income	27/2½	26/7¾	20/2¼	18/10¾
Food cost	7/5¼	6/9¾	6/3¾	5/8½
Margin over food cost	19/9¼	19/10	13/10½	13/2¼
Food per bird per day (oz.) ...	4·54	4·20	4·77	4·34
Average egg weight (drams) ...	33·2	32·4	33·6	33·2
Percentage 1st grade eggs ...	70·50	64·0	80·6	76·1
Average final body weight (oz.)	86·2	79·6	81·8	78·6
	5 lb. 6 oz.	4 lb. 15½ oz.	5 lb. 1¾ oz.	4 lb. 14½ oz.
Mortality	20	23	2	11

A Comparative Study of the Behaviour of Los Banos Cantonese, Nagoya, and Single Comb White Leghorn Pullets in Battery-Laying Cages. F. M. Fronda and R. C. Evangelista. Philippine Agriculturist, Vol. 27, 1938, p. 502.

Of the three breeds studied, Los Banos Cantonese had the lowest food consumption, but also the lowest egg yield. For conversion of food into eggs, however, this breed was more efficient than the other two.

A Comparative Study of the Economy of Egg Production of Birds kept in Battery-Laying Cages and those kept in Outdoor Laying Pens. F. M. Fronda and R. C. Evangelista. Philippine Agriculturist, Vol. 27, 1939, p. 683.

Hens and pullets kept in laying cages had a lower food consumption than those kept in ordinary laying houses and having access to grass runs. In cages mortality was also lower while production was about the same—under each system. Other comparable groups of birds on grass runs had cod liver oil omitted from their diet. The effect in this case was to reduce the efficiency of the food still further and to reduce body weight.

Weight of Hens. A. Puhakka, Finland. Nordisk Fjäderfätidskrift, No. 2, August, 1939.

1. The best production in kilos. and number is attained when the weight of the hens varies between 1·8 and 2·2 kilo. For hens both of higher and lower weight the production has fallen.

2. The best winter production is attained by hens with weight varying between 1·6 and 2·0 kilo.

3. The weight of the eggs has risen steadily with increasing live weight of the hen.

4. As regards weight-production the best egg-weight has varied from 57·5 to 67·5 grammes. But it must be noted that for hatching-eggs as well as for market-eggs the best egg-weight is from 57·0 to 65·0 grammes.

Poultry Production. W. A. Lippincott and L. E. Card. Sixth Edition, 603 pages, 216 illustrations. Henry Kimpton, 263, High Holborn, London, W.C.1. Price 18s. net.

The new edition of this well-known American text book, revised by Professor Card, retains the main features of previous editions. A new section on the endocrine glands (or glands of internal secretion), by Dr. F. B. Hutt, has been added, and the sections on physiology, nutrition and marketing have been expanded. The growing importance of commercial egg production is reflected in the changes, but the technical problems of table poultry production are less adequately treated. The section on marketing has been expanded a little to include modern work on the diagnosis of egg quality, but omits to stress the admitted shortcomings of candling for the diagnosis of internal quality.

A new feature that will appeal to students is the addition to each chapter of a list of literature references. On the other hand many will be surprised and disappointed to find that the chapter on poultry parasites and diseases has been eliminated. Although this subject is so complex and important that it can only be treated adequately in a separate volume, a concise summary of the existing state of knowledge might well have been included.

The book is eminently one for the student, but will be found interesting and valuable by all who desire to have available for reference a comprehensive survey of the whole range of modern poultry husbandry.

Economic Aspects of Poultry-keeping in Canada with special Reference to Egg Production. S. Bird and J. W. Sinclair. Central Experiment Farm, Ottawa. Scientific Agriculture, Vol. 19, 1939, p. 551.

Conclusions :

1. Difference in feed cost of various sizes of eggs amount to 1·756 grammes or 4·3 per cent. feed per egg for every 1 oz. per dozen difference in the size of eggs.

2. Due to the volume of feed required to maintain body weight the smallest possible bird giving maximum production of standard sized eggs is, economically, the most desirable unit.

3. On the evidence here presented small and large mature birds of the breeds herein analysed have about equal chances to lay large or small eggs. This relationship holds between breeds as well as within a breed. Size of egg in the mature bird is therefore genetically and evironmentally uncomplicated by body size.

4. In the immature bird ovary and oviduct are apparently developed proportionately to the body size as in such birds egg size shows an important correlation to body size.

5. The average production for Canadian well kept birds of the White Leghorn and Barred Plymouth Rock breeds appears to be at the rate of about 52 per cent. for the year.

6. Total annual feed consumption per bird of the White Leghorn and Barred Plymouth Rock breeds as herein represented appear to be about 69 and 97 lb. respectively when the birds are maintained in cages. When similar birds are allowed the freedom of a pen about 82 and 106 lb. will be required respectively.

7. Calculations of net revenue over cost of feed have been presented for the two breeds under conditions obtaining in cages as well as in pens. The more favourable balance shown by birds of the Leghorn breed is solely due to the smaller feed cost of maintaining the comparatively lower body weight characteristic of this breed.

8. On the average throughout Canada the producer receives 67·9 per cent. of the price paid by consumers for eggs.

On the Calculation of Corrections on Radiation during Calorimetric Investigations. L. I. Schechtman. From the Diagnostic Laboratory of the Scientific Research Institute of Poultry Husbandry, Moscow.

Summary :

1. The difference in the caloric content of 1 gramme of matter between calculations made according to Stoman's simplified formula and Stoman's complicated formula, has in our experiments been positive (with a plus sign), and has not, on an average, exceeded 0·06 per cent., varying to an insignificant extent in different groups.

2. This difference calculated according to Schukarev's formula was found to be positive, negative and nought for each group.

3. Since the caloric content of 1 gramme of matter calculated according to Stoman's simplified formula gives the more stable results coinciding with those obtained from Stoman's more precise formula, while the deviations are so insignificant that they amount to several times less than the allowance made for errors, we are able to recommend the use of Stoman's simplified formula for scientific research work, particularly in zootechnics where temperature is registered at intervals of 1 minute.

4. Schukarev's formula may also be recommended for the above mentioned calculations, but the results received are less stable. These sometimes coincide with the results obtained from Stoman's complicated formula, while at times they yield either positive or negative deviations.

5. The use of Stoman's simplified formula saves from 10 to 12 minutes for each calculation and reduces the possibility of mistakes in calculation.

Bibliography of Poultry Publications. U.S. Department of Agriculture, 1938.

This compilation by the Departmental Poultry Committee, of references on poultry subjects includes Department publications, popular and scientific articles, and published addresses by employees of the Department.

A Few Practical Experiences in the Use of Poultry Manure in Horticulture. J. Wrennall. Harper Adams 23rd Annual Poultry Conference, August, 1939.

Good results with chicken and duck manure in growing tomatoes. In applying poultry manures, the method should be little and often. If too much is given even in the growing season, it is wasteful and detrimental, seeing that

its chief element is ammonia. If over-applied to grass land, it will produce rough strong grass and destroy the finer herbage, but if applied with judgment, good results are sure to be obtained.

Laying Batteries. My Experiences in the Construction and Management of Laying Batteries. A. S. Adams. Harper Adams Poultry Conference, August, 1939.

Description of a poultry farm that is less than an acre in extent, yet has about 2,500 laying cages and rearing appliances which rear over 2,000 pullets each year. None of the replacements ever touch earth, are fed entirely on dry mash and only get water and grit in addition. The cages are suspended in pairs from the roof by wire cables running over a central revolving shaft.

Five Years' Experience with Hen Batteries. M. Montgomery.

The advantages and the disadvantages of the merits of pullets or second-year birds are much influenced by particular circumstances.

Results of Laying Battery Experiments, 1938-39. J. Bennett.

The first experiment started June 21st, 1938, and finished May 22nd, 1939. 94 birds were placed in batteries, 99 birds were housed in an intensive house. The figures show that as far as numbers of eggs, income, food cost and margin over food cost are concerned, there was no significant difference between the birds kept in the battery and those in the intensive house. There was a significant difference in the egg weight and body weight. In the battery the eggs were heavier and the body weights higher. Mortality (battery 21·3 per cent., intensive house 23·2 per cent.) appears to supply the greatest difference. Ovarian trouble has been responsible for most of the deaths.

The Use of Artificial Lights for Turkeys. H. L. Wilcke. Iowa Experiment Station. Poultry Science, Vol. 18, 1939, p. 236.

Experiments extending over four seasons gave evidence that turkey females may be brought into earlier egg production by the use of artificial lights either in the morning and evening or all night. It required approximately 6 weeks for turkeys to reach a reasonably high level of production after the lights were turned on. The total number of eggs per bird to the end of June was increased by artificial lighting, while egg weight was not affected. Neither lighting nor heating had any significant influence on fertility or hatchability of the eggs. Total feed consumption was not affected by the use of either heat or light, but heating resulted in a much higher consumption of mash in proportion to grain as compared with the unheated groups.

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