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discussed in turn, concluding with a list of references to the published papers dealing with the group. One chapter (on the anatomy of the Diptera) is intended to serve as an introduction to insect morphology, and deals at length with certain matters which therefore need only a brief reference in the description of other groups.

As in the past, many important advances in knowledge have depended on the study of non-pathogenic organisms, the authors have included accounts of many blood-sucking arthropods which have, so far as we know at present, no connexion with disease.

A most valuable feature is the inclusion of keys to the genera and species, which have been compiled by various specialists, and which should prove of the greatest service in the identification of specimens, especially to the isolated worker who has no type collection for reference.

In accordance with the main object of the book, particular attention has been paid to the description of methods of breeding and laboratory manipulation of the different groups, and a special chapter deals with histological and general laboratory technique.

As is necessary in a work of this kind a considerable amount of the matter has been compiled, but there is also a large amount of original work both in the text and in the figures.

The book is clearly written and very fully illustrated with photographs and excellently reproduced drawings, and we have no hesitation in recommending it not only to those who, by reason of opportunities of time and place, contemplate original research, but also to those who wish to follow in an intelligent manner one of the most important branches of modern medical investigation.

C. J. C.

Plague Investigations in India. (Ninth Report, Journ. of Hygiene Plague Supplement IV).—Extensive observations have been carried out by Kunhardt and Taylor, assisted by R. G. Izer, T. K. Menon, B. V. Varadhachari, R. Ragharendra Rao, and K. Narazan Rao, as to the conditions of climate and physical geography in relation to the incidence of plague in a number of districts of the Madras Presidency. Their conclusions are summarized as follows:

1. From 1898 to 1910 ninety per cent. of the plague deaths in the Madras Presidency have occurred in certain districts which immediately adjoin infected areas in the Bombay Presidency and Mysore State. The Bellary and Nilgiri districts as well as the Hosur taluk in Salem district, and the Kollegal taluk in the Coimbatore district, have been most severely and persistently infected.

2. In certain years, especially when the temperature has been lower, and the humidity higher than normal, plague has extended to places immediately adjacent to the infected areas of the Madras Presidency mentioned above, and serious epidemics of plague have developed especially in certain large municipal towns, while the disease in the surrounding villages has generally been mild.
(3) Although plague has invaded the Madras Presidency, it has shown little tendency to flourish in places beyond the limits indicated above. These limits had been attained by the year 1903. Such districts as have been affected for the first time since 1904 have returned comparatively few deaths from this disease.

(4) While the districts which have suffered most from plague have the characteristic in common that they are in the closest proximity to infected areas outside the Presidency, they also resemble each other in being the most elevated and coolest parts of the Presidency.

(5) A low-lying, comparatively hot, and dry plain, separates the areas at present infected from the more humid and cooler coastal regions, especially in the north of the Presidency. Plague has rarely occurred on the east coast, but on the west coast the seaport towns of Mangalore and Calicut, which have intimate trade relations with Bombay, have suffered from the disease.

(6) In seeking for an explanation of the limited distribution of plague in the Madras Presidency, it is difficult to evaluate the influence of the various factors which favour or prevent the spread of infection. For any given place, a number of circumstances, some more, others less favourable to the development of the disease, are at work together. Thus, while the severely infected areas of the Madras Presidency are situated in close proximity to similarly infected areas in charge of other administrations, being for this reason more open to infection, these same areas enjoy a climate which approximates to that which, from a study of plague in other parts of India, we have come to regard as favourable to plague. It appears that the proximity to infected areas, and the facilities for communication with them, seem to have been more important than its climate in determining the plague incidence in the Bellary district. This is supported by the fact that the Kurnool district, with a very similar climate, but more distant from infected centres, and with less rapid and efficient means of communication, has suffered but little from plague. On the other hand, plague has been severe in the Nigiris, where the population is scattered and the means of communication are indifferent, but where the climate is very favourable for the diffusion of the disease.

(7) An examination of rats and fleas found in places selected in (a) the severely infected area, (b) the moderately infected area, and (c) in the plague-free areas of the Presidency, has shown that in none of them, in the light of the Commission's experience elsewhere, was the number of rats and fleas too small to prohibit the development of an epidemic in them.

(8) Experiments have shown that rats caught in places in Madras which have been free from plague epidemics are very susceptible to plague infection. This indicates that conditions exist in those places which have hindered the successful implanting of infection in them. The authors attribute this comparative immunity to the warm climate obtaining over the greater part of the Presidency.

(9) As plague is carried from place to place in the bodies of infected fleas, and as, even when infected rats are transported from place to place, there is nevertheless an interval when infected fleas are separated from their host before finding access to man, any local conditions affecting the survival of these insects apart from a host are of importance.
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from their host, rat fleas speedily succumb to the combined effects of high temperature and drying. Unfavourable conditions of this kind are found in the hot and dry plains which separate the cooler and moister sea-coast districts from the existing areas of infection in the Madras Presidency. Accordingly this area breaks the chain of communication between the infected area in the west and the cooler regions of the east coast. At the same time facilities for the importation of infected rats to the coastal districts by way of the sea are poor, for no very satisfactory harbour exists on the east coast of the Madras Presidency, where ships can discharge cargoes directly upon the wharves.

The authors conclude that the physical features and climate of the Madras Presidency have an important influence in limiting the distribution of plague in it.

S. Rowland concludes, as the result of further experience, that as the conditions in the culture medium used for the propagation of the organisms which are to afford an antigen approach those which obtain in the body of the living animal, so the efficiency of the antigen against a body strain of plague is increased. In these experiments organisms from the spleen of a rat dead of plague were used, but in a later series of experiments in which the standard virulent laboratory culture, which has recently suddenly risen in virulence, was used, immunization almost completely failed. Attempts to immunize rats and guinea-pigs against serum-grown Bacillus pestis by means of the pseudo-tubercle bacillus failed, though guinea-pigs have been so immunized against broth-grown strains. Vaccination with living avirulent plague organisms (Strong) grown on agar produced a small but distinct immunity in guinea-pigs, but in rats the degree of protection was less than that obtained with the original virulent strain. The rats immunized with the living avirulent strain showed a lower degree of immunity against a culture isolated by Castellani from a case of plague in Ceylon, than when tested with the standard laboratory strain, though the latter was the more virulent. From this he infers that the antigens from these two latter sources are not entirely identical.

In a previous report Rowland showed that a protective and curative serum for rats can be prepared against a broth-grown strain of plague by immunizing horses against a nucleoprotein extract of the same strain. This serum, tried in practice in cases of human pest, proved valueless. He now describes the immunization of a horse with graduated doses of toxic nucleoprotein extract from a body-strain of plague grown in horse serum. This provided a serum of marked protection and curative power when tested on rats against a serum-grown strain.

As the preparation of a nucleoprotein extract of plague bacilli is a somewhat difficult operation, Rowland sought a means of preparing a whole vaccine in which the infectivity could be destroyed without the use of heat or other agency deleterious to the antigen. With this object he carried out experiments on the effects of ultra-violet light. He found that plague bacilli could be killed by five minutes exposure to the ultra-violet light of a carbon arc, but that the killing of the organisms was accompanied by destruction of the antigen. Further researches showed that the region of the spectrum which is responsible for the bactericidal effect is precisely that region which destroys the antigen.

A. W. Bacot reports observations on the length of time that fleas
(Ceratophyllus fasciatus) carrying *B. pestis* in the alimentary tract are able to survive in the absence of a host, and retain the power to infect. Fleas were infected by feeding on moribund mice, and subsequently, healthy mice were introduced into the flea cages. He finds that these fleas are able to carry *B. pestis* for periods up to forty-seven days in the absence of a host and subsequently to infect a mouse. Also that infected fleas starved for forty-seven days and then placed on a mouse, may not infect it for a further period of about twenty days. There is no reason to suppose that these results represent the limit of time after which infection may take place.

In "Further Notes on the Mechanism of the Transmission of Plague by Fleas," he states that an examination of longitudinal serial sections of infected fleas confirms the conclusions already arrived at, and also shows that in some cases, after complete blocking of the proventricular valve, the obstructing mass becomes ruptured, leaving a passage through which blood may flow in either direction and thus, if anything, increasing the infectivity of the flea.

He also studied the development of the plague bacillus in bugs (*Cimex lectularius*) and their power to convey infection. Bugs were fed on infected mice, and subsequently smears of stomach contents and sections of the bugs were examined microscopically, and the infected bugs were allowed to feed on mice. He finds that (1) for a percentage of bugs, and probably for all newly hatched ones, a meal of septicemic blood from a mouse dying of plague is fatal; (2) bugs which are not killed by the infecting meal carry *B. pestis*, and can reinfect mice after a period of forty-eight days starvation; (3) the development of *B. pestis* within the crop of bugs differs from that which takes place in the stomach of the flea in respect of its slower and looser growth, this limitation of activity being accompanied by, and possibly due to, the preservation of structural character of the blood for many days after ingestion; (4) the absence of a valve between the pump and the crop, together with the looser nature of the growth within the bug preclude the idea of mechanical blockage and regurgitation as occurs in fleas, but infection may be caused by interruption during feeding followed by a second attempt.

C. J. C.

**Standardization of Bacterial Suspensions by Opacity** (H. C. Brown and E. W. O'G. Kirwan, *Indian Journal of Medical Research*, January, 1915).—As a standard of opacity the writers use a series of dilutions of a one per cent suspension of freshly precipitated barium sulphate in one per cent sodium citrate. A tube about four millimetres internal diameter containing the bacterial emulsion is compared with similar tubes of the standard suspension in a good light against a clearly printed book. They find that a ten per cent variation in the dilution of the barium sulphate suspension can easily be recognized, and hence expect a similar degree of accuracy in estimation of bacterial counts. To establish their data a careful determination of the number of *Staphylococcus aureus* contained in one milligramme of the dried organism was made, and the dilution of the standard suspension corresponding with an emulsion of the same weight of bacteria in one cubic centimetre of saline fixed. Other organisms were counted against *S. aureus* according to the method suggested by Braxton Hicks, and a table compiled showing the
number of bacteria in one cubic centimetre corresponding in opacity to a series of dilutions from one in eight to one in sixteen of the barium sulphate suspension. They draw attention to the fact that in every case a culture incubated at 37°C. for exactly twenty-four hours was used, for the opacity of a bacterial suspension is dependent upon the age of growth of the contained organisms.

**Agglutinins in the Blood of Cholera Cases.**—Major E. D. W. Groig (Indian Journal of Medical Research, January, 1915) has examined the blood of three hundred and sixty-three cases of cholera. In sixty-four fatal cases the majority showed an absence of specific agglutinins, although some lived for seven days. In the non-fatal cases, however, of which two hundred and ten were examined, agglutinins were well marked by the sixth day, and often reached a high titre (one in four hundred to one in one thousand). A maximum is attained about the seventeenth day, and a drop appears to occur about the twentieth day. Agglutinins were also present in the blood of carriers. Accordingly the test, while of no diagnostic value in acute cases, may be exceedingly useful in the investigation of convalescents or suspected carriers. In the eighteen cases in which the true cholera vibrio as well as a cholera-like vibrio were found by cultural methods agglutinins were developed for the cholera vibrio only. Agglutinins were also found in a few cases out of a number in which the true cholera vibrio was not demonstrated by culture; a fact which suggests that cholera vibrios may have been present. In no case did vibrios other than cholera agglutinate with the sera of the patients from whose stools they had been isolated.

**X-ray Wagons in the Field.**—In the Presse Médicale, December 17, 1913, Médecin-Major Busquet, staff officer at the Ecole d’application, Val de Grâce, Paris, publishes an interesting article on Radiology in various armies during war (“De la Radiologie dans les Armées en Campagne”).

In 1904 a motor wagon was brought out by Gaiffe and Panhard Levassor and tried on manoeuvres in France. Examination of the patients was carried out inside the wagon. The next motor was designed by Dr. Lesage.

A portable X-ray outfit was tried in certain field hospitals in Morocco. The German Army about 1908 introduced a horse-drawn X-ray wagon. The X-ray work here appears to be carried out by placing the patient for examination on a stretcher supported on two chairs; and two other chairs on either side of the patient are used for suspending the apparatus.

The writer then refers to an Italian field apparatus described in the Military Surgeon. These models, he holds, are able to do a certain amount of work, but do not quite comply with ideal conditions for work in the field.

Three questions require to be considered:

1. The necessity and utility of the apparatus.
2. The kind of apparatus and its special qualities.
3. The conditions under which it will be used.

1. The necessity for such an apparatus was proved up to the hilt in the late Balkan War. Major Metzger, U.S.A., in an article in the
Military Surgeon, holds that an X-ray outfit is indispensable to every group of field medical units.

(2) The apparatus should be capable of being moved about and be ready for use anywhere at any time. It must be able to generate its own electricity and have sufficient potentiality to take pictures with an exposure of a few seconds. This is necessary because of the large number of wounded who will require examination about the same time and in whom immediate operative interference will be indicated.

It must be strong enough to stand frequent removals and be simple enough to be used by people who are not really experts. The question of an examination and radiographic chamber must also be considered. The simplest way is to have a tent pitched along the side of the wagon which, if necessary, can be heated. In this way the operator has fixed ground to work on, and his pictures will not be affected by the vibrations of the dynamo.

(3) With regard to the question of where the apparatus can be most usefully employed, it is generally admitted that they can only be satisfactorily used in field hospitals, and it is here that they are employed in the German and Italian armies.

If one studies a map on which the different phases of a battle have been marked, one is struck by the large amount of ground that is covered, and with the large task that will devolve on the medical service in the collection and treatment of the wounded. The writer then quotes from a lecture by Méd. Inspecteur Mignon: “Imagine for a moment the extent and the aspect of a modern battlefield. It may be forty kilometres long, and fifteen to twenty kilometres in depth. Field ambulances, sections d’hospitalisation, tents, houses, farms and villages represent on it the wards of a great hospital.”

It is in these various places that the wounded will be collected, to save them the pain of removal by lengthy evacuations. “Men wounded in joints or viscera will remain where they are until it is certain that no complications will result from a hasty and lengthy removal.” The teaching then of modern wars is that there will be large numbers of wounded who cannot be evacuated and that medical and surgical aid must be sent up to them. It is here where an X-ray motor wagon will come in useful. The writer holds that it must be a motor wagon and that it should be attached to one of the medical units in the Army Corps and march in the first or second line transport; at any rate be handy at short notice. After an engagement it could perform a daily tour of the immobilized ambulances to assist in making diagnoses where required.

Messrs. Massiot et Radiguet have constructed an automobile to Méd.-Major Busquet’s design which fulfills all these requirements. It carries three attendants, and on the roof of the car a tent is carried which can be pitched alongside in a few minutes. The illustrations in the article indicate that everything has been carefully thought out.