

vol. i., including the measures of nebulae situated between 0h. and 2h. of right ascension. The first part of this volume will contain the introduction, and will include a full description of the instruments and methods employed in the research.

Vol. ii., including the section 2h.-9h., is to appear soon, and will be followed by vol. iii., giving the results for the region 9h.-14h. (*Comptes rendus*, No. 12).

A LARGE PHOTOGRAPHIC NEBULA IN SCORPIO.—On examining the photographs obtained during his sojourn at Mount Wilson last year, Prof. Barnard found that an immense region near to  $\pi$  and  $\delta$  Scorpii is occupied by a large nebula which is comparable in size, and in the peculiarities of its several branches, with the great nebula in Orion and the extended nebulosity of the Pleiades.

A short description of this nebula, together with a splendid reproduction of a photograph of it, taken with the 10-inch Brashear lens of the Bruce doublet, is given in No. 2, vol. xxiii., of the *Astrophysical Journal*.

The nebula extends some  $4\frac{1}{2}^\circ$  or  $5^\circ$  in a north and south direction, and its brightest portion lies about  $\frac{1}{2}^\circ$  to the south of  $\pi$  Scorpii.

A striking fact in connection with this object is that all the larger stars connected with it are, as might be expected, of the Orion type.

Prof. Barnard thinks that the branching, straggling character of this and similar nebulae tends to discredit the accepted form of the nebular theory of stellar evolution, and doubts whether that theory would have ever been constructed if, at the time, our present knowledge of the appearance of nebulae, as shown by photography, had been available.

#### CANADIAN TIDES.

A PAPER on tide levels and datum planes on the Pacific Coast of Canada was read recently by Mr. W. Bell Dawson, the engineer in charge of the tidal survey, at the meeting of the Canadian Society of Civil Engineers. The survey of the Canadian waters on the Atlantic side has been in progress now for some years under Mr. Dawson's charge, and has so far advanced that permanent tide gauges have been fixed at several representative parts of the coast, and sufficient tidal observations obtained to enable the Marine Department to issue tide tables for most of the principal ports. The survey has now been extended to the Pacific Coast.

In the paper under notice the bench marks and data used by the Admiralty, the Hudson's Bay Company, and the town authorities on the coast have been connected up by levelling, and the bench marks at Victoria, Esquimaux, Vancouver, and other tidal stations referred to one common standard. These levels are given in the pamphlet. The importance of publishing such results is emphasised by the fact that the bench marks of former surveys are now to a great extent useless, because they were never made public, and the level books containing the records of these surveys have been destroyed by fire, and so a large amount of good work has been rendered useless, and subsequent trouble and expense caused.

The tides on the Pacific Coast are peculiar, the leading feature being a pronounced diurnal inequality which accords with the declination of the moon, and is subject to an annual variation with the change in the declination of the sun; also there is an unusually large solar effect relatively to the lunar, especially in the northern part. In some parts of the coast during the greater part of the day there is a long stand or only slight fluctuation near high-water level, with a sharp, short drop to the lower low water which occurs once in the day. Owing to this diurnal inequality the two highest and lowest points in the tide curve for the month may be as much as five days before or after the full and new moon. While the tides on the Atlantic side of Canada follow the phases of the moon, and accordingly the alternations of spring and neap tides are the dominant features, the tides on the Pacific side may be described as declination tides.

The careful study of the tides and of the mean sea-level appears to indicate that this coast is rising at a rate as great as 1 or 2 feet in the century.

#### THE INTESTINAL TRACT OF MAMMALS.

IN a memoir "On the Intestinal Tract of Mammals" (Trans. Zool. Soc. of London, xvii., part v., December, 1905, pp. 437-536), Dr. Chalmers Mitchell extends to mammals the line of investigation which has already, in his hands, yielded results of great interest when applied to birds, namely, the systematic study of the pattern and arrangement taken by the folds and coils of the intestinal tract. With this object, the author describes the pattern of the intestinal coils in a great number of mammals dissected by him, representing examples of each of the principal subdivisions of the entire class. The descriptions are supplemented by an excellent series of text-figures, which show the arrangements in a semi-diagrammatic, but clear and accurate, manner. In the case of mammals of which the author has not been able to procure specimens for dissection, he quotes from the existing descriptions of other authors such details as apply to the problems which are the object of his investigation. Thus the memoir before us gives an account, which is practically complete, of what may be called the general morphology of the mammalian intestinal tract, that is to say, of that portion of the gut comprised between the stomach and the anus. From his investigations the author arrives at a number of interesting conclusions, of which only a few can be mentioned in the limits of this article.

Starting from an ancestral type of vertebrate, in which the alimentary canal ran a straight course through the body, suspended by a mesentery from the dorsal wall of the body-cavity, the gut becomes thrown into a series of folds as the result of a process of growth, whereby it becomes longer than the straight length between its extreme points. The process of elongation can be traced both phylogenetically, by a comparison of different vertebrate types, and ontogenetically, in the development of any given species. The more or less complicated folding of the gut which results involves the dorsal mesentery, and also the blood-vessels draining from the different parts of the gut, which tend to take short circuits between portions of the gut approximated to each other by the process of folding.

The intestinal tract, in both birds and mammals, is divided into two regions, anterior and posterior, by the outgrowth at a certain point of a cæcum or pair of cæca. Probably in all cases a pair of cæca were primitively present, as is usually the case in birds. In mammals, as a general rule, a single cæcum is formed, but in some cases two complete cæca, or a rudiment of a second in addition to the usual one, still occur. In a few cases, however, all trace of a cæcum has disappeared entirely. The intestinal tract anterior to the cæcum is divisible into two regions, the duodenum and the small intestine, or "Meckel's tract," as the author proposes to call it. The latter represents only a very short portion of the primitive straight gut, not more than two or three body-somites; but in nearly all birds and mammals it becomes the longest portion of the gut, growing out to form the greater part of what is known as the "pendant loop" in mammalian embryology, and is the chief absorbing portion of the gut. The intestinal tract behind the cæcum may be called the hind-gut, and corresponds to a much larger portion of the primitive straight alimentary canal than the duodenum and Meckel's tract together. In birds the hind-gut is relatively very short. In mammals, however, it is always long, sometimes extremely so, and becomes divided into two regions, the colon and the rectum. The colon is often greatly lengthened, and thrown into loops or coils. The rectum may also be considerably lengthened, but, as a rule, it is not very much longer than the portion of the primitive straight gut which it represents.

In certain groups of mammals a very primitive type of intestinal tract is still found. As the author points out, however, likenesses which are due to the common possession of primitive features, once possessed by the whole group, cannot be regarded as evidence of near relationship. Equally useless for proof of affinity are resemblances due to the loss or reduction of parts that were once the property of the ancestral stock. Clues to affinity must rather be sought in resemblances depending on definite anatomical peculiarities that are new acquisitions, and the more

complex these structures, the more convincing the evidence they furnish, since it then becomes so much the less probable that the same anatomical device should have been produced twice than that it should have been acquired once only. In the Artiodactyla, for example, "a definite case of an anatomical peculiarity, so well marked and complex as to be a safe guide to affinity," is seen in the elongation and spiral coiling of the proximal portion of the colon. The Perissodactyla and rodents supply other examples of evolution along a definite radius from the ancestral centre. From his investigations the author deduces inferences of importance for the general theory of evolution, especially as regards the limitation of the possible range of variation of organs in any set of animals which have once come to occupy a particular radius. Further changes and elaborations are then restricted by the past history, that is to say, by the limited material which it has furnished for further specialisation. In this way a simple explanation is given for the definite grooves, recognised by many writers, along which the specialisation of organisms must necessarily move, without having recourse to the assumption of any mysterious directive forces. E. A. M.

#### SCIENTIFIC REPORTS OF THE LOCAL GOVERNMENT BOARD.<sup>1</sup>

THE first half of the volume under notice is devoted to the medical officer's report, statistical data, and details of various inspections and inquiries by the Board's inspectors. The second half contains reports of the auxiliary scientific investigations carried out for the Board. The first of these is a memorandum by Dr. Theodore Thomson on rats and ship-borne plague. The conclusion arrived at is that "the part played by the rat in transmission of plague to man, although real, falls far short of the importance which has generally been attributed to it." This may be true, but in view of the predominant part played by the rat in the dissemination of plague in the various Sydney epidemics, it is to be hoped that the campaign against this rodent will in no way be relaxed.

Bearing on the same subject, Drs. Haldane and Wade report on methods of rat destruction and disinfection on ship-board. In this especial attention is directed to the Clayton process, in which sulphur is burned at a high temperature, and air charged with the products of its combustion is pumped into the ship's hold. The gas is rapidly fatal to rats and other vermin, and is germicidal to non-sporing microbes, but it does not penetrate a loaded hold well, and has a deleterious action on certain articles. On the whole, however, it seems to be the best method to employ for rat destruction. Dr. Klein details further experiments on the two types, virulent human and less virulent rat, of the plague bacillus differentiated by him and described in a previous report. Dr. Klein also records some interesting observations on the influence of symbiosis on the virulence of microbes.

An important paper on the differentiation of various streptococci and staphylococci is contributed by Dr. M. H. Gordon. Hitherto the differences exhibited by the members of these classes of micro-organisms, particularly the streptococci, have been slight and indefinite, but by making use of culture media containing various mono-, di-, tri-, and poly-saccharides and glucosides, important differential characters are obtainable. Dr. Sidney Martin has continued his studies on the toxic action of microbes, dealing in the present volume with that of the *Proteus vulgaris*. The results, however, in this case are somewhat indefinite, the toxic reaction being mainly evinced by the development of agglutinin in the blood. Dr. Houston gives a detailed report of the bacteriological examination of normal human dejecta, and of the intestinal contents of sea-fowl and of fish. All gulls contained typical *B. coli* in their excrement in enormous numbers, but guillemots did not contain *B. coli* of any sort. As regards fish, those obtained "from a source seemingly above all suspicion of objectionable contamination, may contain sometimes apparently typical *B. coli* in their interior; in the great majority of

<sup>1</sup> "Thirty-third Annual Report of the Local Government Board, 1903-4." Supplement containing the Report of the Medical Officer for 1903-4.

cases the results were either wholly negative or the microbes that were isolated proved to be atypical in character."

Dr. Alan Green contributes further observations on chloroformed calf vaccine which prove that the quality of the lymph prepared by this method is of a high order.

The above brief review shows that this report contains matter of the greatest interest and importance which should be studied by all bacteriologists and by those to whom the care of the public health is entrusted.

R. T. HEWLETT.

#### INFRA-RED SPECTRA.<sup>1</sup>

THE record of an enormous amount of work on the absorption spectra of organic compounds and emission spectra of various metals and gases in the infra-red region is given in the volume under notice. The investigations were commenced whilst the author was a graduate student at Cornell University, and completed under the auspices of the Carnegie Institution of Washington.

Even to summarise the mass of valuable information contained would exceed the limits of our present space, but it may be said at once that, to workers along similar and related lines, these results, and the descriptions of the apparatus and methods whereby they were obtained, are indispensable.

Part i. occupies nearly seven-eighths of the whole volume, and deals with the absorption spectra of 131 organic compounds up to 15  $\mu$ . As is pointed out in the very complete historical review, all previous workers in this subject have abandoned the investigation at 7  $\mu$  for the alcohols and 10  $\mu$  for some few other compounds.

The description of the apparatus and methods is exhaustive and invaluable. From 0.8  $\mu$  to 2.5  $\mu$  a quartz prism was employed, beyond that, and up to 15  $\mu$ , one made of rock-salt. The source of the radiations was a Nernst lamp "heater," which gives a spectrum of which the energy curve is smooth and continuous. A reflecting spectrometer of 35 cm. focal length was employed for the explorations of the spectrum up to 15  $\mu$ , and a considerable portion of the work up to 7.5  $\mu$  was repeated with a spectrometer of 1 m. focal length.

The distribution of the energy in each spectrum was determined by means of a radiometer similar to that devised by Nicholls, but with some modifications.

The principal reasons for this investigation were the determination of the influence of molecular weight upon absorption spectra, and also the effect of molecular structure. The results show that in different compounds each of these causes in turn acts separately, whilst in other compounds the absorption is produced by the combined effect.

In recording the quartz-prism results the author deals separately with each absorption band in the nineteen compounds investigated, whilst in the other results the compounds are treated separately, notes being made of the chemical structure and properties of each substance where necessary.

Numerous tables set out the numerical results in various forms, whilst 140 full-page *transmission* curves show them graphically. In addition to these the author has written seven brief appendices dealing with side-issues in connection with the apparatus and the investigation and its results.

In part ii. Mr. Coblenz deals with the infra-red emission spectra of various metals, metallic chlorides (alkalies), and gases. The metals were employed as the poles for the arc producing the radiations, whilst the chlorides were volatilised on carbon arcs. The apparatus was very similar to that described in part i., except for a few modifications rendered necessary by the greater intensity and unsteadiness of the radiations.

With the metals, a black-body spectrum due to the oxides, and sufficiently strong to obliterate any emission lines which might be present, was found, and in the alkali chloride spectra no lines were discovered beyond 2  $\mu$ . Of the gases investigated—in vacuum tubes—N was found to be the only one having strong emission lines in its infra-red spectrum. CO<sub>2</sub>, CO, and the vapour of C<sub>2</sub>H<sub>5</sub>HO were

<sup>1</sup> "Investigations of Infra-Red Spectra." By William W. Coblenz. Pp. vi+331. (Washington, D.C.: The Carnegie Institution, 1905.)