And to these sources of difficulty it might, we think, have been added that, in consequence probably of our study of geography from projections of the globe in which the effect of perspective is designedly counteracted as much as possible, we are apt to have a very defective idea of the amount of apparent distortion which it occasions towards the edges of the visible hemisphere. But even when all this has been allowed for, we find, the professor tells us —nor indeed do we need opportunities as extensive as his to convince ourselves of it—that the differences are much too great to be altogether thus explained; and he concludes that the more conspicuous ones are errors in representation. If there is occasional agreement as to the forms, there is still much risk in referring them to the same object, until it has been ascertained by computation that the presentation of the globe towards the spectators was nearly the same. Fortunately, during any given opposition, the position of the planet's axis shifts but little, and in other oppositions the same presentation recurs from time to time; but instead of the correspondence naturally anticipated, the differences are for the most part, as he expresses it, "enormous." And yet amongst them all, coincidences come to the surface, too remarkable to admit the idea of fortuitous resemblance; and we must suppose that many who have taken pencil in hand have not been sufficiently careful as to form and shading, but have followed arbitrary and perhaps very mistaken impressions, from which nothing but absurd and absolutely contradictory inferences of a physical nature could be drawn. T. W. WEBB

(*To be continued.*)

THE ADMIRALTY CHARTS OF THE PACIFIC, ATLANTIC, AND INDIAN OCEANS *

THESE charts have been compiled by Captains Evans and Hull, of the Hydrographic Departments of the Admiralty, from Maury's pilot charts, Fitzroy's and Fergusson's wind charts, charts issued by foreign Governments, and from the works of Dovè, Neumayer, Buchan, and documents in the Hydrographic Office of the Admiralty. They show for the four seasons the pressure, winds, and temperature over the parts of the globe covered by the sea. January, February, and March are properly grouped together into one season, these being the three coldest months as regards the oceans in the northern, and the three warmest in the southern hemisphere.

The most important piece of new work in these charts is the "isobars," or lines of equal barometrical pressure, which are given for the seasons. These isobars for the sea, taken in connection with Buchan's isobars published in 1868, may be regarded as the first approximation to a complete representation of the earth's atmosphere over both land and sea. We have minutely examined these isobars, comparing them with the large amount of new information collected during the past five years from many places situated on the coasts of the continents, or in islands scattered over the ocean, and can come to only one conclusion, viz., that the greatest care has been taken in their construction. Among the very few cases to which slight exception might be taken is the isobar of 29·7 in. of July, August, and September, drawn to southwards of Japan, which observations do not appear to warrant. It should also be pointed out that a serious omission has been made in not stating how the ship barometric observations were reduced to the mean pressures from which the isobars have been drawn.

We are now in a position to draw one or two general conclusions of great importance regarding the distribution of atmospheric pressure over the ocean. In the ocean, to westwards of each of the continents, there is at all seasons an area, or patch, of high pressure, from 0·10 inch to 0·30 inch higher than is found on the coast westward of which it lies. The distance of the centre of the space of high pressure from the coast varies from 20° to 35° of longitude, the average distance being nearly 30°. The position of the centre of the space varies from about 22° to 35° north or south latitude, or stating it roughly it lies about the zones of the tropics. In these spaces the absolute pressure is greatest during the winter months of the respective hemispheres—a condition of things probably due to the fact that during the winter season of the northern hemisphere the great mass of the earth's atmosphere is disposed about the tropic of Cancer, and during the winter season of the southern hemisphere, about the tropic of Capricorn. The position and shape of the isobars seem to be largely determined by that of the continents adjoining. Thus the rounded form of the southern portion of North America, the bending eastward of the west coast of South America from Payta to Arica, and the form of the north-western part of Africa and its "lie" from S.W. to N.E. are all more or less impressed on the isobars bounding the contiguous spaces of high pressures. These spaces are less prominently marked west of those continents which have the least breadth in lat. 30°; thus the area of high pressure is less marked west of the Cape than it is west of Australia, and still less than to the west of North America. The isobars are much farther apart on the western than on the eastern side of these areas of high pressure; indeed in many cases they are as it were drawn out so as almost to reach the continent lying to westward; and in some cases there is even a tendency towards, or the actual appearance of, secondary areas of high pressure to eastwards of continental masses. This is most distinctly seen to eastward of Australia.

We have dwelt thus particularly on these spaces of high pressures because of their importance in atmospheric physics, but more especially because of their vital connection with prevailing winds and the general circulation of the atmosphere. Out of these high pressures, the wind blows in all directions anti-cyclonically in accordance with the well-known "Buys Ballot's Law of the Winds," of which relation the wind charts before us afford abundant confirmation. Keeping this relation between wind and pressure in view, we have presented in these high pressures the proximate causes of the prevailing winds over the greater portion of the ocean; and through the prevailing winds, the drift currents and other of the surface-currents of the sea; and thereby the anomalous distribution of the temperature of the sea as seen in the Chile, Guinea, and other currents, and the peculiar climates of the coasts past which these currents flow.

The small area of high pressure to the east of Australia may be singled out as perhaps the most interesting of the new facts in the charts. During winter the winds along the east and south of Australia blow inwards upon the interior of that continent, whereas in New Zealand the prevailing winds at the same season are north-westerly and westerly, the directions being thus generally opposite on these two coasts facing each other. The space of high pressure between gives a ready explanation of the direction of these winds, as well as of the heavier rainfall on the west of the South Island of New Zealand as compared with that of the North Island, and of the south-east as compared with the south-west of Victoria.

Like praise cannot be given to the charts of the isothermals of air for January, April, July, and October. In the October chart, the isothermal of 60° cuts the east coast of South America near lat. 27°; now at Monte Video, the mean temperature of October is 61·2°, at Buenos Ayres 61·3°, and at Bahia Blanca, in 38°·4 S. lat. 59°·7; that is, the isothermal of 60° should cut the South American coast 11° of latitude farther to the south. The January isothermal of 60° is drawn passing through New

* "Wind and Current Charts for the Pacific, Atlantic, and Indian Oceans," published at the Admiralty, October 1872, under the superintendence of Rear-Admiral G. H. Richards, C.B., F.R.S., Hydrographer.

Zealand near lat. 40°, and the isothermal of 50° near Dunedin; now the mean temperature of January at Southland situated at the extreme south of New Zealand is 57°·6, and at Duned in (550 ft. high) 57°·5; in other words, the isothermal of 60° and not that of 50° ought to pass near Dunedin. Dr. Hector's meteorological reports during the past seven years place this beyond all doubt, and it is unfortunate that the summer climate of this important colony of Great Britain should have been so misrepresented as to appear to be colder than that of Iceland, and altogether insufficient for the ripening of wheat, barley, and other cereals. The July isothermal of 90° is represented as having its eastern extension at the entrance to the Persian Gulf in 57° E. long. Now Murray Thomson's and Blandford's meteorological reports show that the isothermal of 90° extends eastward to about 77° E. long, so as to embrace the Punjaub and the upper tributaries of the Ganges to the west, being thus 20° farther east than is represented on the chart.

The truth is, that, excepting for the months of January and July, there have been no isothermal charts of the months for the whole globe yet published which do not contain many gross errors similar to those we have pointed out. The time is surely not far off when a committee of the British Association, or some competent authority, will take up this subject, and give us a set of new isothermal lines laid down from all data which the great expansion meteorology has received of late years has made available.

The two charts showing the isothermals of the sea for the extreme months, February and August, and the chart showing the surface currents of the ocean, are very valuable. A supplementary chart showing the currents south and east of Asia during the monsoon season is also given. We should suggest for the second edition of the Charts, that charts of the surface currents for both February and August should be given for the whole globe, it being only thus that these important aids to navigation can be adequately presented.

It was pointed out in NATURE some years ago that the prevailing winds and surface currents of the Atlantic are all but absolutely coincident. These Charts enable us now to extend the remark to the prevailing winds and surface currents over all the oceans. Keeping out of view the deep-water currents of the sea to which Carpenter has given so much attention, it is now placed beyond all doubt that it is to the winds we must look as the prime movers of oceanic currents.

MR. GARROD'S NEW CLASSIFICATION OF BIRDS

AT the scientific meeting of the Zoological Society, on Tuesday, February 3, Mr. A. H. Garrod introduced a new Classification of Birds, based mainly on the disposition of their muscles and other soft parts. The following is an abstract of his paper:—

The osteology of birds, judging from the unsatisfactory state of their classification in the present day, is not sufficient in itself as a basis for distinguishing the mutual relations of the different families and genera; and as the peculiarities in the soft parts are very constant, they deserve more consideration than they have hitherto received. The researches of Hunter, Nitzsch, Macgillivray, Owen, and others, have brought to light many facts in visceral anatomy and pterylosis, all of which are of great value in classification. Sundevall is the only ornithologist who seems to have made any generalisations respecting myology, and these have an important bearing on the subject.

My method of work, Mr. Garrod went on to say, has been the following:—After having carefully dissected a few birds that are known to be but distantly related, a comparison of the notes on the individuals examined showed that there were important myological differences between them. Further dissection of species related more or less intimately, indicated broadly the relative value of the peculiarities that were found, when taken in connection with the most approved classification of the present day; and as observations became more numerous the relative importance of the facts observed was more easy to estimate. The muscles which have, on account of their marked tendency to vary in the class Aves, attracted the most of my attention, are all situated in the thigh, and they are five in number: (1) the *femoro-caudal*, which runs from the linea aspera of the femur, near its head, to the sides of the tail vertebræ; (2) the *accessory femoro-caudal*, which runs parallel to the last, and behind it, from below the femur-head to the ischium; (3) the *semitendinosus*, which crosses the first-named muscle superficially, and arises from the lower part of the ischium, to be inserted into the inner side of the tibia-head; (4) the *accessory semitendinosus*, which arises from the distal end of the linea aspera, and joins the fibres of its larger namesake obliquely just before their insertion; (5) the *ambiens*, that peculiar slender muscle which arises from just above the acetabulum, and after running obliquely through the ligamentum patellæ, joins the tendon of the flexor perforatus digitorum. My observations on these five muscles have been made on more than 500 species of birds, including more than 600 specimens, and the results are recorded in a tabular form, in a paper now in course of publication in this Society's Proceedings. For the present, no more attention need be paid to these muscles themselves, but only their presence or absence considered; therefore, to simplify description, a myological formula will be employed which indicates all the facts required in a very precise manner. Calling the first four of the above-mentioned muscles, A B X and Y, respectively, and omitting from the formula thus based, the symbol or symbols which represent any that are deficient, it is clear that a bird, like the common fowl for example, which possesses them all, would be represented by ABXY; and the eagle, in which the femoro-caudal is alone present, by A; whilst the sparrow, which only wants the accessory femoro-caudal, must have the formula A X Y; and the duck, which only lacks the accessory semitendinosus, is represented by A B X. By this means it is possible to make important statements respecting the myology of any bird in a very concise form, which gives great facility towards the comparison of different species. It must here be mentioned that individuals of a species and species of a genus do not vary among themselves in the muscles under consideration. The following table gives the myological formula of the different families of birds, as far as my dissections enable me to go, the only important types omitted being Eurypyga, Psophia, Todus, and Bucco. They are arranged in an order to be subsequently explained, and the presence or absence of the ambiens-muscle is indicated by + or — after each formula:—

TABLE I.

Struthionidæ B X Y +		I.
Casuariidæ	A B X Y — / B X Y —	
Tinamidæ A B X Y +	*Picidæ*	*A X Y* — / *A X* —
Palamedeidæ A B X Y +	*Ramphastidæ A X Y* —	
Gallinæ (excl. Turnix)	A B X Y + / B X Y +	*Capitonidæ A X Y* —
Rallidæ A B X Y +	*Upupidæ A X Y* —	
Otididæ B X Y +	*Bucerotidæ A X Y* —	
(Incl. Cariama and Serpentarius.)	*Alcedinidæ A X* —	
Phœnicopteridæ B X Y +		
Musophagidæ A B X Y +		II.
Centropinæ A B X Y +		
Cuculinæ A X Y +	*Passeres*	*A X Y* — / *A X* —
Psittaci A X Y ±		
Anatidæ A B X +	*Trogonidæ A X* —	