Research Items.

New Light on Drake's Voyage.—Two documents discovered by Miss E. G. R. Taylor in the British Museum throw much light on the plans of Drake's voyage of 1577. One of these documents, reproduced in part with an article in the *Geographical Journal* for January, is a draft plan for the voyage. Unfortunately, the document is mutilated, but careful examination reveals that the ships were to go and return by Magellan's Straits, that unknown shores not in the possession of any Christian prince were to be visited, and that the voyage was to be extended to 30°. Miss Taylor believes that the coast to be examined was not that of western America, which was already in Spanish possession between 40° S. and 35° N., but that of Terra Australis as shown on the Ortelius map of 1570. This coast ran north-west from the Strait of Magellan across the Pacific to the Moluccas. The second document is John Winter's report made on his return to England after losing touch with Drake in the South Seas. Winter's report shows that the westerly winds of the South Pacific made a westerly course impossible for him and no doubt encouraged Drake to turn north to harry the Spaniards and accept the alternative plan of seeking for the Strait of Anian. On his failure to find this strait in lat. 48° N., he turned to his original destination of the Moluccas.

Birds of the *Adventure* and *Beagle*.—When H.M.S. *Adventure* and *Beagle* were sent on a survey to the Strait of Magellan in 1826, the officers were instructed to collect rare, new, or interesting objects of natural history. Capt. King faithfully carried out the order, sending a first collection of 78 specimens of birds from Rio de Janeiro in 1827, and bringing with him on his return in 1830 a further collection, the numbers of which are unknown. These collections contained many new species of birds, and in view of the doubt which has existed as to the final resting-place of the type specimens, Surgeon Rear-Admiral J. H. Stenhouse has given short descriptions of the twenty-one specimens now in the Royal Scottish Museum in Edinburgh (*Scot. Nat.*, p. 181; 1929). Seven appear to be types or co-types of species described as new, but of these three have since been recognised as synonymous.

American Chipmunks.—The "North American Fauna" series of the Biological Survey of the U.S. Department of Agriculture continues its useful course with a revision of the chipmunks. Some impression of the amount of concentrated observation in present-day systematics may be gained from the fact that Arthur H. Howell, in writing this monograph, had at his disposal 1349 specimens of one genus with one species and 13,205 of another with 16 species. The result has been an increase in the number of geographical races recognised. Where *Tamias*, last revised in 1886, had two races, there are now five in a compact species, and where *Eutamias*, revised by Allen in 1890, had 23 forms, 60 have now been recognised. Something of the effect of diverse environmental conditions is suggested by the compactness of the eastern genus, and the extraordinary breaking up of the western genus into a multitude of forms. Interesting accounts are given of burrowing and nesting, food-storing and hibernation, breeding and feeding habits, and the descriptions of the various races are marked by a careful discrimination between summer and winter pelages. The chipmunks, particularly the western forms of the mountains and wildernesses, are of little economic significance, but they are familiar to most Americans, since they approach townships and cities with much more freedom than the native squirrel of Great Britain.

Crabs from Panama.—Mr. Lee Boone, member of the research staff of the Tropical Research Station of the New York Zoological Society, describes several very rare crabs in his paper "A Collection of Brachyuran Crustacea from the Bay of Panama and the Fresh Waters of the Canal Zone" (*Bulletin of the American Museum of Natural History*, Vol. 58, Art. 11, New York, 1929). The crabs were collected by Dr. Willard G. Van Name and his party, during a trip to the Isthmus of Panama and Pearl Islands in the spring of 1926, several hundreds being obtained, all of great interest. Among other rarities were two specimens of *Pitho quinquedentata*, one a female which is the first seen, as hitherto only two males were known, and a very fine example of the 'periscope-eyed' crab, *Euphylax dovii*, one of the Portunidæ. New records were obtained of the large fresh-water crab *Pseudothelphusa richmondi* showing an extended southern range. In this species the young, as in other Potamonidæ, are like the parent at birth, omitting all larval stages. In the present case the abbreviated life-history is probably correlated with the fact that in the dry season there is frequently no water in the stream beds in which the crab makes its home. The paper is illustrated by good photographs.

Studies on *Pectinatella*.—C. M. Brooks (*Proc. Acad. Nat. Sci. Philadelphia*, vol. 81, 1929) records observations on *Pectinatella magnifica*, the largest of the colonial fresh-water Polyzoa, the colonial mass of which sometimes exceeds two feet in diameter. This large gelatinous mass is hollow in the centre and there live flatworms, protozoa, snails, and crustacea; the flatworms are especially numerous and their eggs also are almost always to be found. The young flatworms appear about the time the statoblasts of *Pectinatella* break open and they devour the polypides in large numbers. The formation of statoblasts in *Pectinatella* begins in early autumn and continues until stopped by cold weather. The statoblasts are the chief means of distributing the species. When they first appear they are covered with a layer of jelly which prevents them clinging to the parent colony and they are readily dislodged and swept away by currents in the water, the zone of air-filled cells keeping the statoblast afloat. The covering of jelly soon decays and the hooks then exposed attach the statoblast to floating debris or to other objects. The statoblast develops steadily from the time it is fully formed until the polypide is produced, but the rate of development depends largely on the temperature. The author adds details of the anatomy of the polypide and states that scattered through the mass of food in the stomach are large nuclei, vacuolated and in degeneration, of cells which have migrated from the wall of the stomach possibly to aid in digestion.

Errors in Precise Levelling.—Apart from movements of the earth's crust, considerable errors in precise levelling may occur in several ways. Movements of the peg or bench mark during the night or between successive seasons is a source that cannot always be obviated. The small but appreciable error due to the use of wooden staves is to be prevented in the survey of India in future by the use of invar staves. Irregular refraction may be serious on a long continuous gradient. Lastly, the crossing of wide unbridged rivers involves a great loss of accuracy. In *Professional Papers*, No. 22, Survey of India,

Capt. G. Bomford discusses the errors connected with the last three sources. Recommendations are made for levelling across unbridged rivers in the primary net. Micrometer eyepieces should be used. Crossings should be made at a number of sites covering some miles of the banks. Sites below river junctions should be avoided. Directions are given for the use of sites in the middle of the river when the width renders this necessary. The paper discusses many points of great importance.

Properties of ß-Particles.—Collisions between β-particles and electrons or atomic nuclei are less easy to study than those of α-particles, but two recent investigations indicate that the correct laws of interaction have yet to be derived theoretically. One paper on this subject appears in a recent issue of the *Annalen der Physik* (No. 7), by O. Klemperer, and deals with the scattering of electrons with energies equivalent to 9 kilovolts and 18 kilovolts respectively. These were drawn from a hot filament, and examined by a Geiger electrical counter after passage through thin films of celluloid, beryllium, or aluminium; their angular distribution could not be reconciled with any of the usual laws which were tried. The other paper on the same subject is by E. J. Williams and F. R. Terroux, in the January issue of the *Proceedings of the Royal Society*, and is concerned with the tracks of rather faster β-particles in a Wilson cloud chamber. The results show that the classical theory gives only the order of magnitude both of the primary ionisation produced and of the frequency of production of branched tracks, the observed values being appreciably greater than the classical values, and following moreover a different law of variation with the velocity of the particle. The deflection of the β-particles in branch collisions does correspond, however, approximately to the momentum of the branch, contrary to the results found by Prof. C. T. R. Wilson for slower rays.

Radioactive Constants.—The question of the invariability of the decay constants of radioactive elements has been discussed by Mme. P. Curie in two papers in the September number of the *Journal de Physique*. In the first of these, commenting on a previous paper by L. Bogojavlensky (see NATURE, June 8, 1929, p. 872), she points out that very stringent precautions must be observed before the existence of any change in a constant with position on the earth's surface can be regarded as established. In the second, she describes briefly a number of experiments which have been made by her, or under her direction, in attempts to influence the normal course of radioactive disintegration. These have been made upon radium, radon, and polonium, by exposure to various types of radiation, and although some of the observations have still to be accounted for in detail, Mme. Curie believes that in no case do the results obtained furnish any certain evidence of departure from the generally accepted laws.

Electrons and Protons.—A theory of positive electricity has been put forward by Dr. P. A. M. Dirac in the January number of the *Proceedings of the Royal Society*. The relativity quantum theory of an electron leads to a wave equation which possesses solutions corresponding to negative energies—the energy of the electron of ordinary experiment being reckoned as positive—and although there are serious difficulties encountered in any immediate attempt to associate these negative states with protons, the existence of positive electricity can be predicted by a fairly direct line of argument. Since the stable states of an electron are those of lowest energy, all the electrons would tend to fall into the negative energy states—with emission of radiation—were it not for the Pauli exclusion principle, which prevents more than one electron from going to any one state. If, however, it is assumed that "there are so many electrons in the world that . . . all the states of negative energy are occupied except perhaps a few . . .", it may be supposed that the infinite number of electrons present in any volume will remain undetectable if uniformly distributed, and only the few 'holes', or missing states of negative energy will be amenable to observation. The step is then made of regarding these 'holes' as '*things of positive energy*' which are identified with the protons. A difficulty now arises in ordinary electromagnetic theory which apparently has to cope with the presence of negative electricity of infinite density; this is met by supposing that for ordinary purposes volume-charges must be measured by departures from a 'normal state of electrification', which is "the one where every electronic state of negative energy and none of positive energy is occupied." The problem of the large mass of the proton, as compared with that of the electron, is not discussed in detail, but a possible line of attack is indicated. Dr. Dirac has included the minimum of mathematical analysis in this paper, which can be followed in all essential points by anyone acquainted with the principles of the quantum theory.

Relation between Specific Heat and Temperature.—The *Atti della Pontificia Accademia delle Scienze* (*Nuovi Lincei*) for 1929 contains a communication by A. Denizot on a relation existing between specific heat and temperature. This author has previously directed attention to the formula, $c=a \log T$, according to which the specific heat is proportional to the logarithm of the absolute temperature. This expression is purely empirical and holds only for solid elements. If the values of a are plotted as ordinates against the atomic numbers N as abscissæ, a curve is obtained which is probably continuous under certain conditions and extends at one end to sodium (N 11) and lithium (N 3), and at the other to bismuth (N 83). There is, however, a gap left by the rare earth elements (N 56-72), and the values for boron, potassium, and nickel do not fall on the curve. Although no theoretical foundation exists for the curve, yet the marked agreement shown between the calculated and observed values of the specific heats for most of the elements seems to justify its use for calculating the specific heats of the rare earth elements, zirconium, etc., and also the atomic weights of the recently discovered elements, masurium, florentium, and rhenium.

Gibbs's Absorption Equation.—The December number of the *Journal of the American Chemical Society* contains a paper by McBain and Du Bois in which experiments on absorption in a liquid gas interface, supplementing those already noticed in NATURE (**120**, p. 819; 1927) are described. The results, it is claimed, support the conclusion arrived at in the earlier experiments that the surface of an ordinary solution is a unimolecular surface layer of orientated molecules which serve as points of support for the growth of chains of orientated molecules relatively far into the solution, such chains being evanescent, constantly breaking up as a result of thermal vibrations and constantly being replaced. The absorbed amount can be several times that which is compatible with the well-known equation of Gibbs. When a bubble passes through a solution of a simple substance, it can carry with it from two to eight times as much solute as is predicted by that equation, and from two to four times that which can be accommodated in a monomolecular film of closely packed, vertically orientated molecules. It is suggested that the use of Gibbs's equation to calculate absorption is artificial.