ally are animated with a true university spirit and that the policy of their governing bodies is actuated by true university ideals. The committee does not imply that even among the stronger institutions all are equally efficient or have reached the same stage of development, but it rarely found occasion to think that where weaknesses existed the colleges were unaware of them or would be backward in applying the right remedy when circumstances permitted. The committee assures the Board of Education that in its opinion most of the colleges are fully competent to exercise that "freedom in organising" and "carrying out their important national and international functions" which it is the policy of the Board of Education to secure for them.

The committee recommends that the grant available be distributed in the following proportions:—

		£
University of Birmingham		13,500
University of Bristol		7,000
University of Durham: Armstrong College		8,500
University of Leeds		12,500
University of Liverpool		15,500
University of Manchester		17,500
University of Sheffield		7,000
University College, London		16,000
King's College, London	9,500	11,500
King's College for Women	2,000	
Bedford College, London		7,000
London School of Economics		4,500
East London College		5,500
Nottingham University College		5,700
Reading University College		5,500
Hartley University College		2,400
Total		£139,600

These grants have been calculated on a total of 149,000*l.*, and the committee recommends that the balance (9400*l.*) of the present grant, together with the balance of 2550*l.* from the previous year's Exchequer grant, be reserved pending consideration of a superannuation scheme to be reported on later and be regarded as applicable to the institution of such a superannuation scheme and to other contingencies.

A number of general recommendations concludes the report. The committee recommends, among other matters, that subject to unforeseen contingencies the grants be fixed for a period of five years as from April 1, 1911, and that the grants be regarded as strictly maintenance grants to meet annual expenditure on teaching and research of a university character and standard.

FIORDS IN RELATION TO EARTH MOVEMENTS.[1]

FIORDS have been a powerful influence on modern life, for the existing facility for intercourse oversea is the difference between modern and mediæval Europe which penetrates most deeply into all departments of life and work. The Roman Empire was held together by its roads, and as its conquerors from the wide plains of the east were neither sailors nor roadmakers, Europe was resettled on national instead of on imperial lines. While Europe thus fell naturally into independent States, the most efficient of all means of international communication was being developed on the shores of Scandinavia; for owing to the fiords travel overland there was even more difficult than through the forest-clad plains of Central Europe. In Norway the fiords were the only practicable highways, and they, with their labyrinth of smooth waterways, their tidal currents, which carried boats to and fro independent of wind or oar and their unfailing supplies of food, fuel, and skins, attracted men to the sea as much as the barren highlands repelled them from the land.

The poverty of their own country having driven the Norsemen to the sea, the wealth of the more fertile southern coast-lands tempted them to the career of piracy which made the berserkers the terror of the shores of western Europe. These pirates, however, amply repaid their debt by their contributions to modern seamanship, made in consequence of the geographical conditions of the Norwegian fiords. Eva Nansen's song contains a true statement of the influence of the fiords on the Norwegian race:—

Our mother, weep not! it was thou
  Gave them the wish to wander;
To leave our coasts and turn their prow
  T'wards night and perils yonder.
Thou pointed'st to the open sea,
  The long cape was thy finger;
The white sail wings they got from thee:
  Thou canst not bid them linger!

The white sails of the Norse and Danish Vikings, amongst other things, carried the name fiord far and wide. It is found on the Irish coast, for example, in Wexford, which is said to be derived from the Danish Weis-fiord, and in Waterford from Vadre-fiord; and the name is now accepted as a technical term in general geographical nomenclature.

The word fiord is used in Norwegian for any arm of the sea, including various types of gulfs, bays, and straits. But the name is adopted in international geography for arms of the sea of a special kind. A fiord in this restricted sense is a long inlet which extends far inland between steep parallel walls; it usually consists of long straight reaches, which are bent and receive their tributaries at sharp and regular angles. Its walls are high, as fiords are restricted to mountain regions.

Fiord districts combine the features of mountain and coastal scenery. Many authors have been impressed by a sense of the monotony of fiord scenery, owing to the constant repetition of the same form; it is, however, popular from the easy access to it along smooth waterways, the especial beauty of the cloud forms and the colour effects, which do not pass with the flash of a tropical sunset, but last for hours in the prolonged twilight of most fiord areas. The charm of fiord countries is, moreover, enhanced by the survival, owing to the special geographical environment, of primitive conditions of rural life.

The origin of fiords has given rise to prolonged controversy. The difficulty of the problem is due to the peculiar combination of geographical characters. The fiords are clearly valleys, of which the lower ends have been drowned by the sea. Sea-drowned valleys are of three main kinds.

The most familiar kind is that of ordinary river estuaries, which have been submerged by subsidence of the land. Such estuaries have gentle, rounded slopes and curved shore lines; they are typically funnel-shaped, as they increase seaward, both in width and depth. The Firths of the Tay and Forth, the estuaries of the Thames, Severn, and Humber, and Bantry Bay in south-western Ireland are examples of such drowned valleys. They are well illustrated in north-western Spain, where they are called rias, and this term "ria" has been adopted as the technical name of this kind of drowned valley.

The members of the second group are known as "fiards" from their typical representatives in south-

[1] Abridged from a lecture delivered to the Midland Institute of Birmingham on January 22, by Prof. J. W. Gregory, F.R.S.

western Sweden. They agree with rias by having curved lines, gentle slopes, and indented shores. They differ, however, from rias, as they often include deep basins, separated by rock bars from the outer sea, which may not for some distance reach the depth of the inner basins. Fiards, moreover, usually have no large rivers draining into them, and may receive only insignificant streams and brooks. Fiards are due to a lowland area with an irregular surface of hard rocks having been partially submerged beneath the sea. The essential difference from fiords is that fiards are characteristic of the coast lands which rise to but a slight height above sea-level.

The third group consists of the fiords, which, seen from a steamer or on an ordinary map, have seven chief characters.

(1) They are typically long, straight, narrow channels, and they are usually so crowded and run so far inland that they add greatly to the length of the coast line. Thus, whereas in Norway the length of the coast from headland to headland is 1700 miles, the actual length of the shore line along the fiords is 12,000 miles.

(2) The walls are typically high and steep.

(3) The fiord channels usually have parallel sides, and the fiords bend or branch at sharp angles, and the same angle tends to recur throughout a district. There is accordingly a striking parallelism in the geographical elements of neighbouring fiords.

(4) The fiord valleys are often arranged along intersecting lines like a network of cracks, in contrast to the converging tributaries of a river system.

(5) The fiords are characteristic of dissected plateaus. All the great fiord districts of the world were formerly plateaus.

(6) Owing to the plateau structure the land extends backward from the fiord walls with gentle slopes and shallow valleys. Streams flow gently across these uplands until they reach the fiord wall, and then plunge down it in great waterfalls, which are especially picturesque in spring, when the rivers are flooded by the melting snow. The highest waterfall in the world, the Sutherland Falls of New Zealand, sometimes leaps, it is said, in one jump of 1900 ft. on to the floor of the fiord valley of Milford Sound. The upland valleys which join the fiords have not been cut down to the level of the main valley, but enter abruptly high upon its side. They are therefore "hanging valleys."

(7) Finally, the amount of land beside the fiords suitable for cultivation is usually limited to small tracts at the head of the fiord or on small deltas along its sides. The amount of cultivable land in a fiord district is small, and fiord countries are therefore sparsely populated. One of their main values will be as the playgrounds for more crowded countries. They sometimes have rich mineral deposits, as in Alaska; but many American authorities claim that even there the scenery will prove the most valuable economic asset.

The previous characters can be observed by a tourist from the deck of a steamer, but if we could remove the sea and travel over the fiord floors three fresh geographical features would be revealed.

The walls which rise high above the sea surface would be seen to descend steeply to extraordinary depths. The deepest known fiord is the Messier Channel, in Patagonia, which reaches the depth of 4250 ft. The Sogne Fiord is the deepest in Europe, with the depth of 3780 ft. Some of the lakes which may be regarded as inland extensions of fiords are also surprisingly deep. Thus Lake Morar, in the western Scottish Highlands, of which the surface is 22 ft. above sea-level, is 1017 ft. deep; and this fact is all the more striking as the sea to the west does not reach that depth within the distance of 120 miles.

The deepest part of a fiord basin is usually at some distance from the sea; the floor rises seaward until it is covered only by shallow water, or projects above the surface and the fiord becomes a lake.

Fiords are therefore often separated from the outer sea by submerged thresholds. This fact was first discovered by Captain Cook in Christmas Sound, Patagonia; he found to his danger that on passing up that fiord he lost the anchorage which he had at its mouth. The existence of a threshold is such a frequent feature of fiords that it is regarded by some authorities as an essential character.

The removal of the water from a fiord would show that it has a flat floor. The valley is trough-shaped, whether empty or partially filled with water. The flatness of the floor can be learnt by cross sections from charts, or seen on the floor of the undrowned part of a fiord valley.

The problem presented by fiords is therefore that of the formation of systems of steep trough-valleys, which are arranged in networks so that the land beside them is broken up into rectangular blocks, and usually have deep inner basins separated from the sea by shallow thresholds.

The simplest explanation of valley formation is excavation by rivers; but this process will not explain the origin of fiords. Thus our British fiords, the Scottish sea-lochs, are not on river valleys; of the chief Scottish rivers, the Tay and the Forth enter the sea through rias; the Clyde discharges into a compound basin which is not a fiord; and the Tweed, Dee, Don, and Doon have no long arms of the sea at their mouths. The chief sea-lochs, on the other hand, receive only small streams. The river systems of Scandinavia, North and South America, and New Zealand show the same independence of the fiords. The fiords are not the outlets of the main rivers. In fact, so far from fiords being made by rivers their existence depends on the absence of rivers, which would convert them into ordinary valleys by wearing back their banks and filling the main channel with sediment.

The failure to explain the formation of fiords by rivers of water therefore led to the invocation of rivers of ice, and many features of the fiord valleys are consistent with their formation by glaciers. The essential difference between the action of water and ice as agents of excavation depends on their difference in plasticity. Water, being very plastic, readily adapts itself to the irregular resistance of the adjacent rocks; it glances lightly off opposing hard surfaces and carves for itself sinuous channels.

Glacier ice flows around opposing obstacles, but as it is less plastic than water it is deflected less readily and bears with persistent pressure against the rocks in its path, and if armed with stones and grit it wears away the rocks like a grindstone. Therefore, whereas denudation by water tends to develop rounded surfaces with curved lines, ice, when confined in valleys, tends to produce straight lines, flat slopes, and angular, facetted surfaces.

The difference between the rounding action of water and the facetting action of ice may be illustrated by reference to the typical forms of pebbles in deposits laid down by rivers and by ice. The typical river pebble is rounded, and often egg-shaped. The typical ice-worn rock in a boulder clay has flattened surfaces, which often meet sharply along straight edges, like the facets of a gem. The same differences can be recognised on a larger scale in the topography of a glaciated district.

Further, a river flows around the base of the spurs from the sides of its valley, and often tends to lengthen them, whereas ice slowly cuts away the toes of these spurs until they end in triangular facets. These facetted ends are well shown on many of the spurs that run down to the Alpine glaciers, and they can be recognised on many Scottish mountains and valleys.

A glacier flowing down a valley presses against the spurs from the two sides and gradually rubs them away. It thus converts a sinuous river valley into a straight canal-like or trough-valley, which is the characteristic form of fiord valleys, of many glacier valleys, and of some of the lower Swiss valleys, such as that of the Rhone—though it is not the usual form of the higher level Alpine valleys from which glaciers have retreated.

There is also an important difference between the powers of ice and water in deepening their valleys. A river, except where it plunges over a waterfall, cannot deepen its valley lower than the outlet. Deep rock basins can only have been made by river action by a combination of three processes: first, the elevation of the country high above sea-level; secondly, the cutting of deep valleys by rivers; and thirdly, the uneven subsidence of the land, so that the mouth of the valley either sank slightly or remained stationary, and was thus left as a raised threshold. The existence of deep fiord basins and their thresholds cannot, however, be thus explained in many and in perhaps the majority of cases.

Ice, however, has greater powers of irregular vertical excavation than water. It moves slowly, and its great weight presses heavily upon its bed. Fragments of the loose material beneath the ice may be frozen into the sole of the glacier and be thus carried away. There is much evidence that the power of a glacier to cut away fresh, undecayed rocks is limited, except where they project into the path of quickly moving ice; but ice acting on weathered, decomposed rock can pick it up and remove it grain by grain. Mining experience shows that the depths to which rocks are weathered varies very irregularly; along the outcrop of a lode there may be a succession of places where decomposition has gone deeply, separated by ridges of fresh and hard rock. A glacier has greater powers than a river in eating out such weathered material, and thus forming rock basins.

The attack of glaciers on the rocks beneath them is aided by a second process. Many geologists hold that rivers owe their main power of cutting down hard bars of rock to pot-hole formation, which beneath a river cannot extend deeply below sea-level; but there is no such limit to the depths to which pot-holes are bored beneath a glacier; a stream of water plunging down a glacier mill may drill pot-holes into hard rocks deep below sea-level, and where many occur together the surface may be lowered into a rock basin. Hence glaciers have some powers of hollowing out basins greater than those of rivers. There are, however, other factors which counteract this process, and cause slowly moving glaciers and sheets of snow and ice to protect their beds, for the rock beneath them is preserved from the wear and tear of wind and water, from shattering by heat and frost, and from atmospheric decomposition.

The distribution of fiords has also been claimed as proof of their glacial formation. There are nine main fiord districts in the world, and of these the most famous are in high latitudes and in districts which were formerly occupied by ice. Thus in Europe they occur in Norway, Scotland, Iceland, and Spitzbergen. In America they are found in Greenland and down the western coast throughout Alaska and Canada. They disappear further south, and reappear again in the far south of South America in areas where glaciers still exist upon the mountains, and there is clear evidence of the former extension of the glaciers to sea-level.

The famous fiords of New Zealand are in the south-western corner of the country, where the glaciers formerly reached sea-level; while the North Island, where, according to many New Zealand geologists, there is no satisfactory evidence of low-level glaciers, has no fiords.

It is therefore claimed that fiords are limited to countries that have been glaciated, and that their restriction to such regions is proof of their glacial origin. Nevertheless, in spite of its attractiveness, the simple theory which explains fiords as due to the action of glaciers appears inadequate. Many fiords were no doubt occupied by ice, and have been moulded to their present form by ice; but they were not necessarily formed by it. Fiords are not limited to formerly glaciated areas, and even in glaciated countries their distribution is inconsistent with their glacial formation. Thus a sheet of ice covered nearly the whole of the British Isles, and, according to most authorities, it extended as far south as the line between the estuaries of the Thames and the Severn. The fiords of Great Britain are, however, almost limited to western Scotland, although the ice covered most of the eastern coasts, and there flowed over rocks of the same character as those beside the western fiords. Some of the glaciated areas in eastern England consist of soft beds, upon which glacial erosion should have been particularly effective. Nevertheless, there are no fiords in Yorkshire, for example, although the hills that reach the coast were buried under deep ice, and are composed of comparatively soft rocks. The best English fiords are in Cornwall, where some of the harbours, like those on the opposite coasts of Brittany, have many characters which show that they were originally true fiords; and Cornwall is one of the few English counties which admittedly were not glaciated.

Moreover, the plan of the fiord systems in each country does not appear to be that which would have developed as the result of glacial erosion. The chief fiord systems in the world have the same essential plan. Each fiord area is long and curved; in most cases a series of channels extend along the coast, and from them other fiords run inland, and are usually connected by others, or by deep valleys, so that the country is divided into angular blocks.

These networks are not the arrangement that would be expected if fiords had been excavated by glaciers, for in that case the main channels should be radial from the chief centres of snow fall. The course of the fiords is inconsistent with the lines of flow of the chief glaciers. The glaciers discharged from the highlands or from great domes of snow which sometimes formed on the lee side of the existing watersheds; the ice flowed by the most direct channels to the nearest low land or the sea. Many of the fiords owing to their directions were quite useless to the outflowing ice; they appear to have been simply filled with stagnant ice, and the main flow of the glaciers was above and across them.

The inconsistency between the direction of the lochs and the lines of flow is well shown in many parts of Scotland, as for example, by the map of the ice movements in the area around Colonsay in a recent Scottish Survey memoir. It is also well shown in the Shetland Islands, where the main fiords, lochs, and other geographical elements trend north and south; but the ice movement was from east to west at right angles to the fiords.

The final and most convincing argument against the glacial origin of fiords is that they are pre-glacial. They are older than the ice which once occupied them. They are due to a series of uplifts which happened mainly in Pliocene times after the great Miocene movements which in Europe formed the Alps and the associated mountain chains. In nearly all cases the fiord valleys were formed in Pliocene times; hence the Pleistocene ice used the fiords and did not originate them.

It is therefore necessary to find an explanation of these complex valley systems independent of the ice action, which has given some of them their most conspicuous features. Facetted spurs and long parallel-walled valleys with hanging valleys upon their sides are formed by other than glacial agencies. They may be due directly to earth movements, as in the fiords of Dalmatia. Thus the famous fiord of Cattaro is flanked by facetted spurs, and the formation of the facets is due to recent faulting. The straight Dalmatian trough-valleys with their high walls and hanging valleys are due to recent earth movements, aided by the comparative weakness of the rivers owing to the porosity of the limestone which is the prevalent rock. These fiords are due to the earth movements which formed the Adriatic Sea, and all the fiord systems of the world are related to earth movements. Their networks do not resemble valleys cut by erosion, but intersecting fractures. The most striking features in the distribution of fiords connect them not with ice movements but with earth movements. The fiord systems of all parts of the world are arranged, not in radial lines from the highlands, but as angular networks resembling intersecting cracks in slabs of twisted glass. This fact is apparent from Kjerulf's plan of the fiords of southern Norway, which showed that all the fiords, lakes, and main valleys of that country can be arranged into a number of groups each with a definite direction, and the different series cross at sharp angles. The same arrangement of the fiords on intersecting lines is shown in Alaska, Patagonia, New Zealand, and Scotland.

The Scottish lochs and their valleys may be arranged in four groups. The most conspicuous lines in the coast of Scotland run east and west, as in the Pentland Firth and the southern side of the Moray Firth. Many of the western lochs, such as Loch Hourn, Loch Leven, Loch Eil, Loch Rannoch, and Lower Loch Etive, trend in this direction, which also occurs in the northern coast of Connaught in Ireland, and along the northern coast of Wales.

The second series of lines trend north and south at right angles to the first.

The members of the third group trend north-east and south-west; they include Glen More, the line of the Caledonian Canal, the Kyle of Tongue, the valley of the Spey, Upper Loch Etive, Loch Awe, Loch Fyne, many of the lochs around the Sound of Jura, and the central part of Loch Tay.

The direction of the fourth group is at right angles to part of the Glen More lines, and its series of valleys and lochs extend north-west and south-east, and include Loch Broom on the north-western coast and Lower Loch Fyne and Loch Crinan, and the Sound of Islay; also various inland lakes, such as Loch Shin.

These directions are not those that would be expected in valleys formed by glacial erosion. The largest centre of glacial accumulation in Scotland must have been the Grampians of eastern Aberdeenshire, for though the highest point of the area around Ben Macdhui and Cairngorm is slightly lower than the summit of Ben Nevis, it belongs to the largest area of highlands in Scotland. All this land was unquestionably covered by ice, and in no part of Scotland are glacial phenomena better displayed. Most of the ice probably flowed eastward and north-eastward and reached the North Sea; but nowhere along the eastern coast are there any fiords, and in spite of the great power of the glaciers, even the long narrow fresh-water lochs are confined to western Scotland.

Ben Nevis was also intensely glaciated, and the chief ice movements in that area were from south-west to north-east, for the great centre of accumulation was over the country between Ben Nevis and the coast, owing to the heavy precipitation of snow piling up a huge ice dome. Valley glaciers radiated from Ben Nevis in the last stages of the glaciation, but the chief lochs in this district are not radial from Ben Nevis, but form a circular series around it.

The angular fiord networks also occur in regions where there are no indications of the former existence of glaciers. Thus the colony of Hong Kong, including the adjacent peninsula on the mainland of China, has a fiord-like series of intersecting valleys, and a most beautiful example of the same arrangement occurs in the peninsula of Sinai. The Gulf of Akabah has many of the characters of a fiord, and Prof. Bonney has so called it; and, if Sinai were partially submerged, it would be divided into angular islands and peninsulas, separated by parallel-sided, steep-walled valleys, which would form a typical series of fiords.

The explanation of fiord valleys as due to intersecting fractures explains the chief facts of their distribution. It explains their restriction to plateau countries, as it is only where wide areas have been uplifted that they are shattered by regular intersecting cracks. It also explains their restriction to areas of old rocks, for the younger rocks yield by stretching and not by cracking.

The fiord valleys were not formed by gaping cracks of the full width of the present valleys. The cracks caused narrow clefts along the planes of weakness, which have been widened by denudation. Water and air enter them and cause the decay of the rocks. Streams remove the weakened rock material, and the clefts are gradually widened into river valleys, and if the country be subsequently glaciated the ice enters the valleys and completes their formation.

Uplift alone is, however, inadequate to produce fiords. Subsidence also is necessary to let in the sea. In nearly all fiord countries the last movement has been a fresh elevation. Many fiord thresholds appear to be due to a tilting of the country at the last uplift.

Fiords, therefore, are produced in regions which have undergone repeated earth movements. They mark out areas of the crust which in recent geological times have undergone alternate elevation and depression. These regions are mainly polar and circumpolar, as in the equatorial zone the uplifts have been more local. There are numerous raised coral reefs, but the tropical coasts of Africa, Australia, and America lack the widespread raised sea beaches which are so charactertistic of the chief fiord regions. The restriction of the fiord areas to high northern and southern latitudes gives a clue to the cause of the fiord movements. They may be explained as a deformation of the earth which is more marked in the polar than in the tropical zones. If a flexible circular band be rotated about its axis it becomes oval, and the radial movement is greater on the flattened polar sides than on the raised equatorial zone. The deformation of the earth which produced the fiords caused greater vertical movements in the polar and circumpolar regions than in the tropics, and thus fiords are characteristic of higher latitudes.

I have therefore endeavoured by this rapid survey of a wide subject to show that fiords are not only attractive from their unique scenery and their special historic interest, but that they give important evidence relating to the structure and mobility of the earth. The spirit of maritime adventure born in the Scandinavian fiords gave the European races the mastery of the sea and a political predominance which is world-wide in its influence. The geological study of fiords leads to geographical problems that are also world-wide in their range, for the view that fiords are due to local superficial agents chiselling out furrows on an impassive earth explains neither their features nor distribution. Fiords teach more significant and far-reaching lessons; they point to deep-seated forces which affect the earth as a whole. However greatly fiords may have been moulded by ice, wind, and water, they are not primarily due to those agencies, which have used the fiords, not made them.

The ultimate cause of fiords is the rupture of certain wide areas of the earth by the pulsation of the crust under the play of titanic forces set at work by the great Miocene disturbances which upheaved the chief existing mountain systems of the world.

SOCIETIES AND ACADEMIES.

LONDON.

Mathematical Society, April 11.—Dr. H. F. Baker, president, and temporarily Prof. A. E. H. Love, vice-president, in the chair.—A. **Cunningham**: Mersenne's numbers.—G. N. **Watson**: A modification of Liouville's theorem.—G. H. **Hardy** and J. E. **Littlewood**: Contributions to the arithmetic theory of series.—G. B. **Mathews**: Complex binary arithmetic forms.—H. S. **Carslaw**: An application of the theory of integral equations to the equation $\nabla^2 u + k^2 u = 0$.—H. F. **Baker**: (i) Some transformations of Kummer's surface; (ii) the curves which lie on a cubic surface.

PARIS.

Academy of Sciences, April 9.—M. F. Guyon in the chair.—E. H. **Amagat**: The variations of the pressure coefficient with temperature and on some points which depend on it in the study of the internal pressure of fluids. The pressure coefficients of argon are calculated from experimental data obtained in the laboratory of Prof. Kamerlingh Onnes for temperature ranges, -121.2° to -109.9°, -102.5° to -57.7°, -57.7° to 0.0°, and 0.0° to $+20.4^\circ$; for hydrogen at temperatures -217.4° to -182.8°, -182.8° to -103.6°, -103.6° to 0.0°, and 0.0° to 100.2°; for helium, at temperatures -258.9° to -182.8°, -182.8° to -103.6°, -103.6° to 0.0°, and 0.0° to 100.3°. All the results point to a small diminution of the pressure coefficient as the temperature increases. The changes observed are much larger than would be expected from the values of the specific heat at constant volume.—E. L. **Bouvier**: The classification of the genus Caridina and the extraordinary variations of a species of this genus, *Caridina brevirostris*. The variations of this species have led the author to reject the existing classification of the Caridinæ based on the rostral structure; suggestions for a new scheme are put forward.—Paul **Sabatier** and M. **Murat**: The direct addition of hydrogen by catalysis to the benzoic esters: the preparation of the hexahydrobenzoic esters. The addition of hydrogen to methyl and ethyl benzoates by the catalytic action of reduced nickel requires the temperature of the reaction to be maintained exactly at 180° C. Good yields of ethyl and methyl hexahydrobenzoates are thus obtained.—Kyrille **Popoff**: The influence of the various methods of photometric measurements on the estimation of stellar magnitudes.—Ch. **Jordan** and R. **Fiedler**: Contribution to the geometry of convex curves and of certain curves which are derived from them.—A. **Cotton** and H. **Mouton**: New substances showing magnetic double refraction. The straight chain carbon-compounds and some of their derivatives remain inactive in a strong magnetic field. Substituted paraffins, however, containing the nitro-group or a halogen exhibit magnetic double refraction.—Albert **Colson**: The singular features of certain proofs in physical chemistry. A reply to a recent note of M. Langevin, dealing especially with the van't Hoff theory of solution.—Ed. **Griffon** and A. **Maublanc**: The microsphœra of the oak.—Paul **Macquaire**: Two combinations formed by iodine and the tyrosine obtained by the trypsic hydrolysis of albuminoid materials. Analyses are given of a definite diiodo-derivative of tyrosine; by the action of boiling water on this substance a new iodine derivative of tyrosine was obtained containing less iodine.—A. **Desgrez** and Mlle. Bl. **Guende**: The influence of an excess of sodium chloride on nutrition and on renal elimination. An excess of common salt in food favours auto-intoxication.—Gabriel **Bertrand** and F. **Medigreceanu**: The normal manganese in the blood. Traces of manganese were found in blood from the sheep and the horse; negative results were obtained with blood from man, rabbit, chicken, and duck. The amount of manganese present in the blood of man and the higher animals is much less than has hitherto been supposed.—Ed. **Bourquelot** and M. **Bridel**: The action of emulsion upon salicin in alcoholic solution. Salicin is hydrolysed by emulsion in solutions containing proportions of alcohol up to 90 per cent. In aqueous solution the hydrolysis is not complete, about 5 per cent. of the salicin remaining unchanged.

BOOKS RECEIVED.

Notes and Answers to Exercises in "A Shorter Geometry." By C. Godfrey and A. W. Siddons. Pp. 16. (Cambridge: University Press.) 6*d*.

Note sur le Vol des Oiseaux. By E. Delsol. Pp. iv+23. (Paris: Gauthier-Villars.) 1 franc.

The Cause of Cancer. Being Part iii. of "Protozoa and Disease." By J. J. Clarke. Pp. xi+112+viii plates. (London: Baillière, Tindall and Cox.) 7*s*. 6*d*. net.

Mikroskopisches Praktikum für systematische Botanik. (I., Angiospermae.) By Prof. M. Möbius. Pp. viii+216. (Berlin: Gebrüder Borntraeger.) 6.80 marks.

Anleitung zur mikroskopischen Untersuchungen von Pflanzenfasern. By Dr. G. Tobler-Wolff and Prof. F. Tobler. Pp. viii+141. (Berlin: Gebrüder Borntraeger.) 3.50 marks.

Handbuch der vergleichenden Physiologie. Edited by H. Winterstein. 20 Lief. Band iv. (Jena: G. Fischer.) 5 marks.

British Association for the Advancement of Science. Portsmouth Meeting, 1911—A Catalogue of Destructive Earthquakes, A.D. 7 to A.D. 1899. By Dr. J. Milne. Pp. 92. (London: The British Association.) 5*s*.

The Mafulu Mountain People of British New Guinea. By R. W. Williamson. Pp. xxiii+364+plates. (London: Macmillan and Co., Ltd.) 14*s*. net.

Oxford Gardens. Based upon Daubeny's Popular Guide to the Physick Garden of Oxford: with Notes on the Gardens of the Colleges and on the University Park. By R. T. Günther. Pp. xv+280. (Oxford: Parker and Son; London: Simpkin, Marshall and Co., Ltd.) 6*s*. net.

Handbook of the Technique of the Teat and Capillary Glass Tube, and its Applications in Medicine and Bacteriology. By Sir A. E. Wright. Pp. xvi+202. (London: Constable and Co., Ltd.) 10*s*. 6*d*. net.

On the Backwaters of the Nile. Studies of some