is exceptionally fine, this promises soon to be a leading industry in the islands.

About Hilo especially, but common also elsewhere, was a very conspicuous black fungus, that covered the leaves completely in many cases, and attacked indiscriminately a great variety of trees.

From Hilo I proceeded to the volcano of Kilauea, some thirty miles distant, and about 4000 feet above the level of the sea. As this volcano has so often been the theme of travellers' descriptions I will not linger over it. In the vicinity are many interesting plants, among them a species of Vaccinium with sub-acid yellow and red berries something like cranberries. These "ohelo" berries are much esteemed, and are especially good when cooked. Some two miles from the volcano is a superb grove of koa trees, the largest trees I saw anywhere in the islands. One of these standing alone, and with magnificent spread of branches, must have been ten feet in diameter. The road to the volcano lies for much of the way through a fine forest. In the lower part the ohia trees were loaded with their beautiful crimson fruit, and present a very showy appearance. Of flowers, the species of Ipomœa were the most conspicuous; but the scarlet flower-bracts of Freycinetia were conspicuous at times, for here this latter plant may often be seen running to the tops of the tallest trees.

The glory of this road, however, is the tree-ferns, which all along excite one's admiration. The carriage road is not yet completed, and about thirteen miles must be done on horseback. Of this more than a mile is over a corduroy road made out of the trunks of ferns! Such a road, if not very durable, is yet very pleasant to horses. As these trunks lay prostrate, in the damp atmosphere, most of them were already sending out new fronds, and in due course of time the road will be fringed with a hedge of great fern-leaves. Indeed, in some of the more open parts of the road farther down, where the ground is completely occupied by a small tree-fern growing in dense thickets, as these are grubbed out to make way for cultivation, their trunks are piled up to form fences, and soon sprout out so that they make a beautiful and close hedge of fern-leaves.

On leaving the volcano I went down on the other side of the island. The rain being almost entirely intercepted by the mountains, this leeward side is very dry, and the ride to Punaluu, where we were to take the steamer, was not especially pleasant. Vegetation is very scanty, and nothing particularly interesting was noted in this line. The soil on this side of the island, especially in the district of Kona, is very fertile, and when water can be had, produces magnificent crops of all the tropical staples, pine-apples, cocoa nuts, coffee, sugar, &c., all especially fine; and we feasted on these cocoa-nuts and pine-apples as we sailed along this picturesque, if somewhat barren, coast.

A short, flying trip was made to the Island of Kauai, the richest botanically of all the islands, as it is the oldest geologically. According to Hillebrand, not only is the number of species larger than in the other islands, but the species are more specialised. Here I saw several species of the curious woody Lobeliaceæ, of which there are several genera that form either shrubs or small trees. I saw several species of Cyanea, with stems six to eight feet high, with long leaves crowded at the top of the stem and many white or purplish flowers, much like those of Lobelia, but somewhat larger and less open.

As in all the islands, there is on Kauai a great difference between the windward and leeward sides. I drove for about thirty miles along the windward side of this island through some of the most beautiful scenery of all the islands. Near the sea were rolling plains and hills, with here and there groves of Pandanus and Hau—the latter a dense spreading small tree with large yellow hibiscus-flowers—and at one point we drove through a magnificent grove of kukui trees, the finest I saw anywhere. As we reached that part of the island which is most fully exposed to the moisture-laden trade-winds, vegetation became extremely luxuriant. Numerous valleys with clear streams flowing down them, their bottoms given up to rice plantations, were to be seen here, with the rice in all stages, from the young spears just standing above the water to golden-yellow patches of ripe grain. At Hanalei, my destination, I found excellent accommodation and a delightful bathing beach, the latter especially attractive after a thirty-five mile drive over dusty roads. Hanalei is beautifully situated on a picturesque bay, with bold mountains rising directly back. The next morning a native was hired to go with me into the woods, and the day was spent in collecting. The variety of trees, as well as other phænogams, is much greater here than in Hawaii; the ferns, also, were very fine. Here I obtained a prize in a fine lot of the prothallia and young plants of Marattia, as well as some other interesting things.

Want of space forbids going into details, but no botanist visiting the islands can afford to miss Kauai.

In position, the Hawaiian Islands are unique, being more isolated than any other land of equal area upon the globe. More than 2000 miles separates them from the mainland, and 1860 miles from the nearest high islands. Of purely volcanic origin, thrown up from an immense depth, they have always been thus isolated. As might be expected, the flora is very peculiar, more so than in any other country. According to Hillebrand, of 800 species of spermaphytes and pteridophytes that are strictly indigenous, 653, or 75 per cent., are endemic. Taking out the pteridophytes, the spermaphytes show over 81 per cent.; and the dicotyledons over 85 per cent. that are found only in this group.

For a thorough study of this very curious flora, a long time would be necessary, as many species are extraordinarily local, and many of the most interesting localities are very difficult of access. The islands differ extremely among themselves, and exhibit in a most interesting manner the correspondence that exists between the variety and differentiation of forms and the ages of the islands. The formation of the islands has proceeded from north to south; and Kauai, the northernmost of the large islands of the group, is also the oldest and much the richest botanically, especially as regards spermaphytes; and, according to Hillebrand, the genera and species are more differentiated. Hawaii, the southernmost of the islands, is much the poorest in forms, although in the Hilo district the conditions are most favourable for a luxuriant development of forms.

In the latter island is the last active volcano of the group, Mauna Loa, with its two craters, of which the well-known crater of Kilauea is the great sight of the islands, and visited constantly by tourists from all parts of the world.

A few days after my return to Honolulu from Kauai, and six weeks from my first arrival there, I boarded the *Monowai*, the through Australian steamer bound for San Francisco, which was reached in due season after an uneventful passage. And so ended my first trip to the tropics.

INSTRUMENTS FOR THE EARTHQUAKE LABORATORY AT THE CHICAGO EXPOSITION.

THE first earthquake instrument ever invented, a drawing of which is shown on the wall, is in all probability that of Chōkō, dating from the year A.D. 132. The first instrument used for keeping systematic records in Japan was Palmieri's modification of the contrivance sketched out by the late Robert Mallet. Since this not only have all forms of seismographs and seismoscopes employed in Europe and America been employed, but many special forms have been designed in Japan, with the result that rather than Japan borrowing from Europe and America, these countries are using inventions which had their origin in Japan. A few of these instruments are exhibited in this laboratory. The main feature in their construction is that they all work from "*steady points*," and for small earthquakes at least, we can say with confidence that the diagrams they yield are absolute measurements of the earth's motion. From diagrams written on stationary plates we know the extent and the direction of the principal vibrations in a shock, but when the movements are recorded on a moving surface, we know the period or the rapidity with which the movements follow each other. From these latter diagrams the acceleration or suddenness of movements may be calculated, and the factors given to engineers enabling them to construct to resist known forces, rather than simply building strongly because an earthquake is strong.

INSTRUMENTS EXHIBITED.

1. *Seismograph writing on a glass disc.*—Here we have horizontal pendulums writing the earth's motion as two rectangular components on the surface of a smoked glass plate. The vertical motion is given by a vertical spring lever seismograph. The rate at which the plate revolves is accurately marked by an electrical time ticker. The movements of the latter are governed by a pendulum swinging across and making contacts with a small vessel of mercury.

The revolving plate is kept in motion by clockwork, which is set in motion by an electric seismoscope. (See No. 8.)

2. *Seismograph writing on a drum.*—In this instrument the record is written on a band of paper, the diagram being less difficult to interpret because it is written to the right and left of a straight line and not round a circle.

3. *Seismograph writing on a band of paper.*—In this instrument not only is the diagram written along a straight line but it is written with pencil,—the trouble of handling smoked paper being therefore avoided. When the earthquake ceases, the drum ceases to revolve, but if a second or third earthquake should occur, it is again set in motion. By this means a series of earthquakes may be recorded, the resetting of the instrument being automatic.

4. *Seismograph without multiplying levers.*—This instrument is intended to record large motions, the horizontal levers not being prolonged beyond the steady points to multiply the motion. For large earthquakes, when the ground is thrown into wave-like undulations, special instruments which measure tilting are employed.

5. *Duplex pendulum seismograph.*—In this case a steady point is obtained by controlling the motion of an ordinary pendulum with an inverted pendulum. The record consists of a series of superimposed curves written on a smoked glass plate.

6. *Mantelpiece seismometer.*—This is intended for the use of those who simply wish to know the direction and extent of motion as recorded at their own house. It is a form of duplex pendulum, and it gives absolute measurements for small displacements.

7. *Tromometer.*—This is one form of an instrument which is used to record movements which are common to all countries, called earth tremors. Every five minutes, by clockwork contacts and an induction coil, sparks are discharged from the end of the long pointer to perforate the bands of paper which are slowly moving across the brass table. If the pointer is at rest, then a series of holes are made following each other in a straight line, but if it is moving, the bands of paper are perforated in all directions round what would be the normal line of perforations.

The earth movements which cause these disturbances are apparently long surface undulations of the earth's crust, in form not unlike the swell upon the ocean.

A more satisfactory method of recording these motions, which has been used for the last two years, is by a continuous photograph of a ray of light reflected from a small mirror attached to a small but extremely light horizontal pendulum.

8. *Electrical contact maker.*—These instruments are delicate seismoscopes, which on the slightest disturbance close an electric circuit, which, actuating electric magnets, set free the machinery driving the recording surfaces on which diagrams are written.

9. *Clock.*—At the time of an earthquake the dial of this clock moves quickly back and forth and receives on its surface three dots from the inkpads on its fingers. It thus records hours, minutes, and seconds, without being stopped.

10. *Model of an earthquake.*—The bent wires represent the path traced by an earth particle at the time of the earthquake of January 15, 1887. The numbers indicate successive seconds. This model was made by Prof. S. Sekiya.

11. *Safety lamps.*—These are lamps which if overturned are at once extinguished. One of these is a European invention and the other Japanese.

12. *Pictures.*—The pictures on the walls show the effects of the Great Earthquake of October 28, 1891, the devastation following the Eruption of Bandaisan in 1887, and several of the more important volcanoes in Japan. They were made by Prof. W. K. Burton.

JOHN MILNE, F. ŌMORI.

Seismological Laboratory, Imperial University of Japan, Tokio.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Last Term the Board of Faculty of Natural Science recommended that an honour examination in Natural Science should be instituted, bearing the same relation to the Final School that Moderations bear to the Final School of Literae Humaniores. The recommendation of the Board was not unanimous, and on the matter coming before the Hebdomadal Council last week, it was put aside on the ground of want of unanimity among the various scientific departments. There was much to be said both for and against the proposed examination. It would probably have raised the standard of the chemical and physical work done by biologists, but would have forced an additional subject on the chemists and physicists, which they were very unwilling to assent to.

CAMBRIDGE.—The Adams Prize has been awarded to Prof. J. H. Poynting, F.R.S., late Fellow of Trinity College, for a memoir on the methods of determining the absolute and relative value of gravitation and the mean density of the earth.

The Professor of Pathology (Mr. Roy) gives notice that on Thursday, February 9, a lecture and demonstration will be given by Dr. Hafkine, of the Pasteur Institute, on his method of conferring immunity against Asiatic cholera. The lecture will be delivered at the Pathological Laboratory at 4.30, and will be open to members of the University.

The office of Esquire Bedell has been rendered vacant by the death of Mr. F. C. Wace, a distinguished mathematician, formerly Fellow and Lecturer in Mathematics at St. John's College, and thrice elected Mayor of the Borough of Cambridge.

SCIENTIFIC SERIALS.

Wiedemann's Annalen der Physik und Chemie, No. 1.—Essay towards an extension of Maxwell's Theory, by Hermann Ebert. The author obtains expressions for dispersion and absorption of waves of the order of light-waves analogous to those obtained by Goldhammer, and shows that they may be derived from Maxwell's fundamental conceptions by applying them to the case of rapidly changing displacements.—A new kind of magnetic and electric measuring apparatus, by G. Quincke. These are made of glass, ebonite, and wood. No screws are used in their construction, and they are claimed to cost a tenth of the price of ordinary instruments, with equal accuracy. In each of them the needles are suspended at the hollow centre of a vertical circular glass disc.—On a null method for measuring the dielectric constants of conducting liquids, by Friedrich Heerwagen.—On a phenomenon analogous to Newton's rings observed during the passage of Hertz electric plane waves through plane-parallel metal plates, by Ludwig Boltzmann. The author removes an apparent contradiction between Maxwell's theory and Hertz's observation that even excessively thin metal plates do not transmit electric waves a few decimetres long, by showing that this is not due to absorption, but to the limiting conditions at the surfaces of separation deducible from Maxwell's formulæ.—On a medium whose mechanical properties lead to the equations propounded by Maxwell for electromagnetism, by L. Boltzmann.—On some questions concerning Maxwell's theory of electricity, by L. Boltzmann.—The index of refraction of electric rays in alcohol, by H. O. G. Ellinger.—On the electrification of air in glow and brush discharges, by Ad. Heydweiler.—On the calculation of magneto optic phenomena, by P. Drude.—Spectra of aluminium, indium, and thallium, by H. Kayser and C. Runge.—On the infra-red spectra of the alkalies, by H. Kayser and C. Runge. A criticism of Benjamin Snow's work on the same subject.—Investigations concerning interior conduction of heat, by Richard Wachsmuth.—On the absolute value of the thermal conductivity of air, by A. Winkelmann.—On a modification of the transpiration method suitable for the investigation of very viscous liquids, by C. Brodmann. The substance was made to pass from a funnel-shaped reservoir through a capillary tube into a beaker standing on one pan of a chemical balance. The time was noted at which the amount of liquid passed into the beaker was large enough to overcome the counterpoise in the other pan, and to disturb the equilibrium, and further small weights were added and similarly dealt with. The temperature was kept constant by a spiral water-pipe and felt jacket, and local differences and variations of level and buoyancy were corrected for. The liquid experimented upon was glycerine, and the temperature curves were hyperbolas.—Notes on M. Cantor's thesis on capillary constants, by Th. Lohnstein.—Note on the purification of mercury, by W. Jaeger.

Notes from the Leyden Museum.—Of volume xiv. numbers 1 and 2 were published in April, and numbers 3 and 4 in July last. Edited by Dr. F. A. Jentink, this volume contains 282 pages and ten plates. The notes on Mammals are; by the editor on *Semnopithecus pyrrhus*, Horsfield; and on *Pithecir melanurus*, S. Muller (Pls. 3 and 4). In volume xii. Dr. Jentink,