

LEAGUE OF NATIONS.
COMMITTEE ON INTELLECTUAL CO-OPERATION.

ENQUIRY
INTO THE CONDITIONS OF INTELLECTUAL WORK.



SECOND SERIES.

INTELLECTUAL LIFE
IN
VARIOUS COUNTRIES.

NORWAY.

NATURAL SCIENCE.

BY

KRISTINE BONNEVIE,

Ph. D., Professor of Zoology at the University of Christiania,
Member of the Committee,

in collaboration with Specialists representing various
Branches or Institutions of Science.

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NOTE .

The sole object of the Committee on Intellectual Co-operation in publishing these reports is to draw attention to the questions of organisation and intellectual co-operation which arise in relation to each of the subjects dealt with. The Committee does not propose to treat these subjects exhaustively, but merely to draw the reader's attention to them and to provide an opening for fresh suggestions.

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* *In collaboration with the custodians of zoological institutions in Trondhjem, Stavanger, and Tromsø, as regards the said institutions.*

NATURAL SCIENCE IN NORWAY

BY

KRISTINE BONNEVIE

in collaboration with

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INTRODUCTION.

In answering the question put to me with regard to the present state of Natural Science in Norway, I have been fortunate enough to obtain the assistance of specialists in the various branches, who have proved their interest in intellectual co-operation by giving, each in his own line, a short review of the work being done there and of the present condition of the workers in the various branches.

Before, however, entering upon these special topics, it will be of interest to attempt a short survey of the general conditions of Natural Science work in Norway, conditions which govern its development.

It should first be remembered that Norwegian Science is a relatively young branch on the tree of human knowledge, the only University in Norway having celebrated its first centenary in 1911. Before its foundation, Norwegian students had to go to the University of Copenhagen, an education which, of course, involved great expense which relatively very few Norwegians could afford. During the eighteenth century academic culture was represented virtually by the clergymen alone, and thus we find the well-known *Bishop Gunnerus*, of Trondhjem, and others, as the pioneers of Natural Science in Norway. Gunnerus himself, during his travels on the Trondhjemsfjord and along the coast of Northern Norway, made many discoveries concerning marine fauna and flora, and he instructed the clergymen of his diocese to use every opportunity of making observations and of collecting objects of interest from the point of view of Natural Science. Thus he founded the "Natural Museum of Trondhjem" belonging to the "Kgl. Norske Videnskabers Selskab" (Royal Norwegian Academy of Science). His name is at present borne by the Researchship of the Biological Station of Trondhjem (*see below*).

By reason of its geographical position, as well as of its physical conditions, Norway is a real laboratory for research work. When, therefore, the Norwegian University was opened at Christiania, in 1811, the most various problems were, by Nature itself, put before the scientists connected with it.

The mountains and the valleys of our country, its "fjords" and its long and interesting coast-line, surrounded by thousands of skerries and islands, were all calling for *Geologists* to unravel their mysteries—a call which has been followed notably by men such as *B. M. Keilhau* (1798–1858), *Th. Kjerulf* (1825–1888) and *W. C. Brøgger* (1851). The work of these prominent scientists has been concentrated especially upon the "Kristiania-felt," a field of investigation which, as regards its geology and mineralogy, has been characterised as one of the utmost interest.

A flora like that of Norway, covering a field from the seashore up to the mountain glaciers, and from the boreal region of Southern Norway to the Arctic, with its short but brilliant summers, represent for the *botanist* a whole series of scientific problems of general interest. The foundations of our knowledge in this field were laid by *M. N. Blytt* (1789–1862), the first professor of botany

of the Norwegian University. Among his many pupils should be mentioned in the first rank his son, *Professor A. Blytt* (1843–98), whose theories upon the development and immigration of the flora have made his name well known among scientists concerned with the general problems of botany.

Along the whole west coast of Norway, the Gulf Stream forms the basis of an abundant animal life and plant life, which also plays a very important part in the natural conditions of the great Norwegian fisheries. Here, again, Nature called for scientists, and in this domain the work was taken up, not so much by the zoologists of the young University, as by a clergyman living on the West coast of Norway, isolated from the scientific world, but in the near vicinity of the mysterious, and until then practically unknown, life of the lower animals in the sea. This was *Michael Sars* (1805–69), who has been generally acknowledged as one of the world-pioneers of marine zoology. He proved the existence, in the marine fauna of Norway, of southern forms carried northwards by the Gulf Stream, together with specimens of Arctic life, which even in the most southern part of Norway may be found in the great depths of the fiords.

His son, *G. O. Sars* (b. 1837), sharing and developing the work of his father, succeeded in making a connection between science and practical life through his discoveries concerning the eggs and early life of cod and herrings, as well as with regard to the life and development of the microscopical world of crustaceans and other small organisms, floating with the currents along the Norwegian coast and forming so important a part of the fish-food that the success of our fisheries is very greatly dependent upon them. This practical line of scientific work was later carried further by *Dr. Johan Hjort* (b. 1869), who, as the leader of the Norwegian Fisheries Survey, and in co-operation with representatives of other nations, rendered great services to the scientific exploration of the currents and biology of the Northern Atlantic Ocean.

The geographical position of Norway as an outpost of Europe towards the Arctic, with its midnight sun in the summer, and with its long winter nights, was a call to explorers also in other branches of science. The whole *Arctic region*, which in so many respects still constituted a *terra incognita*, was an attractive field of investigation for descendants of the old Norse Vikings, who in *Fridtjof Nansen* have found a representative combining in his person the courage and strength of a Viking with a true scientific spirit. His successor, *Roald Amundsen*, has, as is well known, extended his explorations also to the Antarctic Pole.

The *Northern Light* (Aurora Borealis), the moving rays of which make the dark winter nights of Norway a brilliant and fascinating spectacle, naturally became an object of the most careful investigation by Norwegian physicists. In this field *Professor Kr. Birkeland* (1867–1917) took the lead, first boldly raising the problem and then laying down the lines of its solution. The same problem has also been, and is still being, attacked from the mathematical side by Professor *Carl Störmer*, and from the physical side by *Professor Lars Vegard* (see Physics). The phenomena of the Northern Light have, through the efforts of these scientists, ceased to be among the mysteries of the polar night, and have been subjected to the searchlight of modern science.

Even in other branches of cosmic physics, the geographical position of Norway has formed the basis of scientific investigations. This is the case, for instance, with *Meteorology*. The long and mountainous coast-line turning towards the open Arctic and Atlantic Oceans offers excellent opportunities for studying the rise and development of clouds and cyclones, while, at the same time, the population of this coast-line are, by reason of their occupation as fishermen, especially dependent upon the weather. These two facts have certainly played a part in furthering the striking progress of Norwegian meteorology within the last ten years. But this progress has in the first instance been determined by the physical theories of Professor *V. Bjerknes* (b. 1862), who, together with assistants and collaborators, has succeeded in establishing new and promising methods of forecasting weather (see Meteorology).

Finally, it should be mentioned that the geographical configuration of Norway, with its narrow isolated valleys, in which the same families have been living and can be traced back through hundreds of years, makes our country a good field also for the *study of the human race*. Anthropological, ethnographical and genetical studies of various elements of the Norwegian population are, therefore, at present playing a considerable part in our Natural Science.

Many other branches of investigation might have been added as coming also under the head of "national" problems. The problems here mentioned, however, are not only national, all of them having a bearing also on the solution of general scientific problems. Much of the scientific work performed at our University is, at the same time, fully international in material as well as in method.

Norwegian scientists will, I am sure, never be in want of interesting and attractive scientific problems. These are placed before our eyes in abundance wherever we go. Such problems need, however, for their solution, not only scientists, but also laboratories, teaching institutions for securing the recruitment of scientific workers, and last, but not least, the resources necessary for the carrying on of research work.

Besides the University of Christiania, other centres of scientific research have arisen—at *Trondhjem*, where the Museum of *Gunnerus* existed even before the University; at *Bergen*, with its Natural History Museum and laboratories, the leaders of which are also teaching candidates for University degrees; and, further, the museum of *Tromsø*, which concentrates its work upon investigations of Arctic fauna and flora, and that of *Stavanger*, the geographical situation of which makes it a very good place for ornithological studies.

"*Norges Landbruks høiskole*" (The College of Agriculture) was erected at *Aas*, near Christiania, and "*Norges tekniske høiskole*" (Polytechnic Institute of Norway) was opened at *Trondhjem* in 1910.

With regard to *financial resources*, Norwegian science has, until quite recently, had to work under very hard conditions, the salaries of scientific men having, until about ten years ago, been relatively very low, while, at the same time, no funds existed which could effectively support their work. A change set in, however, at the end of last century, when, in honour of *Dr. Nansen's* return from his North Polar Expedition, a scientific fund was founded, bearing his name. This fund has, mainly through the admirable work of *Professor W. C. Brøgger*, steadily increased; at present, its capital has reached the considerable sum of about four million crowns, and it includes a whole series of separate funds for special lines of scientific research work.

In 1911, when the centenary of our University was celebrated, a new fund, "*Jubilæumsfondet*," was founded, which has now reached an amount of 700,000 crowns.

While the Nansen fund distributes every year fellowships to scientists throughout the country, the grants of the "*Jubilæumsfondet*" are given only to the functionaries of the University.

Finally, a few years ago, the Norwegian Storting granted a sum of three million crowns to form the "*Forskningsfond*" (Research Fund), the interest of which is distributed in relatively large sums for the support of scientific undertakings on a large scale.

A fourth fund even ("*Varekrigsfondet*") was founded in 1920 for the special support of applied science.

Thanks to the very important assistance given by these funds, the work of Norwegian scientists has, in the last ten years, been greatly facilitated. We have every reason to appreciate the foresight displayed by both State and University authorities in securing capital for the support of science, at a moment when it was still possible to do so, and in such a way that it can be kept alive throughout the period of general depression which is now following the world-war.

After these observations about the general conditions of Norwegian science, we may now turn to more special topics, treating separately the following branches of Natural Science:—

Physics, Chemistry, Meteorology, Geology, Botany and Zoology.

PHYSICS.

I.

For a long time, the only institute for research and systematic advanced teaching of physics in Norway was the *University of Christiania*. In the year 1910, however, a new polytechnic institute of university standing, the *Polytechnic Institute of Norway*, was opened at Trondhjem. The programme of this institute includes both systematic teaching and research work in physics. According to this programme, the institute has been equipped with a physical laboratory for both purposes mentioned above.

As may be expected, the foundation and growth of the institute is closely connected with the progress of technical sciences in our country, with the rapid growth of our industry and with its rising economic importance.

Industrial development, on the other hand, has received a very strong impetus from one of our leading physicists, the late *Professor Kr. Birkeland*. His discoveries and inventions relating to the oxidation of nitrogen in the electric arc gave rise to our large-scale saltpetre industry of the last decade.

A great variety of other industries have followed in the wake of this one, and have drawn the attention of the population to the immense natural resources of energy which we possess in our waterfalls, and through the inter-action which always exists between a highly developed industry and the fundamental technical sciences—physics and chemistry—this industrial growth has further drawn our people's attention towards those branches of science themselves, and has thrown into strong relief their paramount importance to all forms of industry. Even if the goodwill towards science and learning in general thus created in our people is of a somewhat platonic character and can scarcely be regarded as resulting from a deep and full understanding of the rôle which science has to play in modern society, it has at least influenced very favourably the attitude both of the daily Press and of the public authorities towards its demands. Consequently, our Government is, broadly speaking, guided by the same goodwill, and has made, for the benefit of scientific work, all the appropriations allowed by our economic resources. In addition to such appropriations from the State, we have in the course of the last decade obtained valuable research funds by means of private donations.

The public interest in scientific work and progress thus displayed has, as may be expected, especially covered all forms of applied science, the practical use of which is apparent to everybody.

In spite of such an attitude of goodwill from government and public opinion, Norwegian physicists have up to the present worked under very unfavourable conditions. In fact, our physical laboratories are very poorly equipped. In particular, the physical laboratory of our University is so inadequate that it does not even afford the necessary facilities for the elementary teaching of students, to say nothing of research work.

Partly as a consequence of the great difficulties our physicists have met with in the domain of experimental work, they have up to the present preferred problems of a *geophysical* or *cosmo-physical* nature.

Another reason for their preference for problems of the latter kind may be found in the very nature of our country. With its exceptional climatic conditions, its long coast-line from the 58th to the 71st degree N.L. and its northern situation, it offers a highly interesting field for the study of various geophysical problems, *e.g.*, the polar aurora, the earth's magnetism and the dynamics of the ocean and the atmosphere. In all these branches of study, Norwegian investigators have worked with considerable success, and have even been able to play a leading part in international scientific progress. Indeed, as far as international science is concerned, the best contributions of our physicists are certainly those dealing with geophysics.

Geophysics alone, however, have not absorbed all their interest and energy. In spite of the poor laboratories, some of our physicists have, even in experimental work, reached out beyond the

scientific horizon of our own country. In this connection it will be sufficient to mention the remarkable experiments of the late *Professor Kr. Birkeland*, illustrating the nature of aurora borealis and other phenomena which have a fundamental bearing on the various hypotheses of cosmogony. In the history of science, these experiments will perhaps play an even greater part than his fundamental researches on the oxidation of nitrogen.

I may further mention *Professor V. Bjerknæs's* juvenile researches on electric oscillations, and the life-work of his father, the late *Professor C. A. Bjerknæs*, in research in the field of force in fluids agitated at some point by pulsating or oscillating forces. The last-named experiments, which were of their kind fundamental, were carried out in some of the most modest cellar-rooms of the University and with very poor experimental facilities.

The energy and industry in scientific work thus displayed by the older physicists are characteristic also of the younger men. Some of them, headed by *Professor Vegard*, the successor of *Kr. Birkeland*, have taken up experimental work with no less energy than their predecessors, and have succeeded in contributing results of international value to such modern branches of physics as crystal analysis by X-rays, the constitution of the atom, etc.

But in spite of all the efforts of a couple of earnest investigators, we shall have in this country no solid foundation for a modern school of physics until we have secured laboratories which correspond to modern demands.

The author of the present report has consequently considered it a duty to give much time and energy to the struggle for such laboratories. This struggle will, before long, be crowned with success. Two years ago the Storting made the appropriations requested for the building of a new physical laboratory at the Polytechnic Institute of Trondhjem. Moreover, some appropriations have been made for a new laboratory at the University. The erection of the laboratory at Trondhjem will be finished within the next year or two.

In connection with the plans for the laboratory—which will be in every respect adequate to modern requirements—the author has also worked out plans for a reorganisation both of teaching and research work in physics at the Polytechnic Institute, aiming at giving each of these branches of sciences as free and independent a position as possible among the technical and other scientific curricula represented at the institute.

As regards the proposed new physics laboratory of the University, it is hoped that building may be begun next year.

With these two new laboratories, we shall in a few years—as far as laboratories are concerned—possess all the facilities, for which we can reasonably hope, for a national school of physics. Our physicists will no longer have such heavy odds against them as they actually have at present compared with physicists elsewhere, and, thanks to the strong intellectual powers of our people, the writer trusts that this development will mark something of a new era in the history of science of Norway.

In addition to the general characteristics here given, the following statistics and facts may finally serve to elucidate the actual state of physics in our country. The scientific staff of the University laboratory consists at present of two professors and three lecturers. The salaries (10,000–13,000 Kr. for full professors, 4,500–8,500 for lecturers) are paid from the official salary lists. The corresponding numbers for the laboratory of the Polytechnic Institute at Trondhjem have been: one professor, one lecturer and two teaching assistants.

All these professors and teaching assistants are supposed to be capable of conducting research work.

Besides the two laboratories referred to, we have few institutes which can offer to physicists situations where research work is supposed to be done. One such institute is the *College of Agriculture at Aas*, with a professor of physics and a physical laboratory chiefly for teaching purposes. Another is to be found at *Bergens Museum* and its geophysical institute, likewise with a professor of physics (chiefly for research work) upon its staff. For the last-named institute a small research laboratory for geophysics and physics is under construction.

In this connection, I may further mention our meteorological institutes, where a couple of physicists find employment of a scientific nature, and our higher schools, some of which have small physical laboratories for teaching purposes.

It should be understood, however, that, on the whole, a very limited number of physicists can secure a livelihood by means of research work. This fact, of course, strictly limits the influx of post-graduate students of physics. For the greater number of such students practically no other livelihood is offered than that of a lecturer at some higher school, and the regular advanced teaching of physics at the University has up to the present been organised as a part of the curriculum for teacher's certificate examinations.

In the last decade, however, the conditions for making a living out of research work in physics have decidedly improved. The number of professorships at the State institutes has been more than doubled. Moreover, the interest in scientific industrial research is rapidly growing and will, as soon as economic conditions permit, no doubt result in the establishment of research laboratories and in an increasing demand for physicists for industrial research.

To meet such demands, it has been proposed, in the most recent schemes for physics teaching at the Polytechnic Institute mentioned above, to organise a course of study leading up to a special degree in physics or technical physics.

At the same time, according to the law of September 23rd, 1921, a new certificate examination for degrees in physics and other special branches of science and letters has been organised at the University, in addition to the existing lecturer's certificate examinations.

We can thus say that there has been, on the whole, a decided improvement in the general conditions of physics teaching and research, and that this improvement will probably be maintained, provided that the present economic depression does not weaken our economic strength over a longer period than is anticipated.

Our economic resources, it must be remembered, are, to say the least, far from being inexhaustible, and, apart from the consequent limitations on scientific work, our physicists, as well as all our other men of science, will have always to fight against the disadvantages inevitable in a more or less isolated scientific milieu.

(Signed) SEM SEELAND.

PHYSICAL INSTITUTE,
UNIVERSITY OF CHRISTIANIA.
June 16th, 1923.

II.

In recent years physical science has, as we know, made very rapid progress. The discovery of new facts and of new and fundamental principles of the constitution of matter has created new fields of research in practically every branch of pure and applied physics.

The line of physical research which has been followed in recent years at the Physical Institute of this University forms, in a sense, a natural extension of the field of research traversed by my predecessor, *Professor Birkeland*, the object of his study having been the elementary properties of electricity and matter, and their application to cosmic phenomena. New results, however, as well as new methods have in many respects given new directions to the work.

The work which has been carried out at my institute, partly by myself and my collaborators, and partly by the assistants as well as by the students, has been in connection with the following subjects :

A great deal of research work has been done on *cosmic problems*, especially the *aurora borealis* and allied phenomena. The results have been published partly in the book "The Position in Space of the Aurora Borealis," and partly in a number of papers which have appeared in English, German, French and American journals.

In *pure physics* investigations have been carried out on the *structure of matter and electricity*.

During the last six years a number of papers has been published on the *atomic constitution of solids* studied by means of the defraction of X-rays by the crystals. The X-ray analysis has also been applied to the solution of practical problems.

Important experimental and theoretical investigations on the *magnetic properties of bodies* have been carried out by *Dr. O. Frivold*, while *Dr. J. Holtsmark* has been conducting important investigations on the *emission of light and soft Röntgen rays*.

A number of students have taken their "special degree" in physics, and they have, as a rule, been doing investigations on problems falling into line with my own field of research.

Most of our work has had a purely scientific aim. The results have been published in scientific journals and proceedings, and I should say that our work is not very widely known to the public. The public is, however, beginning to realise the importance of introducing scientific methods into all branches of practical work, but there is still much to be done in our country in order to secure an intimate co-operation between science and industry.

So far as the development of physics depends on the material and facilities for work, I think that the building of a new institute at the University will mark perhaps the most important step towards the better standing of physics in our country. Within four or five years we should, I think, be installed in our new institute.

Since there have been but a few active workers in pure physics, and since most of the research work has been carried out at the University, there has been no organisation of physicists covering the whole country. At the Physical Institute of Christiania we have a *Physical Society*, the main object of which has been to give accounts of new investigations and discoveries, and to discuss physical problems. The society has not yet published any of its proceedings. In most small countries the question of publication tends to present difficulties. A number of papers in physics are published in "Kristiania Videnskapselskaps Skrifter," and in geophysics and cosmic physics a series of papers are now published under the title of "Geofysiske Publikationer." But these publications are neither so regularly nor so quickly distributed as is desirable, and, if we wish to make our results more rapidly known to the world, we must publish them in some of the principal journals of Great Britain, Germany, France or the U.S.A.

Although the activity in physical research in our country has not been very extensive, I think, nevertheless, that the work which has been done has in several branches made valuable and important contributions to the development of natural philosophy.

In a small country like ours, situated on the border of civilisation, it will always be difficult for men of science to maintain contact with the scientific world and to follow the rapid progress of science. Thus we feel deeply the lack of that stimulus and continual re-orientation which is the privilege of those who are working in or near the big centres of science.

It is clear that a country like ours would welcome any institution or organisation which could bring us into more intimate and personal contact with other scientific workers. International associations and conferences may be a great stimulus, but not many scientists have an opportunity of visiting them.

For the progress of physics in our country, I think that an intimate intercourse between the various Scandinavian physicists would be of the greatest value. A Scandinavian association of physicists has now been constituted, and will hold conferences, as far as possible, every year. The best way of getting into touch with sciences, however, is to travel and to study abroad. Any young man going in for physics ought to study a couple of years abroad. Further, the more advanced students should occasionally be given the opportunity of studying abroad for one or two terms.

(Signed) L. VEGARD.

PHYSICAL INSTITUTE.
UNIVERSITY OF CHRISTIANIA.
May 1923.

CHEMISTRY.

Instruction in chemistry—in the extended use of this term—and the study of chemistry is in Norway carried on at the *University*, at the *Polytechnic Institute*, at the *College of Agriculture* and at *Bergen's Museum*; of these the two first-named are the most important.

At the Polytechnic Institute chemical engineers are trained. Here also there are opportunities for research work and for acquiring the degree of Doctor of Chemistry. At the University all the physicians and pharmacists are being taught chemistry, as are the teachers of the higher schools. Some of the latter have a thorough education in chemistry, viz., chemistry is their principal course. Here also specialists in chemistry may finish their studies with the degree of "Magister" or "Doctor." Many of the latter obtain employment at the institute, as assistant instructors, or in the scientific work.

Even in a neutral country such as Norway chemistry was profoundly influenced by the war. The difficulties of communication, the impossibility of procuring from outside certain chemicals and foodstuffs, tended to create a new chemical industry. This, of course, also caused a change of position of that branch of science. This extraordinary activity in the chemical industry, however, declined very shortly after the end of the war, and the present period of economical depression is paralysing the industry.

This, of course, has caused a decline in the number of students educating themselves for industrial work. This fact appears most strikingly at the Polytechnic Institute, where the number of students is greatly diminished. At the University there are at present just as many—or more—chemical specialists as before the war. The number of medical, pharmaceutical and science students is constantly increasing at an approximately even rate.

At present the Chemical Institute of the University is not large enough to accommodate the regular number of students. In spite of summer courses and of the transference of certain sections of the course to hired rooms, it is not possible to provide accommodation for all those who want to register as students. In such circumstances it is evident that it is especially difficult to provide accommodation and working conditions for specialists. This, again, is a great danger to recruitment. In this connection it should, however, be mentioned that a new chemical institute has been planned, the erection of which will presumably begin in the near future. The war, to some extent, brought to public opinion a better understanding of the importance of chemistry. Nevertheless, a certain amount of improvidence prevails in so far as recognition and funds find their way more easily to applied than to pure chemistry.

During the last eight years, however, several new positions have been created; thus a lecturer in physical chemistry and in radio-chemistry and also one in colloidal chemistry have been appointed. Want of room, however, prevents the two latter from being utilised to the required extent. Some scholarships for the study of chemistry abroad have also been created. One of these is awarded every year by the University, the capital being the gift by a private citizen ("Apotheker Stillesens legat"), and one is awarded every year by the Storting—in the first instance, for five years—for the study of chemistry in England—"Ramsay Memorial Fellowship."

In a small country like Norway, it is of importance that scientifically working chemists may have an opportunity of studying abroad, and the University is doing its best to facilitate this for the younger functionaries. Leave of absence is readily allowed for half or even whole years; free substitution is seldom allowed, but financial assistance in paying the substitute is often granted.

On the whole, we are well supplied with periodicals, so that we have an opportunity of keeping ourselves informed with regard to progress in our branch of science. Much more difficult is the provision of modern equipment. The institute cannot itself afford the latter, but special scientific funds, created partially by the Government, partially from private sources, have rendered good service. For the younger chemists, especially, the help which these funds have rendered during the past ten years has been of immense importance.

Among active organisations in the chemical line may be mentioned "Norsk Kemisk Selskab" (the Norwegian Chemical Association). The seat of the association is at Christiania, and it is the

natural meeting-place for scientific and industrial chemists. It is associated with "L'Union internationale de la Chimie pure et appliquée," and thereby brings us into touch with chemical associations throughout the world.

Most frequently our papers are published in foreign periodicals, but partly in Norwegian ones such as "Videnskapselskabet skrifter," "Archiv for Matematik og Naturvidenskab" and "Tidsskrift for Kemi og Bergvæsen."

(Signed) ELLEN GLEDITSCH.

CHEMICAL INSTITUTE OF THE UNIVERSITY OF CHRISTIANIA.

May 1923.

METEOROLOGY.

The meteorological service has developed greatly since the war. The causes are several. (1) During the war meteorology proved necessary for the military operations, and this produced an increased interest in meteorological science. Especial mention may be made of the importance of meteorology in aerial navigation. (2) This augmented interest had an international character and the consequence was that the various meteorological institutions in all countries obtained more funds. They were thus able to send each other more detailed weather reports than before. Now, therefore, we can secure better information, not only from our own country, but also from abroad, and we thus have a better basis for our forecasts. (3) The development of radiotelegraphy has made it possible to arrange for the international exchange of meteorological observations in a more effective manner than could be obtained by wire. By means of radiotelegraphy also we get weather reports from areas whence some years ago it was impossible to obtain information for the use of the weather service. As regards the Norwegian weather service, I should especially mention the importance of the weather reports obtained from ships in the Atlantic and from our Arctic stations on Spitzbergen, Baren Island, Jan Mayen and East Greenland. (4) Last but not least, we have the advantage of using the new methods for forecasting weather developed by *Professor Bjerknes* in collaboration with the meteorological service.

With improved forecasts, public interest in our work has increased. Since by means of the improved net of meteorological stations, we are at the same time able to give more detailed information on the weather for the use of agriculture, fishing, etc., we are well supported by public interest.

To ensure further progress we need: (1) the recruitment of young men with scientific interests, (2) funds and (3) improvement in the international code for weather telegrams according to our new methods, so that the weather messages from abroad may contain what we need.

Between the meteorological institutes and the other geophysical institutes in Norway there is a collaboration, voluntarily organised and very effective. Further, we try to maintain as close relations as possible with physics, mathematics and mechanics.

The work of the meteorological institutes is partly the purely scientific one of enlarging our knowledge of the atmosphere and of the laws ruling it and of improving our working methods in accordance with new scientific results; further, the practical work of making forecasts and climatological summaries and of answering all questions concerning weather and climate.

In the year 1922 the various departments made official enquiries as to the use of meteorological work. The replies which have come in up to date entitle us to state that the forecasts are of great practical value. The attitude of the press is the same as that of the public. The State pays for all the work, the annual cost of which is now about one million Norwegian crowns. It is not possible to estimate the commercial value of the work, but it may be considered probable that the storm warnings alone are responsible for savings to a value exceeding the cost of the meteorological work.

Only men with scientific interests, who have studied at least mathematics and physics at the University, should be employed as meteorologists. But it is very difficult to obtain such recruits for meteorological work, partly because of the lack of such students, but chiefly because they get

better incomes as teachers in the schools. It would be of importance for the recruitment if there were at the University a professor of geophysics so that the students might get systematic lectures in this branch of science.

The technical education of meteorologists is carried on in the meteorological institutes themselves.

The meteorological service is organised as follows:—

The Norwegian Meteorological Institute (Christiania)					
Forecasting	Met.	Met.	Geophysical	Met.	Arctic
Central	Observatory	Observatory	Institute	Observatory	Observatories.
(Bergen).	(Bergen).	(Aas).	(Tromsø).	(Halde).	

Further, there is at Bergen a meteorological section of the Geophysical Institute, independent of the meteorological service and employed on exclusively scientific work.

The Norwegian Meteorological Institute is the central institution and has all the climatological work and the forecasting for Eastern Norway. The forecasting central of Bergen issues forecasts for Western Norway. The Geophysical Institute in Tromsø is subcentral for the Arctic work and issues forecasts for Northern Norway. Further, all these institutes and observatories have scientific aims. It is proposed to erect a forecasting central also in Trondhjem, but, on account of the cost and the lack of meteorologists, the plan is not likely to be carried out in the near future.

All the meteorological institutes are paid for by the State and none is in any financial difficulties.

The meteorological institutes publish the following periodicals:—

- “Jahrbuch des Norwegischen Meteorologischen Instituts.”
- “Nedbøren i Norge.”
- “Arsberetning for de norske meteorologiske institusjoner.”
- “Oversikt over temperatur og nedbør i Norge.”
- “Daily Weather Charts.”

And, in collaboration with the other geophysical institutions:—

- “Geofysiske Publikationer.”

The foreign institutes exercise a great influence on our work, scientifically by their publications, and practically by the weather reports which they send us. On the other hand, our work has a similar influence on meteorological work abroad. Especial mention should be made of the interest with which our new methods of forecasting have been received in other countries.

We obtain information concerning meteorological work (1) in our own country, through our national organisation, (2) from the rest of the world through the international meteorological organisation or directly from foreign institutes.

The international meteorological organisation is an old one and has, upon the whole, worked well.

We exchange publications with the foreign meteorological institutes, and the International Meteorological Committee arranges meetings, where matters of organisation are discussed. Further, scientific meetings are sometimes arranged by individual countries.

With a view to a better organisation of these scientific meetings, the International Research Council has a section for geophysics. Up to the present, we have not joined this union, chiefly because it has not a real international character. But we need such an organisation.

Meteorological science will develop on the basis of mathematics and physics and by means of improved technical auxiliaries. The chief practical aim of meteorology is to forecast with certainty, not only the weather of to-morrow, but of a more distant future. We are still far from this end, but if we keep our eyes on this object, we shall certainly make progress.

(Signed) TH. HESSELBERG.

NORWEGIAN METEOROLOGICAL INSTITUTE,
CHRISTIANIA.
March 1923.

GEOLOGY.

Under the term "geology", in the following, is also included crystallography, mineralogy, petrology, stratigraphy, palæontology and applied geology.

Since the year 1910 a remarkable change is to be noted in the position of geology in Norway. Up to that time this branch of science was represented at the University of Christiania only, with one chair for mineralogy and geology and one chair for applied geology and mining. As a result partly of the rapid development of various independent branches of geology, but chiefly of the important influence exercised on public opinion by the prominent professor, *W. C. Brøgger*, the scientific staff for geology was doubled in the years 1910-17, and consists at the present time of four professors, two lecturers and five assistants.

In the year 1910 the *Polytechnic Institute of Norway* was established in Trondhjem, and geology is at that institute represented by one professor and one lecturer. At the third centre of science in Norway, *Bergen's Museum*, the mineralogico-geological institute, shows a similar progress and the staff consists now of one professor, one lecturer and one assistant.

In the same period, the staff of the "Geological Survey of Norway" was also doubled, and this progress is due to a growing public understanding of the importance of geological research for practical purposes (mining industry, agriculture, etc.).

According to the above statement, geological work in Norway shows a marked progress in the period since 1910.

The greatest part of the work of Norwegian geologists is original research work, and a review of the publications during the last ten years proves that original investigations are carried on in all branches of geology. By means of public lectures at the University and the other colleges, and through the publications of the Geological Survey, geological knowledge is made accessible to the public.

The public is, of course, interested in the practical results of geological research, and the Press in this country is always open to what the geologists may have to say to the public. A geological fund belonging to the "*Fridtjof Nansen's Fund*" and the "*Sulitjelma Fund*" have been established for advancement of geology.

It is a matter of course that geologists should be to a great extent employed as experts; but the commercial success of geology depends in some degree on the general position of the market and of the mineral industry.

Specialists in geology are recruited chiefly from graduates of geology, but also from mining engineers, and, according to the statement given above, the recruitment seems to have been more satisfactory in recent years.

The economic condition of workers in geology and its branches at the University and the other institutes is the same as that of other scientists. The State geologists at the Geological Survey have a scale of pay equivalent to that of engineers in the public service.

The following list includes the most important and active organisations :—

A. ASSOCIATIONS.

"*Norsk Geologisk Forening*" (Norwegian Geological Society), with 125 members (including twenty foreigners). The Society holds six or seven meetings a year, at which as a rule original papers are read. The Society has since 1905 published "*Norsk Geologisk Tidsskrift*" (Norwegian Geological Review), Vol. VI, printed 1922).

B. RESEARCH INSTITUTES.

"*Norges Geologiske Undersøkelse*" (Geological Survey of Norway), established 1858. At the present, the staff consists of one director, eight geologists and one chemist. This institution publishes geological maps and a periodical series, "*Norges Geologiske Undersøkelser Skrifter*," No. 1 (1891), No. 92 (1922).

“ *Statens Raastofkomite* ” (State Committee for Mineral Resources) undertakes research work on domestic mineral raw materials for industrial purposes, under the leadership of *Professor V. M. Goldschmidt*, Director of the Mineralogical Institute of the University, Christiania.

“ *Norges Jordundersökelse* ” (Norwegian Survey of Soils), connected with the Agricultural College of Norway at Aas.

C. EDUCATIONAL ESTABLISHMENTS.

Mineralogical Institute of the University, Christiania.

Geologico-palæontological Institute of the University, Christiania.

Mineralogico-geological Institute of Bergen's Museum.

Geological Institute of the Polytechnic Institute.

Geological Institute at the College of Agriculture.

At all these educational institutes, scientific research work is performed besides the educational work.

D. MUSEUMS.

Mineralogico-geological Museum of the University, Christiania.

Palæontological Museum of the University, Christiania.

Geological Section of Bergen's Museum.

Mineralogical Section of Trondhjem's Museum.

Geology as such is an international science, but geologists commonly perform their research work on material from their own country. The national work of geologists must always be influenced by the international progress of science; the want of such influence would mean stagnation. Geological work in foreign countries plays, therefore, and must play, a great part in the work of Norwegian geologists.

On the other hand, it may be said that the work of the Norwegian geologists in the course of the last hundred years has been of great influence abroad, thanks to prominent Norwegian geologists such as *B. M. Keilhau* (1797–1858), *Th. Kjerulff* (1825–88), *W. C. Brögger*, *J. H. L. Vogt*, *V. M. Goldschmidt* and others.

Information concerning geological work in Norway is conveyed by means of the “ Norwegian Geological Society,” where new papers are read, and through exchange of papers between workers. The above-mentioned institutes have libraries with complete collections of Norwegian and Scandinavian geological literature.

Throughout the rest of the world our information concerning geological work is conveyed through the reviews and periodical publications, which we obtain partly by purchase and partly by exchange with the Norwegian geological publications. The more important papers of Norwegian geologists are, as a rule, written in one of the most common foreign languages, and Norwegian geologists exchange to a great extent their own papers with prominent geologists abroad.

The geological institutes of the University possess a good library with a complete series of the most important geological reviews and periodicals from abroad. The libraries of the younger institutes at Aas, Bergen and Trondhjem are not so complete. It is an urgent matter to improve those libraries.

The geological societies in the Scandinavian countries (Norway, Sweden, Denmark and Finland) have, since the year 1918, organised “ Scandinavian Geological Meetings ” every two years for the study on the spot of geological questions of common interest.

The various national organisations of workers in geology are the national geological societies, and they long ago formed an international organisation, *The International Geological Congress*, with meetings every third year.

(Signed) JAKOB SCHETELIG.

GEOLOGICAL MUSEUM,
UNIVERSITY OF CHRISTIANIA,
May 1923.

BOTANY.

I.

The state of botanical work in Norway shows slow, but even progress. We have *botanical gardeus* in Christiania, Bergen and Aas, and a small one in Tromsø; *botanical laboratories* in Christiania, Bergen and Aas, a *botanical museum* in Christiania and botanical departments of the Natural History Museums of Bergen, Trondhjem and Tromsø.

The University.—The *botanical garden* of Christiania was the scene (1850–70) of the experiments of *Professor Schübeler* in the acclimatisation of plants. On the whole, however, our botanical gardens are used only for teaching and for demonstrations to the public.

The *botanical laboratory* in Christiania has not yet obtained a building of its own, but is lodged in a private apartment; it is not, therefore, fit for physiological work. A new laboratory building is planned.

The scientific staff of the laboratory consists of one professor and two lecturers, while four specialists also are permitted to have their tables in the laboratory. Courses in *plant anatomy* are held in a special room, with room for about fifteen students.

The College of Agriculture at Aas is a good laboratory for *plant physiology* for the professor, *Dr. Hansteen Cranner*, and has class-rooms for practical courses in anatomy and physiology.

The *botanical museum* in Christiania (Director, *Professor N. Wille*) is new, built in the last years before the war. It contains valuable collections of Norwegian plants, and gives very good opportunities for research work. The exhibition for the public is not yet installed.

For the study of marine algae there are adequate facilities in the *biological stations at Dröbak* (near Christiania), at *Herdla* (near Bergen) and at *Trondhjem*; while studies of plant plankton can be made in connection with the fishery investigations in Bergen.

We have in Norway no special botanical society, the botanists taking part in the meetings of “*Biologisk Selskap*” (Biological Society). Scientific papers are published in the periodicals of the Scientific Academies of Christiania and Trondhjem, as well as in that of Bergen’s Museum.

Norwegian botanists have no special difficulty respecting information upon the international progress of the science; the periodicals “*Botanisches Centralblatt*” and “*Botanical Abstracts*” keep us in touch with the new publications, and we can by correspondence and exchange of papers obtain the information necessary for our work. We have no reason to complain that our work is not known and appreciated in foreign countries. We could wish, however, that the international book trade could be better organised; it would be very useful if a commercial book list like *Friedlander’s “Naturæ Novitates”* could be kept internationally up to date.

Before the war an “*Association internationale des Botanistes*” existed, publishing the periodicals “*Botanisches Centralblatt*” and “*Progressus Rei Botanicae*”; the association still exists, but the “*Centralblatt*” is sold to Germany, and the members no longer pay an annual contribution to the association. This association ought to be revived as a means of arranging collaboration for special purposes.

The annual budget is just sufficient to pay current expenses. More extended scientific operations can hardly be started without extraordinary grants.

(Signed) H. H. GRAN.

BOTANICAL LABORATORY,
UNIVERSITY OF CHRISTIANIA.
June 1923.

II.

The botany of "Bergen's Museum" has of recent years been divided into two independent departments: *Botanic Laboratory* (anatomy and physiology of plants) and *Botanic Collection and Garden* (systematic botany, geography of plants). The work of each of these departments is conducted by a professor.

The botanic collection has, beside herbaria (about 200,000 species), a systematically arranged study collection, open to the public. The botanic garden contains specimens of such plant families as can be raised out of doors in our climate; but the space is very limited, as is consequently also the selection of plant species. In a small hot-house a selection of exotic species is being raised.

The botanic laboratory has been installed in a suite of dwelling-rooms, and is furnished with the necessary laboratory equipment.

In both these departments scientific work is carried on and directed mainly to the solution of problems raised by the nature of Western Norway; at the botanical collection, in the first place, the plant geography of Norwegian vegetation and, at the botanic laboratory, chiefly physiological and practical botanic problems are studied.

Both of the botanic professors give lectures to the students, preparing the latter for examinations and degrees corresponding to those of the University of Christiania.

In both of the said departments the want of space is one of the greatest difficulties to be overcome. It is, however, to be hoped that this situation may be considerably improved for both departments in the near future.

(Signed) JENS HOLMBOE.

BERGEN'S MUSEUM.
April 1923.

ZOOLOGY.

I.

Zoology is taught at the *Zoological Laboratories* of the University and of Bergen's Museum. Three *biological stations* exist, one of which belongs to the University and is situated at *Dröbak* on the Kristiania-fjord. Another station belongs to Bergen's Museum, lying at *Herdla*, an island in the skerries of the west coast. A third station, finally, on the *Trondhjems-fjord*, belongs to the Academy of Science of that town. *Zoological museums*, or departments of zoology in large museums, exist in Christiania, Bergen, Trondhjem, Tromsø and Stavanger.

These different centres of zoological teaching and research work will be considered separately.

The University.—The *zoological laboratory* has within the last ten years undergone an extension of its scientific staff, which now consists of one professor, two lecturers and one assistant. At present the professor of zoology is also the head of the "Institut for Arvelighetsforskning" (Institute of Genetics), founded in 1916, at first working only with apprentice assistants, but from 1918 also with a lecturer.

The public takes a considerable interest in the results of zoological, and especially also of genetic work, this interest being proved by the attendance at summer courses and public lectures, and also through articles in the Press, as soon as results touch upon questions of general interest. Investigations on human heredity carried out on the great peasant families of the isolated valleys of Norway have, indeed, met with the greatest readiness and goodwill from the population investigated.

Besides the great funds mentioned in the introduction, a special fund, "Robert Collett's Legat," was in 1913 left by the great Norwegian ornithologist whose name it bears, to be used for the support of zoologists working on questions concerning Norwegian fauna.

The recruitment of zoologists is intimately connected with University teaching, in so far as all students who have chosen zoology as their main topic should, before taking their last degree,

hand in a scientific paper. During the world war the recruitment has, as is the same in other branches of science, met with considerable difficulties because of the relatively low salaries paid to scientific workers. Through the immense rise of the cost of living, young people have during the war been obliged to abandon an occupation so little lucrative as that of scientific work. The last two or three years have, however, seen undoubted progress in recruitment.

Besides the Zoology group of the "Academy of Science" the following organisations exist: "Biologisk selskab" (Biological Society), with about 100 members, and "Norsk forening for arvelighetsforskning" (Norwegian Union of Genetics), with forty-four members, mostly scientists and physicians.

According to their contents, zoological and genetic papers are published partly in "Videnskaps-selskapets Skrifter" (Christiania) or in more special periodicals, such as "Archiv for Matematik og Naturvidenskab," "Norsk Entomologisk Tidsskrift," "Norsk Fiskertidende" (all edited in Christiania), "Norsk Ornithologisk Tidsskrift" (Stavanger), but to a great extent also in foreign periodicals.

Relations with foreign zoologists are constantly maintained by means of the exchange of papers, by correspondence, or by personal collaboration. A number of foreign periodicals are subscribed for by the laboratory; others can be obtained through the University Library. The exchange of periodicals is, however, considerably more developed in the case of British and German zoological science than in the case of relations with France. Upon this point progress would be very desirable.

Among Norwegian zoologists whose work has been of influence abroad, one name should be mentioned in the first rank, viz., that of *Professor G. O. Sars* (b. 1837). His investigations into the development and migrations of cod and herrings, into the Arctic mollusca, and, above all, into the lower crustaceans, which play so great a part among the pelagic fauna of all lakes and oceans, have placed him in the first rank of zoologists working on systematic lines. Even now, with his 86 years of age, *Professor G. O. Sars* is continuing his work with indefatigable interest. The younger generations of University zoologists are engaged in investigations of various kinds. *Dr. Johan Hjort*, since 1922 professor at the University, is continuing the exploration of oceanic currents, which before the war was carried on by him, as head of our *Fischerie's Survey*, in collaboration with the other nations bordering on the North Sea. In the zoological laboratory, or in connection with it, investigations are made especially on embryology and heredity, but also systematic investigations upon various branches of Norwegian fauna.

The one great difficulty of our work is the want of space and of financial resources for an effective enlargement of the laboratory. A new zoological institute is, however, planned, and it is hoped that within the next ten years this plan may be realised.

The Biological Station of the University at Drøbak is situated on the Kristianiafjord, about two hours journey from Christiania. It was founded in 1895, and has room for about ten students. Its director is at present *Dr. Hjalmar Broch*, one of the lecturers in zoology. The station is open for students during two summer months only, July and August. But during the whole year specialists may visit it for short excursions. Many foreigners have in the past used the opportunity afforded them of making investigations at this station into marine fauna or flora.

The Zoological Museum of the University, which since 1910 has had its own buildings at some distance from the laboratory, has a scientific staff of one professor and three superintendents of special sections of the museum. Thanks to *Professor R. Collett* (1842–1913), who was the curator of this museum during a long series of years, the ornithology of Norway is here especially well represented.

The Natural Museum of Trondhjem, belonging to the "Kgl. Norske Videnskabers Selskab" (Royal N. Academy of Science), is older than the University, having been founded by the famous *Bishop Gunnerus*, already mentioned in the Introduction. The very remarkable fauna of the Trondhjemsfjord, which contains a multitude of coral reefs, is well represented in the collections of this museum.

The scientific staff consists of two superintendents, one of whom is also the director of the *Biological Station of Trondhjem*. This station was opened in the year 1900. It is a State institution in so far as it is administered under a State Department. Its budget is, however, composed of

grants given partly by the State, partly also by the community, or by more or less private institutions of Trondhjem.

Besides purely scientific investigations upon the marine biology of the Trondhjems fjord, this station is engaged also in the more practical work of plaice-hatching. This latter side of its activity is followed with special interest by the public, and it is a well-known fact that the plaice fisheries have in the districts round Trondhjem been considerably augmented within the last ten years. The laboratory of the station is good. Since, however, the curator, *Dr. O. Nordgaard*, is at present the only scientist attached to it, the laboratory cannot be kept permanently open for students, although it has proved to be a favourite place for shorter excursions. Before the war many foreigners, especially Russians and Germans, visited the station. At regular intervals of a few years the students of zoology of the University also visit the station in order to study the marine fauna of Trondhjemsfjord, which, with its abundance of living coral reefs, is of extreme interest. To this biological station belongs an excellent researchship, ready for award since 1920, and carrying the name of the famous bishop, "*Gunnerus*." The leader, *Dr. Nordgaard*, is especially interested in the investigation of the most easily fossilising groups, such as molluscs and bryozoans, and in comparing their recent distribution and conditions of life with fossils of the same groups, thus making contributions to a study of the development of this fauna after the glacial epoch. The results are published in "*Det Kgl. Norske Videnskabers Selskabs Skrifter*" (Trondhjem).

The zoological department of *Stavanger Museum* is at present managed by a conservator, assisted by a preparator, who, however, works for all of the three departments of the museum. The working expenses of the department are covered by the general estimate of the museum, which at present amounts to about 16,000 kroner, to be distributed between the three departments, when the common working expenses have been paid. Formerly, this department collected species of animals of all classes to be employed as exhibition material for the public; but during recent years the work has been concentrated upon the collection of certain species of animals, chiefly from the district round the museum. The present conservator, *H. Tho. L. Schaanning*, has thus mainly concentrated his activity upon ornithology, and hopes in future to be able to develop the zoological department of the museum into a central institute of ornithological research, one of his aims being the erection of a biological station for research work on the life and development of birds. *M. Schaanning* has also started experiments in bird protection in certain parts of the district ("*Jæderen*"), experiments which have met with great interest and sympathy, and which, it is to be hoped, will lead to good results.

Natural Museum of Tromsø.—This museum, which is situated at a latitude of nearly 70 degrees, has, of course, its field of investigation in the Arctic. Although its collections include specimens of ethnographical, geological, archæological and botanical interest, zoology has always been placed in the first rank in the work of this museum. Thus *Dr. Sparre-Schneider* has, by means of his investigations and collections, laid a solid foundation for our knowledge of the Arctic land-fauna of Norway. Many problems present themselves to the zoologists of Tromsø Museum, especially problems regarding the adaptation of the various species to the conditions of life in this region, with the long and dark winter night and the relatively short summer lighted by the midnight sun.

A difficulty of this scientific centre is, in the first place, its isolated position in the far North, which makes it difficult to keep there continuously a competent scientific staff. A further development of its scientific library and its laboratory equipment, and a budget permitting the functionaries of the museum, through regular visits, to keep in personal contact with more southern institutions, will be the best way of facilitating the solution of the many interesting problems of an Arctic museum.

All this is now being attempted, and it is to be hoped that this field also of zoological research will, in the comparatively near future, be effectively attacked by Norwegian zoologists.

(Signed) KRISTINE BONNEVIE.

ZOOLOGICAL LABORATORY,
UNIVERSITY OF CHRISTIANIA.
June 1923.

II.

Bergen's Museum.

The zoological department of Bergen's Museum has, since 1907, developed from being only a collection with a staff of two conservators to a series or more or less independent institutions, viz.:—

The Zoological Exhibition for the public ;
The Scientific Collection ;
The Zoological Laboratory ; and
The Marine Biological Station.

The *Zoological Exhibition*, which, besides representatives of the various systematic groups, contains also a complete collection of Norwegian vertebrates, is very popular. This is proved by the very considerable number of visitors, as well as by the valuable specimens (rare animals) sent to the Museum from the country districts.

The Scientific Collection is a very rich one, and especially representative in respect of the marine fauna of Northern Oceans. It contains, among others, one of the largest European collections of whale embryos and skeletons.

As part of the scientific magazines, two specific collections have recently been founded. One contains skeletons of Norwegian domestic animals, chiefly of horses, sheep and dogs. A regular and valuable augmentation of this collection is secured by means of a Government Bill, making it a duty for horse-keepers to hand in to the museum osteological material of animals, the pedigrees of which are found in the stud-books. This material will after some time be of the greatest value for a study of the development of the race of horses as well as of the inheritance of race characteristics.

The other collection contains all skeleton remainders of Norwegian vertebrates brought by archaeologists, and forms an interesting supplement to those of recent times.

Zoological Laboratory.—The professorship of zoology ("Den Sundt'ske zoologiske lærestol") was established in 1906, and since that time a course, corresponding to that of the University, has been given. The number of students is, however, not great—a natural consequence of the fact that a whole scientific faculty has not yet been definitely established.

Biological Station.—As early as 1891 the first biological station was erected in the near vicinity of the Museum. With the expansion of the city of Bergen, however, the pollution of the sea-water has necessitated the building of a new station, which was opened in 1922, and is most favourably situated at *Herdla*, one of the islands of the Norwegian skerries, two or three hours journey from Bergen. This new biological station is administered by the professor of zoology ; it has seventeen working tables, open to scientists of all nations.

International courses in marine biology were before the war annually arranged by Bergen's Museum, and visited by students from the various countries of Europe. As soon as possible, such courses will again be opened.

A description of the station is found in "Bergen's Museum's Aarbok, 1922".

In accordance with the development of zoological activity the *scientific staff* has in later years been augmented. In 1912 the staff consisted of one professor with two conservators. At present (1923) the professor of zoology is assisted, besides by the two conservators mentioned above, by one amanuensis at the laboratory and another at the biological station.

The international relations of Bergen's Museum are very considerable, and consist in a considerable exchange of its periodical, "Bergen's Museum's Aarbok," with foreign books and periodicals. The scientific collections of the museum have always willingly been placed at the disposal of foreign scientists, who in considerable numbers have used the opportunity of investigating the type-specimens of marine forms. Also the laboratories of the biological station have to a great extent been used by foreign scientists.

The war has, of course, diminished these international relations, the economic difficulties of several European countries having hindered a rapid renewal of the connections broken through the

war. In recent years, however, an improvement in the situation is distinctly noticeable, especially in respect of relations with West European countries.

The exchange of material and publication has, as far as possible, been continued with all nations during the war, in order to facilitate the work of scientists in the belligerent countries, and also in order to emphasise the neutral and international character of science.

(Signed) AUG. BRINKMANN.

BERGEN'S MUSEUM.
June 1923.

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As will be seen from the above statements upon various branches of Norwegian Natural Science, there are certain traits common to them all.

The financial resources for research work can, at present, thanks to the scientific funds, be said to be satisfactory, and so is the opportunity offered to young specialists to go abroad to foreign Universities.

The salaries of scientific workers have been considerably raised within the last ten years, that of a professor now reaching kr. 13,000, while the lecturers are grouped with the teachers in gymnasia with salaries from 5,000–8,000 crowns. But even now the salaries are low in comparison with the high cost of living, so that during the war the recruitment of scientific specialists has met with considerable difficulties. The period of economic depression characterising the last two or three years has, however, caused a remarkable increase in recruitment.

In all branches personal relations exist with foreign scientists, and the exchange of papers and periodicals may, upon the whole, be characterised as satisfactory.

More official relations exist between the northern countries (Denmark, Finland, Norway and Sweden), and there are meetings at more or less regular intervals, the so-called "Skandinaviske Naturforsker møter," the seventeenth of which is being held at Gothenburg this summer.

The scientific institutes of Norway have generally been represented also at the various International Congresses, which before the war were held at regular intervals in the various branches of Natural Science. A general wish exists among Norwegian scientists that international co-operation may again develop upon a truly universal basis.

Hungary :

The General Situation) by O. DE HALECKI,
The Universities) Secretary of the Committee.

India :

The General Situation) by D. N. BANNERJEA,
The Universities) Member of the Committee.

Italy :

The Movement for the Renewal of National Culture, by J. LUCHAIRE, Expert of the Committee.

Japan :

The Teaching of Foreign Languages, by Dr. I. NITOBÉ, Under-Secretary-General of the League of Nations.

Lithuania :

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