

## SCIENCE AND MEASUREMENT

(By Prof. Kerr Grant, M.Sc.)

The famous dictum of Lord Kelvin that "Science is measurement" may perhaps be held to base the definition of "science" on too narrow a principle, for it excludes from its scope not only the mental and moral sciences such as psychology and ethics, but the greater part of those sciences dealing with life and nature like sociology and biology.

Yet there is abundant historical evidence to prove that the progress of any branch of knowledge from an unorganised assemblage of data to a logically interconnected scheme of generalisations—in which latter sense Kelvin doubtless used the word "science"—takes place step by step with the substitution of precise numerical relations based upon enumeration or measurement for vague and subjective estimates of causes and effects.

The full value of measurement in the advancement of a science is seldom attained in its initial stages. In proportion as measurements become more precise with improvements in the instruments employed or the technique of their employment, so does the possibility increase of drawing fresh inferences and discovering unsuspected influences at work.

### Discovery of Argon

A classic instance of a discovery based on increased refinement of measurement was that of the rare gas argon which exists to the extent of nearly 1 per cent. in the air, but the presence of which remained a secret until about 30 years ago.

Lord Rayleigh, in the course of measurements of the densities of some of the commoner gases, executed, however, with much greater care and accuracy than had been shown by others who had previously made these determinations, found a discrepancy between the values obtained from a sample of nitrogen prepared by decomposition of a compound containing it and one extracted from the air. This difference was so slight—about one part in two hundred—that it would probably, perhaps excusably, have been assigned by the average experimenter to an accidental inaccuracy of weighing or measuring the volume of the sample of gas.

But Rayleigh knew precisely the liability to error of his measurements, and was aware therefore that this explanation must be discarded. His further experiments, supported by those of the chemist Ramsay, led to the isolation of argon and the subsequent discovery of a whole group of gaseous elements similar to argon in respect of chemical inertness, the knowledge of which has not only enriched the data and influenced the theories of chemistry, but has led to practical developments already of great industrial importance.

Improvements are continually taking place in the construction of instruments employed for measurement and refinements in the methods of using them. New tools of measurement are also being invented. The discovery of the electron valve by Fleming and De Forest is best known by reason of its use in wireless transmitting and receiving sets for generating electric oscillations in the first, or receiving and amplifying them in the second. It has also a wider if less obtrusive vogue as an aid in fine measurements.

### Sensitivity of Electron Current

By reason of the exquisite sensitivity of the electron current to control by electric or magnetic forces the valve can be used to detect a movement of one ten-millionth of an inch in a charged metal plate, to indicate changes of pressure in the air due to the passage of the lightest cloud overhead, or to magnify the ionising effect of a single alpha ray to the point of visibility or audibility. In such actions it may be compared with a microscope that magnifies one hundred million times.

By methods equally remarkable for their delicacy and simplicity standards of length can be made and compared

with an accuracy of one ten-millionth part of their length. A sensitive spirit level and an accurate surface plate are all-sufficient tools for such comparisons. To my question "What use does such extreme precision serve?" the chief expert in metrology at the National Physical Laboratory replied:—"We find that every new development we make is immediately taken up and applied in workshops or testing-rooms."

Truly, the discipline of the machine-shop becomes daily more and more exacting.

### Triumph of English Clockmakers

In the very important matter of exact time measurement a triumph has been scored by English clockmakers in the production of a clock capable of keeping a rate which varies only by one-hundredth of a second a day in a month, a performance which Mr. Jackson (Chief Assistant at the Royal Observatory of Greenwich) mildly characterises as "remarkable."

After making various corrections for computable errors a formula was found for the rate of "Shortt 3," which has been under observation at Greenwich since January 1, 1925. It fits the astronomical observations over a period of six months with a departure never greater than one-tenth of a second. Such accuracy might well be deemed adequate to the most fastidious purposes.

Mr. Jackson, however, concludes his report with the words:—"It appears that the principle of construction of these clocks is such that they could be used to check the uniformity of the earth's rotation if only material stable for several years to one part in 100 millions could be obtained for the manufacture of the pendulums. At present the two 'Shortt' clocks have been running continuously for 20 months, and a run of a few years would possibly suffice for errors of one second to accumulate in the earth's rotation, but a variation of 1 per cent. in the rate of growth of the pendulums would introduce greater irregularity in the clock error."

"It appears to be impossible to be certain that any piece of material has the required degree of stability, and until pendulums of different material agree in supporting the motion of the moon and planets against the earth's rotation, clocks will not play an important part in checking the uniformity of the earth's rotation."

ADV. 17. 9. 28

### A SEPARATE CHAIR OF LATIN AT THE UNIVERSITY.

To the Editor.

Sir—In the careful report of my lecture on the place of classical studies in the Empire, to which you have very kindly given space this morning, may I correct one natural error? At Manchester we have not one chair of Latin, but two, besides a separate chair of Greek, and it is the only British university yet so well provided. The second chair of Latin is known as that of Imperial Latin, since it is concerned with the Imperial period, but the Augustan age is treated as common to both professorships. May I take this opportunity of expressing my cordial pleasure at the sympathetic reception which has been given in Adelaide to what I venture to call the message from Manchester which I brought. I could not have accepted even such generous invitations as came to me from the Classical Association of Victoria, and seven other Australasian University cities, had not the council of the University of Manchester granted me leave of absence for half its autumn term to enable me to come. The centre of English manufacturing commerce is also the strongest centre of popular interest in classical study and a city not slow to acknowledge its duty to the service of the Empire. That in bearing this greeting it has been my fortune to see something of the work of the University of Adelaide, and its promise of even greater work in the future, will be to me one of the most happy recollections of my life. And if the message entrusted to me should have contributed even in the most fractional degree towards persuading your responsible citizens of the great need there is for establishing a separate chair of Latin in order that, on the side of the Humanities, their university may take its proper rank among the fruitful centres of the world's learning, it would be to me a very great reward. In sincere gratitude for the generous sympathy and hospitality which I have enjoyed.—I am, &c.,

R. S. CONWAY.

September 15, 1928.

REG. 18. 9. 28

## AUSTRALIAN MUSIC.

### Higher Standards Cultivated.

Professor W. A. Laver, Ormond Professor of Music at the Melbourne University, is visiting Adelaide for the examinations of the Australian Music Examinations Board, which were begun on Monday, and, in a brief interview, he said he was impressed with the general standard of the musical student in Australia. It compared favourably, he said, with any part of the world, and that opinion was expressed after a careful study of the position during a lifetime devoted to music.

It was also the studied opinion of many musical critics and artists who had come to Australia from other world centres usually considered to be the home of music and its culture, that the Australian standard was improving rapidly, there being a fine taste for high-class music developed during recent years. This was reflected in the increasing desire of famous artists to come to this country.

### Loves His Work.

Probably no person has been more actively associated with music in Australia than Professor Laver, who retired about two and a half years ago from the position which he held. He admitted yesterday, in reply to a question, that he did not like the inactivity of a quiet life, and when the opportunity offered of taking the position vacated by Professor Heize, the present occupant of the Ormond professorship, who is in Europe on a holiday, he immediately stepped into the breach. After completing the examinations in Adelaide, he will return to Melbourne, and subsequently go to Tasmania.

Commenting on the examinations conducted by the Australian board, Professor Laver said they were growing in popularity each year. During the previous 12 months more than 17,000 students were examined, and it was believed that that number would be exceeded this year. One of the features of the examinations was that the examiners commented upon the work of the student, pointing out the weaknesses for the benefit of the teachers. No other examination board did this. In addition, all the fees received were retained in Australia for the benefit of music, scholarships being awarded, and they had been of distinct benefit to Australians whose talent had been sufficient to send them overseas.

REG. 18. 9. 28

## KOONAMORE STATION.

INTER-ALIA

Four miles from the homestead is the Koonamore Flora Reserve (comprising two and a half miles), which was a few years ago vested in the University Council. There interesting work has been carried on by Professor T. G. B. Osborn (now in Sydney) and his successors to study the regeneration of our native flora. Mr. Sidney Wilcox and his sister gave practical financial support to enable this work to be carried out.

NEWS 19. 9. 28

## CANCER RESEARCH

Government Grants £5,000

### CONDITIONS IMPOSED

The Government, in response to a request made by the special committee appointed by Adelaide University to investigate the problem of cancer, has agreed to grant a subsidy of £5,000 to the committee, on the condition that an equal amount is subscribed by the public, and that the Federal Government also contributes £5,000.

This statement was made this morning by the Hon. H. Tassie (Chief Secretary), who added that the committee had been advised to that effect.

REG. 20. 9. 28

## CANCER RESEARCH.

The Government, in response to a request of a deputation from the Cancer Research Committee, has agreed to grant a subsidy of £5,000 to the committee, on condition that an equal sum is raised by the public, and that the Commonwealth Government also contributes £5,000, making a total of £15,000. This information was given by the Chief Secretary (Hon. H. Tassie) on Wednesday.

## THE RHINELAND

(By Prof. W. K. Hancock)

During the last week the newspapers have been full of gossip about the allied troops in the Rhineland and the chances of their being withdrawn to satisfy Germany. To the plain man this is rather perplexing. Did not the great Powers a few weeks ago sign a solemn engagement to renounce war as an instrument of national policy? Did not Britain and France, Germany, and Italy join two years ago in the Locarno agreement, which guaranteed for ever the eastern frontier of France? Do these treaties mean nothing at all? What can they mean when we still think it necessary to keep our bayonets on German territory?

In September, 1926, the world imagined that this last act of the war (for, so long as German soil is under foreign occupation, the war is not really over) had been finished with. Dr. Stresemann and M. Briand had come to an agreement at Thoiry, and had allowed the terms of that agreement to become known.

Germany was willing to place on the market railway bonds to the value of a milliard and a half marks, with the object of saving the French franc. France in return would consent to a rapid evacuation of the Rhineland. In addition, in consideration of a substantial cash payment, she would restore to Germany the Saar Valley with its rich coalfields.

### Failure of Understanding

There are practical reasons for the failure of this understanding. In the first place, it was never accepted by the French Cabinet. M. Briand was unable to persuade M. Poincare. Any financial help which Germany could offer must come ultimately from the United States of America. Why not go to America direct?

M. Poincare, in fact, found other means of saving the franc. Why, then, should France resign what she considered to be a very tangible form of security for German reparation payments? The Germans, indeed, claimed that, by accepting the Dawes plan, they had satisfied the legitimate demands of the Allies.

But France remained suspicious. Not until 1928 would Germany be called upon to meet her full obligations under the Dawes plan. France doubted whether the plan would stand the strain. Whatever the financial experts may tell her, she still remains suspicious, and hangs on to the Rhineland as "a bird in the hand."

Security for reparations, however, is not the chief point at issue. Between France and Germany there is a great gulf fixed in opinions on the Treaty, the League, and the realities of European politics. The Germans have satisfied the Allied Commission of Control that their disarmament is complete. The Reparations Commission has no complaint to make against them. Is it not, then, insulting and unnecessary to keep an army of occupation on German soil?

### Only Hope for Peace

At Locarno Germany indicated her resolve to renounce for ever the old frontier quarrel with France. Does this count for nothing? Germany claims evacuation as a right; but since a free Rhineland is necessary for her self-respect she is willing to bargain with France, to offer substantial compensation. The only hope for the future peace of Europe, she says, is in a sincere Franco-German collaboration. But this is impossible until Germany is free.

The French consider their occupation of the Rhineland a pledge not only for reparations payment, not only for German disarmament, but for the execution of every clause of the Peace Treaty.

It is not enough, M. Poincare has said, that Germany should renounce war. She must renounce in heart and soul all hope for any modification of the Peace Treaty even by peaceful means—for example, by an appeal to the League of Nations, which is provided for in the Covenant.

France is thinking particularly of the Anschluss, the movement for union