Congrès du Palais de la Découverte

International Meeting in Paris

WHEN the President of the French Republic entered the main hall of the Sorbonne to take part in the opening of the 'Congrès du Palais de la Découverte', many were struck by the civic simplicity of his appearance, contrasting strangely with that usually associated with assemblies in which the political heads of States take part. Even the accompanying sounds of the Marseillaise seemed merely to give an objective commentary on the political situation: 'Contre nous de la tyrannie l'étandard sanglant est levé. . . .' The opening speeches of the Minister of Education, and of Jean Perrin, who acted as president of the Congress, echoed this anxiety. Both speakers affirmed their belief that the independent search for truth embodied in science is the best safeguard of civilization against threatening destruction. Jean Perrin went to the length of acclaiming science as the new supreme religion destined to reign over the happy future.

At the first moment these utterances appeared strange and exaggerated, yet as the meeting went on, bringing out one symptom after another of the world-wide struggle of international science with various local tyrannies, they gained a very simple significance.

The political situation of science unfolded itself as the various delegates rose to greet the Congress. When, after the English and the Americans, the Germans got up they were listened to with the consideration due to the hardy survivors from a great flood. Later in the evening, in conversation with one of the German delegates, he spoke to me about a better understanding between the German and French peoples; and three delegates used what seemed to me to be the same official phrase. The Italian delegates did not mention politics. The U.S.S.R. was not represented by a single member. Great applause went up when the delegate of 'the Spanish Government' was called. He said little, but the words 'in the name of the Academy of Madrid' made all the subdued terror of the situation flare up in a momentary blaze. The Portuguese who followed him, the Jew who spoke later for the University of Jerusalem, evoked in turn their particular fringe of political associations, and so did the fact that no Japanese delegate appeared. By the time the list had finished the political scene of the world was fully illuminated, and on it the new situation of science was well visible.

Science, and generally the independent search of truth, is destroyed when political liberty falls. The totalitarian States which claim to be supreme spiritual beings can admit no independent thought, be it religious, political or scientific. By its very nature such thought must claim superiority to temporal power and is therefore incompatible with totalitarianism. Thus it is quite logical that in such States the position assigned to science by the official philosophies of dialectic materialism and racialism respectively should be merely to serve the higher aims of the State.

In view of this common fate shared by independent science and political liberty, the opening speeches of the Congress appeared in a clearer light. Their appeal to science from the depth of political anxiety was guided by the recognition that the link between science and liberty is completely reciprocal: while the profession of truth needs for its protection the free institution of democracy, these institutions themselves must decay and fall if people abandon their belief in reason. The idea of liberty derives its strength from many roots but among these there is one most vital: the belief that men can reach a better understanding by free discussion, that in fact society can be continuously improved if public life is steadily guided by reasoned controversy. It was a controversy on the question of a single fact from which about half a century ago the present political system of France emerged. A handful of men had faced the violence of the Government and the fury of the populace to establish the innocence of Dreyfus. They won, and modern political France was built on their victory. To-day the rise of a new threat to liberty causes the French Government to appeal with anxious hope to the men whose profession embodies the right to reasoned controversy and whose political duty is to defend this right. M. POLANYI.

PHYSICS

THIS international congress of physicists, chemists and biologists was conceived and organized within ninety days, chiefly through the initiative of M. Frederic Joliot-Curie, who was the chairman of the executive committee. It was attended by eleven hundred men of science

and four hundred other members. Its aims included the intellectual celebration of the success of the Palais de la Découverte, the unique quality of which was described in NATURE of August 21, p. 328, and which was visited by two million persons between May 25 and October 7.

The chief motive of the congress, which gave it exceptional vitality, was the concern of many of the leading men of science in France to struggle for the preservation and extension of the conditions upon which culture, science and democracy are equally dependent. M. Jean Perrin, M. Paul Langevin, M. F. Joliot-Curie and their colleagues are determined to act in support of these principles, which they regard as sacred. M. F. Joliot-Curie told me that good scientific workers would not willingly spare time from the fascinations of research, but to-day it was their duty to appeal to the people.

The scientific meetings were arranged in thirty-seven sections. It was characteristic of the anti-nationalistic spirit that no opening paper was given by a Frenchman. All the first speakers were non-Frenchmen of international standing. Prof. P. Scherrer (Zurich) gave a review of the results published on the nuclear reaction $D+D=\,^3He+n$. Various experimenters find that the number of deutons needed to produce one neutron varies by a factor of 1,000, according to the compound of deuterium bombarded. Scherrer has bombarded heavy orthophosphoric acid with a beam of deutons of 80 microamperes and 130 kv. The number of neutrons and their energy were measured from recoil atoms of helium with an oscillograph in an ionization chamber. For a pure D target and 100 kv. it is calculated that $8{\cdot}9 \times 10^6$ deutons produce one neutron. The energy of the nuclear reaction is $2{\cdot}92 \pm 0{\cdot}3$ Mev., corresponding to a mass for the neutron of 1·0090.

Dr. J. D. Cockcroft described the new high-tension equipment at the Cavendish Laboratory. This is housed in a hall of dimensions 25 m. × 13 m. × 14 m. A 1·2 Mv. generator of the multiplied voltage type has been installed, and another of the same type giving a continuous 2 Mv. is being installed. A 12 Mv. cyclotron is also being constructed. He discussed the transmutation of boron with fast protons. The experiments show that it breaks into three alpha particles in two steps. The first involves the formation of a nucleus excited to the very high level of 3 Mv. He discussed the physical significance of the separate existence of such an excited nucleus.

Prof. Niels Bohr (Copenhagen) described the essential differences between the dynamics of the nucleus and that of whole atoms. In the latter the movements of the constituent particles can be treated to a high degree of accuracy as those of free particles in isolation. This leads to a great simplification, and a complete explanation of the details of the periodic table of the elements. In the nucleus the conditions are different. Here the constituent particles are very closely packed, and therefore under the mutual influence of forces which act only at very small distances. They act, therefore, as a collective system, and the energy of the nucleus is to be conceived as shared among the constituent particles. Disintegration occurs when sufficient energy becomes concentrated through mutual interactions on one particle. The final result of the nuclear reaction is determined by a concurrence between the various possibilities of disintegration and of the radiation of the collective system. From this point of view, the capture and expulsion of swift particles has analogies with the phenomenon of evaporation of a molecule from a liquid surface. One arrives at a notion of the 'temperature' of the collective system, which determines the speed of the ejected particles. In the case where the ejected particles are charged, the influence of the electrostatic forces is predominant, but with neutrons these forces do not exist. The collisions of slow neutrons exhibit resonance phenomena analogous with optical dispersion. Considerable progress has been made with the help of the theory of the collective system towards the understanding of the new data revealed by nuclear transmutations. Bohr remarked that very surprising analogies between the structure of nuclei and of organic molecules might be discovered.

Prof. P. M. S. Blackett (London) gave a thorough analysis of present knowledge of cosmic ray particles. The absorption of the soft component of energy up to 250 Mv. obeys the quantum theory, and the theory of Bhabha and Heitler explains the formation of cascade showers in thick plates. The evidence that the soft rays are Dirac electrons is satisfactory. But what are the hard rays? They penetrate a mile of water and produce their own type of showers. Examination of 5,000 tracks shows that only 20 exhibited abnormal ionization. All the heavy particles appear to be protonic, and Anderson's suggestion of the existence of a heavy electron seems to be rather too simple to explain the experimental evidence. Blackett suggests that, if the hard cosmic rays consist of heavy electrons, then it follows that they must have a variable rest-mass which is a function of their energy, and must change into ordinary electrons below energies of 250 Mv. But other explanations are possible.

Dr. J. Clay (Amsterdam) discussed the penetration of matter by cosmic rays and gave evidence for the existence of artificial radioactivity produced by cosmic rays. He finds that if a chamber

is suddenly covered with lead, the intensity of the cosmic rays passing through the chamber does not fall to a new steady value suddenly. There is a period of gradual decline which suggests the presence of artificially radioactive atoms with half-lives of eight minutes. He has observed similar effects when the lead is removed.

Prof. G. Lemaître (Louvain) gave an account of his analysis of the deflection of cosmic rays by the earth's magnetic field according to Størmer's theory. The equations were developed in a form of Fourier series, and solved with the Bush machine at the Massachusetts Institute of Technology. The principal cone has been exactly determined up to latitude 30°, and the Johnson latitude effect has been satisfactorily explained.

Dr. W. Bothe (Heidelberg) discussed the different methods of the experimental determination of nuclear levels, depending on the spectra of gamma rays and ejected particles. He gave some new data concerning isomeric nuclei, and results of proton and neutron capture which may be interpreted by Bohr's new theory.

Dr. P. Debye (Berlin) gave a lucid exposition of the adiabatic demagnetization method of reaching very low temperatures. He remarked that the method is an excellent demonstration of Boltzmann's principle, because the application of a magnetic field has the effect of increasing the amount of atomic order, which is conserved during demagnetization, so the effect is equivalent to a cooling. Simon's recent experiments show that heat anomalies occur in two regions under the adiabatic process. In the second, at very low temperatures, ferromagnetic properties appear. He explained that the atomic theory of paramagnetism accounts for the experimental data, and also the considerable effect of relatively weak magnetic fields on calorific properties. He extended the notion into the domain of nuclear magnetism, and said that the calculations of Heitler and Teller on the time necessary to produce thermal equilibrium deserve very close attention.

Prof. E. Wiersma (Delft) discussed the recent progress in low temperature research, and Prof. F. Simon (Oxford) reviewed the recent experimental work. He referred to the impossibility of reaching absolute zero, and described the progress in the technique of liquefying helium. He said that Talmud in Leningrad has successfully used the 'bellows' method of liquefying helium which he had proposed ten years ago. Prof. M. Polanyi (Manchester) summarized the Griffith, Taylor, and other theories on the deformation of solid bodies. J. D. Bernal contributed to the discussion with an account of Stepanov's thermal theory of deformation.

Sir C. V. Raman spoke on the optics of colloids, and on ultrasonics in liquids. He described the importance of the optical study of colloids for the determination of the size, form and distribution of the particles, and the analogy between the Tyndall effect and the diffusion of light by molecules. His general lecture on ultra-sonics was illustrated by striking metaphors. He described the experiment of Debye and Sears, and Biquard and Lucas, in which fringes are produced by light passing through a liquid transmitting ultra-sonic waves, as making sound visible, and as introducing the accuracy of optical technique into experiments on sound.

Dr. B. Van der Pol (Eindhoven) gave a lecture with experimental demonstrations of non-linear vibrations, and explained their importance in mechanics, electrical engineering and biology.

Prof. W. L. Bragg (Teddington) spoke on the structure and classification of silicates; Dr. U. R. Evans (Cambridge) on the state of the surface of bodies during corrosion; and Dr. F. London (Paris) on supraconductivity in aromatic compounds.

J. G. CROWTHER.

BIOLOGY

THE Palais de la Découverte, which represents a great effort of popularization on the part of French science, is an attempt, and a very successful attempt, to parallel the South Kensington Science Museum and the Deutsches Museum. In the biological section, for example, there are exhibits of evolution phenomena, embryology, tissue-culture, etc., and continuous demonstrations of such experiments as the Berger rhythm. All the most modern devices such as neon lighting and automatic switching are used to give life to the exhibits and diagrams.

On Friday, October 1, there was no specifically biological meeting, but many biologists took advantage of an elegant description of the polyterpene compounds by Prof. Ruzicka (Basel), who did not fail to point out the biological importance of the sterols and lipochromes while tracing the chemical similarities between them, and their transformations. The following day was entirely devoted to embryology. Prof. Holtfreter (Munich) gave a lucid address in which he went over the fundamental discoveries on which our knowledge of the material interactions of the parts of the embryo during its development is based. He described recent results obtained by his method of explantation of parts of amphibian embryos; thus a piece of the dorsal surface is taken from the neurula and cultivated in isolation: if from the spinal region, a neural ball is formed, surrounded by ectoderm; if from the eye-region, an eye-cup covered with ectoderm is formed, to which a naked piece of brain is attached. Such experiments are