This is notably true of the statement, "the continuance of progress now largely depends upon the scientists of the neutral nations." But then follows the sentence "American scientists can best fulfill their share of this responsibility if the United States remains at peace." Is this not a categorical conclusion based upon premises which are still in the making? Should scientists endorse *as scientists* a conclusion reached in this way, thus responding to the attempt to "crystallize their attitudes toward the conflict" while all is yet in flux?

I venture to raise this question because of the plan to present the peace resolution to the President of the United States as representing the view of American scientists generally.

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ABSTRACTS OF PAPERS

(*Continued from p. 457*)

A method for finding certain types of definite integrals: H. BATEMAN. The method devised by Poisson and Lerch for finding an integral $I(t)$ which exists for $R(t) > 0$ is to first calculate the Laplacian integral whose integrand is $I(t)\ exp\ (-xt)dt$. The corresponding method in which the integrand is $I(t)t^{\alpha}\,dt$ is based on the theory of the Mellin inversion formula, but in using it in practice to obtain effective expressions for $I(t)$ it is advantageous to employ theorems, analogous to Laurent's theorem, for the representation of a function analytic in a strip in a series of rational functions instead of a series of powers of x. Examples of such representations are given.

Solar faculae and solar constant variations: HENRYK ARCTOWSKI (introduced by C. G. Abbot). The daily solar constant values, for the years 1926–1930, have been compared with the areas of faculae in order to search for the direct correlation between solar phenomena and the variations of solar radiation advocated by Dr. Abbot. The solar constant data have been taken from volume 5 of the Annals of the Astrophysical Observatory of the Smithsonian Institution and those of the areas of faculae from the results of measures made at the Royal Observatory, Greenwich, of photographs of the sun taken at Greenwich, at the Cape and in India. It has been found that the mean values for the days of maxima and minima of the solar constant and the five days preceding and following these days give curves similar to those of the faculae of the same dates. The mean maximum as well as the mean minimum of the solar constant variation, however, are slightly in advance of those of the faculae.

Irregularities of absorption in the galaxy: JOEL STEBBINS, C. M. HUFFER and A. E. WHITFORD. In continuation of work previously reported to the Academy the absorption in the galaxy has been derived from measured colors of stars known to be intrinsically white but which are reddened by the effect of dark material in the spaces between the stars. While in general the interstellar dust is concentrated in a thin layer near the main plane of the galaxy, much like the ham in a sandwich, there are many irregularities in its distribution. The layer is of unequal thickness in different directions, being more dense toward the center than toward the anti-center of the system, and there are numerous detached clouds of dust with clear spaces between them and the main absorbing layer. Toward the center where the absorption is greatest, a clear region has been detected extending to 3,000 light-years from the sun, while not far away are dark clouds nearer than 1,000 light-years. However, there is small chance of penetrating through to the galactic center at 30,000 light-years. As the estimated dimensions of our own galaxy and the distances to other galaxies depend upon proper allowance for the absorption of interstellar dust, the irregularity of this absorption complicates such estimates more than has been hitherto realized.

Perceived size of the moon as a function of angle of regard: EDWIN G. BORING and ALFRED H. HOLWAY. The perceived diameter of the moon at the horizon is from one and one half to two times the perceived diameter in culmination. The usual explanation of the moon illusion is that the horizon appears more distant than the zenith, although the moon continues to subtend the same visual angle at every elevation, so that the ascending moon, appearing to approach the observer without increase in the size of its retinal image, must seem as an object to get smaller. This theory, which refers perceived size to perceived distance, provides no explanation of the variation of the perception of distance with the elevation of the observed object. It is known further that the illusion holds for objects more than 30 m distant, but is greatly diminished as the radius of observation is decreased below 30 m. We have shown that the perceived size of the moon decreases with its elevation from the primary position of regard. In this function the elevation of the moon is relative to the head of the observer and not to his body or to the earth. Thus for the supine observer the horizon moon is smallest and the moon in elevation largest. The perceived size diminishes when the head is kept fixed and only the eyes are elevated. It does not change when the head is tilted back so that the eyes are not moved with respect to the head. The direction of change of perceived size is reversed below the primary position. To the erect observer the moon below the horizon, if it could be visible, would appear about as much smaller, angle for angle, when compared with the horizon moon, as the moon in elevation seems smaller. The same form of function is found for the sun when two mirrored images of it are compared through dark filters. The general rule is that objects at a great distance appear largest when the eyes are in the primary position with respect to the head, irrespective of the position of the observer's head and body. No final explanation of the moon illusion can be formulated at present, but these results are more consistent with an explanation in terms of relative torsion of

the two eyes than with the older explanation which referred the illusion to compensatory ocular convergence.

The chemical separation of isotopes: HAROLD C. UREY. The chemical separation of the isotopes of nitrogen and carbon gives the most rapid separation of these isotopes which has so far been devised. Experiments have been made in which 0.75 gram of N^{15} and 0.15 gram of C^{13} have been transported per 24-hour period. The simple process fractionation factor for the exchange reaction between ammonium ion and ammonia is 0.967, favoring the concentration of N^{15} in the ammonium ion, while the simple process factor for the exchange reaction between hydrogen cyanide and cyanide ion is 1.025, favoring the concentration of C^{13} in the gas. These rates of production are for laboratory production. There seems to be no reason why the method can not be extended to plant size apparatus with the production on as large a scale as is required.

Corrosion resistant alloys: H. H. UHLIG and JOHN WULFF (introduced by Karl T. Compton). Various solid solution alloys of the transition and pre-transition group elements have wide application due to their corrosion resistance. This is attributed to their passivity which is usually explained on the basis of an impervious oxide film. Electrochemical, threshold potential and corrosion data are not explained in simple terms on this viewpoint. A consideration of such data for Fe-Cr, Fe-Ni and Cu-Ni alloys shows that corrosion resistance begins at critical alloy compositions; thus, atomic ratios of five Fe atoms to one Cr or two Fe to one Ni are sufficient to induce passivity. This may be attributed to the ability of Cr in the Fe-Cr system to provide sharing possibilities for five electrons of the five nearest Fe neighbors, based on the assumption that Fe with one shared electron is passive. The solution of hydrogen in the surface lattice destroys passivity, the hydrogen electrons displacing Fe-Cr bonds. Chemo-sorption of oxygen may enhance the passive nature of boundary alloy compositions as well as pure metals by electron sharing similar to Cr. The present electron sharing viewpoint harmonizes many of the divergent theories concerning the passivity of pure metals and provides plausible explanation for the corrosion resistant alloys of the transition elements.

A theory of the structure and process of formation of antibodies: LINUS PAULING. There is developed, on the basis of structural information about simpler molecules, a theory of the structure and process of formation of antibodies which is considerably more detailed than any earlier theory. The theory accounts for many facts, such as the observed antibody-antigen ratios in precipitates, the inhomogeneity of antibodies to a given antigen, and the independence of action of antigens in an immunizing mixture. Among the predictions based on the theory are the following: that the denaturation of antibodies is irreversible; that different antibodies on denaturation and attempted renaturation become identical; that decrease in specificity of the antibody and decrease in antigenic power (amount of antibody produced) accompany increase in number of strong groups in the antigen; that a non-protein and non-polysaccharide substance may have antigenic power if it contains suitable groups and its molecules or particles are sufficiently large; that the synthesis of antibodies *in vitro* might be achieved by denaturing serum globulin and removing the denaturing agent in the presence of an antigen or haptene.

The energy and entropy of extension and spreading of mobile monolayers: WILLIAM D. HARKINS, T. FRASER YOUNG and EDWARD BOYD.

The principle of sufficient reason: GEORGE D. BIRKHOFF (by invitation). The basic importance of the principle of sufficient reason (*i.e.*, that everything has a reason) was first emphasized by the German mathematician and philosopher Leibnitz. By means of it he was led to important conclusions, such as a relativistic theory of space and time in opposition to the absolutistic theory of his contemporary, the great Newton. In fact, this principle formed the foundation of nearly all of Leibnitz's general speculations. The principle of sufficient reason is intimately connected with what may be termed the theory of ambiguity, and with the associated mathematical theory of groups. This relationship may be illustrated by means of simple examples taken from a variety of domains, in particular from mathematics and physics. The fact that the principle as yet plays very little part in biological, psychological and social theory is probably due to backwardness in these highly complex fields of thought. Furthermore, it was conjectured that, in so far as philosophical speculations of metaphysical type are valid, these are always based on the same principle. Thus the general conclusion might be symbolized as follows: Metaphysics $\longleftrightarrow$ Principle of Sufficient Reason $\longleftrightarrow$ Theory of Ambiguity = Theory of Groups.

Nuclear fission: K. K. DARROW (by invitation). This talk pertains to the most newly discovered and most sensational mode of transmutation, in which the entry of a neutron into a massive atom-nucleus brings about an internal explosion in which the nucleus is "fissured" or divided into two fragments which share the total mass and charge between them in nearly equal proportions. (In all other modes of transmutation except those affecting the very lightest elements, the division is into fragments of very unequal mass and charge.) The conversion of rest-mass into kinetic energy, or (as is more commonly said) the release of energy, is unprecedented in scale. A multitude of radioactive bodies, many hitherto unknown, is formed; and there is is spontaneous emission of fresh neutrons in great quantities, possibly sufficient to convert the process once initiated into a self-perpetuating one under realizable conditions.

The origin of the submarine valleys on the continental slopes of the North Atlantic: WALTER H. BUCHER (by invitation). Since the submarine slope topography extends to depths far greater than can be accounted for by removal of the water or vertical uplift of the shelf, the forces that produced them must lie in the ocean itself. As the ocean is a "standing" body of water, the only "currents" capable of producing erosion on the continental slope are such as arise through wave-motion. Only such waves can have an effect on the sea-bottom as have wave-

lengths much greater than the oceanic depths. Two kinds of such waves are known: the tides and seismic sea-waves. The tides produce currents sufficient to keep the submarine valleys free from finer sediment. The seismic sea-waves develop much stronger current-like movements than the tide along shores that lie within certain distances from an earthquake epicenter. They must produce correspondingly stronger action on the sea-floor. The seismic sea-waves are not superficial phenomena, but move the whole water column. They travel across the ocean with wave-lengths measured in hundreds of kilometers, in oceans a few kilometers deep. All water particles, therefore, from top to bottom move in paths that are very flat ellipses, the water traveling in one direction for five to ten minutes and then in the opposite direction with average orbital velocities more than sufficient to erode the sediments of the Atlantic slope. The movement persists for many hours, even a day and more. It is competent to notch the slope as cloudbursts notch desert hillsides. Slumping widens the cut as on land, the tides cleaning out the channel between seismic sea storms. The peculiar distribution in space and time of the cable breaks following the Grand Banks earthquake of 1929 become intelligible as a result of such subaqueous erosion. The growth of the Mid-Atlantic Ridge, largely since Miocene time, has furnished abundant volcanic and tectonic disturbances to supply energy for the observed erosion. Contemporary earthquake activity seems adequate to keep it up.

Minute amounts of chemical elements in relation to plant growth: D. R. HOAGLAND (by invitation). Brief survey of various aspects of the relation to plant growth of chemical elements effective in minute quantities. Following the early work of Mazé and other French investigators, of the Rothamsted Experimental Station, McHargue, and Sommer and Lipman, gradually it has become widely recognized that boron, copper, manganese and zinc have specific and indispensable functions in the metabolism of higher plants. Recent experiments give strong support for the view that molybdenum is also an essential element. Since the quantities involved are extremely minute, to prove indispensability of these elements for plant growth requires a highly refined technique. Nevertheless, deficiencies may occur under ordinary conditions of experimentation in the greenhouse and also in practical agriculture. Numerous previously obscure nutritional plant diseases can be explained on the basis of deficiency of one or more of the elements listed above. As illustrations, cases of boron deficiency in many parts of the world and the experience in California with "little-leaf" or "mottle-leaf" disease, caused by zinc deficiency, are cited. Attention is called to certain phases of the problem of availability of manganese, copper, boron and zinc in soils. Reference is made to present knowledge, still very inadequate, of the functions of these elements in plant metabolism, with respect to photosynthesis, oxidation-reduction, and other enzyme systems, nitrate utilization, etc. Problems of toxicity to the plant from excesses of such elements, especially boron, may also arise. The relation of chemical elements absorbed in small quantities by the plant to its nutritional adequacy, as animal food, has marked interest. The quantitative requirements or tolerance of the plant are not necessarily coincident with those of the animal, although minute amounts of certain metals are necessary for both plant and animal growth.

The chemistry of marihuana: ROGER ADAMS (by invitation). The resin exuded by the pluricellular glandulose hairs of the female hemp plant at the time of flowering contains one or more physiologically active substances. This resin is collected directly or the tops of these plants are cut and dried, the coarse material removed and the product finely ground. These hemp preparations are smoked or incorporated in candies, cakes or other articles of food to be eaten in order to produce intoxication. The name used in the United States for hemp products containing the intoxicating principle is marihuana, in India, hashish. The physiological effect in man may be described briefly as the induction of somatic and psychic changes. An attempt is being made to isolate in pure state the substance or substances causing this action. By proper extraction of the resin or the female hemp tops, a high-boiling viscous product is obtained known as "red oil," which contains an active principle. Thus far all attempts to isolate a single individual substance with marihuana action has failed. Prior to the present study a pure physiologically inactive substance, cannabinol, has been isolated from red oil by British investigators who have shown it to be a dibenzopyrane derivative. A second pure substance, cannabidiol, has now been obtained from red oil. This substance is physiologically inactive but gives many of the tests previously assumed to be characteristic of the active principle. The constitution of cannabidiol has not been fully completed, but experimental evidence indicates it to be a 2-dihydrocymyl-1, 3-dihydroxy-5-*n*-amyl benzene with the position of the two double bonds in the dihydrocymyl residue still to be located.

Viruses and their part in disease: W. G. MACCALLUM (by invitation). Relation of viruses to other parasites, especially in causing disease. Their form and extreme minuteness. Methods of isolation and cultivation. Their dependence upon living cells for growth. Their action in producing disease and predisposing to secondary bacterial infection. Their action in producing antibodies and life-long immunity. Their causal relation to tumor growth. The mode of transmission, often by intermediate hosts, such as mosquitoes. Their fairly specific relation to certain hosts. Recent crystallization of a virus as a nucleoprotein, perhaps with ferment activity. Question as to the borderline between inanimate and living.

BIOGRAPHICAL MEMOIRS READ BY TITLE.

Biographical memoir of Edmund Beecher Wilson: THOMAS HUNT MORGAN.

Biographical memoir of Edward Leamington Nichols: ERNEST MERRITT.

Biographical memoir of Ambrose Swasey: DAYTON C. MILLER.