

*Medicine*

First prizes (200,000 roubles each) to :

Alexei Abrikosok and Nikolai Anichkov, members of the Academy of Sciences of the U.S.S.R., for their studies on "Pathological Anatomy: Heart and Vessels".

Sergei Spasdkukopsk, of the Second Moscow Institute of Medicine, for well-known work in surgery and for the study "Actinomyces of the Lungs".

Second prizes (100,000 roubles each) to :

Kolay Petrov, corresponding member of the Academy of Sciences of the U.S.S.R., for studies in oncology and the surgery of ulcers of the stomach and duodenum.

Sergeii Udin, chief surgeon of Sklifassovsky Institute, for his works "Notes on Field Surgery and Artificial Oesophagus", "Notes on Field Surgery", "Treatment of War Wounds with Sulphamide Preparations" and "Some Impressions and Reflections about Eighty Cases of Artificial Oesophagus".

*Military Science*

First prize (200,000 roubles) to :

Ivan Grave, of the Dzerzhinsky Artillery Academy, for the study "Ballistics of a Semiclosed Space".

Second prizes (100,000 roubles each) to :

Evgenii Barsukov, for the historical study "Russian Artillery in the World War".

Mikhail Dubinin, of the Voroshilov Academy of Chemical Defence of the Red Army, for studies in chemical defence.

*History and Philosophy*

First prize (200,000 roubles) to :

Vladimir Potemkin, Evgenii Tarle, member of the Academy of Sciences of the U.S.S.R., Vladimir Khvostov, jointly with a number of others for a work entitled "The History of Diplomacy".

Second prize (100,000 roubles) to :

Sergei Rubinstein, of Herzen Pedagogical Institute in Leningrad, for his book entitled "Foundations of General Psychology".

## COSMICAL ORIGINS OF THE ELEMENTS

PROF. SUBRAHMANYAN CHANDRASEKHAR, assistant professor of theoretical astrophysics at the University of Chicago, described some results of his investigations of the origin and distribution of the chemical elements of the universe in a paper read during the fiftieth anniversary celebrations of the University of Chicago.

The formation of the lighter elements, including hydrogen and helium, can be accounted for at densities and temperatures not markedly greater than those found at present in the universe, but to account for the formation of heavier elements, such as oxygen, fluorine, neon, sodium, magnesium, aluminium, silicon, phosphorus, sulphur, chlorine, argon, potassium and their isotopes, in their present relative abundance, more extreme conditions are necessary. For the formation of the quantities of these elements in anything like their present relative proportions, the density of a 'pre-stellar' universe of one thousand to one hundred thousand grams per cubic centimetre and temperatures of  $6-8 \times 10^9$  degrees seem to be required.

Under such conditions, however, the very heavy elements, like gold and lead, occur only in very small amounts; it thus appears that the pre-stellar stage must have originated at extreme densities and temperatures when the heaviest elements were formed. As the matter cooled to lower densities, the present relative abundances of the moderately heavy elements like silicon and sulphur resulted under conditions of a few thousand million degrees and densities ranging from one thousand to ten thousand grams per cubic centimetre. Finally, the elements lighter than oxygen were formed at a still later stage, when conditions were not very different from those now existing in stellar interiors.

In discussing the formation of energy in giant stars, Prof. Chandrasekhar stated that whereas the Bethe theory successfully accounts for energy production in the sun and similar stars, it fails to explain energy production in the giants. His own calculations show that the production of energy by the lighter elements, including lithium, beryllium and boron, will take place in a spherical shell rather than close to the centre—burning, so to speak, from the centre outward. The energy-generating spherical shell cannot get very far from the centre, leaving only the inner 35 per cent of the star's mass to provide energy; this, he believes, accounts for the presence of the light elements in the atmospheres of the giants.

The theory that supernovæ constitute an intermediate stage in which extremely heavy stars cast off much of their mass in their 'attempt to settle down as white dwarf stars' was put forward by Prof. Chandrasekhar. He pointed to the analysis by Dr. Minkowski, of the Mt. Wilson observatory, of the central star of the Crab nebula, which was identified as the result of a supernova in our galaxy, which 'blew up' in A.D. 1054. His analysis of Dr. Minkowski's results showed that this nuclear star is half-way between the supernova and the white dwarf stage; thus, it will be a white dwarf by approximately the year 2828.

According to the theory of white dwarfs developed by Prof. Chandrasekhar, the upper limit to the masses of white dwarfs is about twice the mass of the sun. Thus, he said, a massive star may undergo great contraction, bringing about the explosion characterizing the supernova.

## RECENT RESEARCH IN OCEANOGRAPHY\*

By DR. G. E. R. DEACON

THE papers in the most recent number of the *Journal of Marine Research* of the Bingham Oceanographic Laboratory, Yale University, for 1941 cover a wide field.

R. B. Montgomery has used four series of observations across the Straits of Florida near Habana to compare the calculated difference of sea-level between the two sides of the Gulf Stream with the figure given by the tide-gauge readings at Key West. The agreement was poor, and among the main sources of error new emphasis is given to the distortion of the picture of the density distribution which is inevitable owing to the change of tide as

\* Sears Foundation for Marine Research. Bingham Oceanographic Laboratory, Yale University. *Journal of Marine Research*, 4, No. 3 (1941).

the ship works her way across the strait—taking about sixteen hours to complete the section. Better agreement between calculations and tidal data has been obtained farther north along the U.S. coast, and it is suggested that the exposure of the tide-gauge at Key West is not altogether satisfactory.

G. L. Clarke has measured the water transparency and light penetration over a large area south of Bermuda as far as the coast of British Guiana. The waters of the Sargasso Sea and North Equatorial Current were clearest; there was less transparency in the more fertile waters nearer the equator and a sharp drop near the South American coast. The measurements were made with photo-electric cells and compared with observations of the depth to which a 'Secchi disk'—a white disk 20 cm. in diameter—could be lowered before it disappeared. The correlation showed a high degree of scatter, but on an average the disk disappeared at a depth where the illumination was 15 per cent of that incident on the surface. The greatest depth to which the disk was seen was 47 m.; the poor agreement with direct measurements is believed to have been due to unfavourable weather conditions and large waves; the disk was viewed directly over the ship's side and not through a tube dipped below the surface.

H. W. Graham has examined the plankton hauls made from the non-magnetic ship *Carnegie* on her last, ill-fated voyage from California to Samoa. The hauls, which were made from a depth of 100 or 150 m., showed a richer plankton in the tropical region, where there is evidence of the upwelling of deep water, than in the southern part of the temperate zone, where there is an accumulation of warm water with less nutrient salts. The author does not mention recent work by Seiwel and Riley, which has an important bearing on the subject.

F. A. Davidson and Elizabeth Vaughan, of the newly constituted United States Fish and Wildlife Service, describe their work on the relations between density of population, size of fish and time of spawning migration for the pink salmon of south-eastern Alaska. Between 1914 and 1920 while the fishery was expanding rapidly the fish declined in abundance, but increased in size and migrated to the rivers at an earlier date. After 1921, when restrictive regulations were introduced, the fish began to regain its former abundance, but decreased in size and migrated later. The authors summarize many influences which have been found to retard growth in a crowded population, such as the production of autotoxins, growth-inhibiting substances, accumulation of excretory products, reduction of available food, and overstimulation due to increased contacts, but they are inclined to believe that the changes in the pink salmon are mainly the result of the varying competition for food as the population increases or decreases.

Mary Sears compares the phytoplankton productivity of the shallow water over the Georges Bank in the Gulf of Maine with that of the neighbouring deeper waters. It was found that the period of diatom abundance lasted longer in the shallow water; the deeper waters are as rich or richer during the peak period at the end of March, but become relatively barren at the end of a month, while the population of the shallow water falls to a twentieth of its peak value at the end of three months. The bank was thus found to be one of the most productive areas of the gulf.

C. E. ZoBell has combined the most desirable features of many bacteriological water-samplers to

produce one which he claims to be non-bactericidal, easily sterilized and capable of aseptic manipulation under the usual collecting conditions. No metal was satisfactory and the containers were made of glass or indiarubber, sealed with a 4-mm. capillary tube attached by pressure tubing. The frame which holds the container is so arranged that the capillary is broken at a file-mark by sliding a 'messenger' down the wire on which the sampler is lowered. The indiarubber containers were used at the greater depths to avoid the effect of the sudden change of pressure on the bacteria when the sample was aspirated through the broken capillary; the containers were sealed hot and full of vapour, straight from the autoclave, and the indiarubber bulb was sent down in a collapsed state, to aspirate a sample as it returned to its normal shape. The possibility of exchange through the capillary while the sampler was being hauled to the surface was not thought to be serious: owing to the continuous reduction of pressure the main movement is outward.

## SMOKE ABATEMENT AND RECONSTRUCTION

MANY minds are turned to post-war conditions, when problems such as unemployment will coincide with opportunities for reform of layout and rebuilding of cities. The National Smoke Abatement Society has submitted to the Ministers concerned a memorandum on smoke prevention in relation to initial post-war reconstruction in Great Britain (Nottingham: National Smoke Abatement Society, 2d.).

The memorandum is concerned only with the prevention of smoke in the new building that will take place immediately after the end of the War. Provided that early attention is given to this question, it is considered that practically the whole of this building can be made smokeless.

The memorandum first proposes that the important principle be established of ensuring the use of suitable appliances and plant by requiring all new installations of fuel-burning equipment to have the previous approval of a special authority. By this method, which is common in the United States and elsewhere, both fuel economy and smoke prevention can be promoted.

The complete smokelessness, it is said of commercial buildings, that is, all premises other than industrial and domestic, may be readily achieved and should certainly be assured. Open fires should not be permitted in such premises except in special cases, when the use of smokeless fuels should be made obligatory. Industrial plant of all kinds is included in the proposals for the previous approval of new installations, and in many cases the control should also cover use and maintenance.

Much can be done to improve the standards of heating in domestic houses and flats apart from smoke prevention, but if the requisite attention is given to the problem in good time, it is likely that either the whole or a great part of the new housing could be made completely smokeless. The chief problem appears to be that of the supply of smokeless fuels suitable for open grates and other appliances, which must be correlated with the volume and rate of housing. This and other questions should be examined by a Government committee or board,