The David Dunlap Observatory, Toronto

ALTHOUGH most of the astronomers of Canada are graduates of the University of Toronto, hitherto the University has possessed no observatory. This want has been recently supplied by the munificence of Mrs. D. A. Dunlap, who has presented the University with a 74-inch reflecting telescope, as well as a handsome administrative building. The inauguration ceremony took place on May 31, the chair being taken by the president of the University, Canon Cody, in the presence of the Lieutenant-Governor, Dr. Bruce, Sir Robert Falconer (a former president of the University), Mr. Mackenzie King (a former Prime Minister of the Dominion), professors of the University, and astronomers from Great Britain, Canada and the United States, and a thousand interested visitors.

After a dedicatory prayer by the Rev. E. W. Wallace, Chancellor of Victoria College, the chairman read letters of congratulation from the president of the International Astronomical Union, the president of the Royal Astronomical Society of Canada, Sir James Jeans and Sir Arthur Eddington. He then called on the architect, who handed a golden key to Mrs. Dunlap. She opened the door with the words, "In loving memory of my husband, David Alexander Dunlap, I now present this astronomical observatory to the University of Toronto, believing this memorial will express his deep interest in astronomy, and I hope through its equipment great advances will be made in the science", and handed the key to Dr. B. M. Macdonald, chairman of the Board of Governors.

After a warm expression of thanks by Dr. Macdonald, a sincere tribute to Mr. Dunlap was paid by him and by the Lieutenant-Governor. The president then called on Prof. Chant, the director of the Observatory, and noted that the inauguration had been fixed on Prof. Chant's seventieth birthday. Prof. Chant referred to Mr. Dunlap's great interest in astronomy, and said that in 1926 he ventured to lay the project of an observatory in Mr. Dunlap's memory before her. The foundation stone was laid in 1932 by Mr. Moffatt Dunlap. "To Mrs. Dunlap all the credit is due; were it not for her there would be no observatory here."

Mr. Cecil Young, manager of the firm of Sir Howard Grubb, Parsons and Co., then gave an account of the large telescope and dome which were described and illustrated in an article in NATURE of October 14, 1933. Sir Frank Dyson gave the good wishes of the Royal Astronomical Society, and congratulated Prof. Chant on the great interest in astronomy in Canada, which was in large measure due to him. Short addresses were given by Prof. H. D. Curtis, director of the Observatory of the University of Michigan, Prof. V. Slipher, director of the Lowell Observatory at Flagstaff, Prof. H. Shapley, director of the Harvard College Observatory, and Dr. W. E. Harper, director in charge of the Dominion Observatory at Victoria.

The Observatory is situated in 160 acres of ground on Richmond Hill, some twelve miles north of Toronto, from which a beautiful view extends in all directions. It is sufficiently distant from Toronto to avoid smoke and glare, and yet near enough to the University. The number of good observing nights is estimated at about 120 in the year. The administration building is a handsome structure of stone, surmounted by three domes for smaller telescopes. It contains office and computing rooms, a library and well-equipped workshops. The large telescope is in a steel dome with the necessary insulating material to diminish changes of temperature, and was constructed by Messrs. Sir Howard Grubb, Parsons and Co. The general appearance of the telescope in relationship to the dome is very satisfactory. The clockwork and the electrical movements of the telescope and dome fulfil all requirements. The mirror of 74 inches is of pyrex, made by the Corning Company of New York. The grinding and figuring of the mirror were carried out at Newcastle, under Mr. Cyril Young's direction, by Mr. Armstrong, the very competent artist of the firm. The spectroscope was constructed by Messrs. Adam Hilger, Ltd., and is admirably adapted to determine velocities in the line of sight for which the instrument will be generally used. Telescope and spectroscope were thoroughly tested by Mr. R. K. Young. In Mr. Young, Mr. Hogg and Mr. Millman, Prof. Chant has an able, experienced and enthusiastic staff. We may look with confidence for an excellent output of work from the David Dunlap Observatory.

F. W. DYSON.

Humoral Transmission of Nervous Impulses*

IN 1921 it was proved for the first time that the modifications of the heart's function, caused by stimulation of its nerves, are due to substances liberated by the stimulation, called transmitters: acetylcholine and an adrenaline-like body respectively, which in their turn bring about the effects of stimulation. This 'humoral transmission of nervous impulses' occurs, not only in the heart, but also with stimulation of all the other vegetative nerves. Whether it also happens within the somatic nervous system is not yet settled.

The nerves releasing transmitters on stimulation do not influence the *function* of their effective organs otherwise than by this release. But we must attribute to them an influence—independent of the release of the transmitters—on the *sensitivity* of their effector organs to peripheral, directly applied stimuli.

The discovery of the humoral transmission of nervous impulses discloses the hitherto obscure mechanism of the effect of nervous stimulation in general, and also particularly of peripheral inhibition.

As to the point of attack of nervous stimulation, that is, the localisation of the release of the transmitters, there are two possibilities: either the nerve-ending or the effective organ. There are many arguments against the latter possibility, but the former is supported by the following: (1) after nerve

* Substance of the Ferrier Lecture delivered by Prof. Otto Loewi, professor of pharmacology in the University of Graz, before the Royal Society on June 20.

degeneration, the transmitter disappears, even in cases in which the effective organ is not degenerated at all; (2) on stimulation of the preganglionic cervical sympathetic the transmitter is liberated, not within the ganglion cell, but at the synapse—in other words, from the nerve-ending. Regarding the *mechanism* of the release we have to consider also two possibilities: either the transmitter is newly formed by the nerve-stimulation, or it is made diffusible, being split off from a combination already present in the nerve-ending. The decision between these alternatives cannot yet be made.

The lapse of time between the nerve-stimulation and the response of the reacting organ is extremely short, even in organs like the heart, where the transmitter has to pass a certain distance in order to reach the effector cells. The transmitters disappear somewhat quickly, the time of disappearance being dependent on the type of action which they have to produce.

The point of attack of the transmitters is not a part of the neurone, but the functioning, effective organ itself. The fact that the transmitters, when artificially injected, mainly act at points in relation to which they are normally liberated, can be given, as yet, only a teleological interpretation. Since the transmitters can diffuse into the blood from the point of their release, they can, in principle, also affect remote organs, though under physiological conditions this may never happen. Obviously such a distant action is unnecessary, as such needs are fulfilled by the hormones.

Finally, the question is considered whether the difference between the action of the hormones and that of the transmitters concerns only the sphere or also the character of their action. The hormones of two of the ductless glands, both being neurotropic and differing from all other ductless glands by properties common to them only—the adrenal medulla and the posterior lobe of the hypophysis—initiate or modify, according to need, the specific *function* of the organs, as the nerves or the transmitters do.

All the other ductless glands are not neurotropic; they depend largely on the anterior lobe of the hypophysis regarding their development and state; their secretion is going on continuously and automatically, though partly controlled by the nervous system. Their action is concerned less with the *specific functions* of organs than with *general conditions*—state and metabolism. In other words, there are differences not only regarding the sphere but also regarding the character of the action of the nerves and the transmitters, on one hand, and that of the hormones on the other.

Cosmic Ray Results of the American Stratosphere Balloon *Explorer I*

BRIEF accounts have been given in NATURE[1] of the flight of the American stratosphere balloon *Explorer I* and the subsequent mishap by which it was at first feared that most of the valuable photographic records had been destroyed. Subsequent expert development of the films shows that, whilst the whole of the objectives have not been

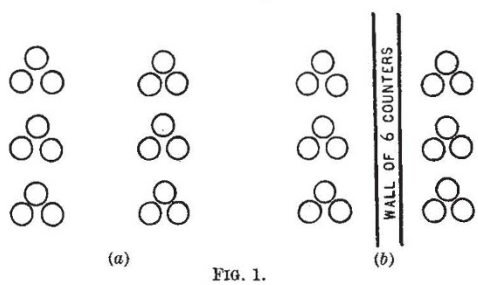

FIG. 1.

secured, those records that have been saved have yielded interesting and confirmatory results to collateral researches.

Swann and Locher have contributed an article on "The Variation of Cosmic Ray Intensity with Direction in the Stratosphere", and Millikan a short article on the results of the flight in "Stratosphere Series, No. 1" of the U.S. National Geographic Society. In the former of these researches, as many as 168 Geiger-Müller counters were employed. These were disposed as in Figs. 1*a* and 1*b*. In each case three counters close together form a unit, and corresponding ones of the nine counters on either the right or duplicate left side of Fig 1*a* must be influenced for a count. There were four such banks for the directions 0°, 30°, 60° and 90° to the vertical. In Fig. 1*a*, the counters are in the 0° position. The whole system was now duplicated as in Fig. 1*b*, with the addition of a wall or partition of six *neutralising* counters dividing each bank. Apart from the influence of this wall on the time resolution, the arrangement of counters in Fig. 1*b* would have the greater directive tendency. Two systems of recording were employed, one in which the total number of counts in a given time was integrated, and the other in which each individual count was recorded and timed. The curve of the spatial distribution of the rays at an altitude of 40,000 ft. for the two arrangements of the counters is shown in Fig. 2, in which the curve *a* corresponds to the arrangement of Fig. 1*a* and the

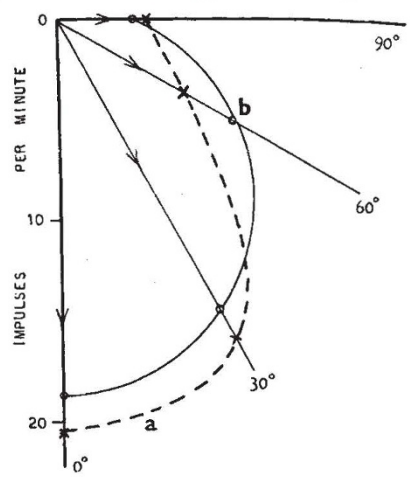

FIG. 2.

curve *b* that in Fig. 1*b*. The number of counts varies from about 5 per minute for rays from the horizontal direction to about 20 per minute from the vertical at this height, whilst the more recent results from a flight by J. Piccard in America give similar curves up to 53,000 ft. The dotted curve *a*, which includes