Hessel de Vries, Physicist and Biophysicist

On 23 December 1959 death came to Hessel de Vries, at the age of 43. De Vries was professor of physics at the University of Groningen and a member of the Royal Dutch Academy of Science. Not only in the realm of physics but to all of science and to all scientists his death is an almost irreparable loss.

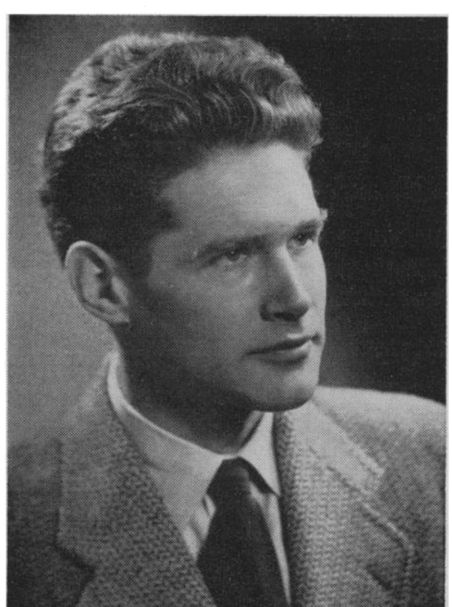
His scientific career lasted little more than 20 years. During that time he made significant contributions to divergent fields of natural science. Once his interest in a problem was aroused, he did not rest before he had thoroughly investigated all its consequences; less essential matters had to wait until a solution had been found and a deeper insight had been reached.

It is impossible to give here a survey of his work which would be in any way complete. In reading through his more than 80 publications, one's attention is repeatedly drawn to subjects which are but loosely connected with the main fields of his research. I will therefore restrict myself to pointing out some of the results of his work in the three principal fields in which he became particularly distinguished: neutron physics, the area of his doctoral thesis; biophysics, in which he received a chair in 1954; and carbon-14 research, which he had fully mastered and which he developed in Groningen to a degree of perfection unequaled anywhere.

During the period in which de Vries conducted his research in nuclear physics (1938–1946), information about the interaction of nuclei with neutrons was scarce and not very reliable. In particular, measurements of resonance parameters produced doubtful results at a time when the time-of-flight method had not yet been developed. The filter methods for measuring resonance widths, published by de Vries in 1942, resulted in substantial improvement in this field.

In 1943 de Vries had already become interested in the biophysics of the sensory organs, and at this time he published an article on the influence of the quantum character of light on vision. Some years later this work was extended to include an investigation of color vision; among other things he developed an ingenious method for independently measuring the sensitivity curves of the blue, green, and red receptors. With this method, different kinds of color blindness could clearly be distinguished. In particular his measurements of the sensitivity curve of the red receptors in the long-wave region became widely known. He explained the form of this curve by assuming that the thermal motion of the molecules supplies the energy that the quanta of red light lack for stimulating the red receptors. A confirmation of this theory was found in the "red shift" of the sensitivity curve, occurring when the temperature of the eye is raised. Anyone working in Groningen at that time remembers these experiments, where the test subject was placed in a transformer vessel filled with hot water. This water was kept at the right temperature by Bunsen burners.

Hearing also became a subject of de Vries' investigations. These studies embraced all functions of the ear, especially the transport of sound within the auditory passages. Involved, too, were studies of the static and dynamic sense of equilibrium and of the microphonic activity of the semicircular canals and the cochlea. When his knowledge of the anatomy of the inner ear proved insufficient, de Vries applied himself to detailed study. Together with Kuiper he made extensive measurements of the microphonic activity of the lateral line organ of fishes. Here, for instance, an explanation was found for the rectification occurring in the cupula.



Hessel de Vries

In the course of his physical research on the senses de Vries was often able to demonstrate, in a surprisingly quantitative way, to what extent nature had succeeded in optimal construction of the organ. In particular, threshold values of sensitivity often proved to be such that Brownian motion could have no adverse influence.

In his biophysical work de Vries learned not only the attractions but also the pitfalls which nature has provided for those who want to force her into the mold of a physical model. Sometimes his theories proved to be wrong; he acknowledged this once with the words: "A theory may be wrong, but that does not matter; it is more important whether it is usable, whether it widens our scope and incites new experiments." A survey, with many references, of his biophysical work may be found in *Progress in Biophysics* [H. de Vries, "Physical aspects of the sense organs," *Progr. in Biophys. and Biophys. Chem.* **6** (1956)].

How important physical methods and a physicist's point of view can be for research in fields not originally of a physical nature was again and even more impressively demonstrated by de Vries in his application of the carbon-14 method to archeological, geological, and climatological problems. Since there exist excellent surveys of the carbon-14 method [for example, H. de Vries, *Ned. Tijdschr. Natuurk.* **23**, 277 (1957)], I shall only mention here how he succeeded in improving this method to such a degree that at Groningen it is now possible to determine ages up to 50,000 years with small quantities of carbon, and up to 70,000 years when the samples can be enriched in the C^{14} isotope.

The important improvements of the carbon-14 method made by de Vries resulted from strenuous labor, guided by his thorough understanding of the physics of the method. In the first place he discovered that carbon dioxide can be used as a gas in a proportional counter, provided it is extremely pure. Carbon dioxide counters are now used in almost every carbon-14 laboratory. Their greatest advantages over counters with solid carbon are their much higher efficiency, which makes possible the use of much smaller samples, and the fact that they can be filled easily and accurately. Further, de Vries developed methods of purifying the gas in little more than one hour. His thorough analysis of the background of the counter led to effective measures for its reduction and to a correction for fluctuations in its intensity. Much attention was always given to the chemical pre-treatment of the samples. Especially in old samples, the possibility of contamination with recent carbon was always carefully investigated. Very often de Vries went to dig out his samples himself, even to North America, in order to be absolutely certain that the samples were not, through injudicious treatment, contaminated by recent carbon.

De Vries contributed to many investigations of archeologists and geologists, not only by dating their samples but also by actively engaging in their research. His own particular interest, of late, lay in the chronology of the climate of the last glacial period. He published many new facts about this in the last year of his life.

Besides his study of the "macro"-climate, de Vries discovered a remarkable correlation between "micro"-climate (that is, temperature fluctuations within a period of about 100 years) and fluctuations of ± 1 percent, with respect to the average, in the carbon-14 activity of the last 400 years. Although this made many datings of more recent samples less reliable, on the other hand it did explain some serious discrepancies.

De Vries often saw his scientific work as a game, but he played this game with the utmost concentration, its rules being the laws of nature. He used these laws in a way which clearly demonstrated how they had become a part of him. His ways of dealing with physical problems provided an example worth more than many a neatly prepared lecture. He disliked all ostentation, to such a degree that in lectures he often glossed over his own achievements. His untimely death is a great personal loss to many scientists all over the world.

H. DE WAARD
Laboratory of Physics, University of Groningen, Groningen, Netherlands

Science in the News

Radiation Standards: Testimony at Congressional Hearings Tends To Be Reassuring

Despite some differences in emphasis there appeared to be a broad agreement among the several dozen scientists who appeared at the radiation hazard hearings ending last week that the risks involved at present levels of exposure are quite small compared either with other hazards of modern life (cigarettes, air and water pollution, and automobile accidents, to name three) or with the benefits derived from the use of radiation.

The testimony, before the Joint Committee on Atomic Energy, emphasized that there are substantial uncertainties about the amount of harm, if any, that is likely to result from the low dose rates to which people are now being exposed. Because of this the witnesses agreed that it was prudent to take steps to see that exposure is kept as far below the recommended "guidance levels" as practical. There were differences of opinion over just how much concern is justified over the probable damage stemming from current exposure rates, but none so sharp as to lead anyone to suggest that the Radiation Protection Guides proposed last month by the Federal Radiation Council need to be revised downward. These guides, it was repeatedly pointed out, do not represent danger points but only control points below which the likelihood of any individual being harmed is believed to be so small that any reasonable increased use of radiation that promises some benefit should be permitted. The current level of exposure for the general population was estimated to amount to 10 percent or less of these guidance levels, and there appeared to be little likelihood that the general level of man-made radiation would climb near the over-all guidance levels in the foreseeable future.

The guides apply to all man-made radiation, including fallout, with the exception of medical uses. These medical uses were said to account for 90 percent or more of the exposure to man-made radiation, but since their contribution to the health of the public far outweighs the most pessimistic estimates of the incidental damage from them they cannot be considered a health hazard in the sense that other exposure to radiation is so considered. In any event, whether to take a given x-ray was felt to be a matter to be decided by the physician handling the individual case. But it was pointed out that improvements in x-ray technique and equipment could probably reduce the incidental hazard for both the physician and patient by 10 percent, and perhaps considerably more, without in any way limiting the benefits. A reduction of this size would probably be equivalent to the complete elimination of all other man-made radiation.

Radiation Protection Guides

Based on statements such as the report of the National Committee on Radiation Protection which appeared in the 19 February issue of *Science*, the method for calculating the radiation guides appears to be this: You assume, first, that there is no threshold level below which radiation is harmless; second, that the probable effects are directly proportionate to the dose; and third, that the damage from chronic exposure to low dose rates will be the same as for a dose of the same total size accumulated at a high rate in a short