observed surrounding objects that show great contrast. This must be ascribed to the action of the phase strip on the diffracted light. As we saw before, the phase strip is meant to act only on the direct light. However, the diffracted light, which fills the whole aperture of the objective, will for a small part be intercepted by the phase strip, and this part remains inactive. To find the effect of this missing part, we consider the reverse case, that it would be the only active part. Because of the narrow strip, it would form an image of much less resolving power, that is, blurred by diffraction. Because this part is missing, the "strip image" must be subtracted, in amplitude, from the full image formed by the whole aperture. The interference with the direct light then results in a very diffuse and weak negative image, appearing as a bright halo around dark details and as a dark halo around bright details.

With the straight phase strips used in the beginning, the halo may be disturbing, because the strip image of a small detail is by diffraction spread out in only one direction, namely, perpendicular to the strip. This makes small bright spots in the image appear as if they were marked by short, crossing pencil streaks. To remedy this I soon introduced *annular strips,* which make the halo spread out in all directions, so that it is much fainter and indeed quite harmless.

Zeiss in Jena slowly continued with the design of instruments. After several more of my visits, after some years of development work, and after further delay by the war, they brought out phase contrast objectives and accessories in 1942.

George James Peirce, Pioneer American Plant Physiologist

THE death of George James Peirce on 15 October 1954 marks the passing of a man whose scientific career spanned the entire development of plant physiology in the United States. He was born in Manila on 13 March 1868; when he was 6 years old he returned to the United States with his widowed mother, who established a home in Cambridge, Massachusetts. And after receiving his secondary education in the public schools of Cambridge, Peirce entered Harvard University and graduated in 1890.

Peirce majored in botany at Harvard, and the teacher most influential in directing him toward a particular discipline of botany was George L. Goodale. Goodale's special field of interest was what was called "physiological botany," which placed greater emphasis on structure than on function. Two years after graduating from Harvard, Peirce went to Germany for graduate study. It was natural that, as a man trained under Goodale, he should study both plant anatomy and plant physiology. The first semester in Germany was spent at Bonn in the laboratory of Strasburger, the great plant morphologist. The remainder of his time abroad was spent at Leipzig, primarily in the laboratory of the plant physiologist Pfeffer. In addition, Peirce received extensive training from Fischer in the infant science of bacteriology. His dissertation for the doctorate, which was granted in 1894, was prepared under the guidance of Pfeffer and was entitled "A contribution to the physiology of the genus *Cuscuta*."

Although Peirce did little original research in bacteriology, he remained interested in its development for many years. However, it is of interest to note that he was the first to offer a course in bacteriology both at Indiana University and at Stanford University. He was among the first in the United States to trace the source of epidemics of typhoid. At Bloomington, Indiana, the source of an epidemic was found to be contamination of the water supply; at Palo Alto, California, it was traced to the milk supplied by a local dairyman.

Upon returning to the United States in 1895, Peirce was appointed assistant professor of botany at Indiana. Two years later he joined the faculty at Stanford, an institution with which he remained associated for the next 59 years. From his first year at Stanford and until he became emeritus in 1933, his primary teaching activity was in the field of plant physiology. In his course on experimental physiology, offered during his first year at Stanford, the emphasis was on function instead of on structure, as in the "physiological botany" he had been taught the decade before.

To Peirce plant physiology was not exclusively a laboratory science but rather was one where illustrative material should be drawn from the outdoors whenever possible. His two books on plant physiology, *Plant Physiology* (1903) and *The Physiology of Plants* (1926), mention numerous examples of the physiology of plants growing in the open. When the weather was favorable, he often took his class in plant physiology outdoors for the lecture. The lectures were presented in a small garden near his laboratory, where he could emphasize a point by directing the students' attention to a nearby plant. Emphasis in the plant physiology that was taught 50 years ago was quite different from that of today. This is well illustrated by the space devoted to different topics in his *Plant Physiology.* At that time the subject of irritability occupied the attention of many plant physiologists, and so it is not surprising to find that nearly a quarter of the book is taken up by the chapter entitled "Irritability." This is in contrast with present-day treatises on plant physiology, in which no author devotes a chapter to the topic and several do not think it a subject worth listing in the index.

The research activities of Peirce during his first decade at Stanford covered a wide range of plants, including algae, lichens, liverworts, gymnosperms, and angiosperms. In many cases the stimulus for undertaking an investigation can be seen in his keen eye and inquiring mind when outdoors. Examples of this are his studies on colorless shoots growing from stumps of redwood and on the explosive discharge of antherozoids by certain liverworts.

The small number of articles published by Peirce in botanical journals during the following decade might lead to the erroneous assumption that he had done little research during this time. This is far from the case. The results of investigations during these years are available, but to find them one must go to the records of various federal and state courts instead of to scientific journals. The shift in the field of investigation arose through a proposal to build a large copper smelter a few miles north of Stanford. In order to forecast the probable effects on the vegetation of the area, Peirce was appointed a member of a panel commissioned to visit all other copper smelters in the United States that handled 1000 tons or more of sulfurous copper per day and to observe their effect on the surrounding vegetation. These field observations were supplemented by extensive studies on various plants in a greenhouse where definite amounts of one or more of the ordinary constituents of smelter smoke were introduced into the air. As a result of these and further studies, Peirce appeared as an expert witness in several suits involving damage to vegetation by fumes from smelters. In southern California he studied the extent of the damage to citrus groves that had been caused by cement dust from a nearby cement mill. In connection with this, he devised a quantitative method for showing the extent to which a layer of cement dust on a leaf reduces photosynthesis.

About 1920 Peirce turned to a new field of investigation—the ascent of sap in trees. A summary of his theory on the manner in which sap moves up a stem comprised his address as retiring president of the Botanical Society of America in 1933. This address, entitled "Observations on sap hydraulics," was published in 1934 in the *American Journal of Botany*.

George Peirce was a man greatly beloved by students and colleagues. As the memorial resolution adopted by the faculty of Stanford well states:

> His general philosophy of life was built around the central theme that to get the most out of life one must serve the University, the community, and one's fellow citizens with humility and a cheerful kindness. He lived his philosophy consistently and with a constant twinkle in his eye. His kindness was to him no effort—it was his way of life.

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News and Notes

A Cytological Congress

We present two reports on the 8th International Congress for Cell Biology for reasons suggested in the introduction to G. Pontecorvo's report: confusion between the terms cell biology *and* cytology. *Several of last summer's lists of Meetings and Conferences in* Science *(21 May, 18 June, and 16, 23, and 30 July) contained the following items for September, always separated by one other item:*

1–7. International Soc. for Cell Biology, 8th, Leiden, Netherlands. (W. H. K. Karstans, Botanical Laboratory, State University, Nonnensteig 3, Leiden.)

1–8. International Cytological Cong., Leiden, Netherlands. (P. G. Gaillard, Histologisch Loboratorium, Rijksuniversiteit, Leiden.)

We solicited two reports. Two arrived and our confusion became apparent. We believe the two complement each other and publish both with the permission of both authors.

The 8th congress of the International Society for Cell Biology was held in Leiden 1–8 Sept. 1954. About 300 biologists from Europe, Israel, the Americas, Japan, and India met in the picturesque Dutch university town. The meetings were held in the University Hospital and visitors were housed in Noordwijk, a North Sea resort a few miles away. The half-hour run in the streetcar to Leiden provided welcome opportunities for informal discussions or for simply enjoying the lush green of the Dutch landscape spotted with the vivid color patches of flower beds and crisscrossed by large and small waterways alive with windmills and boats.

The congress was divided into plenary sessions in the mornings, with 3 lectures of a general nature reviewing various fields of cellular biology, and meetings of 3 to 4 concurrent sections in the afternoons where short papers in the same fields were read. The main topics were (i) induced enzyme synthesis; (ii) intercellular substances in animals and plants; (iii) immunobiological concepts of growth and differentiation; (iv) biochemistry of gene action; (v) virus synthesis; (vi) mitochondria; (vii) nuclear and chromosome structure; (viii) thyroid secretion; (ix) morphogenetic interaction between cells; (x) cell division and mitotic poisons; (xi) active cell surface; (xii) submicroscopic organization of cytoplasm. There were also two sessions on cytochemistry and one on tissue culture. (Abstracts of the papers were printed in *Excerpta Medica* 8, No. 9).

From these topics and the titles of the papers presented one can see the wide ramifications of cell re-