

## MEMORIAL RESOLUTION

### CORNELIS BERNARDUS VAN NIEL (1897 – 1985)

Cornelis Bernardus van Niel, Herzstein Professor of Biological Sciences Emeritus at the Hopkins Marine Station in Pacific Grove, was born in Haarlem, The Netherlands, on Nov. 4, 1897. He died in Carmel, California, on March 10, 1985.

In his youth in the Netherlands, despite pressure from his elders to enter the family furniture business or some other industrial or business career, van Niel was increasingly inclined toward more intellectual pursuits. An early interest in science led him to study chemistry at the Technological Institute in Delft, where he earned the Chem. E. degree in 1923. There he was exposed to microbiology through the lectures of the famous Dutch microbiologist Martinius Beijerinck during the last year of Beijerinck's teaching career. Soon after, van Niel began to pursue microbiological research under the direction of Beijerinck's successor, Albert Jan Kluyver. After van Niel graduated, Kluyver offered him an assistantship in the laboratory, where van Niel continued to work for several years, receiving his doctorate in 1928.

Kluyver's laboratory was an exciting and intellectually stimulating place in which to work. The enormous variety in metabolic potentialities observed among microorganisms was just beginning to be comprehended in terms of biochemical mechanisms. A few great micro-biologists of previous generations, such as Pasteur, Winogradsky, and Beijerinck had perceived amidst the diversity of metabolic activities displayed by microorganisms an underlying unity in physiological functions such as energy generation and synthesis of cell constituents. In a 1926 paper on "The Unity in Biochemistry" Kluyver and Donker extended these concepts to the level of biochemical mechanisms, proposing that all biochemical pathways could be comprehended as variation on a few simple themes. Largely because of van Neil's early experiments with photosynthetic bacteria, the paper extended the principles of biochemical unity to photosynthesis -- a vital process that for many years had been regarded as beyond the reach of dissection by standard biochemical means. Van Niel's doctoral thesis was a definitive study of the metabolism of propionic acid bacteria, which included the finding (of practical interest to dairy bacteriologists) that certain strains of propionic acid bacteria enhance the flavor of butter by production of diacetyl as a metabolic product.

In 1929, van Niel joined the Stanford biology faculty at the Hopkins Marine Station in Pacific Grove. There he continued his studies of photosynthetic bacteria from the perspective of comparative biochemistry. His work was brilliantly successful, both in indicating a common mechanism of photosynthesis in green plants and in bacteria and also in reducing the photosynthetic process (conceptually) to a series of biochemical steps similar to those used in respiration or fermentation. The essence of van Niel's conclusion was that the primary event in all photosynthesis is a photochemical cleavage of water to form a strong reductant and a strong oxidant. The reductant is then used to reduce CO<sub>2</sub> to carbohydrate, while the oxidant is reduced by an available reductant -

water in the case of higher plants, H<sub>2</sub>S or various organic compounds in the bacteria van Niel had studied. Van Niel's pioneering work and insightful analysis laid the groundwork for most subsequent research on photosynthesis, beginning with isotopic studies showing that the oxygen generated in green plant photosynthesis is derived entirely from water, not from CO<sub>2</sub>.

Starting in 1930, van Niel began to offer annually a summer course at Hopkins, whose aim was to educate American students in the methods and concepts of microbiology and comparative biochemistry developed by Beijerinck and Kluver. The 1930 class comprised a single pupil, R.E. Hungate, a Stanford graduate student who subsequently did his doctoral research in microbiology. The fame of the course soon spread, however, and by the 1940s it attracted many more applicants than could be accepted. These included not only graduate students from Stanford and elsewhere, but increasing numbers of established and eminent investigators who came from all over the world to be initiated into the teachings of the Delft school. Pacific Grove became the Mecca of American microbiology. The impact of van Niel's course on a whole generation of microbiologists was felt both in the course of their research and in the teaching methods they adopted on his example.

The class ran three full days a week. Laboratory and lectures took place in the same room with no set schedule. During a typical class day, after the students had spent some time examining their cultures and analyzing their results, van Niel would convene the class for a discussion of their collective observations and how to interpret them. There followed a skillfully guided Socratic dialogue, which sometimes culminated in a group decision as to what experiment should logically follow. At this point van Niel revealed that the materials for just that experiment had been prepared and the students proceeded to do it. At other times the discussion led, without a formal transition, into one of van Niel's lectures.

A lecture might last for several hours (sometimes broken by intervals of additional class discussion) and consisted of an eloquently delivered, exhaustive, scholarly, and engrossing account of the history of research in the area of the day's experiment. It was a strenuous regime for the teacher, but a fascinating experience for the student. The typical textbook approach, where acknowledgment of the discovery of a phenomenon is closely followed by an explication of our current, apparently secure understanding of its basis (avoiding all the muddles that may have transpired in the interim) was anathema to van Niel. In his treatment, the initial observations led to tentative conclusions, similar (perhaps identical) to those the class has just drawn from their own results. Consideration of alternative hypotheses generated further experiments, described in turn, which may have produced firmer conclusions, but ones that were still challengeable and capable of disproof. It was a vivid history, in which famous scientists and their lesser known opponents came alive as protagonists and antagonists in the debates of the past and all were given due credit as contributors to the synthesis that had eventually been arrived at. The current state of knowledge seldom emerged as much more comfortably secure than the misconceptions it had replaced. It was the ideal preparation for students embarking on careers in experimental research.

A dominant feature of van Niel's teaching was the constant awareness that observation and experiment, rather than authority, must be the final arbiter in any scientific disagreement. Although virtually every scientist accepts this concept in principle, it does not always come across to students as a practiced creed rather than a declared ideal. As any scientific discipline matures, students increasingly tend to learn basic concepts as rules whose truth is established and whose manipulation is to be mastered. As a teacher, van Niel conveyed his strong philosophical commitment to the scientific method, applying it not just to his own discipline but to all aspects of human knowledge. In an autobiographical article written near the end of his career, he described how his interest in science developed from a visit as a teenager to a farm where experimental plots of soil were tested for the effect of various treatments on agricultural productivity: "The very fact that one could raise a question and obtain a more or less definitive answer to it as the result of an experiment was a revelation that deeply impressed me, particularly because I had grown up in a milieu where any kind of question was invariably answered by the stereotyped reply: 'Because somebody (usually a member of the family) said so'." In his lectures, he liked to describe science as "a way of life", and he provided an excellent model for such a life style. As might be expected, van Niel instructed his own children in accordance with the principles of his teaching.

Besides his teaching and personal research, van Niel supervised the research of numerous students and postdoctoral fellows, many of whom have achieved eminence in microbiology and biochemistry. These students worked on a wide range of microbiological problems, reflecting both van Niel's catholic interests in the microbial world and his insistence that the choice of the problem should come mainly from the student rather than from him. His students almost always worked and published independently. Van Niel provided advice, inspiration, guidance and criticism, but he was not one to use students or co-workers as helping hands in achieving his own ends.

Van Niel was known as "Kees" to his friends and graduate students, who appreciated his affectionate warm nature, not apparent in his formal lectures. Early in life he said he was attracted to acting, which may explain his effective demonstrations of historical experiments and the dramatic quality of his teaching in which he used suspense, surprise and the joy of discovery. He had a happy family life; his wife Mimi protected him from others when he was exhausted after a summer of teaching and especially later when he was ailing.

He is also survived by his son Jan (now a professor of biology at Western Washington University at Bellingham) and two daughters, Ruth Winning of Santa Rosa and Ester Went of Pullman, Washington (wife of biologist, Hans Went).

For several years following his retirement from teaching at Stanford, he held a visiting professorship at the University of California at Santa Cruz. During his retirement years, he was often visited at Pacific Grove by former students and alumni of his course who frequently were impressed anew by the breadth of his knowledge and the depth of his scholarship.

Van Niel received many formal honors. In 1954, he was elected president of the American Society for Microbiology, which later made him an honorary member. He was

also a member of the National Academy of Sciences, the American Academy of Arts and Sciences, the American Philosophical Society and the French Society for Microbiology. He was awarded the National Medal of Science (U.S.), the Emil Christian Hansen Medal (Denmark), the Rumford Medal (American Academy of Arts and Sciences) and the Antonie Van Leeuwenhoek Medal (Royal Netherlands Academy of Sciences). He received honorary doctorates from Princeton, Rutgers, and the University of California, Berkeley.

Both through his research and his teaching, van Niel had an enormous impact on the direction of microbiological research in other laboratories. The community of microbiologists throughout the world, as well as his colleagues at Stanford, is greatly indebted to him.

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