van Niel’s Course in Microbiology—a Sequel

The modern microbial diversity summer course at Woods Hole and others like it remain true to the van Niel legacy

Ralph S. Wolfe

Several generations of biologists raved—some still do—about the summer course in microbiology that C.B van Niel devised and taught, beginning in 1930 and continuing for several decades. The article about van Niel’s microbiology course at the Hopkins Marine Station by Susan Spath (ASM News, August 2004, p. 359) provides a rewarding overview of his impact during that formative era of microbiology. Indeed, her brief article should whet the appetite for her much more detailed account of that period in microbiology that is the basis of her 1999 graduate dissertation, “C. B. van Niel and the Culture of Microbiology.”

The Original van Niel Course Had a Distinctive Rhythm

The original van Niel summer course had no bells announcing the beginning and end of lectures, no students rushing through experiments so they could get to their next class, and no exams. His mission was to present a historical overview of evolving knowledge about the physiology and biochemistry of microbes to serious-minded investigators from areas other than microbiology; he would accept microbiologists into the course as observers only.

Known for the rigor of its extended hours, the class day also had defined breaks: coffee in the morning, lunch, tea in the afternoon, and dinner. Students lived microbiology three full days a week from 8 AM well into the evening. That schedule provided Van Niel, the only instructor, vital breaks: Tuesdays, Thursdays, and weekends.

Van Niel’s course came to be widely recognized and much imitated, spawning many courses like it at colleges and universities over several decades. Unfortunately, however, many of these van Niel-like courses became locked into rigid formats—something that tends to happen when courses move into the canon of formal education.

However, there is one 37-year-old course that comes close to being the modern sequel and spiritual successor to van Niel’s original course, and that is the course in microbial diversity that is taught each summer at the Marine Biological Laboratory (MBL) on Cape Cod at Woods Hole, Mass. Patterned after van Niel’s course, the MBL summer course is intended for advanced graduate students, postdoctoral students, and established scientists, and their brief residence on Cape Cod provides students and faculty with near-ideal marine and freshwater environments for studying diverse microbes.

• Van Niel’s original mission was to provide an overview of the physiology and biochemistry of microbes to serious-minded investigators.
• The summer microbial diversity course at the Marine Biological Laboratory at Woods Hole, Massachusetts, is patterned after van Niel’s original but adapted to suit modern needs and practices.
• One strength of the MBL summer courses is that each set of directors brings new tools, a fresh approach, and personalized emphases that persist for four to five years.

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Holger Jannasch Brings Microbial Subject Matter to MBL

Administrators at MBL in 1969 asked Holger Jannasch, a marine microbiologist who was on staff at the nearby Woods Hole Oceanographic Institution, if he would become director of a new MBL summer course in marine ecology with the goal of developing a course on microbial ecology. This concept was new for MBL, which had built its reputation for convening highly focused summer courses and for assembling top-notch researchers with a special interest in marine animals, but not in microbiology. Here at long last, MBL leaders recognized the value in developing a course on microbes!

Jannasch met and interacted extensively with van Niel at the Hopkins Marine Station. Moreover, Jannasch greatly admired the man, his research, and the summer course with its distinctive “Delft School” approach to teaching microbiology. Jannasch was also careful and thorough, not someone to leap blindly into this new responsibility. Accordingly, he sought advice from others, including me, for help in developing and teaching the MBL course that he was organizing. Because he wanted the course to be a van Niel-type course, he set out to recruit instructors who had directly experienced van Niel’s course.

Jannasch also asked Edward Leadbetter, now of the Woods Hole Oceanographic Institution, to join the effort. Both Leadbetter and I were then teaching full-semester, van Niel-type courses with long laboratories as part of our respective regular teaching loads, and neither of us thought that we could present a similar summer course and then go home and start over again without burning out. We figured that we needed an abbreviated approach that would still be based on the Delft School course and would feature three full-time instructors for the summer plus guest lecturers.

The MBL summer course deviated in other minor ways from the original van Niel regimen. Thus we designed it for students to meet daily, Monday through Friday, and from 8:30 AM into the evening, as well as Saturday morning, which followed a long-established MBL tradition. After summer students were introduced to basic techniques for handling microorganisms, they then were put to work enriching and isolating representatives of various microbial groups, with the lactic acid bacteria being the first on this list because they are a straightforward challenge for students who are still establishing their prowess in isolating microorganisms.

Soon enough, in the MBL tradition, each student would join the research program of an instructor in the program. After a few summers, Selman Waksman offered a yearly contribution from the Waksman Foundation to help support the course, significantly expanding opportunities for participants and further attracting both students and instructors. Jannasch was director for 10 summers.

The late Harlyn Halvorson, who was then at Brandeis University in Waltham, Mass. and who
also had taken van Niel’s course, in 1979 became the next director of the MBL summer course. One of his great talents was in raising money and he put that talent to work by ensuring the course was on solid financial footing, bringing additional instructors and students.

Genetics, Molecular Biology Added to the Course during the mid-1980s

In 1983, Halvorson convinced me to become the next director, taking over after he completed his 1984 summer session. I was sure that an updated version of the course would be needed in 1985 when I was to begin teaching. In addition, I revised another standard feature of the course by having each of the students initiate research projects rather than join research programs of their instructors.

Since van Niel’s original course, microbiology had changed greatly, moving into complex areas of genetics and molecular biology in addition to the traditional areas of physiology and biochemistry. To me these changes meant that the students would benefit if I could bring on a codirector with expertise in genetics and in using molecular tools. Peter Greenberg, who had been a student in the course in the early 1970s, agreed to be my codirector, and Caroline Harwood of the University of Washington, Seattle, was appointed the first course coordinator.

Our goal was to emphasize that microbes, not instructors, were the stars of the course. To do this, we embraced van Niel’s format of presenting lectures in the laboratory, and they were augmented by mini-symposia that featured guest lecturers on Saturday mornings. Jannasch played a pivotal role in recruiting students from Europe, and the Waksman Foundation continued to be generous to the course. In addition, we obtained support from federal granting agencies.

One continuing strength of the MBL summer courses is that each set of new directors brings new tools, a fresh approach, and personalized emphases that persist for four to five years. Martin Dworkin of the University of Minnesota, Minneapolis, and John Breznak of Michigan State University (MSU), East Lansing, served as codirectors following Greenberg and Wolfe’s tenure. Edward Leadbetter and Abigail Salyers of the University of Illinois, Urbana-Champaign (UIUC), were the next directors for five years. Caroline Harwood and Alfred Spormann of Stanford University in Stanford, Calif., decided four years of directing the course would be about right. The current directors are Thomas Schmidt of MSU and William Metcalf of UIUC (Fig. 1).

Each year the course has a different “menu” because, during the winter months, directors of the course become “chefs,” developing elaborate plans for each microbial “feast-of-the-week” during the coming summer, deciding which areas to feature and whom to invite for the 20 or more guest lectures. For student research projects, Sippewissett salt marsh, one of the best-studied marshes in the world, provides one source of diverse microbiologic materials (Fig 2). Oyster Pond Inlet, fronting Vineyard Sound, provides a brackish niche from which to isolate other microbial species.

Meanwhile, nearby Cedar Swamp is a small freshwater habitat, whose name refers to the surrounding and partly submerged collection of white cedar trees that contribute to its character.
Soon after students arrive each summer, we take them to Cedar Swamp where they perform the Volta experiment, in which local anaerobic methanogens release combustible methane that successive groups of students take delight in setting ablaze (Fig 3).

In addition, live sea animals are maintained and cultured in a special facility where seawater is continuously pumped to laboratories. Manufacturers of scientific equipment provide their latest model instruments for students to use in their experiments. In such an environment, research projects may be limited only by the imagination of the student, and, as was also true in Van Niel’s era, lifelong scientific associations and collaborations among students may arise from their experiences during the course of a summer.

Genomics the Latest Addition to the MBL Summer Course

The current course directors lately tackled the ambitious goal of adding genomics-based approaches to the MBL summer course, while retaining the rich traditions from the Delft School of microbiology. In addition to isolating and culturing physiologically diverse microbes, students use DNA sequences to establish the phylogeny of isolates and to explore the structures of complex microbial communities. Metagenomic studies, which involve cloning and sequence analysis of DNA isolated directly from particular habitats; stable isotope probing, which enables investigators to isolate DNA from organisms that grow on specifically labeled substrates; and single-cell DNA sequence analyses are among the other techniques and methods that summer students are encouraged to use.

Based on the incredible diversity of microbes at hand in the many habitats in and around Woods Hole, there will be no shortage of discoveries awaiting future students of the Microbial Diversity course. van Niel’s course was an extension of the Beijerinck Delft course. Similarly, the MBL course is an extension of van Niel’s course.

Meanwhile, there are newer and welcome additions to the van Niel legacy. The GeoBiology course at Catalina Island grew from the conception of a group of scientists assembled by the Agouron Foundation, who chose Kurt Hanselmann to help start this course, and chose the University of Southern California (USC) and the Wrigley Institute of Environmental Studies to help administer it. Will Berelson of USC joined Hanselmann and together they forged this course, in some ways in the model of the MBL course with which Hanselmann was familiar. In 2006 the Hopkins Marine Station course by Alfred Spormann, who was a student and later codirector of the MBL course, further added to the legacy (Microbe, February 2007, p. 60).

More information on the NBL summer course is available online at http://www.mbl.edu/education/courses/summer/course_micro_div.html.