

MOUTH PIPETTING: A THREAT MORE DIFFICULT TO ERADICATE THAN SMALL POX

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Perhaps no practice in the biomedical research laboratory has been more resistant to change than mouth pipetting. As Dr. Arnold G. Wedum pointed out in his third and final previously unpublished paper, which is published posthumously in this issue of *JABSA*, mouth pipetting was first recognized as a hazard in 1894 and largely went unabated for most of the twentieth century. Even at Fort Detrick the practice was not prohibited until 1963. At the National Institutes of Health and the Communicable Disease Center (now the Centers for Disease Control and Prevention) of the U. S. Public Health Service, mouth pipetting was not broadly discouraged until the 1970s.

Dr. Wedum's manuscript, "Pipetting Hazards in the Special Virus Cancer Program," was prepared as a background document for distribution at the first biohazards conference held in January 1973 at the Asilomar Conference Center, Pacific Grove, California. The purpose of the conference was to review and discuss potential occupational health hazards associated with research involving animal tumor viruses. The conference was sponsored by the National Science Foundation, the National Cancer Institute and the American Cancer Society.

In 1972 the National Cancer Institute (NCI) established minimum biological safety standards for contractor laboratories of the Special Virus Cancer Program. The standards included the statement, "There shall be no mouth pipetting in any of the laboratories." With Dr. Wedum's full support and counsel, the NCI thought that the Asilomar Conference would be an appropriate venue to encourage scientists to consider establishing a national consensus standard for safety in tumor virus research. While the Conference was highly successful in addressing the relevant scientific issues needed to assess the potential health hazards of tumor virus research, and in sharing knowledge about safe practices (Hellman, 1973), the idea of a national consensus standard that would prohibit the practice of mouth pipetting was never considered. The NCI, however, established safety standards for research involving oncogenic viruses in 1974 (DHEW, 1974). The standards were required to be carried out in laboratories of the NCI and were recommended nationally for adaptation and adoption by all other organizations involved in oncogenic virus research. The standards contained the provision, "Mechanical pipetting aides shall be used for all pipetting procedures."

The reluctance of scientists to forbid the practice of mouth pipetting remained evident during the International Conference on Recombinant DNA Molecules held at the Asilomar Conference Center in February 1975. At this second Asilomar Conference on biohazards in biomedical research, there was extensive review of scientific progress in research on recombinant DNA molecules and much debate regarding both the potential biohazards of this work and strategies for setting appropriate safeguards. Throughout the meeting there was interest in describing a category of experiments of such minimal risks that the practice of mouth pipetting would not be

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considered more than a benign hazard for laboratory workers. The summary statement of the Conference described four containment categories corresponding to levels of estimated risk—minimal, low, moderate, and high (Berg, 1975). The minimal risk containment category was described as "...intended for experiments in which the biohazards may be accurately assessed and are expected to be minimal." An operational procedure recommended for this containment category was "...the use of cotton-plugged pipettes or preferably mechanical pipetting devices." The low risk, moderate risk, and high risk containment categories prohibited mouth pipetting. The Asilomar guidelines served as interim recommendations for the safe conduct of recombinant DNA research until the National Institutes of Health issued its Guidelines for Research Involving Recombinant DNA Molecules on June 23, 1976 (Federal Register, 1976).

Dr. Wedum served on a special committee that had been convened to review the proposed physical containment section of the draft NIH Guidelines and to provide supplemental information to explain more fully safety practices appropriate to recombinant DNA research. Prudent pipetting practice was a specific biohazard control technique reviewed by this committee. The committee recommended that the NIH Recombinant Advisory Committee (RAC) prohibit the practice of mouth pipetting at all containment levels. The RAC chose, however, to encourage the use of pipetting aides rather than prohibit the practice of mouth pipetting at the minimal level of containment, which was designated P1. The pipetting requirement adopted for the P1 level of physical containment read:

Although pipetting by mouth is permitted, it is preferable that mechanical pipetting devices be used. When pipetting by mouth, cotton-plugged pipettes shall be employed.

In the supplemental information on physical containment (Federal Register, 1976), which was not a mandatory section of the NIH Guidelines, Dr. Wedum's prudent pipetting practices were described in full detail. The first of ten practices read, "No infectious or toxic materials should be pipetted by mouth."

Determination and persistence were two traits of Dr. Wedum that complemented his abundant wisdom. Undoubtedly, he would have been proud to know that these characteristics which he inspired in others helped to eventually bring about a national code of practice that banned mouth pipetting. This occurred in 1978 with the first revision of the 1976 NIH Guidelines (Federal Register, 1978). The P1 pipetting provision was changed to read, "Mechanical pipetting devices shall be used; pipetting by mouth is prohibited." This was not, however, an easily won revision as was evident in a statement made by NIH director Dr. Donald S. Fredrickson when he issued his proposal to revise the 1976 NIH Guidelines (Federal Register, 1978):

I have made one decision that will not be regarded with equal pleasure by all engaged in recombinant DNA research. P1 containment previously permitted mouth pipetting. In accord with a previous recommendation by the European Molecular Biology Organization (EMBO), its virus Working Group strongly

recommended prohibiting this practice; and so did NIH safety advisors. The RAC at its meeting on April 27-28, 1978, recommended that mouth pipetting be prohibited only for those P1 recombinant DNA experiments involving viral DNA. Rather than create two separate classes of P1, and in recognition of the present availability of excellent mechanical devices for pipetting, I am proposing that mouth pipetting no longer be permitted in P1 containment. Since it is already prohibited in P2-P4 containment, this bans the use of mouth pipetting for any experiment covered by the Guidelines.

It is interesting to note that during this time (1977-78) when biosafety experts and scientists were discussing biosafety practices and debating the appropriateness of mouth pipetting for a new scientific frontier, two unrelated laboratory events occurred—one having profound importance to public health and both causing embarrassment about biosafety practices in laboratories. The last known case of small pox was associated with an exposure from a laboratory source in July 1978, at the Medical School at Birmingham University, U.K. This infection occurred less than one year after the last known natural case of small pox. Further, from January 1977 to September 1979, 21 cases of laboratory-acquired typhoid fever in the United States were reported following the voluntary introduction of *Salmonella typhi* into laboratories for proficiency testing and research purposes. Mouth pipetting was the probable cause for two of these infections (Blazer, 1980).

The 33rd World Health Assembly declared on May 8, 1980 the global eradication of small pox. This is heralded as one of the greatest public health achievements of all time. This achievement is in stark contrast with the episodes of mouth pipetting that continue to threaten the health of laboratory workers. Biosafety professionals will need the determination and persistence demonstrated by Dr. Wedum throughout his career to bring about the change that will embrace high biosafety standards and eliminate mouth pipetting as a cause for laboratory-acquired infections. This task should now be easier to achieve than in Dr. Wedum's era.

Over the last two decades the conclusions and recommendations in Dr. Wedum's manuscript have been validated and largely achieved. Oral pipetting is a recognized hazard that can adversely affect the health of laboratory workers. Federal regulations promulgated by the Occupational Safety and Health Administration prohibit the practice of mouth pipetting blood or other materials that may contain bloodborne pathogens (Federal Register, 1991). And, a national consensus standard or code of practice for biosafety in microbiological and biomedical laboratories has been established (DHHS, 1984).

The eradication of mouth pipetting is certainly an achievable challenge for laboratories supported by biosafety professionals. Should not we be able to declare by the year 2000 that this challenge has been met.

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