

One of the greatest concerns that exists for animal scientists is the negative publicity about the use of certain animal products in our diet. Information on the nutritional composition, processing, storage and preparation must be developed for use in grade school and high

school courses and for communicating with people who are not livestock oriented.

The animal scientists of the future will face many challenges but I believe they will make many contributions and perform an outstanding service to mankind.



Kenneth McMahon, Chairman

BACTERIOLOGY

A review of the research that is being conducted by members of the Department of Bacteriology shows the emphasis that is being placed on agricultural and environmental microbiology. From the extensive research in public health that was done by the late Dr. Casper Nelson during the 40 years preceding his retirement in 1954, research has been expanded into areas related to agricultural production and the quality of the environment.

During the past several years investigators have responded to the need for providing information that could result in improvement of nitrification and nitrogen-fixation, increased efficiency of photosynthesis, improvement of water quality, more efficient waste disposal and better diagnosis and control of animal diseases.

Recently research activity has increased because the Department was given the opportunity to move to a new building and acquire an additional research scientist in 1975.

Nitrogen-Fixation and Nitrification Studies

Fixed nitrogen is essential for crop production. The probable doubling of the demand for food by the year 2000 has prompted research to provide the vast quan-

ties of fixed nitrogen that will be needed. The growing awareness of environmental quality and limitations of nonrenewable resources has led to increased interest in nitrogen-fixation performed by bacteria.

In related research funded through the Science and Education Administration of the USDA with funds appropriated to the Agency for International Development, inoculant technology is being adapted to the needs of developing countries. Inoculants are preparations containing *rhizobia* which are applied to fields to establish nitrogen fixation.

In recent research in cooperation with the Department of Entomology, several insecticides were tested for possible harmful effects on important microbiological processes in soils. Among these processes were nitrification in soil and the nitrogen-fixing symbiosis between the *Rhizobium* bacteria and leguminous plants such as soybeans, alfalfa and sweetclover. No inhibition of nitrification at normal rates of pesticide application was found.

In cooperation with the USDA Northern Great Plains Research Center, microorganisms associated with grasses used in revegetation of reclaimed strip mining

areas are being studied.

Photosynthetic Microorganisms

The population of the world doubled between 1930 and 1976. Fortunately, the yield per acre of wheat in advanced agricultural areas nearly doubled during the same period, largely because of advances in plant breeding and cultural practices. However, there is evidence that further yield increases by these methods may be levelling off. Consequently, there is now much interest in attempts to increase the efficiency of photosynthesis as a means of breaking through an anticipated plateau in the rate of increased crop yields.

At the heart of the photosynthetic process is carbon dioxide (CO₂) fixation, which makes any aspect of the metabolism of CO₂ of supreme importance to agriculture. Next to the CO₂-fixation reaction itself, the enzyme carbonic anhydrase may be of primary importance since it could control the amount of CO₂ available to the system. This is because carbon anhydrase is believed to play an important role wherever there is CO₂ transport and/or a need for equilibration between CO₂ and bicarbonate, as in the CO₂-fixing system.



Bayard Sleeper examining a culture of photosynthetic bacteria being used in a study of microbial carbonic anhydrase enzymes.

With these considerations in mind studies of carbonic anhydrase enzymes of some photosynthetic microorganisms have begun. It is hoped that a contribution can be made in this way toward a further understanding, and ultimately, an enhancement of the CO₂-fixation process.

Water Quality and Waste Disposal

Water quality of rivers and lakes is determined in large part by land use adjacent to the water body. If inadequately treated municipal or feed lot sewage is permitted access to water, a public or animal health problem may arise. Runoff and/or erosion from heavily fertilized farmland may result in accelerated eutrophication and siltation of lakes and streams. Coal mining and

coal conversion plants located near streams may have such deleterious effects as acid-mine drainage or discharge of toxic nondegradable organic and inorganic substances. River and lake sediments act to trap and concentrate nutrients and microorganisms. If suspended into overlying water, these may adversely affect water quality far downstream from the original source of pollution.

The possibility of optimizing livestock lagoon operation for low temperatures is being investigated. Using laboratory-scale models of hog waste digesters, operated at various temperatures and feed rates, it was found that the bacteria in the digesters do not quickly adapt to low temperatures (e.g., 4° and 15°C). Further studies are being undertaken to determine the location of the inefficiency and the feasibility of alleviating the problem.

Diagnosis and Control of Animal Diseases

Although there has been a marked reduction in the prevalence of brucellosis in cattle during the past several years, some animal disease specialists have expressed doubts that brucellosis can be eradicated in the United States. There has also been a resurgence of human brucellosis since 1974. A National Academy of Sciences Committee reviewed the current status and adequacy of brucellosis research in 1977, and the recommendations for future research included the development of reliable, practical diagnostic tests.

Studies with the objective of developing an agar-gel immuno-diffusion (AGID) tests for detection of *Brucella* antibodies in human and bovine sera were initiated in 1977. A slide test using a standardized antigen was developed, and results are being compared to those obtained with the tube-agglutination test. Preliminary results show close agreement between the tube-agglutination and AGID techniques when the agglutination titer is 1:100 or higher.

Progressive pneumonia of sheep is a fatal disease caused by a virus. Immunization may provide a means of preventing the disease, but before an effective vaccine can be developed, information about the immune response of sheep to this virus is needed. The secretory immune response to the virus has not been characterized. Since the target organ of the virus is the lung, a primary site of IgA production, stimulation of the secretory immune system at this site may provide protection against progressive pneumonia virus.

In cooperation with the Departments of Veterinary Science and Animal Science, experimental vaccines have been prepared and administered to a number of animals in the NDSU sheep flock. One vaccine was administered as an aerosol, designed to stimulate an immune response in the lungs, the target organ of the virus. The other vaccine preparation was injected intramuscularly to stimulate production of serum antibodies. Sheep immunized by each method eventually will be exposed to the virus to determine whether either vaccine preparation conferred protection from the disease.

A related study was initiated to determine which class of antibodies can act against the progressive pneumonia virus. Sheep produce a number of different classes of antibodies. If the study shows one class is more active against the virus, subsequent vaccine preparations will be administered by a route which most efficiently stimulates production of those antibodies.