what to prepare themselves to do the rest of their lives. A summary of information in the National Register of Scientific and Technical Personnel, released by the National Science Foundation, shows that the average salary during the 1956–58 period of all those in agricultural sciences was only $6,625 compared to $10,872 for medical sciences; $10,436 for chemical engineering; $8,462 for physics; and $8,660 for chemistry.

**Applied Soil Science and Its Relationship to Career Opportunities**

Stanley B. McCaleb

The study of soils is unique because it requires such a broad background in the basic sciences. Within any segment of study the soil system varies from the biological to the geological, from micro to macro, from atoms to complex landscapes, from the depth of the oceans to outer space, and from the concrete to the nebulous.

Advances in technology in the past two decades, with emphasis on specialized techniques, have increased the demand for highly trained soil scientists within the technical field of soils as well as in the broad spectrum applications in industry. The importance of basic sciences must continue to be stressed as the foundation for soil science curricula, and teachers should use these fundamentals more effectively in course work. Soil Scientists must be trained at the professional level to cope with the complexity of problems normally encountered and present certification plans lead in this direction.

Figure 1 shows the relationship of the basic sciences to the various levels of study within the field of soil science. The concentric circles indicate the level of achievement, the intensity fields of study, and the interrelation of areas of specialization. The innermost circle, which represents either less or different preparation in the basic sciences, leads to a B.S. degree in production agronomy and will not be discussed further. The discussion will be based on the fundamental approach that leads to advanced degrees, better training in soils, and specialization; all of which provide the opportunity for successful careers in agriculturally-related applications.

The fundamental sciences are divided into four segments in the illustration: chemical, biological, physical, and mineralogical. The training at the B.S. level draws heavily on all four segments, while at the M.S. degree level, some degree of specialization emerges. Intensive study within one or more of the segments is selected by graduate students working toward the Ph.D. degree. Potential accomplishments within the field of soils, and in non-agricultural applications, are related to the twilight zone that utilizes two or more of these segments. Specializations within any major segment leads to an application in Soil Science. The influences of biological and geological materials are known to alter physical and chemical properties, but the interacting mechanisms are still unknown.

This is a real problem for agriculture and will continue to be until some way is found to put the practice in a more competitive position. We cannot afford to have the best of what is good for the young people as well as for the older scientists.

Of the many contributions our colleges of agriculture make, none can surpass the importance of training—later to become leaders of vision capable of explaining and leading the constant change in agriculture. Good science is the most vital resource.

Twilight Zones in Soil Science

The outstanding advances in Soil Science of the past decade have resulted from more intensive study. Recent advances in soil physics have resulted in the inclusion of hydrology, climatology, and ecology into the classical concepts. Structural-inorganic chemical, plant biochemistry and nutrition have been designated by names, i.e. soil-physical chemist, soil mineralogist, and microclimatologist. In spite of all we have learned to date, much still remains to be known about the complex system we call the soil.

The interplay of physical, chemical, and biological materials on geological materials to produce soils of recognized kinds has received new impetus from advances in the field of Soil Science. The influences of biological materials in soils and their relationship to ecology, many of which are known as "organo-mineralogy" are not well understood. The increased international interest in our understanding of the complex system we call the soil is terminal, are opportunities as lower echelon research personnel. The diversity of training builds an encompassing knowledge of laboratory techniques that can be used in almost any research laboratory. Progress from limited only by the professional interest and the individual.