WINTER QUARTER COMMENCEMENT ADDRESS

March 20, 1987

John P. Hirth

President Jennings, graduates, guests and colleagues. I shall comment today on pride, on change, and on challenge. Your achievements, being celebrated here, are a source of pride for yourselves, for your families and friends, and for your professors.

Let me first consider the basis for this pride. It is said that the most satisfying success of a teacher is to be surpassed by one of his students. In that case, I am most successful, because I feel that I have been surpassed by all of you. Indeed, you could regard yourselves as the most successful class ever to graduate in the sense that your path to graduation has been more difficult than those of the classes that preceded you.

As an example, let me compare your university days with mine. My own freshman math sequence consisted of algebra and trigonometry, topics most of you took in high school. Parallels exist in many areas where not only are courses more advanced, but also the subject matter is greatly expanded. New disciplines, such as Computer Science, have appeared. Even extracurricular activities are more demanding. Today's little league sports teams require more commitment and are better drilled than yesteryear's high school or college teams.

Subtle pressures in everyday life seem also to have increased. While World War II was occurring in my formative years, hearing of it from a radio commentator or in the newspaper made it seem somewhat removed and remote. Today, with rapid worldwide TV transmission, the problems of the day appear in our homes in the evening.

There are other examples, but these suffice to show that you have come through a more rigorous test than was the case in earlier years. I do note that not everything is different. Observations made while walking across the oval, or jogging along the river on a warm spring day, indicate that methods for the occasional pursuit of idleness are largely unchanged.

Let me continue with the theme of change. The pace of change was impressed on me as youth by a favorite remark of my grandmother, who was born in 1876. She would comment on the wonder of the transition from the horse and buggy...to the train and automobile...to the airplane, in her lifetime. She lived to be 94, and at the end of her life she added to her list man stepping onto the moon. Looking back, I now find parallel advances in my own lifetime. The trends can be illustrated by four examples that touch on my own area of materials research.

In the mid-1920's, much was known about the structure of materials and about the periodicity of the elements. At that time, the famous atomic physicist, Lord Rutherford, advised young students not to pursue a career in physics because all of the important problems had been solved. Five years later came the discovery of quantum wave mechanics, with its profound effect on fundamental understanding in the physical and biological sciences.

I witnessed a similar lack of foresignt just two months ago, with regard to superconductivity, where an analogous advance has been discussed recently in the newspapers. When superconductivity was discovered 75 years ago, the maximum critical temperature for superconduction was 7 degrees above absolute zero for the metal lead. By the 1960's this had advanced to about 25 degrees above zero for metallic compounds, but it stuck at that level, still requiring the use of scarce and expensive liquid helium to achieve superconduction.

In January, 1987, the National Research Council met to consider future needs and opportunities for materials. The written report on the electric power industry stated that the prospects for superconducting power transmission were bleak and could be dismissed because of the lack of progress in research to increase the critical temperature. On the very day of the meeting, it was announced new compounds had been developed with critical temperatures of 40 degrees above zero. One month ago this value was increased to 98 degrees above zero.

The race is now on at every major research institution in the world, including OSU, to push the temperature up further with the goal being room temperature. Already there are enormous implications for more efficient and enhanced power generation and power transmission. A frictionless high speed train magnetically suspended above the rails and riding on an air cushion could also become economically feasible.

These two examples show the unwisdom of predicting that "It can't be done." Two other examples emphasize the importance of size scale. You have witnessed the explosive increase in computer use in recent years. Von Neumann's first computer at Los Alamos, in the 1940 war years, used mechanical relays for information storage, with a characteristic size per unit of about one centimeter or the span of a fingernail. Today's microchips have transistors one-ten-thousandth as large, that perform the same function. Some of you may have a pocket calculator with you. An equivalent device, using the mechanical relays of Von Neumann, would be the size of St. John Arena.

Microscopy is another illustration of differences in size scale. In 1950, the maximum magnification at most laboratories was achieved with optical microscopes that would resolve about one-millionth of a meter, roughly the size of the transistors in the previous example. Today, an additional factor of 10,000 in resolution has been achieved with electron microscopes, field ion microscopes and tunneling microscopes. We now can resolve single atoms in metals and inorganic crystals, with important applications in improving material properties. One also can resolve the spiral form of organic structures such as DNA and RNA with great implications for biotechnology.

There have been analogous advances in many fields. For a few examples: The green revolution in agriculture, the possibility of genetic architecture in bioscience, virology and immunology in medicine, and the new view of the universe in Astronomy and Physics. In the arts we have modern forms in all areas. There are even improvements in physical skills, with today's athletes being bigger, faster and stronger than those of the past.

In some areas, however, progress is not so evident. If we compare a play by Aristophanes or by Skakespeare with a current drama, we can question whether humans get along with one another any better than they did in the times of early civilization. Also, exponential growth can present great problems. For one example, atomic energy holds forth both promise and threat. For another, demographically, one-half of the human beings ever born are alive today and growth is projected to continue. Also increasing are both the use of natural resources and the per capita rate of consumption of natural resources. Hence, one wonders whether we are approaching limits of growth in these areas. There are ecological concerns with waste disposal, with clean water, and with interactions with the atmosphere and ionosphere. Analogous growth problems occur in many fields.

Thus, problems exist and they may grow more severe. However, as Emerson has told us, such problems should be faced with optimism, for it is at the times when problems seem the most unsurmountable that man's greatest advances are made.

It is clear from these examples, that there is no question that the world will be dramatically altered in twenty years, when you are entering your mid-careers. This then is the challenge: that you regard your graduation today not as an end to education, but rather as an indication that you are prepared to continue to educate yourselves to deal with a changing world.

As a final word, then, congratulations on your success ... go forth and be successful!