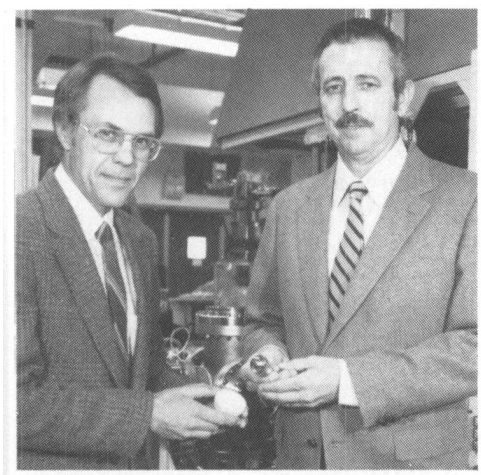
# Ion-Implanted Material Leads the Way for New Generation Prosthetics

## Artificial Hip Joint Presented to President Reagan

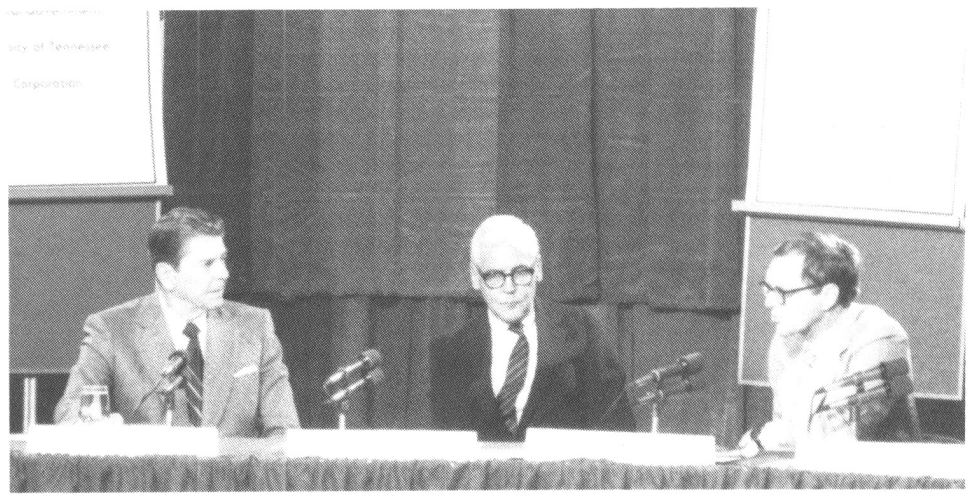
A new process for improving the wear properties of a titanium-based alloy used in artificial hip and knee joints was described to President Reagan in September at a presidential briefing held at the University of Tennessee. Describing for the President the importance of industry/government/university collaboration, Oak Ridge National Laboratory Director Herman Postma chose the new process as an example of how such cooperative research work can result in a successful commercial product.

Postma emphasized the potential humanitarian and economic benefits of the new process. Approximately 100,000 total hip joints and 60,000 knees are surgically implanted per year in the United States at an estimated cost of some $3.2 billion. Many of these are revisions of previous operations, and, in addition, many patients who need surgery are advised to wait until the they are older because the anticipated lifetimes of devices are too short. Improving the technology of prosthetics cannot only alleviate suffering but can also provide economic benefits by reducing the number of revisions, reducing patient care and rehabilitation, reducing the need for pharmaceuticals, and improving the productivity of the workforce.

In laboratory tests, it has been shown that the process, involving the implantation of nitrogen ions into the near-surface region of the material, reduces the wear rate of the alloy by a factor up to 10,000. The treatment of the alloy also improves the wear performance of the mating plastic component. These results can contribute directly and indirectly to improved hip and knee joints.



**Leaders of the research work, Raymond A. Buchanan (left) and J. M. Williams.**



**President Reagan listens as Postma (right) discusses research on ion-implanted materials for hip joints. Jack Reese (center), chancellor of the University of Tennessee, looks on.**

Johnson & Johnson Products, Inc., Orthopaedics Division and Spire Corporation, two Boston-area firms, are collaborating in marketing products utilizing the new process. Johnson & Johnson Products, Inc., is a leading national manufacturer of orthopaedic devices and Spire is a high-technology firm whose specialties include ion implantation. Knees are expected to be the first product.

J. M. Williams, scientist in ORNL's Solid State Division, led the collaborative research work with Raymond A. Buchanan of the University of Alabama-Birmingham. Williams is co-chair, with M. F. Nichols and W. Zingg, of MRS's first symposium on Biomedical Materials being held at the 1985 Fall Meeting.

Ti-6A1-4V is a titanium-based alloy originally developed for aerospace applications because of its light weight and high strength properties. Currently, the most important use for ion implantation technology is in the semiconductor industry where it is used to introduce dopants into the surface of solid-state electronics. Treatment of orthopaedic devices is expected to be the next important commercial application for the technology. The cost of the treatment is small compared with the substantial surgical and hospitalization costs for a hip or knee operation.

### Research Reported at MRS Meetings

The research into the use of ion-implanted titanium-based alloy for application in surgical implants was first reported at the 1983 MRS Annual Meeting and is published in *Ion Implantation and Ion Beam Processing of Materials*, edited by G. K. Hubler, O. W. Holland, C. R. Clayton, and C. W. White, Volume 27 of the Materials Research Society Symposia Proceedings series. (See "Effect of N-Implantation on the Corrosion—Wear Properties of Surgical Ti-6A1-4V Alloy," by J. M. Williams, G. M. Beardsley, R. A. Buchanan, and R. K. Bacon.)

A panel discussion being conducted at the Biomedical Materials Symposium at the 1985 Fall Meeting will further explore the material for surgical applications. The panel, led by Stephen Gordon of the National Institutes of Health, includes: Raymond Buchanan (University of Alabama-Birmingham), K. W. Greer (Johnson & Johnson Products, Inc.,), P. Higham (Howmedica, Inc.), J. Parr (Zimmer, Inc.), J. T. Scales (University of London), and D. Mears ( University of Pittsburgh). The panel will be conducted Wednesday, December 4, at 3:30 p.m. in the America Ballroom, Westin Hotel.

In addition to materials for orthopaedics, other particularly strong aspects of the program include cardiovascular materials and materials for bioelectrodes. The four-day Biomedical Materials Symposium begins on Tuesday, December 3.

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