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Implementation of New Materials into Orthopedic Implants

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ABSTRACT:

We will discuss the translation of a diverse set of new material technologies into orthopedic implants. In all the applications, the implementation of the new materials was accelerated by basic research leading to a new fundamental understanding of the relationship between processing, structure, and mechanical properties of the constituent materials. The examples span implants and new materials that have been successfully used in over ten thousand patients, to materials yet to be cleared in a device by the FDA. The topics to be overviewed include: The development and understanding of deployable shape memory polymers to mitigate damage when reattaching soft tissue to bone. A fundamental breakthrough on the processing and machinability of shape memory alloys to enable a paradigm shift in the success of large bone intramedullary fusion devices. A new approach to the formation of an interconnected surface porosity in a high strength polymer that results in the first ever FDA clearance and clinical success of an all polymer spinal fusion cage with porosity. Finally, a 3D printed, bio-mimetic elastomer is shown to have early promise as a reliable and long-term soft tissue replacement or scaffold.

BIOGRAPHY:

Professor Gall's received his BS, MS, and PhD from the University of Illinois Champaign-Urbana in Mechanical Engineering. He is currently the Chair of Mechanical Engineering and Materials Science at Duke University, and his technical expertise is in the discovery and mechanical properties of novel materials. His contributions to the scientific community range from the creation and understanding of multiple new functional biomaterials to the discovery of a new phase transformation in gold nanowires. His publications have been cited over 14,400 times with an H-index is 66. In addition to his research and teaching, he has consulted for multiple companies, the US Military and the US Intelligence Community. He is a passionate entrepreneur who has founded five medical device start-ups, including MedShape and Vertera which have been sold in part or fully to large public companies. He works closely with early stage companies to commercialize new technologies in the medical device space.