THE POWER OF 3-D

ORBITAL FACIAL RECONSTRUCTION USING 3D BIO PRINTING TECHNOLOGY

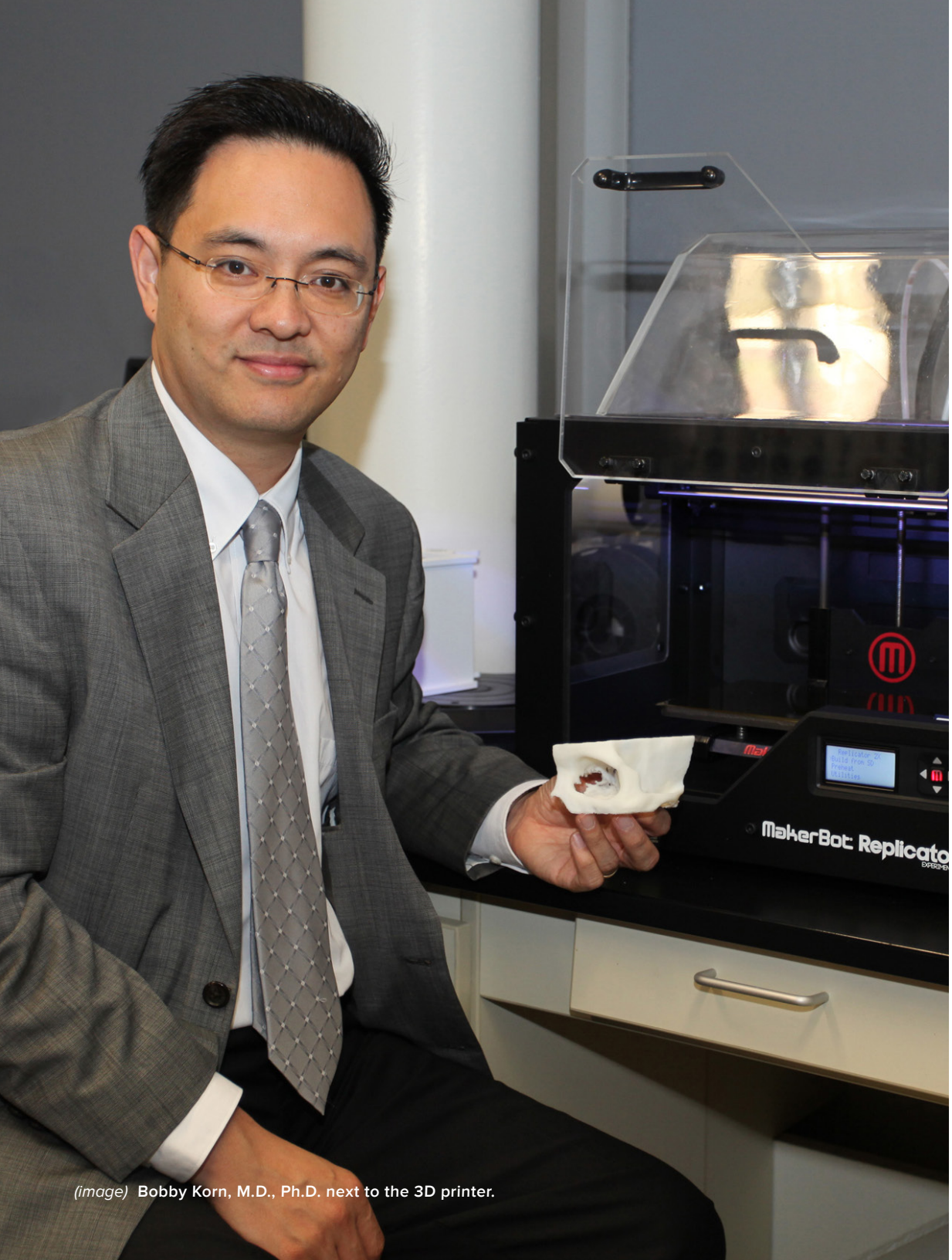
(image) **Customized 3D printed orbital model used for surgical reconstruction.**

"I saw the angel in the marble and carved until I set him free."

MICHELANGELO

Oculofacial expert Bobby Korn, M.D., Ph.D., Associate Professor of Clinical Ophthalmology in the Division of Ophthalmic Plastic and Reconstructive Surgery, recognized the challenging task of rebuilding a patient's face after removing a massive tumor under his cheek and was going to need some 21st century assistance. The surgical removal required that all underlying bone under the eye socket, as well as the surrounding sinus, had to be excised out to leave behind an eye with no support and a gaping hole under it. Though the prognosis after tumor removal was excellent, and the patient could expect to live a long life, the options of reconstruction were very limited.

Eventually, Dr. Korn and the Shiley team decided to customize a scaffold that would be



(image) **Bobby Korn, M.D., Ph.D. next to the 3D printer.**

a replacement support to hold the eye in place and provide a rigid framework under the cheek by using a new and novel technology known as “3D Bio Printing.” They created a three dimensional software generated replica of the eye orbit derived from CT scans of the patient and then used this to 3D Bio Print a rigid mold to serve as a template to fabricate the new eye socket. A commercially available biodegradable implant was then fabricated right on the surgical field using this 3D Bio Print. “The implant was successful and within three months the patient regained functional eye activity and cosmesis, to bring back a smile in his face and a twinkle to his eyes,” said Dr. Korn.

Unlike traditional machining that can create objects by cutting material away, 3D Bio Printing, also known as “additive manufacturing” is a bottom-up technology paradigm that builds structures by layering many thin layers on top of each other. Researchers can place components of interest in the “bio ink” used for 3D Bio Printing such that different components can be added to a computer generated scaffold design to mimic a bioactive “tissue”. Since the 1980’s, the invention of 3D printing has been adapted to manufacture a widening array of commercial and medical related products ranging from aircraft parts to prosthetic limbs.

The Shiley team’s renowned eye-care reputation has achieved another first in the world by utilizing 3D Bio printing to perform this delicate eye orbital reconstruction. The use of appropriate bio components (stem cells, islet cells, tissue scaffolding components, etc.) at the predetermined locations in the newly placed layers of the 3D Bio Printer will one day allow for the creation of living, biologically active implants, tissues or other biological replacement structures. “The exciting future promises of this technology is the ability to use a patient’s own cells as constituents of the “bio ink” to develop individualized, customized replacement implants, organs or to print tiny strips of organs – and then transplant that into a damaged or diseased organ,” explains Dr. Korn, “as we enter into the era of personalized medicine where therapies and treatments are tailor-made for specific individuals.”

Don O. Kikkawa, M.D., Chief of the Division of Ophthalmic Plastic and Reconstructive Surgery stated, “We recruited Dr. Korn to join our division based on his research and interest in stem cells. His innovative ideas paired with 3D printing technology have the potential to revolutionize orbital reconstruction.”