SPECIAL SECTION GUEST EDITORIAL

Pioneers in Biomedical Optics: Special Section Honoring Professor Ashley J. Welch, University of Texas at Austin

Professor A.J. Welch is one of the founding fathers of the field of tissue optics and laser-tissue interaction. He is also one of the nicest and most laid-back people you will ever meet. In the series of "Pioneers in Biomedical Optics" special sections of the Journal of Biomedical Optics, this special section is in honor of Prof. Welch and his contributions to the field.

The young Welch family (circa 1962).

Born and bred in Ft. Worth, Texas, he spent his entire career in the Lone Star State. A.J. graduated from Texas Technological College (now Texas Tech University) in Lubbock, Texas, with his BS degree in electrical engineering in 1955. He was raised primarily by his mother who early on instilled in him the value of a good education. With obvious talent in science and math, engineering was the thing to do in order to get a good job somewhere. During his time at Texas Tech he also met Pat and they married in 1954.

After his undergraduate degree, he worked for General Dynamics in Ft. Worth on automatic control systems for the B58 airplane. A.J. was bored stiff and could not get used to the "hurry up and wait" style of working. Given the opportunity he decided to pursue his MS degree by taking classes in the evening and studying during the "wait" times at work. He graduated with his MS in electrical engineering from Southern Methodist University (SMU) in 1959. Motivated partially by the dissatisfaction with his job (and seeing some of his colleagues who were test pilots lose their lives), partially by seeing his grandfather being very ill, and partially by his mother who was a physical therapist, he wanted to use his engineering knowledge to solve problems in the medical field.

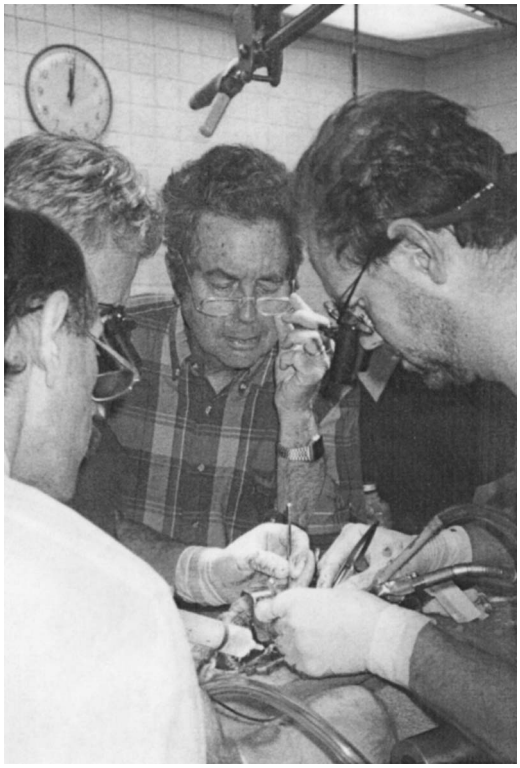
A.J. is a visionary. In the days before biomedical engineering (BME) as we know it today existed, he was determined to pursue a career in which he could use his engineering skills and mindset to solve problems in medicine. He was awarded a grant from Tulane Medical School to do electrophysiology research at Rice University. He enrolled in Rice University in 1960 to pursue his PhD degree, dedicating himself to his research that was aimed at recording time-varying evoked potentials in the cat brain upon visual stimuli. To a large extent this was really a signal processing task for which his electrical engineering background was highly appropriate. Telling is the fact that in 1963 (!) he was named the Schleider Scholar in Biomedical Engineering. He graduated in 1964 and started in a faculty position at the University of Texas (UT) at Austin that same year. In the late 1960s, he served on the BME committee there. Presently, BME is flourishing at UT Austin, in no small part thanks to the vision of people like Prof. Welch.

Prof. Welch demonstrating an experiment (early 1960s).

More telling about A.J. as a person is that he arrived at Rice with two young daughters (2 and 4 years old at the time) and his wife expecting a third child in tow. Like any ambitious young researcher, he was dedicated to his research but from 5:30 to 7:30 p.m. every day was his time with Pat and his three daughters. Anyone who has ever worked with A.J. or has met him knows of his love, devotion, and dedication as a husband, father, and grandfather.

His venturing into the field of laser-tissue interactions occurred largely by chance when, as a young assistant professor in the early 1970s, he got involved in writing a proposal in response to a solicitation from the U.S. Air Force to investigate laser flash blindness in pilots and determine safe levels of laser exposure in the eye. He was awarded this grant and started what was to become a nearly 40-year career investigating laser-tissue interactions. In the early days this was accomplished by placing thermocouples in the retina of monkeys in order to measure the temperature induced by laser exposure, the first of such *in vivo* measurements. A.J.'s early papers in the field of laser-tissue interaction involved the modeling of light distributions in tissue and the ensuing thermal effects. Several of these are still often-cited classics. In 1984 he organized an international workshop on laser-tissue interaction that brought people from around the world to Austin, Texas. This workshop turned out to be a significant event

and the start of many lifelong collaborations, perhaps none more significant than the one with Prof. Martin van Gemert from the University Medical Center in Amsterdam. Ultimately this collaboration resulted in the book *Optical-Thermal Response of Laser-Irradiated Tissue*, which was published in 1995. This book has become a classical reference for anyone in the field and is known to many in the area of light-tissue interaction simply as "The Book." For Martin and A.J., putting it together was a monumental task that they described as "the closest thing to childbirth a man can experience." Currently, plans are under way to write a second edition (and hopefully, as in nature, the birth of this second child will be easier).



Observing a surgical laser procedure (1998).

During his career, Prof. Welch has made significant contributions to many aspects of the field of light-tissue interaction. During his career he has lectured all over the world and has accumulated too many honors to compile here. His work on the development of models to predict light transport in tissue, determination of optical properties of biological tissue, and unraveling of the biophysical mechanism of continuous-wave and pulsed laser ablation of tissue are well known. His work on time constant models to describe laser-induced thermal effects in tissue is among his most cited and most significant. More recently, he has engaged in clever ways to overcome one of the major obstacles to clinical utility of light-tissue interaction, rendering tissue effectively transparent by using chemical agents to selectively modulate tissue scattering properties.

In addition to his direct impact in the field of light-tissue interaction, perhaps A.J.'s most important legacy is the people he has educated. Nearly 50 graduate students have completed their PhD degrees under A.J. Welch's direction and almost 100 graduate students completed their MS degrees in his lab. Over the years, many visiting scientists came to his lab and worked with him. So many of his former students went on to productive careers in academia, industry, and government. Many went on to become faculty at, for example, Oregon; Florida; Texas; Wayne State; UT Medical Branch at Galveston; Vanderbilt; Wyoming; Arizona; California, Irvine; Istanbul; Seoul; Paris; Amsterdam; and the U.S. Air Force Academy. Similarly, his students joined companies such as Northrup Grumman, Bell Labs, Pharmacyclics, Johnson & Johnson, and numerous smaller (start-up) companies. Others ended up in the Air Force Research Lab and other national labs.

Prof. Welch receives a lifetime achievement award of the College of Engineering at the University of Texas at Austin from Dean Ben Streetman (2004).

From the perspective of two of his former students, A.J. is one of those people with whom you realize you were lucky to be associated, whom you look up to as a role model of how a professor should mentor his students. He never told you exactly what to do or how to do it but would help you find a way to frame the problem, define a path to solve it, and see you through the process. He has the amazing ability to look at seemingly meaningless data and extract information out of it, asking the critical questions and putting his finger on the one part that ended up making no sense. His pragmatic character allows his students to tackle and address the most complex problems in the field. He always had ideas on how to proceed and what to do next even if it looked like things were heading down a dead-end street.

This special section contains 28 papers on a wide variety of topics, largely representative of A.J.'s broad interest and impact in the field of tissue optics. Many people with whom A.J. has worked over the past four decades have contributed to this special section, from his first cohort of graduate students from the early 1970s (Drs. Clarence Cain and Gerrit

Polhamus) to his most recent students (Drs. Stumpf and Rylander) as well as many of his long-time friends and collaborators. We hope you will enjoy this special section as much as we have enjoyed putting it together.

We are certain all who know A.J. Welch professionally or personally share the same sense of privilege to have been associated with this great scientist, this pragmatic engineer, this honorable man and gentle soul.

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Special Section Guest Editors