In Memoriam:
Charles J. Burstone (1928-2015)
Burstone Biomechanics: a Living Legacy

Charles Justin Burstone (*CJB*) is best known for his tenure at the University of Connecticut (*UCONN*), but the ***epicenter for biomechanics*** was at Indiana University (*IU*). CJB contributed substantially to the expression of his passion, and to the subsequent development of the bioengineering group at Indiana University and Purdue University at Indianapolis (*IUPUI*). Charlie's contributions to orthodontics were profound, and in addition he had broad interests in photography, art and music. He was particularly fond of Wagner's operas.

Family Background: CJB was born April 4, 1928 (*reportedly in Kansas City*) to an Eastern European, immigrant family living in Clayton Township, St. Louis, MO. Dr. Lester Burstone was a Russian dentist, who immigrated from Poland in 1920. He married Rose, an immigrant from Ukraine, who was 13 years his junior. CJB had one older brother, and the family lived over the father's dental office at 6369 Clayton Rd. (*This is <4 miles from the site Angle's First Orthodontia Course in the Olivia Building.*) The senior Dr. Burstone died of an acute MI at the age of 74, but CJB's mother lived to 92. According to CJB, she never understood why "*he did not have a dental office like his father.*" However, like his father, Charlie died of a massive MI, but not until the age 86. The timing of his death fits the online life expectancy for the Burstone name (*86.3yr*). Charlie would have appreciated that, because he was highly accomplished in statistics, a skill he learned on his own from an IU medical school statistician.

Marvin S. Burstone: CJB's older bother was born in 1922, and graduated with a DDS from Washington University, St. Louis (*Wash U*) in 1946. He specialized in Oral Pathology, and was subsequently appointed to the National Institute of Dental Research (*NIDR*). Marvin was a brilliant young scientist; he developed the azo-dye coupling reaction for localizing enzymes in histological sections (*histochemistry*). This is the method for in situ detection of alkaline and acid phosphatase in bone sections, in addition to many other applications in dentistry and medicine. Charlie took great pride in the scientific accomplishments of his "*famous*" brother, who died prematurely at the age of 43.

Korea: After earning a DDS in 1950 from Wash U, CJB practiced with his father for a short time, and then entered the US Air Force (*1951-53*). Deployment to Korea exposed another facet of his unique persona: photo-journalism. Charlie recorded the challenging wartime culture for average Koreans, with both photographs and movies. These historic documents were requested by the Korean government in 2011, to be archived the National Folk Museum. CJB was devoted to Korea and it is fitting that his last lecture was delivered in Seoul, shortly before his death. Charlie died doing what he loved!

The Indiana Years: In 1953, CJB entered the IU Orthodontics Program, chaired by J. William Adams, a former student of Alan Brodie, and a strong Tweed advocate. John Lindquist (*subsequently AAO President and ABO Director*) was the other full-time instructor. John was Charlie's research mentor, and remembers him as by far the smartest student in the program:

W. Eugene Roberts,
Consultant,
International Journal of Orthodontics & Implantology

"*He not only mastered orthodontics and cephalometrics research, but became proficient in statistics and mechanical engineering.*" Other famed clinicians also contributed: Morris Stoner, Rolenzo Haynes, and Hudson Kelley. When CJB graduated in 1955, Tweed Philosophy was his clinical foundation, and soft tissue cephalometrics was his Master of Science (*MS*) thesis, entitled: The Integumental Profile. Below is a 1980 photograph of many of the Indianapolis orthodontists who were instructors or classmates of CJB. The photo was taken by John Lindquist at a birthday party for Dr. J. Willams Adams.

Indiana University orthodontists of the Burstone Era, clockwise from the left: Drs. Morris Stoner, Frank Hapak, Jack Vorhies, Jim Baldwin, J. William Adams (Dept. Chair), and Hudson Kelley. CJB practiced orthodontics in Dr. Kelley's office.

Dr. James Baldwin was a former West Point Cadet with an MS in Physics from Yale. He was a classmate of CJB, in the following IU class (*1956*). Jim provided the spark for Charlie's career interest in biomechanics: ***applying statics and equilibrium to orthodontics***. They traveled to Purdue-West Lafayette to discuss the new concepts with the mechanical engineering faculty. Their historic presentation on "*biomechanics*" was at the 1960 meeting of the Midwest Component of the Angle Society (*Chicago*). After that, Jim and Charlie's paths in biomechanics diverged. Jim was content to apply the principles to continuous arch therapy, but Charlie focused on arch segments, and determinate mechanics. CJB's ***Segmented Arch Technique*** was published in a classic Angle Orthodontist article in 1966. He moved on to UCONN in 1970, but retained a strong commitment to Indiana.

The Roberts Connection

Dr. W. Eugene Roberts (*WER*) expected to study with Dr. Burstone at Indiana University, but while WER was in military service, CJB moved to UCONN to form a new biomechanics-oriented program in conjunction with Dr. Sam Weinstein. That was a wonderful opportunity for WER to blend training in bone physiology, under Harold Frost and Web Jee, with the biomechanics of Burstone and Weinstein. As a graduate student, WER was amazed with the depth of Dr. Burstone's intellect. He was brilliant, but they did not always agree in biomechanics because CJB was a physicist and WER was a biologist (*bone physiologist*). They had many interesting discussions over the years. WER quickly came to appreciate Dr. Burstone's almost religious fervor for biomechanics, and attempted to pass on that enthusiasm to his students. In addition to a number of students WER trained during a 1974-88 tenure at the University of the Pacific (*UOP*), there were 11 PhD-

Orthodontics students trained at Indiana University (*IU*) from 1988-2008. All of the latter group of students completed a PhD at IU, but a couple of them studied orthodontics elsewhere.

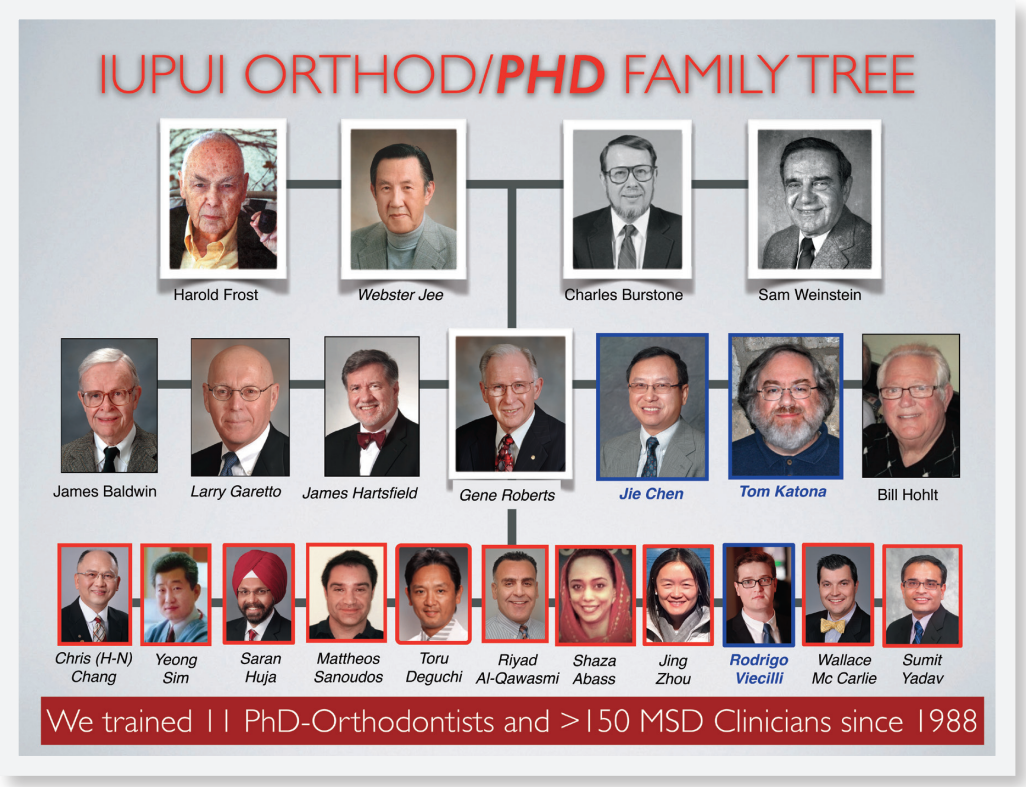
As we approach the 2015 Burstone Biomechanics Symposium, October 22-24, in Indianapolis, WER is currently working with two former students (*Dr. Burstone's Grand-Students*), Chris Chang and Rodrigo Viecilli, on a special application of engineering technology (*finite element analysis*) to a study of skeletal Class III correction. In addition to PhD-Orthodontics training, Chris and Rodrigo have training in surgery and engineering, respectively. Collectively, they have helped propel Dr. Burstone's concepts of determinant mechanics, for explaining the retraction and distal rotation of the lower arch to correct skeletal Class III malocclusion.

The Continuing Influence of Dr. Burstone

After graduating from UCONN in 1974, Dr. Burstone and WER had limited interaction, but CJB was always prepared to guide the careers of his former students. Charlie's telephone calls were never for small talk, he usually had an opportunity available! Sometimes the conversations were a bit cryptic, because he did not want to appear overbearing, but his guidance was usually pretty clear. In late 1987, CJB announced that the Chair was open at IU, and that would be a great opportunity for WER to have increased interaction in engineering. The move from San Francisco was a bit challenging, but indeed IU was just as Charlie predicted. It opened a range of new opportunities to expand the science of orthodontics.

In 2004, Dr. Burstone called WER to tell him about a student he found in Brazil (*Rodrigo Viecilli*), and sight unseen he should admitted to the IU PhD/Orthodontics Program. The instructions were followed and WER was rewarded with an outstanding addition to orthodontic biomechanics community. Rodrigo is now at Loma Linda University and he is working closely with Chris Chang and WER in defining clinical mechanics. All of this is a continuing legacy of Dr. Charles Burstone.

In 2006, Dr. Burstone called to discuss doing "*something*



significant for biomechanics at IU." After some discussion, he personally endowed, at the level of $500,000, the ***Burstone Biomechanics Symposium*** that will meet every two years at IU, forever! This will be a lively forum for the legacy of Dr. Burstone, indefinitely.

Chang-Burstone Art Connection

Dr. Burstone had many occasions to interaction with his Grand-Student Chris Chang. A notable occasion was the 2009 AAO Meeting in Boston, when Chris's wife Shufen photographed three generations of Burstone era orthodontists: Chris Chang, Charles Burstone, Gene Roberts and Jim Baldwin. Dr. Burstone and Dr. Baldwin were classmates who developed the concepts of biomechanics at IU in the 1950s. Dr. Burstone trained Dr. Roberts, and he in turn trained Chris Chang. Chris was so impressed with the photograph that he had it painted in oil, and the original is on display in the IU Orthodontics Department. A copy of the painting subsequently appeared on the cover of News and Trends in Orthodontics in January, 2011.

After the sudden death of Dr. Burstone in February, a special memoriam was planned for October 22, 2015, in Indianapolis, immediately prior to the Burstone Biomechanics Symposium. Chris Chang, the "*Renaissance Man of IU Orthodontics,*" prepared a sculpture of Dr. Burstone to be cast in bronze. Miniature busts will be presented to the speakers and former students returning for the Burstone Memoriam October 22.

Conclusion

Dr. Charles Burstone introduced many advanced biomechanics concepts that are applicable to almost all fixed appliance systems: lingual arch, transpalatal arch, intrusive base arch, T-loops, auxiliary segments etc. The bottom-line was he preferred ***statically determinate systems***: "*the orthodontist and not the wire should do the thinking.*" Since much of modern orthodontics emanated with Edward Angle in St. Louis, it is interesting that Dr. Burstone was raised within 4 miles of the original Angle school. Building on the mechanical intuition of Edward Angle, Charles Burstone provided a ***scientific*** rationale for the biomechanics of our specialty. A quote from his classmate Jim Baldwin was quite telling: "*I can't believe he died. He was younger than me. I thought he would go on forever. I guess life is a* ***finite element***."

Epilogue

It is unfortunate that Dr. Burstone is no longer with us to enjoy the progression of the innovative biomechanics of orthodontics and dentofacial orthopedics. The extra-alveolar (*E-A*) anchorage concepts, developed by Dr. Chang and his colleagues in Taiwan, are a prominent example of the expanding capacity to treat complex malocclusions conservatively. Indeed, the Burstone Biomechanics Legacy marches on!

Respectfully submitted,

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