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Industry Funding for Neurosurgery Research

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The role of industry in funding medical research and innovation is not new. For decades it has had a strong positive influence on research and adoption of new technologies, publication of articles, career development of individuals, and the overall advancement of a particular discipline or field.[1] It engenders partnerships between institutions and collaborations between individual physicians and scientists, is a strong source of funding support for educational activities, and buoys fledgling research endeavors at institutions without a large research infrastructure.[1] Through the years, it has brought advances to the medical field, benefiting countless patients and the population at large. At times, the boundary between academic efforts and private industry can be blurred or in a continuum, but this is largely to the benefit of society—think of all the advances in neurosurgical spine and endovascular instrumentation to name a few that have benefited thousands of patients and saved scores of lives. Most of these advances would not have occurred without careful partnerships between academic researchers and strong industry support. Therefore, the support that physicians and scientists receive from nongovernmental industry sources is an integral part of the fabric of modern medicine, past, present, and in the foreseeable future.[2,3]

No doubt, there are constraints. For physicians, there are concerns regarding conflict of interest (COI) or accurate reporting of results, or worse, failure to disclose the existence of the relationship.[4-7] There are also periodic instances of ethical lapses that taint the medical community, but these are the exception rather than the rule and they are constantly being addressed and rectified—at a local and national level and with ever-increasing scrutiny.[8] Strict regulations governing physician–industry relationships are in place to protect the rights of patients and to avoid unscrupulous conduct; history has taught us that painful lesson and there should be no compromise in that. But this must be carefully balanced against the element of discovery and innovation—allowing researchers to look beyond or think out of the box without stifling their freedom—and ensuring they receive the right support.[9]

Let us look beyond the narrow perspective of the medical arena for a moment and determine how other scientific fields have fared with this combination. One great example of a partnership or continuum between academic research and industry and its effect on society is the story of Amar Bose and the company eponymously named after him.[10] To understand just how profound his thinking was and how radical his approach, one

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Abbreviations and Acronyms
AANS: American Association of Neurosurgeons
COI: Conflict of interest
CT: Computed tomography
EMI: Electric and Music Industries
MIT: Massachusetts Institute of Technology
NIH: National Institutes of Health
NREF: Neurosurgery Research and Education Foundation
VHA: Veterans health administration

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has to go back in time a few decades to his initial years at the Massachusetts Institute of Technology (MIT). As a young teacher and researcher working at MIT in the early 1950s, Bose was intrigued by the concept of how the brain perceived sound. He felt that the reception, amplification, and perception of sound by the human ear was more than the physics of sound waves, or the mechanics of vibration. There was a profound neural and psychological component to it as well, not a common or well-understood concept a century ago. His study and research gave birth to the field of psychoacoustics and laid the foundations for one of the most revolutionary breakthroughs in the music and sound industry.[10] Bose translated his scientific achievements into a commercial venture and gave us the magnificence of concert sound in the comfort of our homes and quarantined us away from distractions with the wonder of noise-canceling headphones—and the innovations continue to this day. Bose, who passed away a few years ago, created the perfect balance of perception and distortion of sound in a tightly packaged electronic bundle and defied conventional wisdom. And he did it with a combination of knowledge, ingenuity, a bold mind, perseverance,—and the right support.[10]

Medical research breakthroughs are no different—a creative mind, bold spirit, and perseverance in the face of recurrent failure, are perhaps the most essential ingredients for a successful research career. Most individuals who pursue this calling possess those qualities in abundance. There is one more element that is important—the input of physicians experienced in the nuances of clinical care and application of new technologies. For technically demanding surgical fields like neurosurgery, this is a critical element as this experience translates into better decision making, patient safety, and improved outcomes. These researchers and physicians need the appropriate logistic and financial support; without that, even the most promising endeavors can wither. Philanthropy and industry support for research is actually the sap that sustains the system, and medicine, and other scientific or nonscientific disciplines, have all benefited from this.[9] Further downstream, society reaps the benefits, as Dr. Bose showed us. This is not new. Through the ages, a pioneering spirit, or team effort, buoyed by financial support from individuals, private organizations, or government agencies, has allowed us to improve our lives and those of others. It is the fundamental reason research is so important and financial support for research is so essential. Amar Bose's story is legend; his father actually borrowed $10,000 so his son could attend MIT.[10] So also Phil Knight, and the ingenious way Nike was born, or Apple, Microsoft, Facebook. The list is long and inspiring. But the environmental cues for these amazing stories can be very disparate or unexpected; it could be the hallowed halls of a famous institution like MIT or Harvard or the humble environs of a less august background. In fact, one of the most pervasive and effective imaging tools in modern medicine was born in a rather unpretentious fashion — and with industry support. Its impact on neuroscience and neurosurgery in particular has been so profound that the story bears telling.

Godfrey Hounsfield grew up on a simple country farm in rural England, the youngest of 5 children. His simple and somewhat isolated existence allowed him the freedom to think and experiment. As he describes it, he spent his days tinkering with electronics or mechanical devices and using his imagination to create outlandish schemes. Hhe once built a rudimentary hang glider that launched from stacks of hay behind his home, almost killing himself in the bargain.[11] At grammar school, his response to most academic overtures was tepid but he excelled at math and physics. A brief stint in the Royal Air Force allowed him the opportunity to learn more advanced electronics and radar technology. He went on to get an engineering degree and eventually a position at the Electric and Music Industries (EMI) research laboratories in Middlesex, United Kingdom. At EMI, he gravitated to computers and imaging technologies and came up with the concept of using a computer to stack thin photographic slices and cobble them into a 3-dimensional image. His concept met with universal skepticism, but EMI, buoyed by record sales of songs by a similarly avant-garde rock band named the Beatles, decided to bestow the princely sum of $40,000 to Hounsfield and his team to bring this concept to fruition.[11] Hounsfield's first prototype was a cumbersome device that took almost 9 days to produce an image. His team used pigs and human brains as subjects. Skepticism at their efforts was quickly joined by a healthy dose of ridicule from the radiology community. James Ambrose, a radiologist at London's Atkinson Morley Hospital, had similar doubts but gradually yielded and moved into a partnership with Hounsfield, producing the first working prototype of a computed tomography (CT) scanner. In 1971, they produced one of the first reliable images, that of the human brain (revealing a frontal brain tumor). In 1972, they presented their work to the medical community and forever changed the trajectory of modern imaging. Hounsfield went on to receive the Nobel Prize for medicine in 1979 and was eventually knighted.[11] At present, CT scanners are one of the most ubiquitous medical devices with uses permeating to all aspects of medicine. It is projected that the global market for CT scanners will be approximately $5.7 billion by the year 2020. Therefore, a relatively good rate of return on the initial investment EMI made in Hounsfield's research.

Governments and private organizations understand this and are willing to devote effort and financial resources to research. These advances benefit society, are financially lucrative, and propel the field forward. Funding for research, in neurosurgery or other medical disciplines, comes from a variety of sources.[5] Let us start at the top. The National Institutes of Health (NIH) is the world's leading underwriter of multidisciplinary, collaborative, and innovative, biomedical research.[12] It vast portfolio of 27 institutes and centers supports the physical infrastructure and intellectual efforts of 36,440 research projects across the United States and beyond through a highly competitive grant process. For fiscal year 2017, the federal budget allocated $33.1 billion (an increase of $825 million more than 2016) to the NIH to further its mission and goal of promoting innovative research. Almost 81% of all NIH funds go to 2500 institutions and 30,000 individuals who work outside the NIH. The core requirements for any researcher to be able to access these funds is to have a good track record in the field, adequate support structure to achieve the goals of the project, a project that is novel and original, and not otherwise funded.[12] Sounds simple, right? Not really—this is not an easy task and there are constraints to NIH funding. It is actually an arduous process that requires an extensive track record, robust research facilities, an already thriving program, and a large time-commitment. Just knowing the literature or subject and having an innovative idea or research question is not enough. Larger