Lessons from a Career as a Physician Scientist

—Looking Back and Looking Forward—

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Looking Back

Ever since my first memories of childhood, I wanted to be a doctor. My mother's reflections on her father and his wonderful qualities as a human being were intertwined neatly with his qualities as a giving and caring physician. Thus I asked for and received a stethoscope for my fourth Christmas. I often took old syringes, filled them with water and inoculated my mother, brother or sister through a needle into a sponge placed on their arms. I spent many an afternoon in my family doctor's office working as her "assistant". This dream to be a physician carried me through my childhood but somehow in the process of growing up, the dream changed to becoming a businessman like my father. As a college student I majored in history and was headed for a career as a financier until my first job as a summer intern in a major Wall Street investment bank when I learned that crunching numbers in a bank office was not nearly as much fun as I had imagined. After one week in that position, I rekindled my old aspirations to be a physician, left the job in the bank and signed up for a summer school course in chemistry on my way to medical school. Here I am now as a physician and, parenthetically, along the way I also became a businessman. I have learned many lessons in the process and would like to share them with you. I have also gained insights into the future which I wish to relate to you as well.

One of my earliest surprises in becoming a doctor was that my vision of the profession as one of laying hands on people and making sage diagnostic and treatment plans was jolted by the discovery that medicine is science. One cannot take care of patients without knowledge of the intimate details

of the biology and chemistry of the human body. The clear fact is that to be an excellent physician requires one, first and foremost, to be an excellent scientist. This knowledge of science must not be a static one. Until medicine, I always felt I could master any subject I studied in school. Alas, one can never master the science of medicine. To be a physician, then is to relegate oneself to a lifetime of learning. By the same token, the student of medicine must also be a teacher of medicine. The science of medicine is learned from those who have preceded us as students of medicine and perpetuated and advanced by us as teachers to those who follow us. In this light, it is easy to see that to be a successful physician, especially one committed to an academic life, it is important to identify an excellent mentor. A mentor will not only teach you the facts about medical science, he or she will help you to learn how to think about science and, if the mentor is a good one, will help you to meet the right people who can advance your career. The lessons of a good mentor are always passed on through subsequent generations as inevitably the best pupils of an excellent mentor become outstanding mentors in their own right. In my own specialty of gastroenterology, the lineage of outstanding professors and leaders in the field can be traced to but a handful of outstanding teachers such as my own mentor Dr. Morton Grossman.

Having learned to become a physician and committed to becoming a physician scientist engaged in the wonderful world of academics, what has turned out to be the critical successful factors in my career? First, the key to becoming a successful career scientist is to be a good writer. If this is surprising to you, it should not be. To be a good writer, one must be able to marshal one's thoughts in a cohesive fashion and then convey them to others so that they can be understood. It is not possible to do scientific work in this day and age without research funding and to obtain such money one must

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sell one's ideas to a funding agency. This is not just a matter of expressing one's self, it is a true competition based on the merits of one's ideas as written and conveyed to a judge. After having succeeded in obtaining research money, writing becomes important once again when the work is completed. A scientific finding is worthless unless it is shared with the rest of the world in its full glory and significance. This requires excellent writing, for in order to be published, the results must be conveyed to another panel of judges in a competitive process for space in the best scientific journals. All too often I have witnessed excellent careers in prospect die on the vine for want of writing skills.

A second critical success factor in academic medicine is the ability to learn new things on a daily basis. It may be surprising but too many careers are wasted by scientists who are married to one thing, whether it be a technique or a theory or a disease and then don't move beyond it. Science is an ever changing landscape and one's ability to adapt to the change will define one's success. Always expect the unexpected. My best work was attained when experiments produced the wrong results. Look at problems from all angles. Right-sideup may not be as informative as upside down. Never be afraid to try new approaches. Don't be a prisoner to a technology. If one can teach methods to the uninitiated, why should it be difficult for you to learn new methods for yourself. Never mistake technique or method for science. Science requires thinking, a hypothesis that must be tested and results that must be synthesized. Methodology, especially the methodology that may be in the highest fashion today, may seem elegant but in the barest form it is technology that is not difficult to learn.

Perhaps the most important critical success factor is resiliency. Being a physician, especially a physician scientist, is to learn how to fail over and over again, but also to learn to come back from the failure to fight another day. Those of us who have cared for patients know that all too often we are not able to save our sickest patients. Despite our best efforts and the most modern available science our patients die from time to time and we cannot save them. It only spurs me on with a greater sense of urgency to learn more, discover more, apply more knowledge to the next patient I try to treat. In sci-

ence, one faces a similar fate, more experiments fail then succeed. Most applications for research money are turned down. I can count on one hand the number of my scientific manuscripts that were accepted for publication without first being rejected or requiring substantial modification. I have always learned to expect the best but prepare for the worst and this adage could not be more appropriate as applied to a career in medical science. One should never be discouraged by failure, just prepare for it and use the failure as a springboard for generating the energy, resolve, and commitment that it will take to succeed the next time around. It takes enormous optimism and resiliency to overcome the true obstacles that stand between a physician and the well being of the patient.

Looking Forward

Many winds of change have buffeted our profession in recent years and will fundamentally color the way we practice medicine in the future. Perhaps the most important scientific discovery in human biology is the sequencing of the human genome at the dawn of the 21st century. The genome will alter forever how we think about human disease and consider ways to treat it. All human disease is caused by a genetic predisposition or an environmental influence such as a toxin or an infection. Knowledge of the genetic basis of human disease requires a practitioner to learn about the principles of genetics, not as an esoteric subject in school, but as a practical tool in patient management. For example, if one diagnoses a patient with colon cancer, it isn't enough just to take the cancer out. Doesn't one now have to identify the genetic basis of that cancer in search of the same lesion in the patient's relatives? The genome also provides the basis for diagnosis and treatment of disease. Genetic markers will predict long in advance those patients who must be followed for the inevitable consequence of a genetic predisposition to a problem. The publication of the human genome also provides the entire book of targets for pharmaceutical intervention to treat diseases. In addition, the genome provides the basis for genetic manipulation to alter the course of a disease, otherwise known as "gene therapy". All of these developments have raised other important issues to be faced by physicians, the ethical, legal and social

consequences of their actions. While such issues have existed for as long as medicine has been practiced, increasingly, governments and legislators have become more active players in the debate and physicians must learn to participate in the discussion.

As society has faced the moral issues raised by the advancement in the science of medicine, so also has it begun to take a hard look at the rising cost of healthcare which inevitably follows newer and more expensive approaches to diagnosing and treating disease. While it would seem a simple argument that society can't keep paying more and more for healthcare, one thing is certain : whatever it pays for must be worth the cost. It is no longer acceptable to perform procedures or apply tests and treatments simply because they are available. There is a clear mandate for us to demonstrate that the outcome of our ministrations as a physician is reduced cost, improved health, or a longer or better life. This requirement to show positive outcome demands a new level of gathering and submission by physicians of data which can be aggregated to derive true information of value. Ultimately, there will be important disease management algorithms that must be followed, some of the management being administered by healthcare professionals other than physicians and some by the patients themselves. In a sense, physicians may find themselves entering into a new social contract to provide a positive societal outcome from their efforts. No longer will it be tolerable for physicians to function as "lone rangers" practicing their own variation of medicine without regard to proven outcome data.

One of the most remarkable revolutions observed in all aspects of society has been the "microchip revolution" and medicine, as part of society, has not been spared. The ready availability of computers, databases and the world wide web has provided to physicians instant access to the universe of medical knowledge. More importantly, their patients have the same access. Today, patients are increasingly well-informed about their problems and the scientific basis for them. It is not unusual in the US for physicians to be faced with pa-

tients in the clinic armed with the most advanced information about their diseases and a host of questions which are difficult to answer. Indeed, a picture is emerging of three parties in an examining room, the physician, the patient and the computer terminal, interestingly with the first two on one side of the table and the computer on the other. In this setting, we physicians must learn how to harness the opportunity of better informed patients to more intelligence in managing their problems. Although we could easily find it embarrassing to face a patient who is more up to date in medical knowledge than we are, medicine has always been about judgement in how the knowledge is used and it is our experience that gives us that quality which we can bring to the bedside. To be successful as physicians in the future we must view our patients as our colleagues in their care and we must consult with them, talk to them openly about their problem, ask for their opinions, and then render our carefully considered judgement on diagnosis or treatment. The empowered patient can only mean improved care, which must be our ultimate mission in their management.

Conclusion

With all the challenges facing physicians in the future, a lifetime of working hard, a continuous requirement for learning as a student, frequent failures in our undertakings, and continuous intrusions into our practice by governments and legislatures, why is medicine still an attractive career? Most of all, because it is fun. The challenge of using all of one's intelligence, knowledge, and experience in the resolution of our patients' problems is as exciting as taking a journey through uncharted waters. The scientific explorations required to take that journey are exhilarating. When one ray of light is shown on the problem and an intervention conceived and applied to relieving the suffering of a single individual, the sense of victory and gratification is second to none that one can experience in life. Our patients await us. We must embrace their problems with urgency to help them do more, feel better and live longer.