The Medical Commencement Archive
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Arthur S. Levine, MD

University of Pittsburgh School of Medicine
Commencement

Dr. Levine became Senior Vice Chancellor for the Health Sciences and Dean of the School of Medicine at the University of Pittsburgh in 1998. He was named the John and Gertrude Petersen Dean of Medicine in 2013. He is also Professor of Medicine, Molecular Genetics, and Neurobiology in the School of Medicine. The faculty of the University of Pittsburgh ranks fifth nationally in NIH research funding, and Dr. Levine has been instrumental in fostering the University's remarkable research trajectory. Dr. Levine has focused his priorities on studies that exploit the vast amount of data emerging from the human genome project and on the newly emerging and powerful technologies that enable us to visualize the three-dimensional structures, locations, and interactions of the proteins encoded by genes as they exist at particular times in particular cells. Beyond his University responsibilities, Dr. Levine works closely with the University of Pittsburgh Medical Center (UPMC), one of the largest academic medical centers in the U.S., to ensure that health care delivery, biomedical research, and education—the three legs of the "classic academic stool" – remain equally strong and well positioned for future growth. He has also fostered the transfer of research discoveries to commercial applications, believing that contributing to the economy promotes a healthy society. Prior to his leadership appointment at the University of Pittsburgh in 1998, Dr. Levine served at the National Institutes of Health for more than three decades, having joined the National Cancer Institute in 1967. From 1982 to 1998, he was the Scientific Director of the National Institute of Child Health and Human Development, widely recognized as one of the world's leading centers in developmental biology. Earlier in his career, Dr. Levine played a leading role in clinical research on childhood malignancies, and he was one of the first to carry out systematic investigations on the prevention and treatment of opportunistic infections in patients with cancer. Throughout his career, Dr. Levine has also been engaged in molecular biologic research. He and his colleagues carried out the first physical and genetic mapping of SV40, a mammalian tumor virus. These investigators were also the first to work on naturally occurring viral recombinant DNAs, and the results provided an important source of information in the beginning of the recombinant DNA era. Dr. Levine continues to direct his own laboratory, which is focused on the molecular mechanisms that maintain the fidelity of the genome. Until recently, these studies were focused on cancer etiology; currently Dr. Levine is engaged in research on the root molecular cause(s) of Alzheimer's disease, believing that this is not a curable disease but one which must be prevented. Dr. Levine, who has authored or co-authored more than 280 scientific publications, has been widely recognized for his achievements. He has chaired numerous national and international scientific meetings, been elected to membership in many of the leading research societies and has held visiting professorships and distinguished lectureships at many universities here and abroad. Dr. Levine has served on the editorial boards of four scientific journals and was editor-in-chief of *The New Biologist*, a journal of cellular and molecular biology. He received the Meritorious Service and the Distinguished Service Medals of the United States Public Health Service, The Surgeon General's Exemplary Service Medal, the Distinguished Alumnus Award and an Honorary Doctor of Humane Letters from the Chicago Medical School, and the NIH Director's Award. Dr. Levine is a graduate of Columbia College where he majored in comparative literature and edited *The Columbia Review.* In 1964, he received his M.D. from the Rosalind Franklin University of Medicine and Science (formerly the Chicago Medical School). After an internship and residency in pediatrics at the University of Minnesota Hospitals, Minneapolis, Dr. Levine served as a fellow in hematology and biochemical genetics at the University of Minnesota prior to joining the NIH.

Good afternoon. This is the day when you look both backward—completing an era and graduating, and you look forward—commencing a new one. My job is both to celebrate you and help push you out of the nest. I have to say that the sight of you young scholars is inspiring.

Many of you grew up knowing you wanted to be physicians or scientists and planned for this day from an early age. Perhaps you are second or even third generation doctors. Your focus and drive are admirable.

But others came to medicine from less direct pathways—as chefs, pilots, musicians, moms. To all of you, let me just say that I can relate to this, as yours is a pathway that I shared—but in an era that was perhaps less welcoming to what we euphemistically call "nontraditional" students than Pitt Med has been during my tenure as your dean.

As an undergraduate, I had majored in Russian literature and shunned all of the traditional pre-med courses. In fact, it never occurred to me to go to medical school until on the eve of my college graduation, my father asked me how I intended to make a living. I recalled that the one mammalian species with the longest period of dependency on its parents--is the medical student. And so, I took the necessary courses, and went to medical school. But once in medical school, I happened on Rosalind Franklin's photos of the crystal structure of DNA, and told my father that what I really wanted to do was to drop out of medical school and become a molecular biologist. He told me that this was a fine idea, but he would then send me a bill for every day of education for which he had paid–starting with day-care. And so here I am, both a physician and a molecular biologist, and about to be an ex-Dean.

As I reflect on these transitions in my own life, I think of five life lessons that I wished I had known on my graduation day.

First Life Lesson: Words

As you can tell from my early background, I'm a word lover, and my first life lesson relates to the power of words. As physicians and biomedical scientists, you will find that words can be as powerful as many drugs, and as penetrating as our extraordinarily sophisticated modern imaging tools.

Regardless of the shape that health care reform efforts take, there's no question that the provision of health care will change in both the immediate and foreseeable future. You will work together with other professions, and this is where communication—words—will be critically important. You can't recapitulate the Tower of Babel in your interactions with one another. Rather, you will all need to share one another's vocabularies—to create and use a common

language—if you are to function as the Pittsburgh Penguins did in their 2017 Stanley Cup victory.

But your goal is—arguably—more important than the Stanley Cup. It is to establish common patient care goals, resolve conflicts, and build consensus so that you consistently provide excellent health care to your patients.
So where does that leave you as you move on to residency training or to your first position as a card-carrying scientist? I'll come back to where I started and ask you to think about where we would be in biomedicine without the power of words.

Words that will enable you, as health care providers, to get Mr. Smith to tell you, reluctantly, that he's only taking his blood pressure medicine every other day because he can't afford the co-pay.

Words that will not only motivate a particularly stubborn patient with emphysema to finally give up smoking but that will also challenge all of your patients to assume a measure of personal responsibility for their health—to think about prevention before treatment becomes necessary.

Words that will convey heart-felt sympathy when medicine and technology have run their course, and there is nothing left for you to do but offer your consolation to a dying patient's family.

Likewise, for those of you receiving an advanced science degree today, it is the words you choose that will convince the NIH that your proposal is genuinely worthy of support. And it will be your words, printed in the pages of Science or Nature, that will disseminate your findings into the larger world of biomedicine and enable them eventually to be translated into practice.

To all of you, I say:

Choose innovative and imaginative words as you wrestle with the latest setback in your research or a particularly difficult diagnosis.
Choose fearless words, especially in the face of seemingly insurmountable hurdles and risks.

And choose words like "how" or "why" that can lead to probing or challenging questions because the difference between good medical science and great medical science is often in the quality of the questions asked.

Let me also urge you to invoke the power of words at the national level. Use the power of words with those who can effect the change we need, including

lawmakers, media leaders, and your most powerful partners—the patients you care for. A quote from Dr. Martin Luther King is apropos here; he said, "Of all the forms of inequality, injustice in health care is the most shocking and inhumane."

If we hope to address these concerns and begin to solve these problems, we—and I include all of you in this mandate—cannot be content with simply being practicing physicians or productive scientists. We must speak and write words with the power to effect the health of our patients, our community, our society, and our culture. I began my reach toward medicine as a wordsmith, and that has stood me in good stead as a physician and as a scientist; I urge the same for you. Words can be priceless, but can they ever be cheap? Here, I am reminded of the talking dog. A man is driving in the countryside and sees a sign in front of a house, "Talking Dog for Sale, $10." The man can't believe it, knocks on the door, and the owner emerges. The driver says, "How can you possibly be selling the world's most unique dog for $10?" The owner says, "Come to the backyard, and I will show you the dog." The driver, incredulous, introduces himself to the dog, and says, "Tell me about yourself." The dog says, "Well, I was born with this absolutely unique gift and eventually word of my gift reached Washington. Then I was employed by the CIA, the FBI, and the Department of Homeland Security. They wanted me to go wherever in the world there were terrorism suspects, listen to what they were saying to one another, and then report back to Washington. I traveled everywhere—New York, Paris, London, Casablanca, Baghdad, Bogota." The driver, still incredulous, returns to the owner, and says, "How can you be selling this absolutely unique dog for only $10?" And the owner responds, "The dog is a liar—he's never been out of the backyard."

Life Lesson #2: Science and the Humanities

Let's return to the realm of the humanities where we investigate what really matters and what makes us human.

I'm not sure I could have articulated it as a student, but I know now that the most exciting ideas and intellectual advances often occur in the space where disciplines collide. So my second life lesson: We all do some of our most important work when we find our way to this space. One critical nexus is between the humanities and the sciences. Each informs the other in important, but often ineffable, ways. As Steve Jobs said, "technology alone is not enough—it's technology married with liberal arts, married with the humanities, that yields us the results that make our hearts sing." Jobs wisely insisted that computer scientists work alongside artists and designers.

It's difficult to imagine today, but there was a time when there was no distinction between the humanities and the sciences.

The week he became vice president in 1797, Thomas Jefferson presented a paper on fossils to the American Philosophical Society. And, while serving as our nation's president, he also served as president of that society. This dual role of scholar and politician is nearly impossible to imagine in a modern president. (Of course, multiple things that I thought impossible in a modern American president have proven otherwise.)

I worry now that the creativity that emerges at the nexus of science and the humanities is threatened, as many universities cut humanities courses in favor of technology-related skills courses. Of course, both are essential to bettering the human condition.

Some have said that the humanities are under attack precisely because they encourage students to think in more complex ways than the simplifications of our current political and corporate discourse.
In fact, we need more complex and creative ideas. We should be encouraged to cultivate our curiosity and question dogma. Have hare-brained and crazy notions. Be disruptive, take risks, abjure the incremental and safe. Dare to fail!

You should figure out where your comfort zone is—then get out of it to explore a bit. You may be very sure of what you're good at—and that's a good thing. But make sure you explore different cultures, interrogate ideas that are antithetical to what you believe, and examine art forms that you just don't get. In short, try things that don't reflect your own self-image.

Next Life Lesson (#3): Value basic science even if you don't practice it!
In research, this sometimes means simply following one's curiosity and trying to solve the biggest, most tantalizing mysteries one can imagine, regardless of whether it seems practical. To borrow a phrase from Richard Feynman, who said the same about physics, "Physics is like sex. Sure, it may give some practical results, but that's not why we do it."

Time and time again, we've seen that intellectual pursuits driven by curiosity—rather than by an attempt to develop a specific application—have yielded our most transformational ideas.

In science, we call this basic vs. applied, and, in addition to being a physician with roots in the humanities, I'm one with a passion for basic research embedded in my viscera. As might be said of the humanities, basic research is challenging: Its fruits may not emerge for years, and many see it as complex, abstract, remote, not practical.

Curiosity-driven research into bacteria, for example, has yielded amazing biological insights with powerful implications.

The discovery that bacteria can dice the DNA of attacking viruses into useless fragments, using restriction enzymes, led to a Nobel Prize in 1978. These DNA-cutting enzymes have since become the genetic engineering workhorse of what is now a $500 billion biotech industry.

That industry is currently on the cusp of a revolution, thanks to the discovery of yet another obscure bacterial defense mechanism, this one known as CRISPR. This is the process by which bacteria take snippets of viral DNA and insert them into their own genomes so that, even generations later, the bacteria recognize these viruses and are prepared to defend themselves against the infection. Research driven by curiosity—rather than an attempt to develop a specific application—has actually given us some of our most transformational capabilities. Dr. Jennifer Doudna of the University of California-Berkeley once described CRISPR as "probably the most obscure thing I ever worked on." That was before she and her colleagues realized and demonstrated that it was possible to manipulate this bacterial mechanism to edit the human genome almost as easily as editing film—deleting genes we don't like and substituting new ones at will. And we have our innate curiosity to thank, since nobody could have predicted this outcome when CRISPR was known only as a peculiar defense mechanism in bacteria.

CRISPR, as you've probably heard, has also opened the door to genetic modification of human sperm and egg cells, even human embryos. It offers the possibility of editing non-disease traits like intelligence or physical appearance—ushering in profound ethical considerations and questions; again, the link between science and the humanities.

A third mechanism used by bacteria to defend themselves against viruses is called c-GAS-STING in mammalian cells. It is the ancestor of interferon, a critical element of our innate immune system and one with a therapeutic role in some cancers. Think of it! One seemingly simple bacterium, matched to the curiosity of scientists simply wishing to understand how these bugs defended themselves against viruses. Not just one, but three separate defense systems in the lowly bug, the discovery of each leading ultimately to applications now that a few years ago would have bordered on science fiction!

But could there be such a thing as too much curiosity?

I am reminded of the story of the three prisoners about to be executed – the first, a minister, the second a soldier, and the third a health science student. The

minister's head is on the guillotine, and as a hush draws over the large crowd assembled to watch death in the making, the heavy blade plunges downward but stops an inch from the minister's neck. The crowd demands his release, because it is a sign from God. Next, the soldier is led to the guillotine; the blade plunges and again, it stops an inch from the man's neck. The crowd demands his release as well, since clearly, God has acknowledged the soldier's bravery and heroism. Finally, the health science student mounts the guillotine but looks up at the top, studies the blade's mechanism, and says, "…. You know, I think I see what the problem is."

Life Lesson 4: Health Care

I think every generation of new physicians believes that they are entering their profession at the most exciting, yet challenging, moment. I hope you share this feeling as you receive your diplomas today. For me, medicine and biomedical research retain the same excitement today as they did on the day I graduated. But they also retain the same challenges—in fact, I would argue that the scale of these challenges has escalated steeply as the nation's broken health care enterprise goes further into a ruin that your generation will be challenged to salvage. Let me cite some of the evidence:

The number of Americans without health insurance increased again in 2018 by more than a million, from 29.5 million in 2017 to about 30.5 million, and more than 87 percent of the uninsured are in working families. Consequently, it has been estimated that 45,000 Americans die unnecessarily each year.
25 million more Americans could lose health care coverage if the ACA were overturned.

Today, our nation spends more than $3.3 trillion a year on health care, but what are we getting for all of this money? Clearly, not enough. The U.S. now ranks last out of 16 industrialized countries on measures of morbidity and mortality amenable to medical care. Quality of care is highly variable, and opportunities are routinely missed to prevent disease, disability, hospitalization, and mortality. For a nation so richly invested in health care, and for all of our tremendous research advances, when it comes to getting evidence-based clinical care to the people, we are failing.

Our goals should be to move the nation toward high-quality, affordable, and accessible health care and to slow the growth of health costs, which now consume 18 percent of our economy, nearly twice the average of other developed nations, but as I have noted, with worse outcomes.

Even if we someday fix health care, there is still the issue of aging, its biology, and its concomitants—especially Alzheimer's disease. As we improve the

prevention of cancer and heart disease, and we live longer as a result, the incidence of neurodegeneration rises dramatically.

And, incidentally, speaking of prevention, why is it that physicians are generally paid to treat illness, but not to prevent it?

In the health care system that will be our future, I believe that we share the ideal of harnessing all of the resources at our disposal to improve the human condition. Achievement of this ideal will require us to recognize the role of science in health care, and to ensure that treatment is grounded in scientific evidence. Given the way our minds work, it's not always easy to abandon the hypotheses that were drilled into our heads during our training — but we must train ourselves to be lifelong learners. We must analyze the new evidence, and if it holds up to the rigor of the scientific method, we must embrace and implement the new—at least until the next paradigm shift comes along. Remember, it was just a few years ago that perimenopausal women were almost routinely prescribed hormone replacement therapy until additional studies demonstrated that the hoped-for cardiovascular benefit was not supported by the evidence from larger, more rigorous trials, and that the treatment increased women's risk for certain types of cancer.

Final Life Lesson: Zeitgeist (Spirit of the time)
You and I need to be brave enough to live our professional lives creatively and boldly. With that honor and privilege comes a profound responsibility to generate knowledge and be a force to make the world a better place. At this very moment —this Zeitgeist—we need you to help humanity figure out how to shape a future in which we all can thrive.

Every era has a Zeitgeist, a unique spirit that summarizes and captures it. The Zeitgeist of this time may well be defined by the singular issue of our planetary health. Here, then, is where we must assemble together, imposing on medicine and science our sense of history and evolution, how we have visualized and sung to our planet, our deepest grasp of what truly matters. We have one generation— to get planetary health right before it is too late to reverse the damage that has been done to it. Your generation may well be defined by this singular issue.

These are the five things I've learned since my own graduation:
Choose your words wisely and compellingly;
Get out of your comfort zone;
Feed your curiosity and question dogma;
Lead health care, don't follow it; and,
Challenge the Zeitgeist.

Why these five life lessons? Well, it's not for your own personal fulfillment. Don't get me wrong—I want you to be fulfilled, and I think this advice will help you in that regard. But I give you this advice for one simple reason: We need you. We need your talents and your creativity. You were chosen by one of the most selective institutions in the nation. You've been challenged by faculty members who demand original, provocative work. You've passed every test, and by doing so, you've demonstrated that you deserve to be among the graduates of this world-renowned institution. Again, with that honor and privilege comes a profound responsibility—yes, a responsibility!—to be a force for good in the world. And at the moment, we need you to help humanity figure out how to shape a future in which we all can thrive.

Congratulations, and go with my very best wishes for every success.