Who the heck is David Baltimore?

By Eleftherios P. Diamandis

My research lab consists of 12 Ph.D. students and 12 postdoctoral fellows and associates. At a weekly lab meeting last spring, someone asked, "Who is Vladimir Ilyich Lenin?" I was rather astonished to discover that other than me, no one in the room recognized Lenin's name.

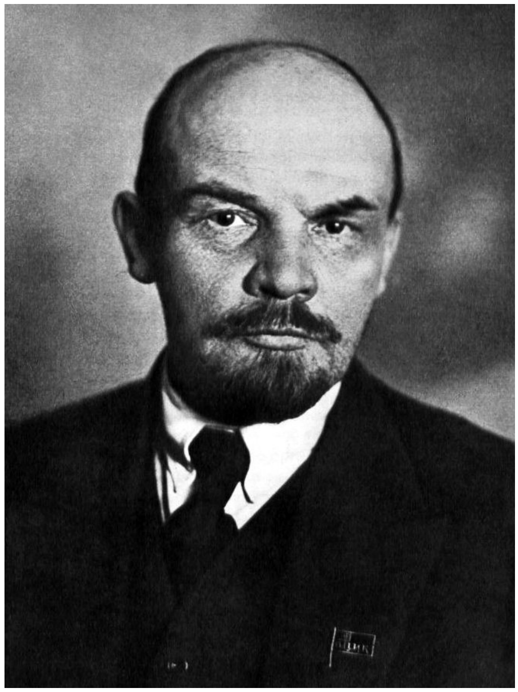
Perhaps being able to name the first leader of the Soviet Union is of little concern to today's young scientists. After all, the man was not in their field. But it is also the case that several of my own and other graduate students and postdocs are not familiar with many of the giants of modern science.

For instance, a student of mine once complained about an unfair question that was asked during the final examination of a Ph.D. thesis containing a series of reverse transcription-polymerase chain reaction experiments. The unfair question was simply, "Who discovered reverse transcriptase?" At another lab meeting, a guest speaker showed a quote attributed to David Baltimore, leaving my staff to ponder, "Who the heck is David Baltimore?" (See box.) Not too long ago, at a final Ph.D. examination on regenerative medicine, I asked who discovered inducible pluripotent stem cells. The candidate responded that the discovery was made by a Japanese group but he failed to name the Nobel Prize winner.

These kinds of knowledge gaps are not limited to North America. When I presented to a group of medical students in Spain recently, I asked if anybody knew of Spaniards who had won Nobels, and again there was silence.

Perhaps when you are starting out these days, reciting the names of distinguished predecessors in your field can seem like a trivial exercise in view of the mountains of material you need to learn for a competitive specialty. When I ask younger scientists why they don't recognize the greats, the answers I receive range from "How would I ever know?" to "I really know a lot about my specialty, but I am not good with names."

But it's not only the names that concern me. This generation, encouraged to focus on current technologies, is also not trained, as previous generations were, in essential math and measurement techniques. Many students are unable to prepare a buffer unless following a recipe, do not understand basic measurement principles – such as those of pH, absorbance and fluorescence – and cannot define the difference between a molar concentration and an absolute amount (i.e., 1 pmol/L vs. 1 pmol). When performing simple calculations, such as verifying the ratio of 99/10, they often turn to a computer or calculator. And when it comes to statistics, they sometimes do not understand the difference between a t-test and a Mann-Whitney U-test or ANOVA. They can, however, use the computer to calculate them.



Vladimir Ilyich Lenin

During a lab meeting, I asked my students, "Which measured signal is larger: 99 or 100?" and they thought it was a bad joke. But they appreciated it when I explained that if the uncertainty of the two numbers is 2 percent or higher, then the two signals are the same (or, more accurately, not statistically different). Finally, some of my students can explain how a mass spectrometer works, an instrument that is used daily in my lab, but are generally stuck when you ask them the difference between a C-8 and a C-18 column used for the up-front chromatography step.

Why is this happening? Although there might not be one particular reason, it appears that the dissemination of ready-made reagents and purchased services is exacerbating the issue. In my opinion, these allow for a faster research pace at the expense of the educational component of in-depth technical knowledge.

A related observation is that our wet lab, which was very crowded 15 years ago, is now usually empty. I find most of my graduate students sitting at their desks performing complicated bioinformatics analyses of their own or using publicly available databases to delineate mechanisms of disease and hunt for new biomarkers.

I suspect that not knowing the old folks, the old math, and the old techniques is common in many other research labs. But beyond an old guy like myself getting worked up about it, is it really a bad or worrisome development?

Scientific knowledge is expanding at an exponential pace, and our new scientists in training have little time to learn the fundamentals of basic techniques or to remember names of legends. Most likely, this situation will get worse with time.

Don't get me wrong –the younger generation is not only brilliant at using and adapting to newer technologies but also very resourceful and well equipped to solve meaningful scientific questions in the years to come.

Still, I strongly believe that having a solid foundation in basic principles will matter for young students who aspire to true relevance in their field. In a global, competitive world, the people most likely to succeed are those with both deep and broad knowledge and good communication skills.

Let us go back to Lenin for a minute. Imagine sitting at a table with another five or ten speakers at a conference you organized, and each speaker is specialized in one thing. How will you ever sustain a discussion for two or three hours if the only thing you know (even if perfectly) is very narrow?

Scientists are expected to have knowledge and opinions about other peoples' work – especially hot general topics like climate change, pollution, renewable energy, stem cells, new cancer therapies, epidemics, animal and human cloning, and so forth. Even politics, sports, music and movies have a place for discussion in such settings.

But how can we remain generally informed while pursuing our more narrow questions?

One way to sustain a well-rounded phenotype is by reading broadly, including leading general and specialty journals, magazines, and newspapers, even if you seem to have no free time. You likely will be a far more memorable individual if you show off multiple interests beyond your specialty. And if, during a discussion, you name one or two Nobel Prize winners from decades ago, you may get an interview for a job at one of your invitees' institutions.

Regarding names of Nobel laureates, here are my suggestions:

We have 20-plus freezers in the lab, and I propose naming each after a Nobel laureate. It's tough to miss the name when you are opening the freezer!

When Nobels are awarded in early October each year, we could hold a special lab meeting with three presentations: one on the new winners and two on previous ones, starting, let's say, in 1950.

3. Have a hall of fame in the corridor or lab displaying some Nobel winners and their work.

Regarding analytical knowledge, we senior scientists and mentors should advise, remind and expect our students to know the principles of fundamental techniques and their limitations so that data are interpreted properly. After all, we bear responsibility for the validity of such data, especially when published.

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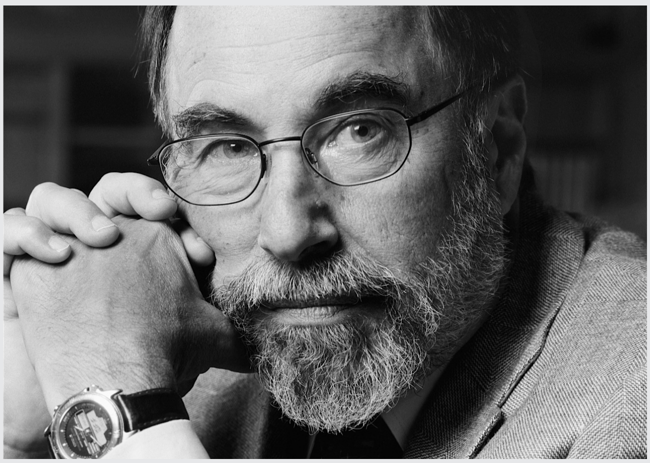

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David Baltimore

• An American biologist, university administrator, and 1975 Nobel laureate in physiology or medicine for discovering the enzyme reverse transcriptase
• Served as president of the California Institute of Technology (Caltech) from 1997 to 2006
• Currently president emeritus and professor of biology at Caltech
• Served as president of The Rockefeller University from 1990 to 1991
• Served as president of the American Association for the Advancement of Science in 2007
• Won the U.S. National Medal of Science in 1999