# Commentary: Let's re-create Bell Labs!

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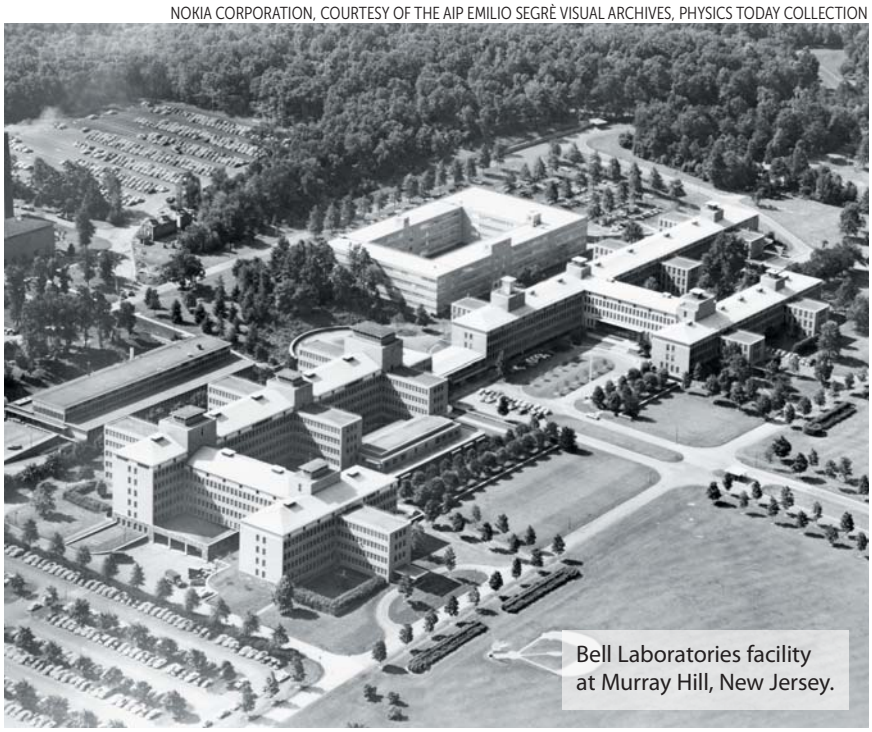

Bell Laboratories facility at Murray Hill, New Jersey.

Bell Labs was the research arm of the American Telephone and Telegraph Company (AT&T). During its golden era, from approximately 1925 to 1985, researchers could alternate between targeted development projects and new directions of their choice. Bell Labs recruited the brightest people, put them together in a crowded research setting, and often gave them only top-level guidance. That strategy may seem risky, but it led to remarkable breakthroughs and discoveries, including radio astronomy, the transistor, the CCD, the laser, information theory, the detection of cosmic background radiation, and new effects in solid-state physics. Those advances transformed the communications industry and resulted in eight Nobel Prizes.

In my field of atomic and molecular physics, two examples of breakthrough research are the development of laser cooling of neutral atoms, led by Steven Chu, and the optical tweezer, invented by Arthur Ashkin. Neither one was related to the labs' corporate mission of communications.

Bell Labs was a great success, but the breakup of AT&T in 1982 over concerns that it had monopoly power marked the beginning of the end of the labs'unique research culture.[1] It was only one of many outstanding corporate labs of that era that conducted innovative, world-changing research. Another great place for discovery, one that preceded Bell Labs, was the laboratory in Tuxedo Park, New York, created and privately funded by Alfred Loomis. It became a leading facility in radar and ultrasound imaging and other innovative research.[2]

We need a new Bell Labs or Tuxedo Park today more than ever. Civilization in the 21st century is facing great challenges whose solutions will depend not on incremental progress but on bold, creative breakthroughs. The corporate sector, now preoccupied with quarterly earnings and global competition, will not be a likely source of such innovation. One interesting exception is Google X, a semisecret experiment in creative research at Google, where researchers are attempting daunting projects. I am not convinced, though, that pursuing preselected projects in a secret setting is the right approach.

Some corporate R&D efforts have grand goals; for example, Google, Microsoft, IBM, and others are pursuing the development of a quantum computer. Those efforts are tightly focused and directed, without the freedom that was seen at Bell Labs. Likewise, current research at government labs is programmatic and has little room for exploratory research.

Most curiosity-driven research today is conducted at universities and depends primarily on federal funding. The peer-review process directing that funding is astonishingly risk averse, favors large collaborations and facilities, and comes with increasingly onerous bureaucratic requirements. Additionally, even small-scale tabletop research, especially in the US, is experiencing a steady decline in funding. I doubt that corporate leaders, lawmakers, or university administrators can solve these problems.

Our best hope for cutting-edge science that will lead us forward is a research laboratory focusing on applied physical sciences to benefit humanity and a nonprofit foundation to support it. Many existing foundations, following a long tradition of philanthropy in this country, could join forces to realize that vision.

In making my case, I draw on my own experience in academia, working with both federal and nonprofit funding agencies. At key points I was able to secure support from my institution through both a continuing endowment and discretionary funds. That money, obtained without a formal proposal and with no strings attached, allowed me to pursue new directions. For example, my research group developed novel methods to control and cool atoms as an alternative to laser cooling. When that work proved

successful, I was able to attract federal and foundation support. My group's efforts then led to a new and efficient method for isotope separation, again funded by my institution.

At that point I decided to establish the nonprofit Pointsman Foundation to produce much-needed isotopes for medicine, especially cancer therapy (see PHYSICS TODAY, September 2016, page 22). The foundation is broadly dedicated to advances in the physical sciences to benefit humanity. We are starting with philanthropy, but we will be able to sustain our efforts with revenue from isotope sales. The foundation's permanent scientific and engineering staff will incubate new inventions and applications and develop them into products and deliverables without the pressure of venture capital investment firms that demand quick profits. My longer-term vision for the foundation is to establish a parallel basic research laboratory—a new model for discovery and innovation in the spirit of Bell Labs.

Here is how I think this could work: The Pointsman Foundation will appoint a top-level scientific advisory board comprising scientists and engineers who will be compensated for their time. The board will recommend Pointsman fellows, who will conduct independent research at the lab for six years with the possibility of a small extension for outstanding progress. The fellows—typically tenured university faculty in departments of physics, chemistry, and engineering—would be selected for their track record of exceptional creativity. After advisory board recommendations and directors' approval, the fellows would be required to spend eight weeks per year at the laboratory and would hire postdoctoral fellows and technicians to conduct research.

Pointsman fellows could thus maintain their research groups and academic responsibilities at their home institutions. They would be given a yearly stipend of around $400 000 to develop a new experiment of their choice, with only one qualification: that the work be of benefit to humanity. The lab space for a fellow would not be large, perhaps enough for a tabletop experiment. The fellows could utilize the significant resources of their home institutions for fabrication and diagnostics. At the end of the funding period, the equipment would be donated to each fellow's home institution, which would enable them to continue the research if they could obtain funding. That arrangement will free up lab space for the next group of fellows.

If the research leads to inventions, the intellectual property would belong to the Pointsman Foundation, where it would be developed into commercial products that will sustain the foundation in the long term, beyond our initial line of medical isotopes. Sharing royalties with the inventors should stimulate innovation. In many cases, advances might not lead to patents or products, just to basic knowledge. But that is perfectly fine.

Imagine a cadre of fellows working in a stimulating environment and feeding one another intellectually in ways that lead to unexpected breakthroughs. The Pointsman Foundation's laboratory would get several new fellows every year to ensure a constant, enduring flow of creativity.

We cannot predict what will be discovered, but given the example of Bell Labs, we can be optimistic about success. An optimum number of Pointsman fellows—eventually perhaps around 25—would allow the foundation to reap the benefits of cross-disciplinary collaboration. The cost of such a vision would depend on the scale, but I estimate that an endowment for one fellow for a six-year appointment would be around $3 million, including funds for administrative and technical support staff. The cost would be borne initially by philanthropy but would be sustained long-term by revenue generated by the foundation.

It is time to stop criticizing the current poor funding environment and do something about it. I call on the physics community to provide input and help make this vision become reality. Let's re-create Bell Labs!

## References


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