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So long…

…and thanks for all the physics: Bell Labs, home to major experimental and theoretical developments in twentieth-century physics, is turning away from fundamental research.

Things ain't what they used to be. No more so than at Bell Laboratories, the New Jersey-based research company whose story is intricately linked with that of twentieth-century physics. According to reports[1], a combination of reorganizations and resignations has reduced the physics staff of the lab to just four members. The glory days of fundamental science at Bell Labs, it seems, are over.

But what days they were. Bell Telephone Laboratories, as it was called then, was created in 1925 from the merger of Western Electric Research Laboratories and part of communications company AT&T. Alongside a catalogue of achievement[2] in communications technology — beginning in 1927 with the invention of the negative-feedback amplifier and synchronized sound for motion pictures, through the development of cellular networks for mobile telephony to today's 'HDTV' (high-definition television) — the lab has an enviable record in basic physics research, one that includes six Nobel Prizes.

First up was Clinton Davisson, a Bell Labs physicist who shared the 1937 Nobel Prize for Physics[3] with George Thomson "for their experimental discovery of the diffraction of electrons by crystals". In 1977, Philip Anderson took a slice of the prize for theoretical work on the electronic structure of magnetic and disordered systems; in 1998, Horst Störmer, Daniel Tsui and Robert Laughlin were rewarded for discovering and explaining the quantum Hall effect. Most famously of all, in 1956 the Nobel committee recognized one of the most significant inventions of the twentieth century — the transistor, by Bell Labs physicists William Shockley, John Bardeen and Walter Brattain.

It was at Bell Labs that Charles Townes and Arthur Schawlow came up with the concept of the laser; in 1964, lab workers created the continuous-wave carbon dioxide laser, and in 1994, the quantum cascade laser. Steven Chu joined the ranks of the Nobel laureates for more laser-related work — the laser cooling of atoms. On the award of his prize in 1997, Chu wrote[4] of his time at Bell Labs: "We felt like the 'Chosen Ones', with no obligation to do anything except the research we loved best. The joy and excitement of doing science permeated the halls … Bell Labs management supplied us with funding, shielded us from extraneous bureaucracy, and urged us not to be satisfied with doing merely 'good science'."

That pursuit of better-than-good science could lead in unexpected directions. One of the most remarkable discoveries to come out of Bell Labs was serendipitous: the 1965 identification of the cosmic microwave background radiation by radio astronomers Arno Penzias and Robert Wilson. Indeed, radio astronomy was itself the result of a chance discovery made at Bell Labs by Karl Jansky, who had been seeking sources of static in terrestrial radio waves but instead found the radio emission from the centre of the Milky Way.

Penzias and Wilson were intending to measure the intensities of several radio sources in the sky using a 20-foot horn-reflector antenna (pictured), a left-over from a receiver system built at the lab for the Echo satellite[5]. But their data were dogged by unexplained noise, which persisted even after the pigeons roosting in the antenna had been evicted. The noise was in fact the signal of the Big Bang, now dissipated after billions of years to a black-body temperature of 2.7 K. In 1978, Penzias and Wilson bagged another Nobel for Bell Labs.

The breadth of research interests at the lab throughout the past century, and the warm feeling of academic freedom remembered by Chu and others, was possible in large part thanks to a comfortable cushion of funding from parent company AT&T. The communications giant had enjoyed a hugely profitable monopoly over the US market, but that ended with deregulation in the 1980s, and times got harder. In 1996, Bell Labs was spun off into Lucent Technologies, which then merged with French company Alcatel in 2006. Against the backdrop of tougher economic conditions in the telecommunications market, the lab was set reeling in 2002 by the fraud perpetrated by employee Jan Hendrik Schön, who was discovered to have published a string of papers based on falsified data[6].

Gee Rittenhouse, Bell Labs Vice President and Head of Research, talks now of a change of focus for physics research at the lab[1], necessary to respond to the business needs of the company. The future includes an active programme in high-speed electronics, and also in networking and computer science — continuing the tradition of the lab that brought us Claude Shannon's information theory, the Grover search algorithm, UNIX and C++.

There's no arguing against the business needs that are directing Bell Labs away from investment in basic physics, but the past successes of the lab underline the tangible benefit to be had from proper funding of fundamental research. In these 'credit crunch' times, the onus is on governments to maintain adequate funding for physics in our universities and public labs — and to not be satisfied with doing science that is merely good.

References

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