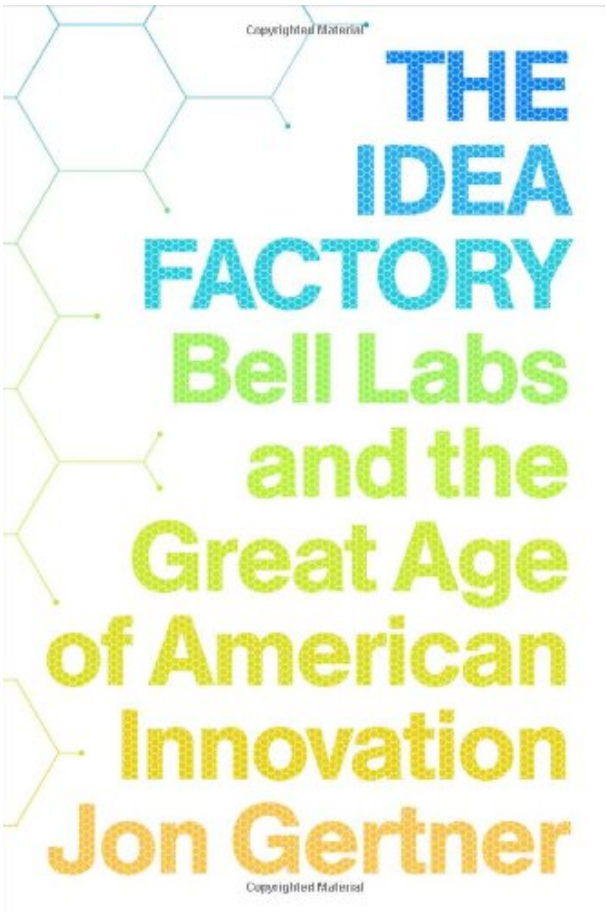
THE IDEA FACTORY: BELL LABS AND THE GREAT AGE OF AMERICAN INNOVATION BY JON GERTNER



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Review
“[F]illed with colorful characters and inspiring lessons...The Idea Factory explores one of the most critical issues of our time: What causes innovation?”—Walter Isaacson, The New York Times Book Review

“Riveting… Mr. Gertner’s portraits of Kelly and the cadre of talented scientists who worked at Bell Labs are animated by a journalistic ability to make their discoveries and inventions utterly comprehensible — indeed, thrilling — to the lay reader. And they showcase, too, his novelistic sense of character and intuitive understanding of the odd ways in which clashing or compatible personalities can combine to foster intensely creative collaborations.”—Michiko Kakutani, The New York Times

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About the Author

Jon Gertner grew up in Berkeley Heights, New Jersey—just a few hundred yards away from Bell Labs. He has been a writer for the New York Times Magazine since 2004 and is currently an editor at Fast Company magazine. He lives in New Jersey, with his wife and two children.

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The definitive history of America’s greatest incubator of innovation, the birthplace of some of the 20th century’s most influential technologies, including the integrated circuit, the communications satellite and the cell phone.

From its beginnings in the 1920s until its demise in the 1980s, Bell Labs—officially, the research and development wing of AT&T—was the biggest, and arguably the best, laboratory for new ideas in the world. From the transistor to the laser, it’s hard to find an aspect of modern life that hasn’t been touched by Bell Labs.

Why did so many transformative ideas come from Bell Labs? In The Idea Factory, Jon Gertner traces the origins of some of the twentieth century’s most important inventions and delivers a riveting and heretofore untold chapter of American history. At its heart this is a story about the life and work of a small group of brilliant and eccentric men—Mervin Kelly, Bill Shockley, Claude Shannon, John Pierce, and Bill Baker—who spent their careers at Bell Labs. Their job was to research and develop the future of communications. Small-town boys, childhood hobbyists, oddballs: they give the lie to the idea that Bell Labs was a grim cathedral of top-down command and control.

Gertner brings to life the powerful alchemy of the forces at work behind Bell Labs inventions, teasing out the intersections between science, business, and society. He distills the lessons that abide: how to recruit and nurture young talent; how to organize and lead fractious employees; how to find solutions to the most stubbornly vexing problems; how to transform a scientific discovery into a marketable product, then make it even better, cheaper, or both. Today, when the drive to invent has become a mantra, Bell Labs offers us a way to enrich our understanding of the challenges and solutions to technological innovation. Here, after all, was where the foundational ideas on the management of innovation were born.

The Idea Factory is the story of the origins of modern communications and the beginnings of the information age—a deeply human story of extraordinary men who were given extraordinary means—time, space, funds, and access to one another—and edged the world into a new dimension.

- Sales Rank: #104426 in Books
- Published on: 2012-03-15
- Released on: 2012-03-15
- Original language: English
- Number of items: 1
- Dimensions: 1.60" h x 6.10" w x 9.30" l, 1.40 pounds
- Binding: Hardcover
- 432 pages

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175 of 182 people found the following review helpful.
The life and times of a great American institution
By Ashutosh S. Jogalekar
During its fifty odd years of existence, Bell Labs was the most productive scientific laboratory on the planet. It won seven Nobel Prizes, contributed innumerable practical ideas underlying our modern way of life and, whether by accident or design, also managed to make some spectacular basic scientific discoveries that expanded our understanding of the universe. How did it possibly accomplish all this? In this authoritative and intensely engaging book, Jon Gertner tells us exactly how.

Gertner's book about this great American institution excels in three ways. Firstly, it describes in detail the genesis of what was then an unlikely research institution. Until then most communication related work was considered to be squarely within the domain of engineering. Bell Labs arose from a need to improve communications technology pioneered by its parent organization AT&T. But the real stroke of genius was to realize the value that basic scientists - mainly physicists and chemists - could bring to this endeavor along with engineers. This was largely the vision of two men - Frank Jewett and Mervin Kelly. Jewett who was the first president of Bell Labs had the foresight to recruit promising young physicists who were proteges of his friend Robert Millikan, a Nobel Prize winning physicist and president of Caltech. Kelly in turn was Millikan's student and was probably the most important person in the history of the laboratory. It was Kelly who hired the first brilliant breed of physicists and engineers including William Shockley, Walter Brittain, Jim Fisk and Charles Townes and who would set the agenda for future famous discoveries. During World War II Bell gained a reputation for taking on challenging military projects like radar; at the end of the war it handled almost a thousand of these. The war made the benefits of supporting basic science clear. It was Kelly again who realized that the future of innovation lay in electronics. To this end he moved Bell from its initial location in New York City to an expansive wooded field in New Jersey near Murray Hill and recruited even more brilliant physicists, chemists and engineers. This added further fuel to the fire of innovation started in the 1930s, and from then on the laboratory never looked back.

Secondly, Gertner gives a terrific account of the people who populated the buildings in Murray Hill and their discoveries which immortalized the laboratory. Kelly instituted a policy of hiring only the best minds, and it did not matter whether these were drawn from industry, academia or the government. In some cases he would go to great lengths to snare a particularly valuable scientist, offering lucrative financial incentives along with unprecedented freedom to explore ideas. This led to a string of extraordinary discoveries which Gertner describes in rich and accessible detail. One feature of the book that stands out is Gertner's efforts in describing the actual science instead of skimming over it; for instance he pays due attention to the revolution in materials chemistry that was necessary for designing semiconductor devices. The sheer number of important things Bell scientists discovered or invented beggars belief; even a limited but diverse sampling includes the first transatlantic cable, transistors, UNIX, C++, photovoltaic cells, error-corrected

communication, charged-coupled devices and statistical process control that now forms the basis of the six-sigma movement. The scientists were a fascinating, diverse lot and Gertner brings a novelist's eye in describing them. There was Bill Shockley, the undoubtedly brilliant, troubled, irascible physicist whose sin of competing against his subordinates led to his alienation at the lab. Gertner provides a fast-paced account of those heady days in 1947 when John Bardeen, Brittain and Shockley invented the transistor, the truly world-changing invention that is Bell Labs's greatest claim to fame. Then there was Claude Shannon, the quiet, eccentric genius who rode his unicycle around the halls and invented information theory which essentially underlies the entire modern digital world. Described also are Arno Penzias and Robert Wilson, whose work with an antenna that was part of the first communications satellite - also built by Bell - led to momentous evidence supporting the Big Bang. The influence of the laboratory was so formative that even the people who left Bell Labs later went on to greatness; several of these such as future energy secretary Steven Chu joined elite academic institutions and won Nobel Prizes (Bardeen won two). It's quite clear that the cast of characters that passed through the institution will probably never again be concentrated in one place.

But perhaps the most valuable part of the book deals not with the great scientific personalities or their discoveries but with the reasons that made Bell tick. When Kelly moved the lab to Murray Hill, he designed its physical space in ways that would have deep repercussions for productive thought and invention. Most crucially, he interspersed the basic and applied scientists together without any separation. That way even the purest of mathematicians was forced to interact with and learn from the most hands-on engineer. This led to an exceptional cross-fertilization of ideas, an early precursor of what we call multidisciplinary research. Labs and offices were divided by soundproof steel partitions that could be moved to expand and rearrange working spaces. The labs were all lined along a very long, seven-hundred foot corridor where everybody worked with their doors open. This physical layout ensured that when a scientist or engineer walked to the cafeteria, he or she would "pick up ideas like a magnet picks up iron filings". Other rules only fed the idea factory. For instance you were not supposed to turn away a subordinate if he came to ask you for advice. This led to the greenest of recruits learning at the feet of masters like Bardeen or Shannon. Most importantly, you were free to pursue any idea or research project that you wanted, free to ask anyone for advice, free to be led where the evidence pointed. Of course this extraordinary freedom was made possible by the immense profits generated by the monopolistic AT&T, but the heart of the matter is that Bell's founders recognized the importance of focusing on long-term goals rather than short-term profits. They did this by gathering bright minds under one roof and giving them the freedom and time to pursue their ideas. And as history makes clear, this policy led not only to fundamental discoveries but to practical inventions greatly benefiting humanity. Perhaps some of today's profitable companies like Google can lift a page from AT&T and channel more of their profits into basic, broadly defined, curiosity-driven research.

Gertner's highly readable book leaves us with a key message. As America struggles to stay competitive in science and technology, Bell Labs still provides the best example of what productive industrial research can accomplish. There are many lessons that modern organizations can learn from it. One interesting lesson arising from the cohabitation of research and manufacturing under the same roof is that it might not be healthy beyond a point to isolate one from the other, a caveat that bears directly on current offshoring policies. It is important to have people involved in all aspects of R&D talking to each other. But the greatest message of all from the story of this remarkable institution is simple and should not be lost in this era of short-term profits, layoffs and declining investment in fundamental research: the best way to generate ideas still is to hire the best minds, put them all in one place and give them the freedom, time and money to explore, think and innovate. You will be surprised how much long-term benefit you get from that policy. As they say, mighty trees from little acorns grow, and it's imperative to nurture those little seeds.

81 of 85 people found the following review helpful.

Missing Some Critical Facts
By Dr. Terrence McGarty
The Idea Factory is a well written presentation of what happened in Bell Laboratories in its early and middle lifetime. The author has captured the view from within the Lab and has presented a history that is in many ways presented in a manner in which the Lab people would have wanted it presented. His conclusions however are subject to significant debate, if not being downright wrong.

I write this review also having heard the author present his work in Madison, NJ to an audience almost totally filled with hundreds of former Labs staff and also as one who spent a great deal of time at the Labs from 1964 through 1972, while going back and forth to MIT, plus over fifty years in the industry.

The author presents the often told tales of Shockley and the transistor, Shannon and information theory, as well as all the management types who formed, directed, and molded the Lab like Kelley and others. Many of these people I knew firsthand and as any observer the view is all too often colored by one's position at the time.

The driving presumption of the author is best stated in his introduction where he says:

"Some contemporary thinkers would lead us to believe that twenty-first century innovation can only be accomplished by small groups of nimble profit seeking entrepreneurs working amid the frenzy of market competition. Those idea factories of the past, and perhaps their most gifted employees, have no lessons for those of us enmeshed in today's complex world. This is too simplistic. To consider what occurred at Bell Labs, to glimpse the inner workings of its invisible and now vanished "production lines" is to consider the possibilities of what large human organizations might accomplish."

This conclusion is frankly a significant over-reach, if not just out right wrong, since it is posited without any basis in fact contained within the book. The author never really looks at the many other parts of the Lab, the tens of thousands who worked on miniscule parts of large systems. The R&D group at Murray Hill was but a tiny part of an enterprise whose overall goal was to ensure the monopoly that AT&T had been granted by the Federal Government and to maximize the profit made in that monopoly.

To understand one must recognize that in the old Bell System profit was defined as a return on investment, meaning the invested plant. Revenue thus equaled expense, plus depreciation plus that profit construct; namely the company could charge whatever it wanted to subject to the regulators limited control. The game was thus to maximize profit, which in turn meant to maximize the invested plant, and not to be maximally efficient in a competitive sense, there was no competition. Understanding the ground rules of the old Bell System is essential to the understanding of Bell Labs. No other company, save perhaps the power utilities, functioned in such a manner. This was the basis of the world view of the Labs, a world of monopolistic control.

But the "creative destruction" of the free market did begin to surround the Labs. It surrounded the Labs in the areas in which the author appears paradoxically to make them most successful. Let me discuss just three examples.

Satellite Communications: The author speaks glowingly of Pierce and his vision of satellite communications. Yet Pierce wanted dozens of low orbit satellites, apparently driven by his desire to have low time delay for voice. He wrote a paper which appeared in Scientific American proselytizing the idea. Based upon that proposal, COMSAT was formed and capitalized based upon a need for this massive investment not only in space segment but also in the complex tracking earth stations. A few days after the COMSAT IPO Hal Rosen

and his team at Hughes launched Syncom I, the first synchronous satellite. Within weeks they launched Syncom II. Synchronous satellites provided global coverage with only three satellites, not the dozens demanded by Pierce's world view. COMSAT was then off with its own satellite, Intelsat 1 and its progeny using not Pierce, but Rosen. Somehow this minor fact is missing from the book.

Digital Switching: Fred Kappel was the Chairman of AT&T in the 60s during the time of the development of the first Electronic Switching System, the No 1 ESS. This system was developed by people such as Ray Ketchledge and others. They had deployed a computer based system, albeit still with analog mechanical switches called Fereeds. Fereeds were small mechanical switches that clicked and clacked. The Fereeds made the new computer elements be the dog still wagged by this old technological tail cross-connection technology. Kappel wanted an all-digital switch and the Labs kept putting him off. But at the time he had another card up his sleeve. AT&T also owned Bell Canada and their Bell Labs entity called Bell Northern Research. So off he went and got them to build the all-digital switch. The entity doing it became Northern Telecom, NORTEL. NORTEL subsequently became a major switch supplier of their new and better switches to the Operating Companies. Thus, in a true sense, Kappel used the entrepreneurial spirit of the Canadians to do what the mass of people at Bell Labs would not do.

The Internet: Now in the mid-1970s the ARPA net was in early development and some of the basic principles were evolving from Government, Academia, and a bunch of small start-up companies like Linkabit and BB&N. ARPA, the DOD advanced research arm had an office called IPTO and they wanted to expand the Internet more aggressively using the public telephone network. Yet since AT&T was a monopoly they somehow had to co-opt AT&T to agree. A first step was to go to a meeting at Murray Hill and seek their support. So off go a couple of folks from ARPA and in Murray Hill they met the standard Bell System meeting of a few dozen people. The senior person, a VP I was told, began to lecture them that if they wanted this accomplished just send them the money and they would deliver what they felt was the correct design. The ARPA folks walked away somewhat aghast and immediately reached the conclusion that they would develop what became the Internet, totally independent of AT&T. This was, in a sense, the final straw since it sowed, in my opinion, the seeds for AT&T's ultimate destruction, not the Judge Greene breakup.

The author, in my opinion, misses many other R&D entities which had a significant role in the evolution of technology, oftentimes well exceeding Bell Labs. Let me discuss just a few:

MIT Rad Lab: At the beginning of WW II Vannevar Bush set out to establish a center for R&D focusing on radar. Bell Labs had tried to capture this jewel but Bush wanted a more innovative and competitive center and as such he chose MIT and from that came the Rad Lab. The Rad Lab was composed of engineers, but they were drawn from many places and the best part was that when the war was over they went back to those many places. The Rad Lab designed radar but radar had the same elements as communications, and specifically digital communications. Thus from the Rad Lab came such innovations as the modem, designed by Jack Harrington, to interconnect signals from distributed sites. From the Rad Labs came rapidly effected engineering systems, and the terms system is critical, because the parts all worked together. From the Rad Labs came a set of book, the Rad Lab Series, which became the bible for engineers who entered the wireless world and the digital age. The Rad Lab was a petri dish that bred hundreds of engineers who went forth and created the core "startups" in the Cambridge 128 areas and also in Silicon Valley.

DoD Design Companies: It is well known that many of the transistor companies were driven by the demands of DOD. Also many of these same types of companies in Silicon Valley and in the 128 Corridor were driven by DOD money as well. Groups of engineers educated from the Rad Lab type entities of WW II came out and started small companies fed from the DOD demands in those days. It allowed for many bright engineers to experience the "startup" albeit at the Government trough.

This this book has strengths and weaknesses. Its strengths are:

1. A well written story of some of the key players in Bell Labs.

2. A well described evolution of the development of the management techniques.

3. An excellent discussion of some of the major personalities in the R&D world at the time.

Its weaknesses however should be considered when taking the author's conclusions to heart. Namely:

1. This is truly a tale written from the perspective of Bell Labs. It totally fails to consider the competitors and thus when reaching his conclusion the author does so without any basis in fact. He totally ignores the weaknesses of such a system as Bell Labs and moreover he fails to consider the alternative entities such as the Rad Lab and its offshoots. In my opinion this is the major failing of this book. It would have been much more credible and useful if the author had looked at Bell Labs in the context of the total environment; the strengths and weaknesses and the competitors and alternative models of research.

2. The monopolistic structure of AT&T was a major driver for what people do and why. The issue of return on investment being the profit, and not revenue less expenses, is a true distortion of what is done and why. This idea of a world view is a formidable force. It molded what the Labs and AT&T did and why they did it. The author seems to be totally devoid of any notion of its import.

3. There were many failures at Bell Labs, and those failures were never truly perceived by those within the system, and it was this blind spot that in my opinion also led to its downfall. The author missed a great opportunity to follow up on this. Instead we see all these Herculean minds making great successes and yet the system collapses.

4. Bell Labs was enormous in size and scope at its high point. I had spent time at Holmdel, Whippany, Indian Hill, Andover and even a brief stint at the remains of West Street. Yet the focus is on Murray Hill and a small part of a small part. This is especially disturbing in light of the author's global conclusion which is reached without a single discussion of these areas. To do Bell Labs justice one must perforce covers these as well. The Pierce, Shockley and Shannon tales are told again and again, but the efforts of the hundreds of thousands of others over the decades are still silent. In the presentation by the author before a mostly former Ball Labs group it was clear that my observation on this point had substantial merit.

Overall there is a significant story to be told but this author does not accomplish it. In fact the author's statement denigrating the entrepreneur and the process of "creative destruction" is made without any attempt to understand the difference between a monopolistic structure and competitive markets. Perhaps if we had kept the old paradigm we would still have our black rotary dial phones.

0 of 0 people found the following review helpful.
Too technical but not technical enough, wanted to be about people but wasn't that either
By 4boyz4me
Review first published on jenasbookreviews.blogspot.com

Started in the 1920s as Bell Labs, the official research and development arm of AT&T, this book delves into the people that made this lab so effective. This is the group that developed the transistor and lasers, digital and cellular telecommunications. There aren't many factors of today's society that has not been impacted by their inventions. But who were these people and why were they so successful in innovation? That is the

question that this books really looks into.

I read this for book club and wanted to like it. I'm always interested in how people come up with brilliant ideas but the way the information was presented was dull and boring. There were pieces that were interesting but it never sucked me in and it felt like it couldn't decide between trying to focus on the people that made it happen or the technology that they developed and so varied between the two which kept it from working well.

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