



Prototype

The Lemelson Center
for the Study of Invention & Innovation

Smithsonian
National Museum of American History

May

The Way the Ball Bounces

Franklin Odo



Asian people have been inventors and innovators for many centuries. The Chinese, for example, developed gunpowder, the compass, and spaghetti. We believe Koreans invented the printing press, well before the Chinese, who developed their version well before Gutenberg. But what's up with "race" and

invention or innovation? And what can Asian Pacific Americans (APAs) tell us about this issue?

APAs are a growing and vital "racial" group. Americans of Asian descent and those who trace their ancestry to the indigenous populations of Pacific islands like Hawaii, Guam, or Samoa now number more than 15 million and make up about 5 percent of the total population. Some have become prominent entrepreneurs like Jerry Yang of Yahoo, chefs like Ming Tsai, U.S. senators like Daniel Akaka, business leaders like Indra Nooyi of Pepsi, and inventors like Amar Bose. And the numbers of spelling bee winners or Westinghouse science awardees or students at MIT (sometimes said to stand for "**M**ade **I**n **T**aiwan") have raised questions about the disproportionate impact APAs may be having on science and innovation in our country.

[Read more ...](#)

Image: A guayule plant. Courtesy [U.S. Department of Agriculture](#).



Notes from the Director

In accepting his appointment as secretary of energy, Steven Chu became the first Nobel science laureate to serve in a cabinet position. His selection was also a first for a Chinese American scientist, the type of societal breakthrough marked each May by Asian Pacific American Heritage Month. Chu, one of the scientists featured in the Lemelson Center's Nobel Prize

centenary celebration, received the award for an amazing piece of experimental manipulation that used laser light to cool or slow down the motions of atoms almost to a standstill, at least in atomic terms. His Nobel citation linked this fundamental discovery to a range of applications, from more precise atomic clocks to atomic lasers to nanotechnology.

Although Chu came from an academic family, he has a talent and an inclination for bridging pure and applied research, a talent that will be critical to his success as secretary of energy. In his [Nobel acceptance remarks](#), he pointed out that these twin interests were ingrained since childhood. "Education in my family was not merely emphasized, it was our *raison d'être*," recalled Chu, echoing the family experiences of many high-achieving Asian Americans. At the same time, he noted,

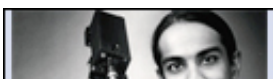
"by the fourth grade, I graduated to an erector set and spent many happy hours constructing devices of unknown purpose where the main design criterion was to maximize the number of moving parts and overall size. The living room rug was frequently littered with hundreds of metal 'girders' and tiny nuts and bolts surrounding half-finished structures." I find it interesting that the latter quotation could have come from almost any inventor. Yet, in fact, this childhood fascination with mechanical toys and devices turns out to be typical of scientists as well, including those at the Nobel level.

Over the years, the Lemelson Center's programs have presented and documented a number of Asian Americans who, like Chu, bring basic scientific knowledge to the service of technology and humanity. Among those featured have been Indian Americans such as [Akhil Madhani](#), an MIT student who invented a robot for heart surgery; [Subhenda Guha](#), a participant in the Center's Solar Shingle Challenge; and [Ashok Gadgil](#), who developed his UV Waterworks purifier for use in his native India.

Nowhere are these skills for bridging basic scientific knowledge and technological innovation shown to greater effect than in Silicon Valley, a powerful magnet for first- and second-generation Asian immigrants, especially those of Chinese and Indian origin. In a landmark 1999 study titled "Silicon Valley's New Immigrant Entrepreneurs," Berkeley professor AnnaLee Saxenian did a quantitative analysis of the contributions of skilled immigrants to California's economy. Among her most interesting findings was that Chinese and Indian immigrants ran 24 percent of Silicon Valley's high-tech businesses started between 1980 and 1998, a percentage far above their representation in the population. In 2007, Saxenian coauthored a follow-up report with a group from Duke University on ["America's New Immigrant Entrepreneurs,"](#) updating and generalizing the earlier report to the national level. Again, the findings were unmistakable: new immigrants have played a major role in innovation and in generating jobs and wealth.

In 23.5 percent of all engineering and technology companies founded in the United States from 1995 to 2005, at least one key founder was foreign-born. And among the immigrant founders, Indians and Chinese (both mainland- and Taiwan-born) have dominated the start-up firms. Yahoo founder Jerry Yang, born in Taipei, exemplifies this trend. One statistic was especially surprising: Of all companies established by immigrants in that decade, 26 percent have Indian founders. And where does the technology underlying these companies come from? According to the World Intellectual Property Organization, Chinese and Indian immigrants to the United States have also contributed far above their percentage of the population to international patent applications. While debates on the effects of globalization and immigration on the nation's economy continue, these reports make it clear that American competitiveness has benefited immensely from the contributions of Asians and Asian Americans.

Best regards until next month,
Arthur Molella
 Jerome and Dorothy Lemelson Director



Have You Seen?

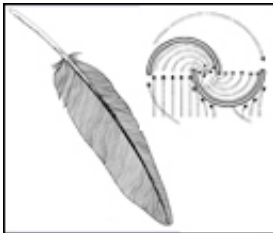
Akhil Madhani created the Black Falcon, a remote-controlled



robot that allows surgeons to manipulate body tissue, sew and tie off sutures, and conduct other delicate procedures through incisions as small as one inch wide. As a child, Madhani enjoyed building with his hands, making models, and designing his own toys. With his older brother Hiten, he would build model rockets. "I always thought biology was kind of icky. I always preferred machines and mechanisms," he said.

Want to know more about Madhani and the Black Falcon? Visit our [Invention at Play](#) and [Innovative Lives](#) websites!

Image: Akhil Madhani. Photo by L. Barry Hertherington, courtesy of Lemelson-MIT Program.



Trivia Challenge

In each edition of *Prototype*, we offer a question about an invention or inventor that you and your friends and family can try to answer. Sometimes the answer can be found on the Lemelson Center's website, where you can also learn a little more about the subject. Email your answer to us at prototype@si.edu along with your name and mailing address.

Each month we'll select winners randomly to receive a small prize from the Center.

Thank you to everyone who entered the April challenge and congratulations to Jo V. of Charlotte, North Carolina, and Ginger K. of Cranberry Township, Pennsylvania, who (among others) knew that looking at the curves in birds' feathers and thinking about airflow led engineer Roman Szpur to design a new turbine that cheaply and efficiently generates electricity from the wind. You can [learn more about Szpur's work](#) on our *Invention at Play* website.

This month's question: Which watchmaking company, in business since the 19th century, introduced the first commercial quartz wristwatch? Extra points if you know the year and model name! Tick tock.... (Well, sort of...)

Illustration of feather by Jessica Madole, with detail from Roman Szpur's U.S. Patent No. 6,345,957, issued 2002.



From the Archives

Ashok Gadgil, a physicist at the Lawrence Berkeley National Laboratory (LBNL) in California, was born in India in 1950. He earned a B.Sc. in Physics (1971) from the University of Bombay (now Mumbai), an M.Sc. (1973) from the Indian Institute of Technology, Kanpur, and an M.A. (1975) and a Ph.D. (1979) from the University of California, Berkeley. As a

senior staff scientist and group leader in the Environmental Energy Technologies Division of the Indoor Environment Program at LBNL, Gadgil is tasked with: leading research on energy-efficiency opportunities in high-technology, ultra-clean indoor spaces; leading research on disinfection of drinking water for developing countries; conducting technical and economic analyses of energy-efficiency opportunities; and

creating policies to accelerate energy efficiency in developing countries.

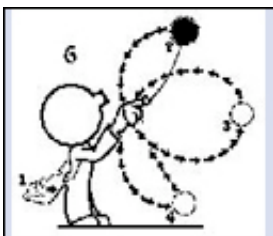
While at LBNL, Gadgil invented the UV Waterworks, a water purifier that provides reliable, inexpensive water disinfection. The UV Waterworks uses ultraviolet light to kill waterborne pathogens--bacteria, viruses, and molds--to purify drinking water. The key to this invention is the effect ultraviolet light has on bacteria and viruses--it triggers the formation of peptide bonds between certain nucleic acids in the pathogens' DNA molecules, which robs them of the ability to reproduce and renders them harmless. Gravity draws the water through the UV Waterworks, passing it into a tray where it is exposed for twelve seconds to ultraviolet light before it flows out a spigot. Gadgil used sheet metal, UV lamps, and stainless-steel piping to create this invention. The affordable cost is the primary and most important feature of UV Waterworks. The entire system (including costs of pumps, filters, tanks, electricity, consumables, and employee salaries for operation) can disinfect four gallons of water a minute, enough to provide safe drinking water for up to 1,500 people, at a cost of only four cents a ton.

Gadgil's efforts to solve problems of energy efficiency in developing countries don't end with the UV Waterworks. In the Darfur region of western Sudan, refugees in camps cook their meals over inefficient wood fires. Refugees seek wood from forests that are almost depleted and they must venture far to gather fuel. Away from the refugee camps, men and women risk being killed, raped, or mutilated. To address these issues, Gadgil, with colleagues and students (from the University of California, Berkeley), helped develop a high-efficiency cookstove made of inexpensive sheet metal. The team modified an existing design to create one that is 55 to 75 percent more energy-efficient than the stove traditionally used in Darfur, and is appropriate to the environmental conditions and food preferences of the local inhabitants. The stove costs approximately \$30 U.S. dollars to manufacture.

Ashok Gadgil earned several patents for his inventions. He participated in the Lemelson Center's Innovative Lives Program in 1998. This program brings middle-school students together with inventors to stimulate young people's creativity and their interest in science and invention. The presentation was recorded and the materials contain videos and audiocassettes of Gadgil discussing his inventive life and his work on the UV Waterworks unit, explaining the process of its invention. You can [read more about Gadgil](#) or delve into [his Innovative Lives Presentation and Interview, 1998](#), on the Lemelson Center's website.

Alison Oswald, Lemelson Center Archivist

Image: Ashok Gadgil. Photo by Jeff Tinsley.



Inventive Ideas for Schools and Families

Thomas Edison said, "To invent, you need a good imagination and a pile of junk." With these words of wisdom in mind, we challenge you to create your own yo-yo using items found in your recycling bin.

A yo-yo is made from two identical discs connected in the

center by a round rod or axle, with a piece of string looped around the axle. To build your own yo-yo, you will need to find materials to make each part: the two discs, an axle, and a piece of string. Most important, you'll need your imagination. [Download the challenge!](#)

And to get your yo-yo juices flowing, learn more about how a Filipino immigrant named Pedro Flores mass-produced and sold this simple toy he had known as a boy in the Philippines—and started a "yo-yo craze" in California in the late 1920s! Check out "[Yo-Yo Ups and Downs](#)" on our website!

Image: Drawing of the three-leaf-clover trick from The Art of Yo-Yo Playing, 1950. Duncan Family Yo-Yo Collection, Archives Center.



Upcoming Lemelson Center Events

Portrait of Invention: A Conversation with Lester Brown
Thursday, June 18, at 7:30 p.m.
Carmichael Auditorium, National Museum of American History,
Smithsonian Institution

Join us for a [special program](#) featuring author and global environmentalist Lester Brown. This latest installment in the Center's Portrait of Invention series offers participants a unique opportunity to engage with Brown, founder and president of the [Earth Policy Institute](#), in a conversation about the challenges of realizing a truly sustainable society. Brown will be interviewed by Marc Pachter, former director of the Smithsonian's National Portrait Gallery.

Prototype, May 2009

Copyright 2009 Lemelson Center for the Study of Invention and Innovation.

All Rights Reserved. 14th Street and Constitution Ave. NW, Washington, DC 20560

Contact us at prototype@si.edu

General Smithsonian Visitor Information: (202) 633-1000

or see more online:

[Lemelson Center website](#)

[National Museum of American History website](#)