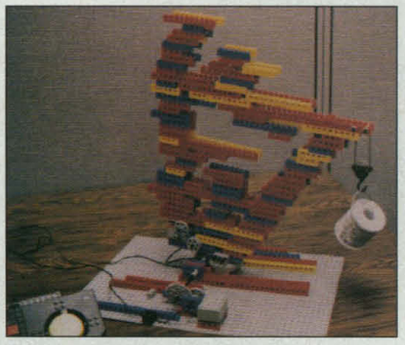
Evolving Toy Story

Few people over the age of 9 would think of Lego construction toys as the building blocks of life. But now two Brandeis University scientists have shown that with a computer program based on evolutionary principles it is possible to "breed" a structure, such as a bridge or a crane. It's a step, they say, toward the "evolutionary" design of robots.

Computer scientist Jordan Pollack and graduate student Pablo Funes designed their structures on a computer using a "genetic algorithm" based on 1000 randomly chosen brick designs. The patterns may evolve in two ways: "Mutation," which will randomly add or change the position of a brick, and "Crossover," which will randomly switch components of two "parent" designs. Each design got a "fitness" score based on weight-bearing ability (for the cranes) or length of span (for the bridges), which determined how likely it would be to have "offspring." When a promising structure eventually evolved, Pollack and Funes would build one out of Lego bricks and test it.



Crane bred by genetic algorithm is clunky-looking but does the job.

The resulting structures are clumsy and inefficient-looking, but they perform as their simulations promise. They demonstrate, says Pollack, that "an incredibly stupid and simple algorithm" can spur the evolution of unprogrammed features. The cranes, for example, evolved a basic engineering principle, always adding vertical struts to add strength to a diagonal arm.

"The unique thing" about Pollack's work, says robotics researcher Randall Beer of Case Western Reserve University in Cleveland, is that he hasn't stopped with computer simulations but is "actually building and testing the evolved structures."

On the Meaning of Seniority in Science

"I think some matters in this world are very tragic and comic at once. When I was in my prime, doing the most advanced research, I was not recognized. [N]ow my creative peak has long passed, [but] my fame grows while I'm making fewer and fewer contributions. ... Since 1992 I have become a member of three [prestigious scientific] academies. Isn't that strange?

"It's indeed absurd that now I am regarded as an authority, since I have cut myself off from first-line research for 5 years. There have never been computer authorities above 55 years old. But there are numerous people above 55 years who have made serious mistakes. ..."

—Computer laser typesetting pioneer Wang Xuan, 61, of Beijing University, adviser to the Founder Group Corp., China's most successful university spin-off, in a speech last October that was recently released to the Chinese press.

Breakthrough for Cuban Biotech?

Things may be looking up for Cuba's struggling biotech researchers, who have been toiling for years without bringing much cash to their impoverished country. The U.S. government recently gave the go-ahead for a Cuban meningitis vaccine to be marketed in this country, raising the possibility of further approvals of biotech joint ventures with Cuba.

Since 1980 Cuba has invested heavily in a fledgling biotech industry, even coming up in 1985 with the only marketed vaccine for group B meningococcal meningitis, which kills at least 17,000 people a year (*Science*, 27 November 1998, p. 1626). But so far Cuba hasn't broken into markets in the developed world, mainly because of the U.S. trade embargo, which severely restricts trade even in food and medicines and applies both to U.S. companies and their non-U.S. subsidiaries.

About 19 months ago, SmithKline Beecham, whose Belgian vaccine lab is owned by a U.S. subsidiary, asked the U.S. Treasury Department for a license to develop the meningitis vaccine with Cuba's Finlay Institute. In late July, the license was finally granted. Cuba will receive food and medicine at first, but royalties will be paid partly in cash. SmithKline plans to test the vaccine in clinical trials and could market it in the United States within a few years, says spokesperson Rick Koenig.

Watchers of Cuban biotech are encouraged. David Allan, chair of York Biomedical Inc. in Canada, thinks SmithKline's success could aid his firm's search for a U.S. partner to market Cuban cancer vaccines. "It's given a lot of confidence to other U.S. companies that might have been less confident before," Allan says.

Museum With a Heart

It will soon be incontestable that Rancho Mirage, California, is a very big-hearted kind of town. A three-story organ is about to rise at the city's Heartland, which bills itself as the nation's only interactive heart museum. Complementing the 12-year-old museum's current exhibits—which include a 3-meter-high robotic rubber heart that can simulate an attack and a gooey wall of touchable blood cells—the new addition will let visitors imagine life as a corpuscle: It will include a glass elevator traveling up the aorta and a ramp spiraling through the chambers. The $3 million steel-and-concrete structure is expected to be completed by Valentine's Day 2001.

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