Brazilian Investors Back Biotech Spin-Offs

Brazil's successful plant-pathogen genome project has brought the country into the new world of biotech. And its venture capitalists may be moving in, too. Two spin-offs from the genome project have become the first high-tech companies in Brazil to attract a private investor.

The funding comes from Votorantim Ventures, a branch of a huge Brazilian industrial conglomerate, which plans to spend $120 million on such companies. The first beneficiaries are Alellyx and Scylla, two firms founded by professors at the University of Campinas in São Paulo, home of the pathogen genome project.

Alellyx intends to develop technology from the genomes of such plants as the orange, sugar cane, grape, soybean, and eucalyptus. Molecular biologist Paulo Arruda, one of the five founders, says the company will receive $12 million over 5 years from Votorantim "to provide the technology that the Brazilian agricultural industry needs." The second company hopes to use an undisclosed initial Votorantim investment to develop bioinformatics software to sell to agricultural biotech companies.

The founders of Alellyx, a spin-off from Brazil's plant-pathogen genomes project.

The genome project was launched in 1997 by the State of São Paulo's science-supporting agency FAPESP, the richest one in the country. But moving those results into the marketplace, says Arruda, "would have been very difficult without the support of venture capitalists."

Secrets of the Didjeridu

The traditional Aboriginal didjeridu—about 2000 years old—looks primitive. But looks are deceiving, claim Australian researchers who recently played the ancient pipe inside an imaging machine.

The examination suggests that the acoustics of the long instrument—made from a hollowed-out tree trunk—are among the most complex of any wind instrument, claims "didj"-playing physicist Lloyd Hollenberg of the University of Melbourne. That's because the entire instrument includes the human vocal tract. In other words, the didj is not just a pipe, but a tube with a valve of flesh—the lips—that is coupled to the player's mouth cavity "right down to the epiglottis," says Hollenberg.

Hollenberg (left) and Wurundjeri instrumentalist Ian Hunter jam on double-stemmed didjeridu.

The didjeridu produces two types of sounds simultaneously—a low buzzing drone, from the pipe, and higher frequency chirps and animal calls that are formed within the vocal tract. A player can keep up a continuous sound with what's called "circular breathing"—squeezing air out of the mouth with the cheeks while taking a breath in through the nose. It's the same principle a bagpiper uses, only he squeezes a bag instead of his cheeks.

Earlier work by Hollenberg's colleague Neville Fletcher, a specialist in musical acoustics at the Australian National University in Canberra, described how a player's vibrating lips make the instrument resonate. Now, the two, along with acoustics experts at the University of New South Wales and medical researchers at the Howard Florey Institute in Melbourne, are investigating the acoustics of the rest of the instrument: the human vocal tract.

Hollenberg made a didjeridu with a tight bend at the end that fit inside a magnetic resonance imaging machine. He then climbed into the scanner with the instrument and got images of his mouth and throat while playing two separate notes. These will be combined with previous findings to produce a computer model of didjeridu playing. The model, says Hollenberg, will help bring scientific understanding of the didj closer to that of Western wind instruments.

The Universe as Computer

In Douglas Adams's classic sci-fi series, *The Hitchhiker's Guide to the Galaxy*, Earth is a gigantic computer created to calculate the meaning of life. An MIT researcher has now calculated how much number crunching the entire universe may have done since the big bang.

Designers of quantum computers are devising ways to use individual subatomic particles to store data and do calculations at the speed limits set by the laws of physics. That raises a question: How much computation can be squeezed out of a given chunk of matter? In a forthcoming paper in *Physical Review Letters*, engineer Seth Lloyd has used quantum mechanics, relativity, information theory, and thermodynamics to estimate the computing capacity of the universe.

Based on its density, Lloyd finds that it can have performed about 10^{120} operations in its roughly 15 billion years. As for disk space—determined by entropy—he figures it can store 10^{120} bits of information (compared with 10^{21} bits on all the world's computers). These numbers can be seen as the minimum required to run a high-fidelity computer simulation of the universe, says Lloyd.

If, indeed, the universe operates as a gigantic computer, it might be "programmed" by random quantum fluctuations, which might explain complex phenomena such as life. "Computers can do really interesting things with little prompting," he notes. Physicist Charles Bennett at IBM's research center in Yorktown Heights, New York, says Lloyd's idea is plausible but that it does not explain why complex phenomena are so stable. Random fluctuations disrupt such systems and initiate competition between complex and simple states. So "why is the competition won by something that's complicated instead of something simple?"

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