Sprouting Up...

Diversa dominates global search for blockbuster microbes

GRAIN

In the last decade the US' Diversa corporation has expanded its bioprospecting activities all over the globe, placing it very high – if not top – of the list of the world's bioprospectors. Diversa is one of an increasing number of companies hoping to make blockbuster biotech products from the estimated 99% of the earth's microbial diversity that cannot be cultured in the laboratory and that has thereby eluded previous scientific study. Its particular interest is in finding enzymes from what it calls extreme environments, which seems to include anything from ice glaciers and geysers to coral reefs and paddy fields.

Diversa bypasses the traditional step of culturing out micro-organisms from samples and jumps right to the DNA. It runs samples of soil, seawater or tissue through its DNA sequencing technologies to get the DNA fragments of all the micro-organisms present in the sample. It then takes this mess of DNA, chops it up into gene fragments and genetically engineers them into easy-to-culture micro-organisms that express the proteins encoded by the genes and screens the proteins for promising enzymes. The company says it has collected the genes for over 3 million micro-organisms and claims to be able to screen a billion genes per day. Diversa's large DNA collection is matched by a large patent collection, now standing at 192 patents, with over 500 patents pending.

Diversa's patented DNA is sourced from around the world. The company has bioprospecting agreements on every continent, with access to at least nine of the world's biodiversity hotspots. The company generally does not negotiate with local communities. It signs agreements with local institutions that have access to sites that it is interested in and then gets them to collect and provide samples for the company in exchange for "training" and a small share of "undisclosed" potential royalties.

Diversa's research offers few practical benefits for local communities. Its agreement with Mexico's National Autonomous University, one of the few to come to light, opened the country's diversity up to the company and in exchange the University was promised only equipment valued at $5,000, technical training in bioprospecting, $50 for each sample collected, royalties of 0.5% on pharmaceuticals derived from the samples and 0.3% royalties for any other products.[1]

The agreements are often portrayed as supporting scientific research but Diversa's activities do little to increase understanding of the ecosystems where it bioprospects because it simply extracts the DNA from samples and screens it for useful compounds. It generates no information about the actual organisms that the DNA belongs to.[2] The other downside of this method is that it leaves bioprospectors searching around in the dark for potential blockbuster molecules. Diversa can work with small samples but finding a valuable molecule can take a lot of samples when you don't know what you're looking for and this mass sampling can put the fragile ecosystems where Diversa often goes hunting at risk. There's also the worry that a successful find can ignite a bioprospecting gold rush for the mysterious DNA.

The real beneficiaries of Diversa's research and bioprospecting are its corporate clients in the pharmaceutical, chemical and agricultural industries. Diversa is working on feed additives for Danisco, pharmaceuticals enzymes for Dow and biocatalysts for the production of fuel ethanol from corn for DuPont. It's also one of the main recipients of funding from the US Department of Defence's BioDefense research program, having received well-over US$ 10 million to date.

But Diversa's closest partner is Syngenta. Early in 1999, Syngenta purchased over 5.5 million shares of Diversa stock and the two began a strategic alliance that led, later that year, to the formation of Zymetrics, a joint venture to develop products for animal feed and agricultural product processing. Zymetrics' first product was an enzyme for animal feed that it introduced in Mexico in 2003 and it plans to launch transgenic corn phytase and amylase products for the feed industry between 2006-2007 through Syngenta Seeds. In February 2003, Syngenta shut the doors on one of its most important research centres in the US and shifted 71 of its researchers over to Diversa as part of a 7-year US$118 million transaction. Syngenta also upped its ownership stake in Diversa to around 20%.[3]

Footnotes

[1] GRAIN, "Sprouting Up: Diversa Deals Revealed," *Seedling*, December 1999. www.grain.org/seedling/?id=164

[2] Colin Deeney, "How scientists are persuading the oceans to give up their secrets," *The Pharmaceutical Journal,* Vol 268 No 7197, 11 May 2002, pp655-656.

[3] Penni Crabtree, "Diversa, No. 1 crop chemical firm in deal," *The San Diego Union Tribune*, December 5, 2002.

[4] BioMedNet profile on Arctos Pharmaceuticals: www.siliconinvestor.com/readmsg.aspx?msgid=16702219

Partner	Date	Terms
Bermuda Biological Station for Research (BBSR)	October 1999	Three-year agreement for bioprospecting collaboration between BBSR and Diversa to collect samples from the shallow and deep waters of the Sargasso Sea, the ocean floor, and the inshore environments of Bermuda's coral reefs. Diversa provides training and equipment to BBSR scientists plus undisclosed royalties on commercial products derived from the samples.
Arctos Pharmaceuticals, Alaska, USA	August 2000	Diversa obtains access to environments covered by agreements Arctos has signed over the previous five years with Alaskan landholding Native corporations, individuals, and other entities. The Arctos access agreements provide local communities with a share of royalties on commercialised products for "passive" access to land, profit sharing arrangements for "guided" access to land and profit sharing and shared intellectual property rights for "contributing" access, which could mean sharing specific ethnobotanic knowledge.[4]
Rutgers University, USA	2000	3-year contract giving Diversa access to samples collected by the University at the Meadowlands toxic Superfund Site in New Jersey. In exchange for collecting the samples and providing them to Diversa, Rutgers gets undisclosed royalties on commercial products derived from the samples.
Russian government	November 2000	Agreement is part of US Department of Energy's (DOE) Proliferation Prevention program that takes Russian scientists out of nuclear weapons research. Diversa collaborates with Bechtel Corp's Idaho National Engineering and Environmental Laboratory. Diversa gets sampling rights to 4-6 sites in Russia in exchange for an undisclosed contribution towards the building of a Russian Ecological Biotrade Centre and undisclosed royalties on commercial products derived from the samples.
Council for Scientific and Industrial Research (CSIR), South Africa	December 2000	Diversa obtains rights to discover genes and commercialise products from environmental samples provided by CSIR. In exchange, Diversa "supports" CSIR bioprospecting activities and pay undisclosed royalties on commercial products derived from the samples.
The Department of Biochemistry, University of Ghana	October 2001	Diversa obtains rights to discover genes and commercialise products from environmental samples in exchange for scientific training, annual research support, and royalties on Diversa's revenues from products derived from sales.
The Kenya Wildlife Service and the International Centre for Insect Physiology and Ecology, Kenya	October 2001	Diversa obtains rights to discover genes and commercialise products from environmental samples in exchange for scientific training, annual research support, and royalties on Diversa's revenues from products derived from the samples.
Marine Bioproducts Engineering Centre (MarBEC), University of Hawaii	June 2002	Diversa obtains right to discover genes from existing material collections and from environmental samples collected by MarBEC researchers in and around Hawaii in exchange for undisclosed percentage of royalties on commercial products derived from the samples. In November 2004, MarBec licenses the right to a Diversa patent covering DNA sequencing. The license gives Diversa commercial access to new genes identified by MarBEC.
BioProspect, Australia	December 2002	Diversa obtains the right to test over 100 purified samples of BioProspect's library of plant samples collected from Western Australia and Queensland for an undisclosed initial sum and a percentage of royalties from commercial products derived from the samples.
Center for Reproduction of Endangered Species, San Diego Zoo (CRES), USA	November 2003	Diversa and CRES to collect samples of microbial communities from endangered species at the San Diego Zoo. Diversa will identify potential product candidates from the samples. No royalty agreement with CRES is mentioned.

Sources: company websites and press releases.