

BUSINESS

All systems go

Industrial chemists are borrowing techniques from drug researchers to track down materials with desirable properties. **Andrea Chipman reports.**

High energy prices and environmental worries are accelerating the hunt for good catalysts. Luckily, industrial chemists have found an unexpected tool to aid their search for better materials to speed up chemical reactions.

The latest addition to their repertoire comes from the drug industry and is known as combinatorial chemistry. The technique allows chemists to automatically synthesize and screen large numbers of compounds at once, helping to track down the ones that will prove useful. It has caught on fast in the petrochemical business, and industries making everything from cosmetics to food look set to exploit it too.

The technology has advanced significantly over the past five years, making it easier for industries to screen candidate materials automatically. The key to success is ensuring that small samples of a material will be reproduced accurately when production is scaled up.

"Assuming you have methods that are scalable, the speed comes from parallelization and automation," says Jason King, a chemist and head of business development at HTE, a company based in Heidelberg, Germany, that specializes in this high-throughput technology. Used the right way, the technique can bring down the cost of materials research and achieve in days or weeks what formerly took months or years.

"There's a huge increase in interest in advancing this technology," says King. "It has come of age at the right time."

High prices and profit margins in the energy business, together with growing demand for environmentally friendly processes, have encouraged major oil companies to buy into the new technology in a big way. They have signed large, long-term contracts with research companies such as Symyx Technologies of Santa Clara, California, which pioneered the approach.

Symyx was founded in 1994 by two biochemists: Alejandro Zaffaroni and Peter Schultz. The two scientists launched the company, which now employs 350 people, to find

new applications for high-throughput methods that were being used in pharmaceutical and genetic research. Zaffaroni had helped to set up Affymetrix, which supplies high-throughput genetic tools, and Schultz is director of the Novartis Research Foundation's genomics institute in San Diego.

Catalysts developed with high-throughput tools have found widespread use in the petrochemical industry, assisting the reactions that break down crude oil and gas, and convert the resultant hydrocarbons into plastics and other industrial products.

Much of the impetus for these advances comes from the fact that large corporations are looking strategically at all their research and development, and trying to raise productivity. "Clients are thinking about research and development at a different timescale and pace," says Isy Goldwasser, a chemical engineer and president of Symyx. "It takes a psychological shift."

Cleaning up

The nascent business of selling combinatorial-chemistry techniques to the process industries is dominated by just three companies: Symyx, HTE and Avantium. Based near Amsterdam,

Avantium is the youngest, having been spun off from Shell Chemicals in 2000. It is developing high-throughput techniques to find suitable catalysts for processes such as hydro-treating — which uses hydrogen to remove contaminants such as sulphur from petrochemicals. Avantium says it has invested "tens of millions of euros" in developing kit that can screen up to 96 candidate catalyst materials at once.

HTE, which stands for high-throughput experimentation, got started a year earlier and is staffed by chemists from both industrial and academic backgrounds. At first, it sought to develop materials of its own, but now draws most of its business from selling software and equipment to larger companies and forming research collaborations with them. Last year, for example, the privately held firm signed a major collaboration of



Pioneering: Isy Goldwasser



undisclosed value with Albemarle, a Virginia-based supplier of refinery chemicals.

"There's interest from refineries because of legislative pressure to improve fuel specifications," explains King. "That's driving a lot of catalyst developers to look at taking this up."

The German company, which employs about 40 researchers, produces systems that can do a quick screen of up to 625 catalyst samples at once, or more thorough screens of up to 48 candidates. Both types of equipment use fixed-bed reactors, in which candidates are loaded into a pipe and gases or liquids passed through them to produce the desired reaction. The quick screens take as little as 20 minutes; in later phases, as the tests get more extensive, reactions can take weeks or even months.

HTE is also interested in using high-throughput techniques to develop cosmetics and other end products. It has devised equipment, such as a dispensing system for viscous liquids, to do this. The equipment can be used to produce as many as 96 different formulations a day, each of which is made up of different mixes of 10 to 15 liquid or powder components, King says. Because the process is completely automated, the results are more accurate and controllable than experiments done by hand.

King says that clients are keen to invest money to improve their research and development process. "Their real source of competitive advantage is technological innovation," he says. "The emphasis on technology is one of the reasons why the whole high-throughput



GETTY IMAGES

Pillars of the community: the petrochemical industry is benefiting from high-throughput techniques, and others will follow its lead.

area has seen such an upswing.”

Being first off the blocks, Symyx has developed a wide range of patented materials, usually in partnership with clients. These include a phosphorus-based material that helps store X-ray images — developed with German film company Agfa — and a plastic used by Japanese semiconductor firm JSR. In total, it has struck deals with major industrial corporations that are worth more than US\$600 million, including a \$200-million, five-year research collaboration with ExxonMobil, the world's largest oil company, and a similar, \$120-million deal with Dow Chemical.

“Chemical corporations aren't used to working with small companies on research in the way pharmaceutical companies are,” Goldwasser says. “Over ten years, we've developed a business model to find ways clients can work with us to solve tough problems. High-throughput technologies are applied to that problem, and the customer owns and commercializes the material while we get royalties based on the value we add.”

Symyx's existing clients spend more than \$10 billion between them on research and development, leaving plenty of scope for expansion. “In my opinion,” says Goldwasser, “we've only scratched the surface of ways high-throughput research can improve the effectiveness of research and development.” ■

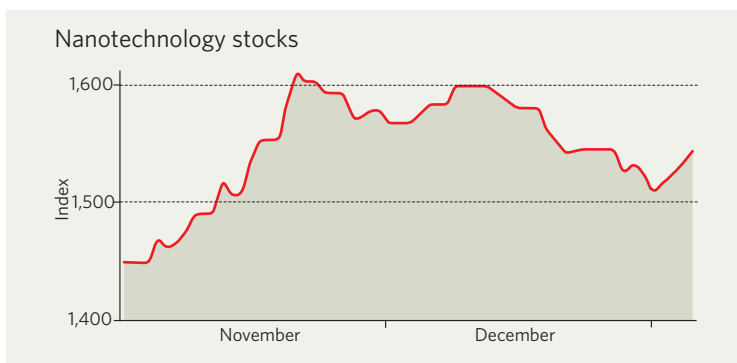
IN BRIEF

LEG UP Wyeth reached an agreement with Seattle biotechnology company Trubion to back its development of drugs based on molecules known as small modular immunopharmaceuticals, or SMIPs. The New Jersey drug company will invest \$40 million in Trubion immediately, with up to \$800 million to follow if certain milestones are met. Wyeth will gain most worldwide rights for marketing drugs developed under the deal, including a treatment for rheumatoid arthritis that is already in phase II trials.

INTELOUTSIDE Semiconductor manufacturers announced plans to move their products — and their brand images — into people's living rooms. At a huge consumer electronics show in Las Vegas, Intel and its largest rival, AMD, said that their next generation of chips would serve as the brains of multimedia home entertainment systems. The companies will brand computers containing the chips, and seek to make them compatible with a range of televisions and stereos. Intel's chip is called Viiv (rhymes with 'five') and AMD's offering is called AMD Live.

HIGH POINT A British pharmaceutical company has won permission from the US Food and Drug Administration to conduct phase III trials of a cannabis-based drug for the treatment of cancer pain. The drug, Sativex, which is obtained from cannabis plants grown at an undisclosed location in Britain, has already been approved in Canada for the treatment of pain caused by multiple sclerosis. The US trial will involve 250 people and take up to three years to complete. The Wiltshire-based company, G W Pharmaceuticals, also announced that it had obtained a US\$15-million cash infusion from Polygon, an international investment trust.

MARKET WATCH



Nanotech stocks ended a topsy-turvy 2005 in customary style, with a sharp rise in November followed by a dip last month. The turbulence emphasizes the point that, although investor interest in the fledgling sector seems to be growing, returns are far from assured.

The Lux Nanotech Index tracks about 30 companies: most of them specialize in nanotechnology equipment or applications, but a few are large manufacturing companies that make use of the new technology.

The index fell slightly over the course of 2005 — and ended the year significantly below its peak value of almost 2,000, attained in April 2004.

Nonetheless, Peter Hebert, founder of New York-based consultancy Lux Research, which compiles the index, claims that the upturn in November bodes well for the new year. Nanotechnology stocks “are starting to

outperform the market and we expect that to continue”, he says.

Strong performers towards the end of the year included Westaim, whose stock rose when it said it would stage an initial public offering of shares in its daughter company Nucryst. The Massachusetts-based subsidiary makes wound dressings, based on silver nanoparticles, that fight infection and inflammation.

The offer took place on 22 December and raised US\$45 million. But it provided no cash-in for initial investors, whose shares on the Nasdaq have since remained stubbornly stuck at their opening price of \$10.

Accelrys, a San Diego company that sells software to help others apply nanotechnology, also surged in value after announcing a nanobiology initiative that will be chaired by top biologist Leroy Hood. ■