

Whereas Boesch must travel to Africa to observe chimps, a new \$14 million primate facility at the Leipzig Zoo serves Tomasello's purposes just fine. He and his co-worker, psychologist Josep Call, are conducting numerous experiments at the facility to determine how human contact affects chimp behavior (see sidebar, p. 1247). Tomasello is also undertaking an intense study of human language acquisition. He's devoting a substantial chunk of his Leipzig funds to recording several hours of conversation each week between several mothers and their children. "We pay the mom to be a research assistant, and she turns on the tape

recorder," he says. The recordings, which begin at about age 2 when children start speaking more than one word at a time, require as much as 20 hours of transcription per hour of tape to ensure their accuracy. Aided by an army of transcribers, Tomasello's group has recorded two children for a full year. "We want to trace the language back all the way, where did it come from. If you go back day by day, it's like an archaeological record."

Although the Max Planck has brought together some of the brightest lights in their fields, observers say it is too early to judge whether the Leipzig recipe will succeed in

spawning a new era of interdisciplinary work in anthropology. The institute plans to create two more departments—one in biological anthropology and one in social or cultural anthropology—and recruit topflight scientists in the coming months. These will be critical partners in the interdisciplinary marriage and position the institute to move beyond the compartmentalization that many researchers believe is slowing down the field. "The real question," says Harvard's Hauser, is whether uniting these disparate fields will "actually influence how they do their work and think about [research] problems."

—MICHAEL BALTER

SCIENCE AND COMMERCE

Chemists for Hire: Have Flask, Will Travel

A new breed of entrepreneurs—synthetic chemists—are selling their skills to drug companies through contract shops

Two decades into the molecular biology revolution—which was supposed to herald the end of the age of chemistry—organic chemists are suddenly in hot demand. Potential drug targets are piling up faster than companies can adequately test them, for lack of those skilled in the art of organic synthesis. That leaves firms such as Bristol-Myers Squibb and Eli Lilly scrambling to add hundreds of chemists to their research staffs—and offering them \$80,000 a head, signing bonuses of up to \$40,000, and moving expenses. Even with those perks, however, there doesn't seem to be enough chemists to go around.

Enter the chemist-entrepreneurs. A growing group of skilled synthetic chemists is seizing the opportunity to build chemistry-for-hire companies that custom-synthesize organic molecules. It's a strategy that many in the pharmaceutical and biotech industry admit is often cheaper and faster than doing it themselves. "There's been an explosive growth in companies set up to do contract synthesis at scales ranging from the milligram to the kilogram," says Gifford Marzoni, a chemistry agent at Davos Chemical Corp. in Englewood Cliffs, New Jersey. Davos is a virtual synthesis shop that booked \$100 million in revenues last year, up 10-fold over the past 5 years, by matching

companies that need molecules with those that can make them.

Evolutionary Chemistry, a biotech start-up in Boulder, Colorado, turned to Davos recently when it needed some modified nucleotides for one of its drug-discovery efforts. Marzoni, in turn, is putting together a deal between Evolutionary Chemistry and a small company that can handle the assignment. "We couldn't afford to hire the chemists that we need, let alone find them, so we have to go outside the company to keep our projects going at full

speed," says Ted Tarasow, Evolutionary Chemistry's director of chemistry.

The dearth of skilled organic chemists goes back at least a generation. In the late 1970s, say longtime academic chemists such as Robert Coates of the University of Illinois, Urbana-Champaign, the best and the brightest students went into molecular biology, not stodgy old chemistry. Indeed, with characteristic hubris, some molecular biologists claimed that biotechnology was going to relegate synthetic chemistry to the back bench of drug development efforts. "Protein therapeutics were the story of the day, then," recalls Bruce Diel, a synthetic chemist and founder of ChemFinet, an online marketplace for synthetic chemists based in Overland Park, Kansas. "Synthetic chemistry was passé."

Around the same time, the negative publicity surrounding environmental disasters such as Love Canal further depleted the talent pool. "The only time chemistry made the news was when something negative happened, and that drove away many good students," says Thomas D'Ambra, who 10 years ago founded Albany Molecular Research, the grandfather of the chemist-for-hire industry, headquartered in Albany, New York. By the early 1990s, molecular biologists were generating a torrent of drug targets—and both pharmaceutical and biotech companies were realizing that protein-based drugs, with their large molecules, were not going to replace small organic molecules as drugs.

Today, with the completion of the human genome project, drug companies big and small concede that they shouldn't have built up their molecular biology capabilities at the expense of their chemistry groups. Bristol-Myers Squibb, for one, has stated that it intends to hire enough chemists over the next few years to shift the biologist-to-chemist ratio in its drug-discovery labs from 3:1 to 1:1. And many biotech companies admit in private that their drug development efforts are hamstrung by the inability of in-house chemists—if they even have any—to

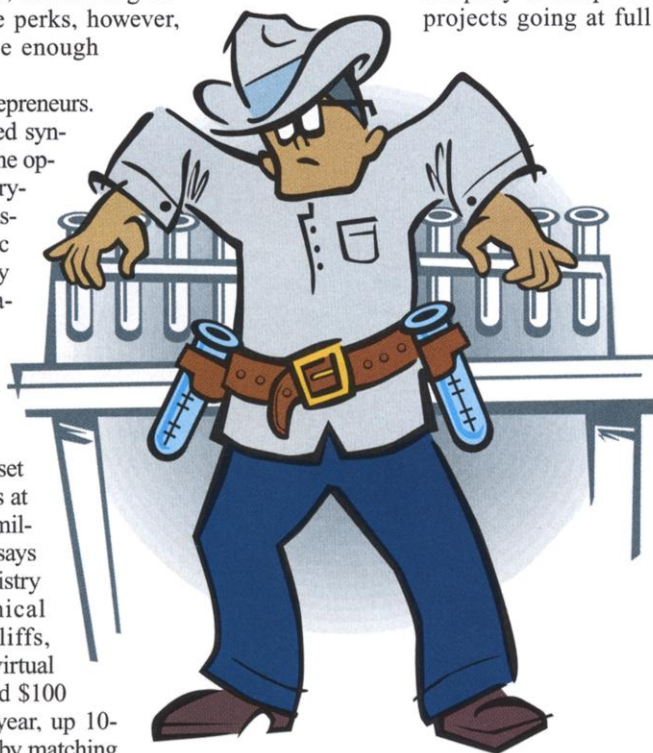
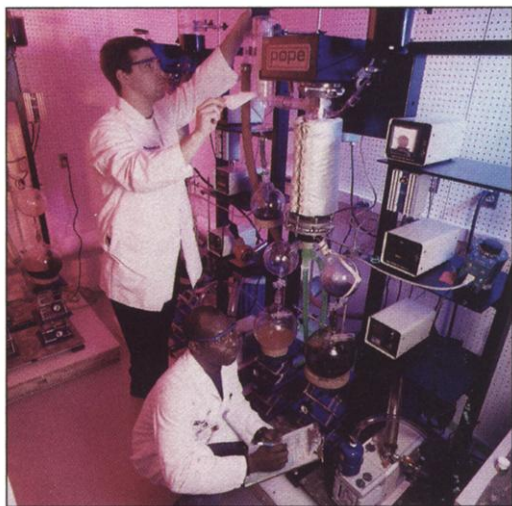


ILLUSTRATION: TIM SMITH



Hot stuff. Suddenly drug companies are scrambling for synthetic chemists—and finding them in short supply.

meet the demands of their biologists. “We have vice presidents asking us why we haven’t done any work on a good target,” says one researcher at a midsized California-based biotech company.

That’s why rent-a-chemist companies such as Albany Molecular Research and Array Biopharma in Boulder, Colorado, have seen revenues as much as double annually over the past few years, although admittedly from a small base. Each company has hired over 100 chemists, with more on the way. Although the two firms are engaged in their own drug-discovery efforts, their assembled chemical talents are largely directed at custom syntheses for partners. Albany Molecular recently placed seventh on *Business Week*’s 2001 list of hot growth companies, and Array was able to complete its initial public offering this past December when other companies refused even to try. “We have been able to capitalize on the increasing demand for high-quality chemical synthesis,” says Robert Conway, Array’s chief executive officer, whose company booked \$5.7 million in revenues during the quarter that ended 30 June, up 152% over the same period a year earlier.

Albany Molecular and Array Biopharma are full-service companies offering a host of chemical services. Clients pay on a sliding scale based on the number of steps in the milligram-to-kilogram journey. In a recent contract, for example, Albany Molecular synthesized more than 400 compounds for use in a cardiovascular drug screen. After the contracting firm identified a lead compound from the initial 400, it came back to Albany—for an additional, larger fee—to further develop the drug candidate. Albany’s partners include Eli Lilly, Aventis, and DuPont, whose spokespersons declined to comment pub-

licly about their use of such contractors.

Other companies are smaller and specialize in a certain type of chemistry. Synthron Chiragenics in Monmouth Junction, New Jersey, makes carbohydrate-based drugs using chemistries developed by the company’s founder and chief scientific officer, Rawle Hollingsworth, for example. Fluorous Technologies of Pittsburgh, Pennsylvania, is an expert in organic syntheses involving fluorine.

If chemists are in such short supply, where do these entrepreneurs find them? “We’ve been remarkably successful at taking people away from the major pharmaceutical companies,” brags Array’s Conway. Adds D’Ambra, “The market is tight, no doubt about it, but we work hard at creating a place that’s attractive to good chemists.” That formula includes competitive pay, plenty of stock options, and

what one chemist called “the opportunity to work with other chemical heads.” Says another, “It’s like being in academia, only I have the chance to be rich. Why should molecular biologists have all the fun?”

And although pharmaceutical companies grumble that these chemist-entrepreneurs aren’t helping to solve the problem but are merely cherry-picking from their labs, their presence hasn’t set off the type of bidding war that recently swept the high-tech industry. So until the inevitable response to supply and demand increases the crop of chemists, Marzoni says that companies like his are a practical alternative. “For those companies that can’t hire enough chemists, which is most of them these days, the only solution is to seek help outside the company.”

—JOE ALPER

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NATURAL DISASTERS

Researchers Target Deadly Tsunamis

Computer models, improved maps of the ocean floor, and new sensory equipment are giving scientists a handle on the causes of giant waves

ISTANBUL—When a colossal wave smashed into a spit of land along Papua New Guinea’s coast on 17 July 1998, it destroyed three villages and killed more than 2100 people. That’s when Costas Synolakis swung into action. The University of Southern California (USC) coastal engineer rushed to the site with an international team of tsunami scientists, including geologists, a seismologist, hydraulic engineers, and computer modelers, to find out every detail they could about the decade’s most deadly tsunami. They measured marks left by the waves, surveyed damage, took statements from shaken survivors, and scrutinized seismologic and hydroacoustic data. But the evidence left them with a persistent puzzle: How could a moderate earthquake off the coast generate such a devastating tsunami, with 20-meter-high waves that impaled bodies on tree branches and smashed every structure in the 25-kilometer-long sand spit between the Pacific Ocean and the Sissano lagoon?

Three years of data collection,

debate, and computer modeling may have turned up an answer. At recent tsunami conferences in Istanbul and Seattle,* and in an article being prepared for publication this fall in the *Proceedings of the Royal Society*, Synolakis, seismologist Emile Okal of Northwestern University in Evanston, Illinois, and several colleagues propose what they believe to be the culprit: an underwater landslide. Evidence of such a “slump” turned up in a detailed bathymetry survey, or map of the ocean floor, co-sponsored by the Japan Marine Science and Technology Center and the South Pacific Applied Geoscience Commission. The survey showed



Hammered. The village of Sissano, Papua New Guinea, was demolished by a tsunami in the summer of 1998.

* NATO Advanced Research Workshop, “Underwater Ground Failures on Tsunami Generation, Modeling, Risk and Mitigation,” Istanbul, 23–26 May.

International Tsunami Symposium 2001, Seattle, Washington, 7–10 August.