

Technion Graduate Students Break Through

Ask Elad Barkan, Yaniv Zohar or Kinneret Keren why they chose the Technion for their graduate studies, and each will say that, first and foremost, it was because of their inspirational professors.

Ask their three professors about their brilliant, hard-working graduate students, however, and it is to these young investigators that Profs. Eli Bilham, Nathan Karin and Erez Braun give immediate and unstinting credit for much of their collaborative breakthrough research at the Technion this past year. (See article below.)

Recognizing the vast contribution of Technion graduate students in all faculties, Technion President Yitzhak Apeloig, who still regularly takes time to drop in on student researchers in the laboratory, has led the administration in making the growth of the graduate school a top priority. Toward this end, the university recently initiated programs such as *Fostering Academic Excellence* to entice top graduate students by providing them with the

resources to focus on their studies and contribute to the scientific and technological research that is imperative for Israel's future.

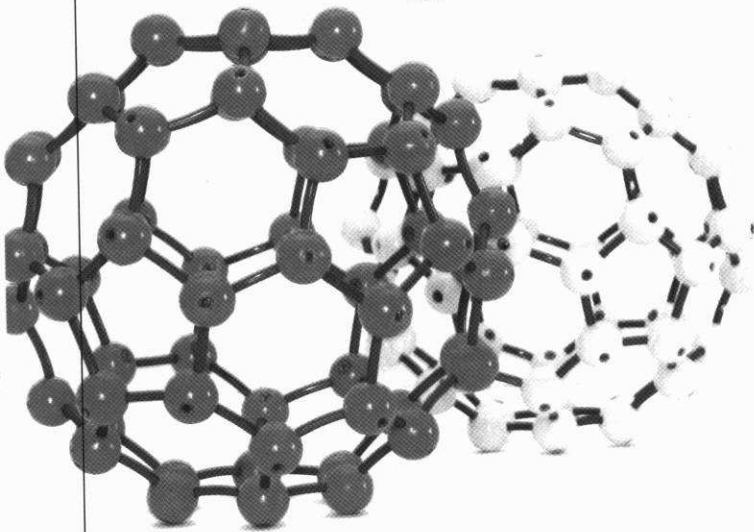
Meanwhile, bright young students such as Elad, Yaniv and Kinneret are already behind the scenes, making that future possible. Meet them in the following profiles:

ELAD BARKAN: THE KID PROFESSOR

"When I was a kid, I was known in the family as 'The Professor,'" says Elad Barkan, 28, who studies computer science under Prof. Eli Biham. Elad recently created international headlines when he discovered a security hole in the giant GSM system (Global System for Mobile Communications), which carries more than 70 percent of all digital mobile phone and global wireless traffic. "I was famous for asking questions. To their credit, my parents always took time to answer me until they no longer knew the answers and told me to open an encyclopedia."

Elad grew up in Petach Tikva,

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The link between these three cutting-edge advances is, of course, that all were made at the Technion.

Breaking Through

CRYPTO 2000 CONFERENCE:

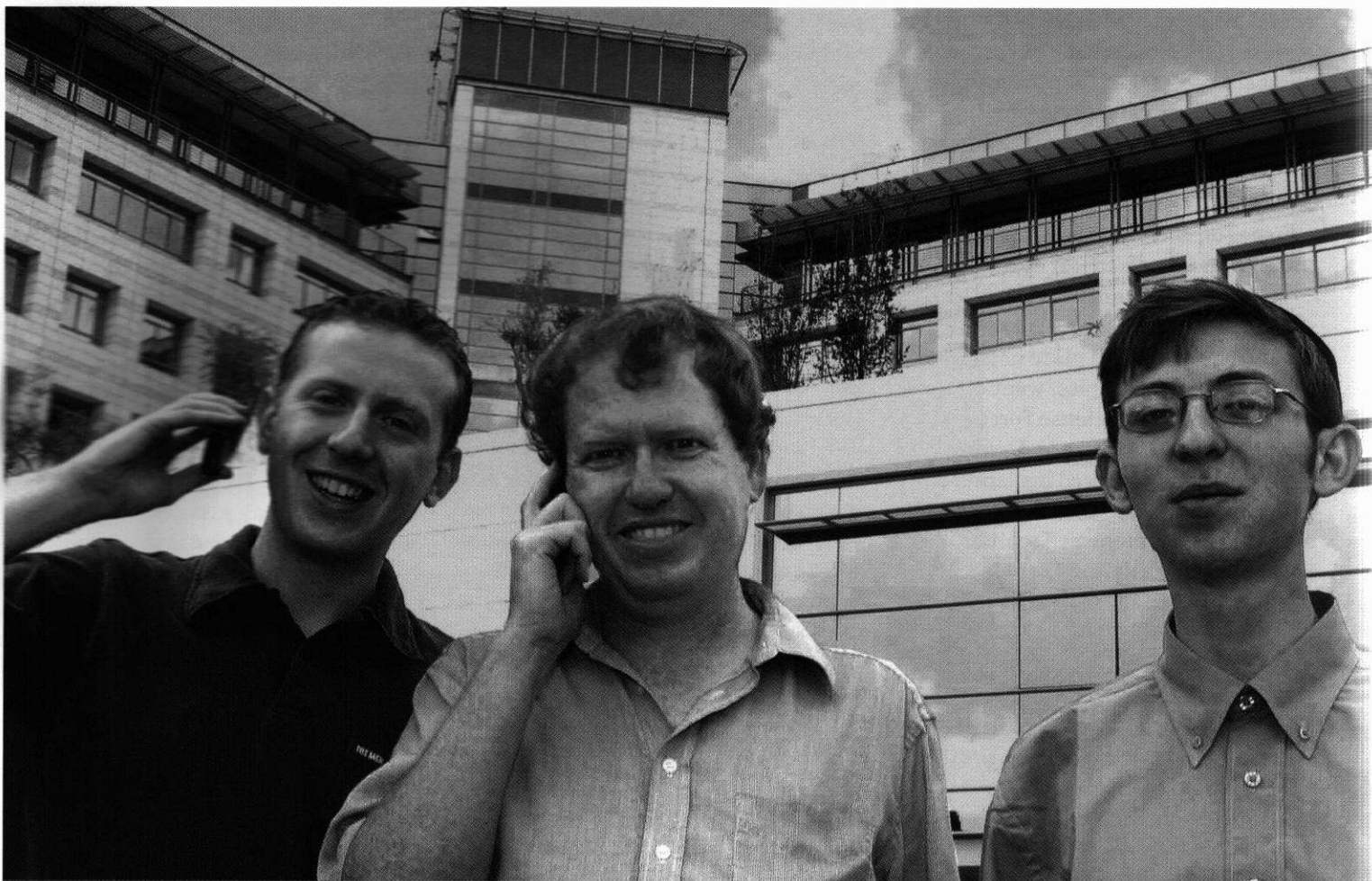
Researchers shock 450 scientists at the world's largest encryption conference at the University of California, Santa Barbara, when they announce they had cracked the GSM cellular phone network encryption code.

JOURNAL OF IMMUNOLOGY:

Scientists seize the attention of the medical world with their report that they had reversed arthritis and multiple sclerosis with a new vaccine that they hope will help those afflicted by all of the 80-plus progressive and incurable autoimmune diseases.

SCIENCE:

Physicists make world headlines with their report in this prominent academic journal, describing how they created a self-assembling molecular-sized electronic transistor in a test-tube, using DNA, proteins, and carbon nanotubes.



Graduate students Elad Barkan (l) and Nathan Keller (r), pictured with their Prof. Eli Biham, were responsible for the dramatic discovery of a security hole in the Global System for Mobile Communications network, which carries over 70 percent of all digital mobile phone and global wireless traffic.

BREAKING THE CODE

The dramatic discovery of the security hole in the Global System for Mobile Communications (GSM) network—which carries more than 70 percent of all digital mobile phone and global wireless traffic, serving 850 million users in 197 countries—began when computer science doctoral student Elad Barkan noticed in astonishment that GSM code writers encoded information in the wrong order, correcting for interference and noise, and only then encrypting the information.

“That is, they gave priority to call quality and in doing so, left a security hole,” says Prof. Eli Biham, who supervised Elad and fellow student Nathan Keller on the GSM project. “Those

who know how, can slip through this hole and listen in to a call while it’s still at the ringing stage. Within a fraction of a second, they can know everything about the call and even use a special device to ‘steal’ it and take on the caller’s identity mid-call.”

In its defense, the GSM Association said the security hole stemmed from its development in the late 1980s when computing power was more limited. An upgrade patch, however, which GSM designed to close the security hole, was easily busted by the Technion team. They sent a copy of their research to the GSM Association to help the network correct its problem. Meanwhile, the researchers are patenting Barkan’s discovery for use by law enforcement agencies.

PUTTING THE BRAKES ON AUTOIMMUNE DISEASE

Across the scientific spectrum and across the Technion campus to the Faculty of Medicine a significant advance has been made against a debilitating group of illnesses. Known as autoimmune disease (and numbering among them arthritis, multiple sclerosis and Crohn’s disease), they result from the body inexplicably turning against itself, and unleashing the lethal power of its immune system against its own cells, tissues and organs.

The starting-point of the new technology was the discovery by immunologist Dr. Nathan Karin and his team that even in autoimmune diseases, the body mounts a defense, producing anti-

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where his mother's family had settled almost 100 years earlier. "My mom is a clinical psychologist, but the rest of us are on the technology side," he says. "My father studied electrical engineering at the Technion, went on to obtain an M.B.A. and now practices law. My younger brothers, Nir and Yuval, followed him into electrical engineering."

The Barkan home was alive with thought and discussion, Elad recalls. At 18, he won second place in Israel's Youth Physics Olympics, went on to serve in the Israel Defense Force's (IDF) Communications Corps and, emerging as a lieutenant, followed his father to the Technion. A semester later, he applied to the American Technion Society-sponsored Chais Family Program for Exceptionally Gifted Students.

"The program is very selective, and the filtering process is tough," he says. "But I was one of 15 Technion students accepted that year. It opened my mind, brought me to new places. Although I was studying computer science, I added core courses in biology."

It was through computer science, however, that Elad made his shocking

discovery of the security hole in the GSM telephone network encryption system.

"I wasn't looking for it," he says. "Three things simply came together. In cryptology, I was being taught to assess the strength of systems and ciphers. In a seminar, I learned a new cryptanalysis method. In my leisure time, I was reading a book, which explained the GSM system. Putting all that together, I noticed something that shouldn't have been there. I took my discovery to Prof. Biham."

Prof. Biham mobilized Elad and fellow student Nathan Keller, also a Chais Gifted Student, to check the discovery and mount a trial attack on the GSM system. A year later, they had sufficient data to publish. "It was very exciting," says Elad. "Research can be frustrating. This gave it a practical direction."

Elad is now working toward a doctorate in cryptanalysis and tutoring Technion students in cryptology. He's uncertain whether he'll pursue cryptology or biology, but his aim, he says, "is to make the greatest advances I possibly can for mankind."

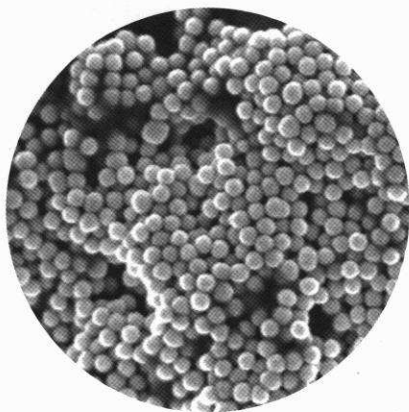
YANIV ZOHAR: PURE OR APPLIED SCIENCE?

Yaniv Zohar, 29, is a member of the Technion immunology team that is developing a breakthrough DNA-based vaccine against arthritis and other autoimmune diseases.

"I've always been interested in medicine and science," he says. "My dad works in hospital administration, and he used to help me get vacation jobs in hospitals. I've been an orderly, a stretcher-bearer and a lab assistant though I did my IDF service as a supply base manager."

"With the Technion on our doorstep and my passion for science, it never occurred to me that I would study any place else," says Yaniv, the youngest of three brothers who grew up in Haifa. "I am now enrolled in the combined M.D./Ph.D. program, following in the footsteps of my brother Ariel, a Technion graduate."

For the doctoral portion of his studies, Yaniv chose the immunology program "because I was inspired by Nati (Prof. Nathan Karin) and wanted to work with him," he says. "Like
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Semiconductor nanocrystals for use in optical components.

BREAKING THROUGH

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bodies to protect itself against the misdirected attack by its own murderous immune system. Too little, too late, however, these antibodies do no more than slow down the disease.

Armed with their discovery, Dr. Karin, graduate student Yaniv Zohar and the rest of the research team decided to try and rally these antibodies against the part of the immune system gone rogue. Their answer was a genetically engineered vaccine that increases production of the healthy antibodies and so boosts the immune system's previously doomed defense.

Tested in animals with arthritis, the vaccine mobilized the healthily functioning part of the immune system and made it strong enough to protect inflamed joints. When the

research team moved on to clinical trials in arthritis patients, they were gratified to find that their vaccine benefited some 70 percent.

"In autoimmune diseases, where one part of the immune system battles the other, our vaccine shifts the balance, giving the edge to the part that protects the body," says Dr. Karin. "It will, we hope, be a far better treatment than anything that now exists, because, after only a few shots, the immune system is retrained."

The Technion group is currently negotiating with a major U.S. pharmaceutical company to develop 'smart' antibodies to protect the body from autoimmune disease, as well as to create DNA-based vaccines that boost the immune system.