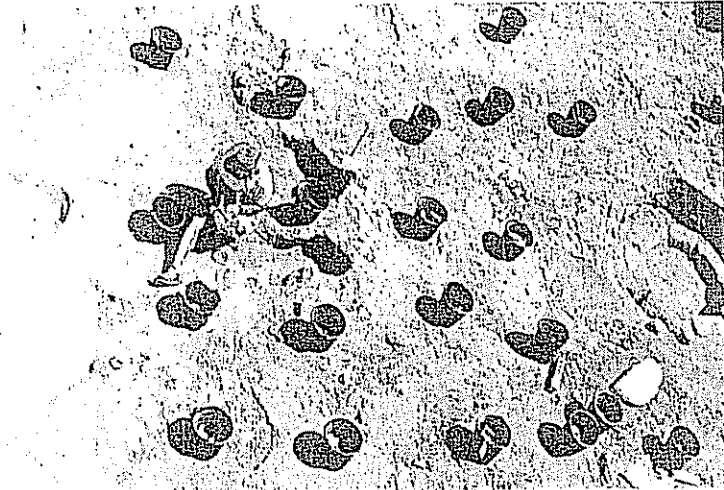


## Using Modern Tools to Reconstruct Ancient Life



Carl Andrews

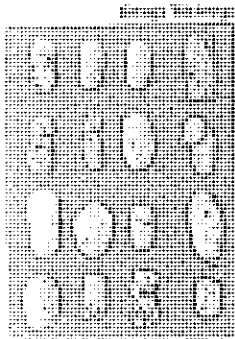
**SOIL SPEAKS** Lint in samples from an ancient earthen floor in Ashkelon, Israel, revealed that clay cylinders found there were loom weights.

By SAM BOGNERIS  
Published January 9, 2012

ASHKELOON, Israel — To the naked eye, the white, powdery substance appeared to be plaster. That's what the professional and volunteer archaeologists at a dig in Israel concluded.

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Loom weights found in Ashkelon, Israel.

stable."

This marriage of social and natural sciences is an emerging discipline that has been called microarchaeology by Steve Weiner, director of the Kimmel Center for Archaeological Science in the Weizmann Institute in Israel, which is collaborating with the expedition.

"The unique approach at Weizmann is not about instruments nor about methodologies,"

To be certain, though, they subjected the chalky dust to spectroscopy and a petrographic microscope, only to discover that it was not a manufactured substance, but decayed plant life and fecal matter.

What that meant to the archaeologists from the Leon Levy Expedition to Ashkelon — a former seaport south of Tel Aviv that was home to successive civilizations over thousands of years — was that structures thought to have been inhabited by people were more likely occupied by animals. That revelation upended their view of what they were excavating.

"For archaeologists," said the expedition's co-director, Daniel M. Master, a professor at Wheaton College in Illinois, "it was the difference between a palace and a

Dr. Weiner said. "It is all about solving archaeological problems with the help of instrumentation — both in the field and in the lab."

Weizmann archaeology researchers have a laboratory on the site here, along with equipment to study archaeometallurgy, ancient DNA, radiocarbon dating and micromorphology, the microscopic structures found in organisms and soil. A \$2 million accelerator mass spectrometer is on order.

"We have developed a whole new integrative approach to archaeology that starts with the team identifying a good problem in the field and then continues interactively between field and lab," Dr. Weiner said.

Dr. Master said: "Steve's team demonstrated that the white lamina that archaeologists have routinely called 'bits of plaster' were actually degraded plant remains. Further, his team showed ways of analyzing these plants that could detect the difference between sheaves of grain and plant bits mixed into animal dung."

Dr. Master and Lawrence E. Stager, director of the Semitic Museum at Harvard University, who has overseen the dig for 25 years, embarked on a mutually beneficial collaboration with the Kimmel Center after Dr. Master was invited to lecture there. Suddenly, new windows opened.

Sifting sediment through flotation turned up lint near mysterious clay cylinders. That discovery, Dr. Master recalled, demonstrated that the clay cylinders were actually loom weights, and "this observation has led to a revolution in the studies of the weaving industry across the eastern Mediterranean in the early Iron Age."

Soil chemistry analysis found that a four-horned altar thought to be a traditional Levantine device for burning incense was not used for burning at all. Archaeologists identified it instead as a Mycenaean and Minoan libation altar on which liquids were poured.

"Our work with the Weizmann team has been a leap forward," Dr. Master said.

Sharing workers and a mobile laboratory allows the expedition to analyze samples rapidly and adjust its excavating techniques accordingly. The application of pure science to practical challenges enables Kimmel Center experts to hone their research skills. The collaboration is not unique, but it is unusual for a discipline that falls between the humanities and natural science.

"In Israel, archaeology is taught in the faculties of the humanities, making it very difficult for archaeologists to fully exploit the powerful new scientific tools," Dr. Weiner said.

"Although there is much good will both on the side of natural scientists intrigued by the exciting archaeological questions to be addressed and the archaeologists who are eager to obtain the information provided by scientific tools, a chasm of miscommunication exists between the two camps," he said. "The frequent result is that minimal benefit is obtained from maximal effort."

The collaboration with the Leon Levy Expedition, he said, means "we excavate, analyze samples in minutes, get results, change excavation strategy, sample as well as we can and then continue in the base camp lab and, between seasons, in the home lab."

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# NEWS NETWORK ARCHAEOLOGY

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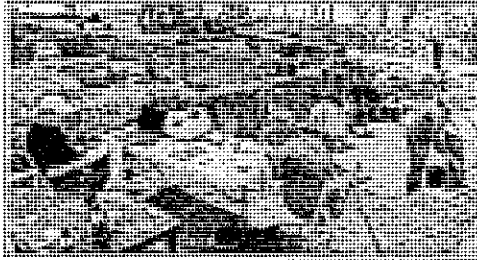
Home / Ancient, ArchaeoHeritage, Archaeology, Breakingnews, Greater Middle East, Israel, Near East / Smarter digs with an archaeology lab

## Smarter digs with an archaeology lab

Posted by TANN Ancient, ArchaeoHeritage, Archaeology, Breakingnews, Greater Middle East, Israel, Near East

2:15 PM

Under the hot sun at Tel es-Safi in southern Israel -- the Philistine city of Gath -- archaeologists have been puzzling over life in the Iron Age city and how it was plundered and destroyed by some invading force hundreds of years before the common era.



Kimmel Center Director Prof. Steve Weiner, left, with field students work on-site at the Weizmann Institute's on-site archaeology lab at Tel es-Safi [Source: Israel21c]

"It was like a mini-Pompeii, a frozen record in a moment of time," says Prof. Steve Weiner, director of the Kimmel Center for Archaeological Science at the Weizmann Institute in Rehovot.

Kimmel's unique onsite laboratory helps archeologists piece together the events of the destruction.

"It has changed the whole paradigm of how to solve archaeological problems in the field using both what you see by eye and what you can reveal with instrumentation -- the microscopic archaeological record, from sub-millimeter scale down to the atomic level," he tells ISRAEL21c. "There's a lot of information embedded in this record."

With the help of the lab, the Weizmann team together with the archeology team from Bar-Ilan University determined that the destruction was not one cataclysmic event in the late ninth century BCE, but more likely occurred over decades, with periods of erosion and abandonment.

"So what people assumed was instantaneous was not that at all," says Weiner. "You can only understand that by getting into all the microscopic details."

The mobile lab is a critical part of a holistic "microarcheology" approach that puts natural scientific methods to work in the field.

### Dig less, find out more

As Weiner describes in *Microarchaeology: Beyond the Visible Archaeological Record* (Cambridge, 2010), much information can be extracted microscopically from excavated materials such as ceramic, bone, rock, ash, plants and sediment.

"The trend in archeology is to excavate less but to extract more information from the archeological record," he writes.

Beginning this process in the field is best, and the Weizmann team was able to

### BREAKING NEWS

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# Israel Academy of Sciences gains four new members

*Prof. Shimon Ullman, Prof. Reshef Tenne, Prof. Avishai Margalit  
and Prof. Mordechai Segev to join 95 current members of body  
responsible for promoting science projects of national significance*

• By JUDY SIEGEL

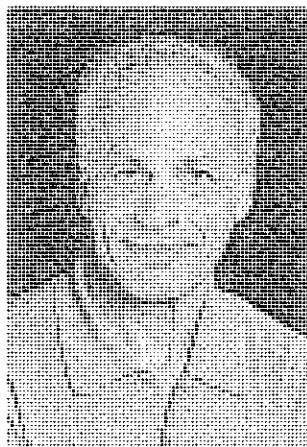
Four eminent scientists will become members of the Israel Academy of Sciences – the official advisory body on the sciences to the government – on Tuesday evening.

Prof. Shimon Ullman, Prof. Reshef Tenne, Prof. Avishai Margalit and Prof. Mordechai Segev will join the 95 current members of the academy, which is responsible for promoting science projects of national significance.

The four new members are all senior researchers from universities and were elected at the academy's general assembly. All those in the academy are experts in the natural sciences, the social sciences and the humanities and have tenure for life.

Ullman, who was born in Jerusalem in the year of the founding of the state, graduated from the Hebrew University in mathematics and physics after serving as a fighter pilot in the Israel Air Force. Later, he also completed a degree in biology and his doctorate in artificial intelligence from the Massachusetts Institute of Technology. In 1986, he was named a professor at both the Weizmann Institute of Science in Rehovot and at MIT.

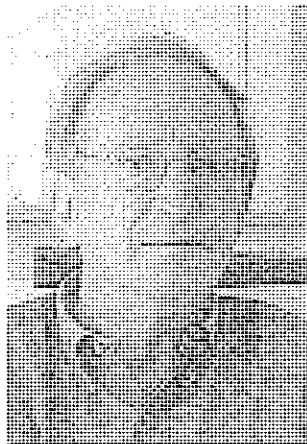
Tenne was born in 1944 to Eastern European immigrants and raised on a kibbutz. After military service, he studied chemistry at the Hebrew University and went on to earn a



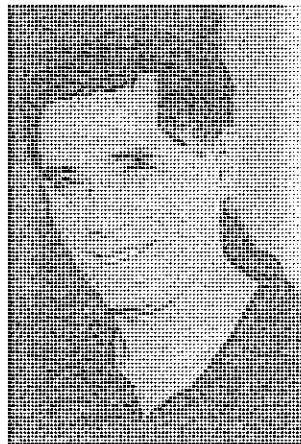
SHIMON ULLMAN



RESHEF TENNE



AVISHAI MARGALIT



MORDECHAI SEGEV

master's degree in physical chemistry, followed by a doctorate in statistical mechanics. After he did his post-doctoral work in the Battelle Institute in Geneva, he joined Weizmann and

researched photoelectrochemical cells.

In 1992, Tenne and his colleagues discovered new forms of materials composed from a relatively small number of carbon atoms structured like

cages, leading to applications as advanced lubricants that in recent years have been used by industry.

Margalit, born in 1939 in the Jezreel Valley, was raised and lived all his life in Jerusalem. After his service in the IDF, he went to the Hebrew University to study philosophy and economics. His doctorate was on the cognitive status of metaphors and afterward he joined the HU philosophy department, where he continued to work and research in the field of the philosophy of language. A recipient of the Israel Prize in philosophy and the EMET Prize, he is also an honorary associate at Queens College at Oxford University.

Segev was born in 1958 in Romania, came on aliya with his family three years later and settled in Haifa. He earned an electrical engineering degree from the Technion-Israel Institute of Technology and after three years of post-doctoral study at the California Institute of Technology was appointed to the staff of Princeton University but returned to Israel in 1998, when he became a research professor at the Technion.

Segev conducts research on non-linear optics, the physics of lasers and imaging and developed many new fields in these scientific spheres, publishing 270 articles in journals. He also received many awards including the Max Born Physics Prize.

DAY TO DAY

**Weizmann Institute  
Professor Wins Israel Prize  
For Physics, Chemistry**

Professor David Milstein of the Weizmann Institute is the 5772 Israel Prize laureate for chemistry and physics, Education Minister Gideon Saar announced Sunday.

Milstein won the prize for his innovative research that finds new ways to create compounds using materials containing metals. His studies have environmental ramifications because they can help develop cleaner industrial processes.

During his research, Milstein discovered new methods for metal-mediated activation of strong chemical bonds. Among his various research projects, the one considered to be most important helped scientists understand the bonds between carbon and hydrogen.

Milstein's research also contributed to understanding catalyzation, the process of speeding up chemical processes. The

processes he studied could lead to the development of various industrial products without creating industrial waste.

For example, a new reaction he developed creates super-strong bonds that "glue" proteins together and could play an important role in the production of products such as nylon. The discovery of this reaction was named by the journal *Science* as one of the top 10 scientific breakthroughs of 2007.

Milstein was born in Germany in 1947 and came to Israel when he was 2.

He did his military service in a classified unit and worked as a senior researcher at Du Pont. Around 10 years ago, he founded the Weizmann Institute's Kimmel Center for Molecular Design, which he now heads.



Co-director, Weizmann Institute  
Prof. David Milstein

**Weizmann  
prof. scoops  
Israel Prize  
for physics,  
chemistry**

By Zafrit Rinat

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# Teva hoping DiaPep277 drug will be the first to succeed insulin injections as diabetes treatment

*Company invested \$170 million in clinical trials last year • If product is approved, peak sales may be between \$500 million and \$1 billion, says analyst*

• By ALLISON CONNOLLY

Teva Pharmaceutical Industries Ltd., the world's largest generic-drug maker, is seeking to transform a compound once rejected by Sanofi into the first therapy to succeed insulin injections as a treatment for Type 1 diabetes.

The therapy, DiaPep277, is made from a human protein that stops the immune system from destroying the pancreatic beta cells that secrete insulin, a hormone needed to convert sugar, starches and other food into energy. The drug also helps control sugar levels in the blood, a late-stage study showed last month.

Type 1 diabetes develops early in life and robs people of their ability to make insulin, according to the World Health Organization. Petah Tikva-based Teva and its partners are aiming to find a drug that preserves the ability to make insulin after companies including Eli Lilly & Co. and Johnson & Johnson have failed. If the product is approved, peak sales may be between \$500 million and \$1 billion, Ronny Gal, an analyst at Sanford C. Bernstein, wrote in a December 2 note.

"Type 1 has a huge unmet need, with no other treatment other than insulin," Aharon Schwartz, the vice president of innovative ventures at Teva, said in an interview. "We believed the risk-benefit ratio was worthwhile."

Diabetes is a chronic illness in which the body either doesn't produce enough insulin or fails to use insulin effectively. About 346 million people worldwide have diabetes, of whom 90 percent have the Type 2 form of the disease, often the result of excess body weight and lack of physical activity, according to the Geneva-based WHO.

## Beta cells

While the exact cause of Type 1 is unknown, scientists believe it occurs when the immune system attacks the pancreatic beta cells

that produce insulin. By the time most patients are diagnosed with Type 1, 80% of their beta cells have been destroyed, Shlomo Dagan, the chief executive officer of Teva's partner, Andromeda Biotech Ltd., said in an interview.

"Right now the only treatment for Type 1 diabetes are insulin injections," he said. "This is not a therapy; it's a replacement."

Lilly and its partner MacroGenics Inc. last year said their experimental Type 1 diabetes drug Teplizumab was not effective in slowing the progression of the disease in a pivotal trial.

Diamyd Medical AB terminated an agreement with a Johnson & Johnson unit to develop a Type 1 diabetes treatment in June after the medicine failed to preserve beta cell function after 15 months, the primary goal in a late-stage trial.

## No competition

"When we started, we thought even if the results are positive, we would have competition," Schwartz said. "Now we are the only game in town."

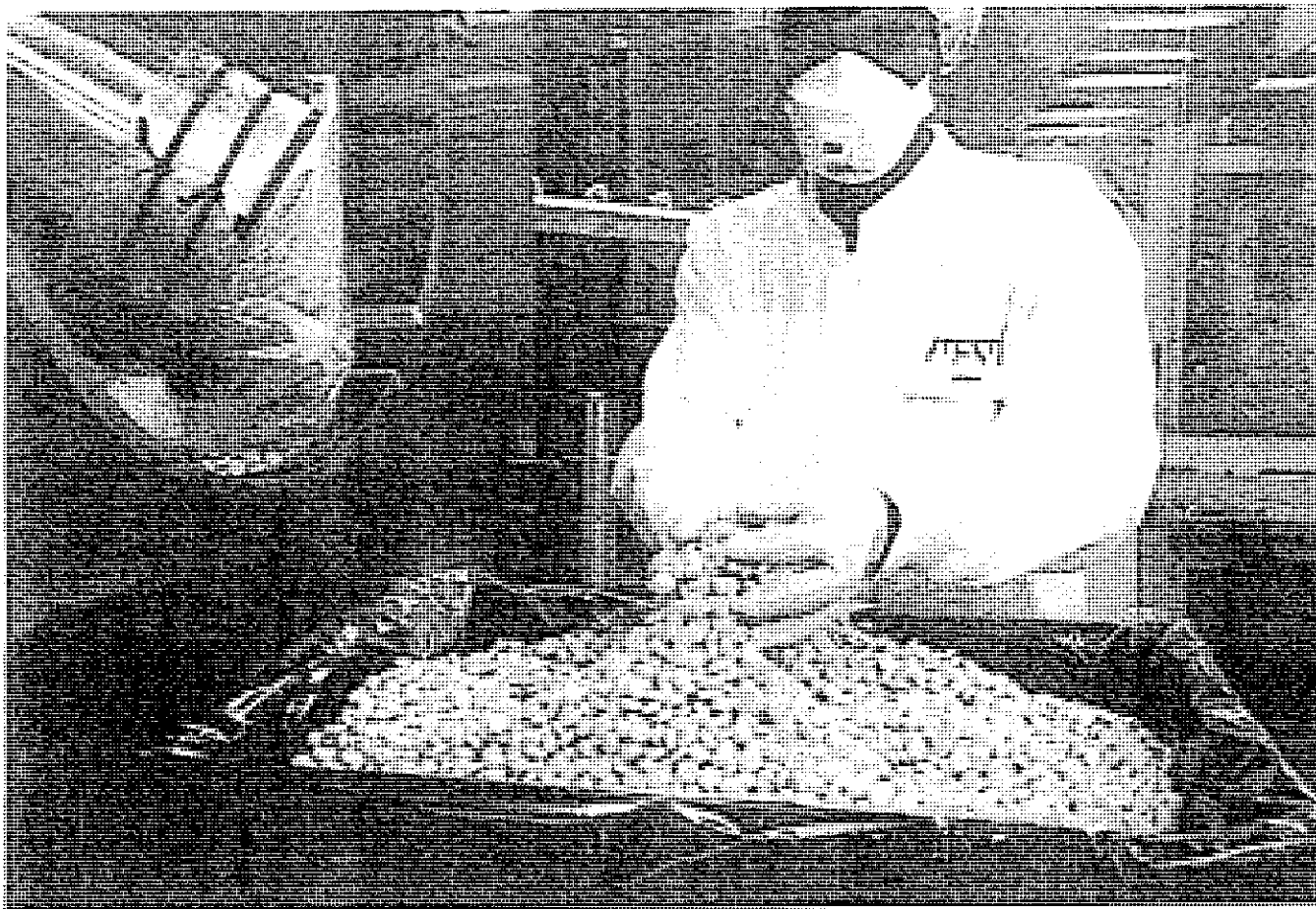
DiaPep277, which modulates the immune system to prevent the destruction of insulin-secreting cells, was invented by Irun Cohen of the Weizmann Institute of Science in Rehovot.

Since then, it has been under development by Peptor Ltd. and its successor companies: DeveloGen AG, which merged with Peptor in 2003, and Evotec AG, which bought DeveloGen last year. Aventis SA, which later became Sanofi, licensed the drug from Peptor in 2002 and returned the rights two years later. DeveloGen sold the drug to Andromeda Biotech in June 2007.

Teva licensed worldwide rights to DiaPep277 from Andromeda Biotech in June 2009 and invested \$170 million in the company last year to fund a clinical trial to confirm earlier results for DiaPep277.

## Teva's stake

Bernstein's Gal estimates the market for the medicine to be



AN EMPLOYEE collects newly manufactured pills in September at Teva's tablet production plant in Jerusalem. (Adam Reynolds/Bloomberg)

about 50,000 patients a year at a price point of between \$5,000 and \$10,000 annually. The product is a "nice asset" for Teva, which will probably get 20% of sales as a royalty rate, he said.

"It sounds like a drug that could provide value to patients who don't have a lot of options," Gal said in an interview. "The question is, does it stop the deterioration of the pancreas or just slow it down?"

If patients lose the ability to produce any insulin, then DiaPep277 wouldn't help, he said.

The drug met both the main and secondary goals of a study in

the last of three stages of human testing generally needed for regulatory approval, Andromeda Biotech, a unit of Ramat Gan-based Clal Biotechnology Industries Ltd., said on November 22. Patients taking the medicine had stable C-peptide levels, which meant pancreatic cells secreted insulin on their own, while there was a decline in those levels among patients taking the placebo.

#### Glucose control

Patients taking DiaPep277 also maintained "good diabetic control" compared with those taking

the placebo. That means patients need fewer daily insulin doses, delaying or reducing complications from diabetes, which include heart disease and stroke, according to Andromeda Biotech.

The trial included 457 Type 1 diabetes patients between the ages of 16 and 45 in Europe, Israel and South Africa. Patients were newly diagnosed and received one subcutaneous injection every three months, on top of their regular insulin injections, Dagan said.

Enrollment in the second late-stage trial, which includes 450 patients in the US, Canada,

Europe, Israel and Argentina, will probably be completed during the first half of 2012. Data from the two-year study is due out in 2014, and the company will use it to apply for approval in the US and Europe, Dagan said.

"Type 1 diabetes has been notoriously difficult to treat," Cord Dohrmann, the ~~chief scientific~~ officer of Evotec who oversaw early trials of the drug as CEO of DeveloGen, said in an interview.

"A number of other applications have failed in late-stage development. There's a lot of hope riding on DiaPep277."

(Bloomberg)

# Meet Israel's big noise in the Big Bang experiment

Daniel Zajfman is helping to play a crucial role in the hunt for the Higgs Boson particle



## THE SIMON ROUND INTERVIEW



IF YOU have any interest at all in science, a chat with Daniel Zajfman can be pretty instructive. As head of the world-renowned Weizmann Institute in Israel, he is at the forefront of scientific research in his country. During an hour's conversation

at his London hotel, topics veer from the origin of the universe to how to make a radio from rotten potatoes.

Zajfman, in London for the organisation's gala dinner, is enthused by the fact that the Weizmann Institute is playing a significant part in the experiments at the Large Hadron Collider designed to nail down the existence of that elusive particle, the Higgs Boson.

Zajfman, a Belgian-born Israeli who has been in charge of the Institute since 2005, carefully explains the importance of particle physics in terms that someone whose scientific education ceased

at the age of 14, might just understand. "This adventure is as important as landing on the moon. And as with the moon landing, the long-term importance may lie in the new ideas and innovations you need to develop to accomplish the objective. To build the Large Hadron Collider you need a leap in science to get this huge machine working. There are many technologies which have been developed for which we might only find a use later."

And the Higgs Boson? "Discovering it will mean that we can pin down a model which has been on the table for

decades. If we do not find the Higgs it will be much more significant because it will mean we have made massive mistakes in the way we understand the world."

Israel's contribution to the experiments lies in the development of part of the detectors used to analyse data. Zajfman feels that the attempt to replicate the moment after the Big Bang serves as a lesson to humanity. "It's an amazing show of human collaboration. The reason you can get hundreds of institutions from different countries all working towards one end is that the

goal is universal. There is no division of culture or politics or religion. The end has the same value for all of us."

Zajfman is proud of the achievements of the institute which consistently punches above its weight in terms of ground-breaking research. "The most important thing we do is hire top scientists. It's more important than even raising money. We can't pay them a top salary but we can provide an environment which is supportive of what they want to do. We allow people to take high risks in their chosen endeavour. It can be chaotic when you work in this way but we have also had a lot of success."

Zajfman is particularly excited about a new drug which may make it possible for those suffering with type one diabetes to inject once every three months rather than take insulin several times a day.

Israel's science and technology sector has driven an economy which has weathered the global downturn better than most. Zajfman puts the country's success down to a number of factors — first, the fact that it has few natural resources. "Our resources are 1.7 metres above the ground — they are our brains. We Jews have always been active in the arts and sciences. It's not genetic, it's cultural. But there has to be a reason why Jews, who

make up 0.02 of the world's population, have supplied 25 per cent of the Nobel Prize winners."

He adds that Israel is a country in which people can progress further and faster than in most other advanced economies. "We are a nation of risk-takers, which is good for a dynamic economy, but less good on the roads."

Zajfman, who is 53, was imbued with a love of science from a young age. Before he could read and write, his engineer father had taught him how to connect electrical circuits. He recalls: "I could put together resistors and lamps at the age of five. Other children had Lego and toy cars, I had electrical circuits."

When he was still young he started to build his own radios. "This really focused me. I even discovered that if you stick electrodes into rotten potatoes, you can receive radio transmissions. I wanted to understand it and the only way was to study physics."

He was happy as a researcher and teacher at the Weizmann for 14 years before he became president. "I had no thought to apply before they asked me, but I'm delighted they chose me. You can make things happen here."

**'OTHER CHILDREN HAD TOYS. I HAD ELECTRICAL CIRCUITS'**



## Weizmann wows with £550k

► WEIZMANN UK used the Wow factor to generate £550,000-plus from its gala dinner at the St Pancras Renaissance Hotel towards the scientific endeavours at the Israeli institute.

Wow stands for "Wonders of Weizmann" and the importance of science education was the theme of keynote

Lord Puttnam (left) and Martin Paisner at the Weizmann dinner

speaker Lord Puttnam. He told the 280 guests: "The Weizmann Institute is founded on the concept of excellence.

"Excellence of experience for those working there, excellence of output as a reward for perseverance and, most important of all, excellence of intent – because that is the quality that will, over time, sustain the soul and the vision of this increasingly vital institution."

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SUNDAY, JANUARY 1, 2012 ■ 6 TEVET, 5772

## Up in a cloud for processing computer data

A declining amount of computing is conducted today on desktop computers; instead, cloud computing – in which operations are carried out on a network of shared, remote servers – is expected to rise as the demand for computing power increases. This raises some crucial questions about security: For instance, can we perform computations on data stored in the "cloud" without letting anyone else see our information?

Research carried out at the Weizmann Institute of Science in Rehovot and the Massachusetts Institute of Technology is moving us closer to the ability to work on data while it is still encrypted, giving an encrypted result that can later be securely deciphered.

Attempting computation on sensitive data stored on shared servers leaves that data exposed in ways that traditional encryption techniques can't prevent. The main problem is that to manipulate the data, it has to be first decoded. "Until a few years ago, no one knew if the encryption needed for this sort of online security was even possible," says Dr. Zvika Brakerski, who recently completed his Ph.D. under Prof. Shafi Goldwasser of the computer science and applied mathematics department.

In 2009, however, a doctoral student at Stanford University named Craig Gentry provided the first demonstration of so-called fully homomorphic encryption (FHE). His original method was extraordinarily time-consuming and unwieldy, making it highly impractical. Gentry constructed his FHE system by using fairly sophisticated math,

based on so-called "ideal lattices," and this required him to make new and unfamiliar complexity assumptions to prove security. Gentry's use of ideal lattices seemed inherent to FHE; researchers assumed that they were necessary for the server to perform such basic operations as addition and multiplication on encrypted data.

Brakerski, together with Dr. Vinod Vaikuntanathan (who was Goldwasser's student at MIT), surprised the computer security world earlier this year with two scientific papers in which they described several new ways of making fully homomorphic encryption more efficient. For one thing, they managed to make FHE work with much simpler arithmetic, which speeds up processing time. And a surprise discovery showed that a mathematical construct used to generate the encryption keys could be simplified without compromising security. Gentry's original ideal lattices are theoretical collections of points that can be added together – as in an ordinary lattice structure – and also multiplied. But the new research shows that the lattice does not have to be ideal, which simplifies the construction immensely.

"The fact that it worked was something like magic, and it has challenged our assumptions about the function of the ideal lattices in homomorphic encryption," says Brakerski.

Their result promises to pave a path to applying FHE in practice. Optimized versions of the new system could be

hundreds – or even thousands – of times faster than Gentry's original construction. Indeed, Brakerski and Vaikuntanathan have managed to advance the theory behind

fully homomorphic encryption to the point that computer engineers can begin to work on applications.

These might include, for instance, securing medical information for research: A third party could perform large medical studies on encrypted medical records without having access to the individuals' information.

### NEW WORDS

• By JUDY SIEGEL-ITZKOVICH

# Israeli and NY researchers find proof of the genetic basis of autism

The neuro-cognitive, developmental disease of autism, whose symptoms appear during the first three years of a child's life, have for years been thought to involve a number of genes, but there was no concrete proof.

Now a team at Cold Spring Harbor Laboratory (CSHL) in New York, led by an Israeli doing post-doctoral fellowship work on mice, has for the first time provided functional evidence that inheriting fewer copies of genes on chromosome #16 leads to autism-like features.

Dr. Guy Horev, of the Weizmann Institute of Science in Rehovot, worked at CSHL with Prof. Alea Mills and colleagues on mouse models of autism that they created using chromosome engineering. The study, of which Horev was the first author, has just appeared in *Proceedings of the National Academy of Sciences* (PNAS).

Autism, or pervasive developmental disorder, is a physical condition connected to abnormal chemistry and biology in the brain and affects the brain's normal development of social and communication skills. Genes have for years been implicated, as identical twins have a much higher risk than fraternal twins or other siblings to both have autism.

"Mice with the deletion acted completely differently from normal mice," said Horev, who is working at Mills's lab. These mice had a number of behaviors characteristic of autism – hyperactivity, inadequate sleep, difficulty adapting to a new environment and restricted, repetitive behaviors.

"Children normally inherit one copy of a gene from each parent. We had the tools to see whether copy number changes found in kids with autism were causing the syndrome," added Mills.

In 2007, CSHL professor Michael Wigler revealed that some children with autism have a small deletion on chromosome 16, affecting 27 genes in a region of

genomes referred to as 16p11.2. The deletion – which causes children to inherit only a single copy of the 27-gene cluster – is one of the most common copy number variations (CNVs) associated with autism.

"The idea that this deletion might be causing autism was exciting," recalled Mills. "So we asked whether clipping out

the same set of genes in mice would have any effect."

After engineering mice that had a chromosome defect corresponding to the human 16p11.2 deletion found in autism, the researchers analyzed these models for a variety of behaviors, as the clinical features of autism often vary widely from patient to patient, even within the same family. Rodents that had been engineered to carry an extra copy, or duplication, of the 16p11.2 region did not have these characteristics, but instead, had the reciprocal behaviors.

For each behavior, the deletion had a more dire consequence than the duplication, indicating that gene loss was more severe.

The mouse models also revealed a potential link between 16p11.2 deletion and survival, as about half the mice died following birth. Whether these findings extend to the human population might be answered by future studies that investigate the link between this deletion and unexplained cases of infant death.

MRI scans revealed that eight different parts of the brain were affected. Horev and his colleagues are now working to identify which gene or group of genes among the 27 that are located within the deleted region is responsible for the behaviors and brain alterations observed.

They believe their findings on mice will be invaluable for pinpointing the genetic basis of autism and for elucidating how these alterations affect the brain. – Judy Siegel

## Better Safe Than Sorry

Our senses have difficulty parsing stimuli linked to a negative event

Performance usually improves with practice, but not if training is a rotten time. A new study shows that people's ability to identify noises declines when the sounds are paired with putrid smells—a phenomenon that may allow our brain to detect danger more quickly.

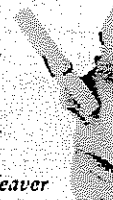
In a study published in May in *Nature Neuroscience*, neurobiologist Rony Paz of the Weizmann Institute of Science in Rehovot, Israel, and his colleagues exposed volunteers to auditory tones presented with no other

stimuli or immediately followed by a rancid or fragrant odor delivered through a nose mask.

After this training session, the subjects were played a series of tone pairs—notes of very similar or identical frequencies—and asked whether the tones in each pair were the same or different. The subjects became better at distinguishing tones similar to those that had been presented alone or with a pleasant scent. But their ability to discriminate tones resembling those

linked to a foul stench worsened—an effect that persisted one day later.

Such sensory confusion could be an adaptation that allows our defenses to rapidly mobilize. "This likely made sense in our evolutionary past," Paz says. "If you've previously heard the sound of a lion attacking, your survival might depend on a similar noise sounding the same to you." —Janelle Weaver





The Medical Edge

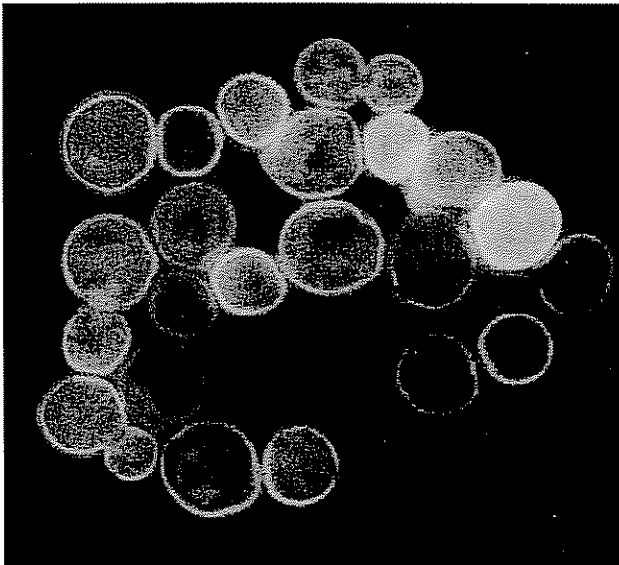
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## How Cells Brace Themselves for Starvation

Yivsam Azgad

March 2nd 2012

Weizmann Institute



Yeast cell membranes (credit: Masur)

environment; the other is a "bad-times" pump that springs into action only when the nutrient becomes scarce. Why does the cell need this dual mechanism?

A new Weizmann Institute study, reported in *Science*, might provide the answer. The research was conducted in the lab of Prof. Naama Barkai of the Department of Molecular Genetics by postdoctoral fellow Dr. Sagi Levy and graduate student Moshe Kafri, with lab technician Miri Carmi.

It had been known for a while that when the levels of phosphate or zinc drop in the surroundings of a yeast cell, the number of "bad-times" pumps on the cell surface soars up to a hundred-fold. When phosphate or zinc becomes abundant again, the "bad-times" pumps withdraw while the "good-times" pumps return to the cell surface in large numbers.

In their new study, the scientists discovered that cells which repress their "bad-times" pumps when a nutrient is abundant were much more efficient at preparing for starvation and at recovering afterwards than the cells that had been genetically engineered to avoid this repression. The conclusion: The "good-times" pumps apparently serve as a signaling mechanism that warns the yeast cell of approaching starvation. Such advance warning gives the cell more time to store up on the scarce nutrient; the thorough preparation also helps the cell start growing faster once starvation is over.

Thus, the dual-pump system appears to be part of a regulatory mechanism that allows the cell to deal effectively with fluctuations in nutrient supply. This clever mechanism offers the cell survival advantages that could not be provided by just one type of pump.

If these findings prove to be applicable to human cells, they could explain how our bodies maintain adequate levels of various nutrients in tissues and organs. Understanding the dual-pump regulation could be crucial because it might be defective in people with various metabolic disorders.

Yivsam Azgad writes for the Weizmann Institute of Science, from where this article is adapted.

Sugar, cholesterol, phosphates, zinc—a healthy body is amazingly good at keeping such vital nutrients at appropriate levels within its cells. From an engineering point of view, one all-purpose type of pump on the surface of a cell should suffice to keep these levels constant: When the concentration of a nutrient—for example, sugar—drops inside the cell, the pump mechanism could simply go into higher gear until the sugar levels are back to normal. Yet, strangely enough, such cells let in their nutrients using two types of pump: One is active in "good times," when a particular nutrient is abundant in the cell's

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## Weizmann scientists have had leading role in global search for 'God particle'

• By JUDY SIEGEL

Weizmann Institute of Science astrophysicists have been prominent in the experiments that have shown "promising signs" of the existence of the Higgs boson – the "God particle" – that provides a framework for all of the subatomic particles in nature and has been sought for decades.

Scientists at the Large Hadron Collider (LHC) and the CERN research center in Switzerland said in an excited announcement on Tuesday that it found some evidence in its experiments of the existence of the

elementary particle.

It was suggested in 1964 by six physicists, including University of Edinburgh physicist Peter Higgs whom it was named after, as a way to explain mass.

The sub-atomic particle called Higgs is the one piece of the Standard Model of Particle Physics that has not been proven to exist, and some scientists believe that the model will have to be rethought if the Higgs is not found.

Prof. Giora Mikenberg of the Rehovot Institute was the ATLAS Muon Project leader for many years and now heads the Israeli LHC team.

Prof. Ehud Duchovni heads the Weizmann Atlas group, as well as a small group looking for SUSY signals. Prof. Eilam Gross is currently the ATLAS Higgs physics group convener.

All are members of the Weizmann Institute's Particle Physics and Astrophysics Department, and they have been part of the effort to find the Higgs since 1987.

ATLAS and its sister experiment in the LHC, CMS, have been searching for the Higgs boson together.

"In 2011, the LHC particle accelerator in Geneva collided over 300 trillion protons,"

said Gross. "All of that enormous energy – seven-trillion electron volts – went into the effort to produce the Higgs boson.

But in each collision, other similar particles are created, and there is no way to foresee what we will find. The chances of a collision producing a Higgs boson are so small that only about 100 are expected to be observed over the course of a year."

Finding possible signs of a Higgs involved looking for statistical anomalies in the data (compared to what the results would look like if there were no Higgs) in the

expected mass range.

The problem is that once these anomalies appear, the scientists had to rule out statistical flukes. But several weeks ago, it was noticed that "extra" events in the probable Higgs range had accumulated in the experimental results during 2011.

"We couldn't believe our eyes – we looked at the screen for ages before we started to digest what we were seeing," Gross continued. "In the past three weeks, the entire Higgs search team in the ATLAS experiment have checked and rechecked the results from every possible

angle. We checked for errors... for bugs in the program."

The ATLAS results suggest that there could be a Higgs boson with a mass of around 126 GeV, and that there is just a 1 in 5,000 chance that the extra events they observed in this particular mass are the result of a statistical fluke, and not the creation of a Higgs boson.

Such fluctuations might still disappear, so the proof is still not at all conclusive, but scientists believe that it bodes well for the next round of LHC collisions, which are due to begin in April 2012.



THIS ILLUSTRATION shows the results of a collision that could represent a Higgs boson from the Atlas experiment. (Weizmann Institute of Science)

SCIENCE & NATURE

## The Truth About Pheromones

Yes, scientists say, your airborne compounds send signals about your moods, your sexual orientation and even your genetic makeup

By Sarah Everts

Smithsonian magazine, March 2012, [Subscribe](#)

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After playing a sad movie scene for a group of women, researchers collected their tears and placed the unidentified fluid under men's noses. The result was a reduced sexual arousal and testosterone levels.

Eric Palma

**More from Smithsonian.com** The sight of someone in tears might make you feel concerned. But the *smell* of tears, researchers say, has a different effect.

- [What's Science Got to Do With It?](#)
- [The Saddest Movie in the World](#)

"You might think—we did—that [smelling] tears might create empathy," says Noam Sobel, a neurobiologist at the Weizmann Institute of Science in Israel. He and his colleagues had women watch a sad movie scene, collected their tears and placed samples of the unidentified fluid under men's noses. The tears did not elicit empathy in a standard lab test, but they did reduce the men's sexual arousal and testosterone levels. Apparently the tears sent a message that romance was off the table.

This study offers some of the most recent evidence that people perceive all sorts of interesting things about one another through olfaction. Airborne molecules that elicit a reaction in a member of the same species are called pheromones, and the most famous ones are potent aphrodisiacs, like androstenone and androstenol in the saliva of male boars. If a fertile female gets a whiff of these molecules, she'll present her rear to the male, a universal gesture in wild pig patois that means, "Let's start a family."

Researchers (as well as fragrance companies) have been hoping to find a human sex pheromone for decades, but so far the search has failed, says George Preti of the Monell Chemical Senses Center in Philadelphia. "That doesn't mean a human sex pheromone doesn't exist," Preti is quick to add. "It just means we haven't found one yet." In fact, some researchers suspect that if there is a turn-off pheromone, as Sobel's team says, there's likely to be a turn-on pheromone.

In one 2005 study, gay men given anonymous samples of sweat preferred the scent of gay men, and heterosexual men fancied the scent of women. One's nose can also help identify a genetically compatible mate. Researchers asked women to rate the odors of T-shirts worn by different men. Women preferred men whose DNA was different enough from their own that it would increase the likelihood of producing a child with a robust immune system.

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From: Yadin Katz, No Cancers  
Published October 12, 2011 08:31 AM

## Sense Of Smell Is Physiological, Not Psychological, Study Shows

Different strokes for different folks? Not necessarily, at least not when it comes to smells: A new research from the Weizmann Institute in Israel shows that odors can be rated on a scale of pleasantness.

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The findings that were published in Nature Neuroscience Journal reveal a correlation between the response of certain nerves to particular scents and the pleasantness of those scents. Based on this correlation, the researchers could tell by measuring the nerve responses whether a subject found a smell pleasant or unpleasant.

Up until now the organizational principle for our sense of smell has remained a mystery. Unlike our sense of sight that was long understood as being arranged for efficiently mapping out visual coordinates and our hearing sense that was figured to be set up according to tonal scale, our sense of smell was never actually cracked by scientist. They have never been sure if there is such a scale for it.

Hints of such an organizational principle of the sense of smell have been seen in different research labs around the world, however without conclusive evidence. Up until now. The team of researchers headed by Prof. Noam Sobel of the Weizmann Institute's Neurobiology Department set out to search for that principle.

Sobel and his team thought that smell receptors in the nose — of which there are some 400 subtypes — could be arranged on the nasal membrane according to a scale. This hypothesis goes against the conventional view, which claims that the various smell receptors are mixed — distributed evenly, but randomly, around the membrane.

In their experiment, the researchers inserted electrodes into the nasal passages of volunteers and measured the nerves' responses to different smells in various sites. Each measurement actually captured the response of thousands of smell receptors, as these are densely packed on the membrane.

The scientists found that the strength of the nerve signal varies from place to place on the membrane. It appeared that the receptors are not evenly distributed, but rather, that they are grouped into distinct sites, each engaging most strongly with a particular type of scent.

Article continues: <http://nocamels.com/2011/10/sense-of-smell-is-physiological-not-psychological-study-shows/>

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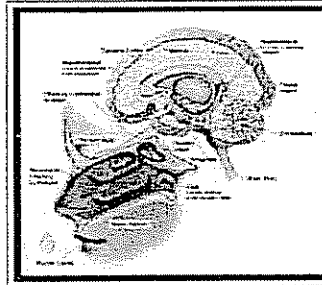
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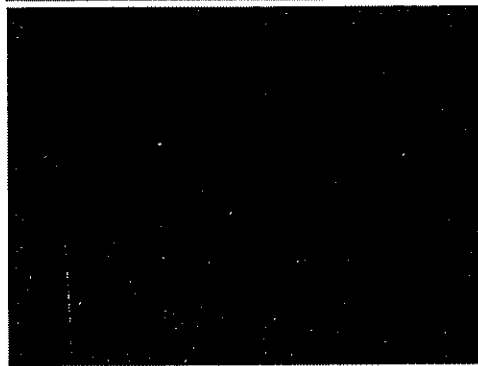




# House of Mind

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## Noam Sobel and His Nose-Controlled Electric Wheelchair

This week I attended a talk by the creator of the revolutionary device shown above, Dr. Noam Sobel, an olfaction neuroscientist at the Weizmann Institute in Israel. Although most of his talk went way over my head, I read some of his more current work and I am impressed nonetheless. Dr. Sobel's conceptualizes sensation and perception in new ways that allow him to employ more creative approaches in order to address his research questions. Two of his more recent scientific feats include:

- He has used fMRI to study chemosignaling in humans and discovered that female human tears reduce sexual arousal (and accompanying neural activation) in men.
- He has successfully placed an electrode inside a human nose (specifically, in the olfactory epithelium) in order to record neural responses to different odors in real time and concluded that the primary axis of olfactory perception is pleasantness.

And not to forget, the wheelchair above is his brainchild. In a 2010 PNAS paper (*cited below*), Sobel describes the design and function of the sniff controlled wheelchair. Using this device, patients use a sniff controlled interface that allows them to drive a wheelchair and text. Turns out that the fine control of sniffing is dependent on the positioning of the soft palate, an area innervated by multiple cranial nerves whose innervation pattern is typically conserved- even after severe injury most of the times. What's even more fascinating is that fMRI during device usage revealed activation of a widely distributed neural network and that device usage shared similar neural substrates with language production.

The device could be potentially life-changing for severely

# Smells Like Old Times

Our sense of smell sways our memory and thought

By Maria Konnikova



Six years ago, on an early morning in September, Molly Birnbaum was out for her regular jog when she was hit by a car. Her pelvis was shattered, her skull fractured, her knee torn. Yet for her, the most serious damage was far less visible: she lost her sense of smell. Birnbaum, now 29, was an aspiring chef, and the loss meant the end of her career. It also meant something else, something that was potentially even more life-changing. “I felt like I lost a dimension of my memory,” she says. “It made me worried about the future. If I couldn’t smell ever again, was I losing this important layer?”

Memory comes in many forms. Every day we constantly receive and process sights, sounds, touches and smells from our surroundings, some of which will become our memories. The nature of those recollections, however, is inconstant. One memory can seem immediate and colorful, as if the event had just occurred, whereas another must be coaxed out of our brain little by little. Although a moment that excites our emotions is more likely to be recorded than a routine experience, the sensory qualities of the event we have buried in our brain also plays a part in how vividly and accurately we remember something.

Although sight dominates our daily life, it has long been thought that smell might have a privileged relation with memory. Until relatively recently, however, the precise nature of that connection remained largely unexplored. Now scientists are revealing that recollections tied to smell can be stronger than memory of other types. Olfaction can transport our

thoughts back to some of our earliest experiences and tint these remembrances with feeling. On the flip side, its absence could be a sign—and potentially a cause—of cognitive decline. Scientists are at a very early stage of developing therapies to train people to smell better, which could one day stave off the deterioration of mental faculties.

## Transported by Scent

Aristotle explored the apparent ties between odor and memory in his treatise from the fourth century B.C., *On Sense and the Sensible*. Since then, people have speculated that the memories elicited by smell are more intimate and immediate than other recollections. When we experience certain smells, we often find ourselves whisked back in time to a specific event or scene. For example, the smell of salsa reminded Birnbaum of watching James Bond movies on television with her dad while dipping chips in the spicy sauce. When she lost her sense of smell, she could still remember eating salsa with her

ANN E. CUTTING



Odors tend to trigger memories of early life experiences, such as baking sugar cookies with your mom.

father, but she could no longer quickly summon that long-ago scenario. Psychology studies support the idea that memories associated with odors are unusually evocative.

number of memories for each type of cue, odors elicited earlier memories, including far more from the first 10 years of life, than did sight or sound cues. Recollections emerging from scents were also

**Memories tied to odors are both older and associated with more time travel-like experience than are recollections of other kinds, research suggests.**

In a 2006 experiment psychologists Johan Willander and Maria Larsson of Stockholm University gave older adults one of three types of cues—visual, auditory or olfactory—and asked them to describe an autobiographical event that came to mind as a result. The participants also rated the event based on its emotionality, vividness and importance. Although the volunteers came up with the same

associated with a stronger feeling of being brought back in time. The results suggest that memories tied to smell are both older and associated with a more time travel-like experience than are other types. The use of odors to trigger memories has led researchers to reconsider the long-held notion that people recall more incidents from their teens and 20s than from any other time in their life. In 2000 psychologist Simon Chu, now at the University of Central Lancashire in England, and his colleagues discovered that although visual memories did peak between the ages of 11 and 25, odor-cued recollections crested between the ages of six and 10.

Rachel Herz, a cognitive neuroscientist at Brown University, sees olfaction as a potential key to a trove of past experiences that would otherwise remain locked. A whiff of a smell not encountered since childhood may bring us back to an event that we had all but forgotten existed, she theorizes.

Smell might have this power because odors themselves are relatively rare, compared with, say, visual stimuli. Every day our eyes are constantly bombarded with images, many of which are quite similar, cre-

**FAST FACTS  
The Nose Knows**

- 1» Recollections tied to smell can be stronger than memories elicited by other cues.
- 2» Most visual memories hark back to when people were in their teens and early 20s, but the greatest number of odor-related recollections come from when we were six to 10 years old.
- 3» An impaired sense of smell may be a sign of cognitive decline and might even hasten memory loss.

GETTY IMAGES

ating confusing interference in the brain. In contrast, our nose detects distinct odors only infrequently, a fact that Richard L. Doty, director of the Smell and Taste Center at the University of Pennsylvania, surmises is key to the evocative power of scent. Because smells are encountered rarely, individual odors are often tied to a unique experience, enabling a strong and stable connection.

Smell has a privileged relation with memory on an anatomical level as well. It is the only sense that connects with the memory system without stopping over to the thalamus, a sensory relay station. Signals travel from the nose to the olfactory bulb and then directly to the hippocampus, an essential hub of memory formation, and the amygdala, which processes emotion. "Memory and odors are just sitting side by side," says research psychiatrist Donald Wilson of New York University Langone Medical Center.

The connection does not end there. In a parallel track, the olfactory bulb passes information to the olfactory cortex, which sits at the surface of the brain just above the ears. Part of this region is involved in complex learning and memory tasks. The olfactory cortex, together with an adjacent decision-making area, the orbitofrontal cortex, processes the information contained in a smell and sends the data back to the hippocampus. This back-and-forth communication ties scents with remembrances.

**Sniffs of Young Noses**

To understand why odors seem to strongly evoke very early life experiences, scientists began to search for other differences in how the senses interact with memory. In 2009 neuroscientist Noam Sobel of the Weizmann Institute of Science in Rehovot, Israel, and his colleagues taught subjects to pair pictures of objects with a smell or a sound, or both. Subjects then viewed pictures of the objects while in an MRI scanner and were asked to recall either the smell or sound associated with each image. In a second round, the researchers paired every object with an opposing odor or sound or odor-sound pair: if the first stimulus had been pleasant, this time, it was unpleasant—and vice versa. Another brain scan and test of these memories followed.

One week later the researchers presented the pictures a third time and asked participants to name the odor or sound that popped into their mind. Overall, people recalled the memories from the first round slightly more than those in the second set. The brain scans, however, produced a more nuanced picture. When a person thought of the first odor, the hippocampus became much more active than when he or she remembered the second smell,

**Whiff of Melancholy**

In addition to unleashing emotions from the past, the ability to detect scents also seems to influence a person's current mood. Psychologist Bettina Pause, now at Heinrich Heine University in Düsseldorf, Germany, and her colleagues have shown that individuals who suffer from depression have a blunted sense of smell. Although it is not clear whether that sensory loss fed the depression or resulted from it, many researchers believe the influence runs in both directions.

For example, some data suggest a bad mood can impair smell. In a 2007 study a team led by psychologist Olga Pollatos, now at the University of Potsdam in Germany, coaxed participants into one of three emotional states—positive, negative or neutral—and then measured their sensitivity to an odor. The researchers found that the people in a negative emotional state had reduced sensitivity to the odor as compared with those in a neutral or good mood.

Anecdotal reports also hint that a loss of smell can spawn sadness. For instance, surgery in the nasal cavities to remove polyps often leads to mild depression, psychiatrists say. As a result of such observations, cognitive neuroscientist Rachel Herz of Brown University believes people can get into a "depression-olfaction loop": sadness suppresses smell, and that sensory loss, in turn, deepens the depression.

The loss of emotional balance may subsequently affect a person's ability to learn and form memories. Depression is often accompanied by a decline in both memory and learning ability. Sufferers have a smaller hippocampus, a key memory center, than nondepressed people and, as a study published in 2010 suggests, a smaller olfactory bulb. —M.K.



suggesting that the brain issues a special tag for first odor associations. In contrast, the hippocampus activity was the same for first and second sounds.

In addition, on the first memory test, the more the hippocampus responded during odor retrieval, the more likely a person was to later remember that first odor as opposed to the second. No such relation existed for sounds. Given the brain's unique response to first odor memories, the smells of childhood may make early remembrances particularly durable.

Although its effect on our earliest recollections may be most pronounced, smell might also facilitate learning more broadly. In a study published in 2007

**(The Author)**

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BEAU LARH CORDIS

neuroendocrinologist Jan Born and his colleagues at the University of Lübeck in Germany asked people to inhale the smell of a rose while studying the locations of 15 pairs of cards on a computer screen. When the participants went to sleep that night in the lab, some of them were exposed to the rose odor, whereas others' sleep was unscented. In the morning, all the participants were tested on their memory for the card locations. Those who had been exposed to the flower fragrance remembered 97 percent of them, compared with just 86 percent for those who had received an odorless stimulus, suggesting that odors can boost learning as memories are consolidated during sleep.

**Waiting to Inhale**

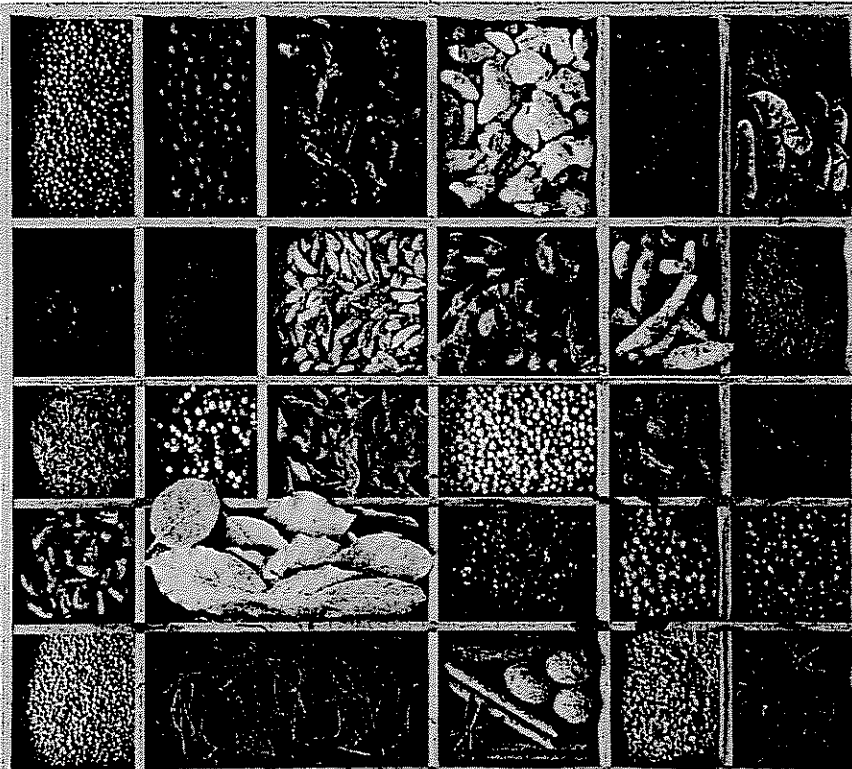
The memories that smell evokes also have a distinct emotional tint. In studies in which Herz and her colleagues asked people to rate the poignancy of various memories, those provoked by odors were steeped in more feeling than those brought to mind by visual, verbal, tactile and auditory cues. In these

studies, the subjective responses of emotion jibed with physical changes, such as heart rate.

Consistent with the anatomical portrait of smell, odors also uniquely recruit brain regions that process both emotion and memory. In a 2004 study Herz's team asked participants to identify a perfume that elicited a pleasant personal memory. One month later the people were shown a picture of the perfume as well as a photograph of a different perfume—and exposed to the odor of each—while inside a brain scanner. The researchers found that the odor related to the emotional memory generated more activity in the amygdala than did the pictures or the other odor. These chosen odors were also the only cues that boosted the neural response in memory-related regions. The brain's response thus mirrors people's subjective impressions that odors possess a unique power to summon emotional memories.

Accordingly, the loss of smell seems to have ripple effects on the integrity of memory and emotion centers. In studies published in 2010 and 2011 re-

Exercising your sense of smell may be able to improve it. One woman who had lost this sense in an accident got it back after studiously sniffing familiar foods and spices. The practice may have contributed to her recovery.



ELENA SCHWEITZER (stockphoto)

searchers at Friedrich Schiller University of Jena in Germany saw shrinkage of neural tissue in both the hippocampus and emotional brain structures in individuals with anosmia (the inability to perceive smells) and parosmia (the distortion of smells), as compared with people with no smell impairments, hinting that a loss of smell may impair memory or emotional processing, or a combination of both.

Such effects might explain Birnbaum's impression that her anosmia, though not wiping out her memory, stripped her recollections of their poignancy. "I'd always had memories that came from smell that were really important to me," Birnbaum recalls. After the accident, "I didn't forget them, but the emotional potency wasn't there." Smell's ties to emotion also become apparent in cases in which the loss of smell leads to depression—or depression leads to the loss of smell [see box on page 61].

Although it is not clear whether olfactory deficits directly impair cognition, they are often an early sign of a declining mind. In 2009 research psychiatrist Monica Z. Scalco and her colleagues at the University of Toronto found that poor performance on a standard test of smell could serve as a very early indicator of cognitive decline in older people. Olfactory deficits in these individuals appear to precede cognitive impairment. Complete loss of smell is also a signature of incipient Alzheimer's disease. In 2010 neurosurgeon Qing Yang and his colleagues at Pennsylvania State University reported that they could use functional MRI to detect subtle deviations in the activity of the olfactory system in Alzheimer's patients that were not present in people without the disease. In the future, doctors might look for such changes to predict the onset of Alzheimer's at a very early stage.

#### Exercise Your Nose

No one yet knows whether improved detection of odors can enhance cognition. Given that it might, however, scientists are looking at the possibility of shoring up people's sense of smell. In some cases, exposure to an odor can improve its detection. Take androstrenone, a steroid found in sweat and urine. About one third of us cannot smell it at all, and for the rest, it smells like either sweaty socks or vanilla, depending on an individual's genetic makeup. In 2002 a group led by Joel Mainland, then at the University of California, Berkeley, demonstrated that exposing insensitive individuals to androstrenone for 10 minutes daily for 21 days gave them the ability to pick up its scent. The researchers' data suggest the changes occurred in olfactory brain systems rather than in the nose itself.

In findings published last November, Wilson and his colleagues revealed that rats could gain or lose the ability to smell the difference between two similar chemicals, depending on the circumstances. The results hint that, as with rats, humans may be able to learn or unlearn how to smell as a result of everyday experiences. If we then inadvertently lose our ability to distinguish among odors—say, as a result of inattention or lack of practice—data suggest that the loss may affect other parts of our brain.

Those of us who end up with declining olfactory abilities may be at risk for a loss of mental acuity or changes in our memories.

As a remedy, some kind of smell training might help ward off such a decline. Doty believes that regular exposure to odors from childhood on—or more mindful attention to existing odors—might thwart a subtle erosion of cognition. In addition, people might be systematically tested for loss of smell just as they are examined for hearing and sight impairments now. "It could be a warning sign if olfaction falls off," Doty says.

Although recovery from anosmia is rare, Birnbaum did regain her sense of smell. No one knows why, but her exposure to odors may have helped. She studiously inhaled odors—from jars of condiments, familiar foods and spices—wherever she went. Birnbaum's brain has not totally rebuilt its memories surrounding these scents. The young woman's early-life flashbacks remain devoid of the expressive color they once had, she says. But in time, as her brain restrings the wires between nose and brain, the salsa may viscerally summon the television once again. M

**Regular exposure to odors from childhood on—or more mindful attention to existing odors—might thwart a subtle erosion of cognition.**

#### (Further Reading)

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### DNA nanorobots seek and destroy disease

Chemistry World 2 | 17 February 2012 | Jon Cartwright

Posted on Sunday, February 19, 2012 1:17:56 PM by [overdem](#)

Researchers in the US have created a DNA-based nanorobot that can work its way through cell cultures, delivering cargo only at specific targets. The development could pave the way for programmable therapeutics, in which nanorobots would provide medical treatment only to certain types of cell or tissue.



The DNA barrel only opens to release its cargo at specific cells

© AAAS

The field of nanomachines has taken off in recent years, mostly thanks to so-called DNA origami. In this technique, DNA strands can be folded controllably into a structure, onto which different molecules can be attached. Researchers have already shown that structures built using DNA origami can perform basic robotic tasks, such as sensing, computation and targeting cells. But, says biophysicist Shawn Douglas at Harvard Medical School in Boston, Massachusetts, no one has ever combined these tasks to do something more sophisticated, such as cell-targeted cargo delivery.

Douglas, together with his colleagues, has now done this with a hexagonal, barrel-shaped DNA robot. The robot is just 35nm across and 45nm long, and is hinged at the base to clasp and unclasp in a clam-like manner. At the top, the barrel has 'locks' made of short DNA molecules that unlock when they bind with antigen 'keys', releasing the barrel's cargo, such as antibodies.

In the researchers' experiment, billions of nanorobots were released into mixed cell cultures. The nanorobots diffused around, coming into contact with different types of cell. To cells without the appropriate surface key - that is, the right antigen combination - the nanorobots did nothing. However, when a nanorobot came across a cell with the correct antigen combination, its locks opened and the cargo was released - in some instances, killing the cell.

'It is impressive, and I am amazed it worked so nicely and cleanly,' says Milan Stojanovic, who researches autonomous therapeutic devices at Columbia University in New York, US. 'It's surely an important contribution and crucial step in the right direction.'

Ehud Shapiro, an expert in the crossover between computer science and molecular biology at the Weizmann Institute of Science in Israel, is also impressed. 'This pioneering and elegant work brings us closer to realising the vision of programmable drugs based on autonomous, programmable devices,' he says.

Douglas says his group is seeing whether they can achieve similar results in mice but he thinks the nanorobots may not be restricted to programmable therapeutics. They could be used for 'diagnostic and even non-medical applications ... anywhere that electronic devices would be too large,' he says.

#### References

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[DNA motors on](#)

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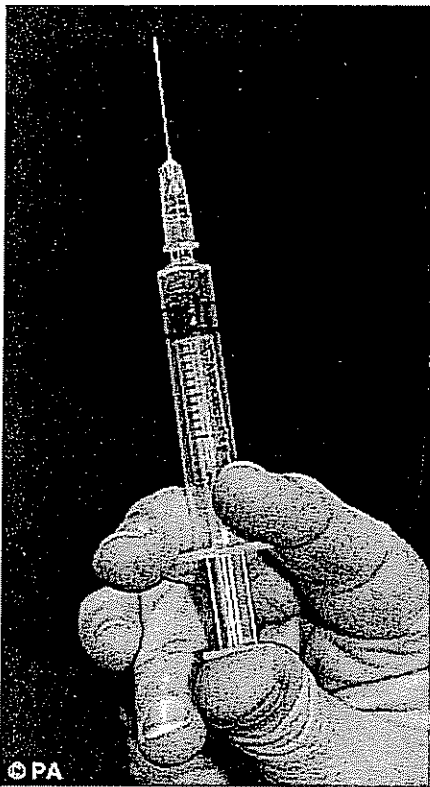
# MailOnline

## Vaccine could halt autoimmune diseases such as rheumatoid arthritis and Crohn's

- Potential treatment proved successful in animal studies
- Could help tackle range of conditions including cancer

By [Sadie Whitelocks](#)

Last updated at 11:55 AM on 26th December 2011



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A simple vaccine could prevent the onset for autoimmune diseases such as rheumatoid arthritis and Crohn's

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A simple vaccine could stop the onset of autoimmune diseases such as rheumatoid arthritis and Crohn's, say scientists.

The potential treatment has proved successful in animal studies and it is hoped the breakthrough could lead to new ways of tackling a range of conditions including cancer.

Autoimmune diseases occur when the immune system mistakes some parts of the body as a pathogen and starts attacking its own cells.

But the new vaccine, based on nanotechnology, stops this process without causing severe side effects.

Lead researcher Professor Irit Sagi, from the Weizmann Institute in Rehovot, Israel, hailed the



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New Vaccine Tested Against Autoimmune Diseases

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Autoimmune diseases, such as Crohn's disease and Rheumatoid Arthritis, or even allergies, are one of the trickiest in the medical world because they occur when the immune system mistakenly attacks itself, causing damage to the entire body.

Israeli scientists from the Weizmann Institute of Science think they have made progress what could be significant progress in the treatment of autoimmune diseases by developing a vaccine.

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Traditional treatment for patients with such diseases generally involves taking anti-inflammatory drugs along with immune suppressants. However, these drugs come with serious side effects, and can even increase the risk of patients developing an infection.

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## "Man in the Moon" Facing Factors Figured

A new study explains why the odds favored the man-in-the-moon side to always face Earth. John Matson reports

March 12, 2012 | 3

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Why is the far side of the moon on, well, the far side of the moon?

The moon is tidally locked. That means that it rotates in sync with its orbit around Earth, so that the same side of the moon always faces us. It used to rotate faster, but Earth's pull slowed it down and locked it in place.

The lunar far side is much more elevated than the near side, which has a group of facelike splotches that some call the man in the moon. All that mass on the far side is pretty attractive, gravitationally speaking. So it would seem to make more sense if the far side of the moon had been the one pulled in our direction.

A new study in the journal *Icarus* offers an explanation for the moon's seemingly unbalanced configuration. [Oded Aharonson, Peter Goldreich and Re'em Sari, "[Why Do We See the Man in the Moon?](#)"] Which way the moon locked into place depended on how asymmetric it was, as well as on the torque the moon felt from Earth's gravity.

Given those factors, the researchers concluded that the chances were about two to one that the moon would lock into place in its current orientation. Which means that in a universe of infinite wonders, the man in the moon is still an odds-on favorite.

—John Matson

[The above text is a transcript of this podcast.]

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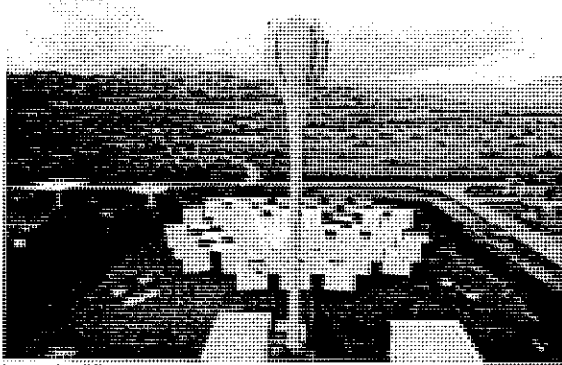
## AORA's Solar Sun Tulip Says Ola Sol In Spain

by Green Prophet, January 19th, 2012

Editor's Note: EarthTechling, always looking to bring you interesting cleantech reading, is proud to [repost this article](#) courtesy of partner [Green Prophet](#). Author credit goes to Karin Kloosterman.



With a 35 meter high sun-ray collection tower and about 50 mirrors positioned to direct the sun, Israel's AORA is about to flip the switch on its latest solar power plant in Spain. The company [created a huge buzz in Israel in 2009](#) when it was the first solar energy company to connect to the national grid. Since, it has been under the radar, and has recently emerged at the prestigious Plataforma Solar Almeria in Almeria, Spain.



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The new ultra-high temperature concentrating solar power (CSP) technology it is showcasing there focuses [heliostats](#), small mirrors, onto a sun collecting turbine built on top of the "tulip" pictured above.

While the plant only produces kilowatts of electrical and thermal energy, and not megawatts like we see at CSP solar plants made by BrightSource or the CSP plant at Kuraymat, Egypt, the idea here is something kind of novel: to create small power plants around or very close to the grid, so that less power is lost along the way, in transmission.

The invention started in the labs of [Prof. Jacob Karni](#) at the Weizmann Institute in the 80s.

The company can build around wildlife corridors, a huge plus if you consider the [BrightSource turtleiasco](#), and there is virtually no down time for maintenance as one of many units can go offline at a time without disrupting the whole system. Other benefits include the ability to power the turbines with alternative fuel at night, when the sun's not shining.

Regulatory hurdles, or quick sand however you want to describe bureaucracy has prevented the company from multiplying its bright tulips all over the Holy Land.

I spoke with the CEO of AORA last week, Zev Rosenzweig and he says that a single unit would cost about half a million USD to set up, and would power about 50 homes in Europe (based on a 2 kw home), a few fewer in the US where consumption is higher. Each AORA plant generates 100 kw of electric power, and an additional 170kW thermal power.

Watch out for [AORA](#) as they flip the switch in Spain on February 7.

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BUSINESS

Power flower



Area's power plants and energy infrastructure are a key part of the region's economic recovery.

As the region's economy recovers, the power industry is playing a crucial role. The area's power plants and energy infrastructure are a key part of the region's economic recovery. The industry is investing in new technologies and infrastructure to meet the growing demand for electricity. This includes upgrading existing power plants and building new ones. The power industry is also investing in renewable energy sources, such as wind and solar. This is helping to reduce the region's carbon footprint and create new jobs. The power industry is a vital part of the region's economy and is expected to continue to grow in the years ahead.

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## News

### Abbott Steps up Presence in Israeli Market

2/8/2012

Since buying Israeli company Starlims in 2010, Abbott Laboratories, which has a finger in just about every biomed pie, has shown heightened interest in the Israeli market. The company is a leader in drugs and diagnostics, and has a thriving medical devices division, and a nutrition division (Similac, for example). It is even active in animal health, and it has launched a new venture capital fund that seeks technologies in Israel.

A few months ago, Abbott signed a multi-year collaboration agreement in pharma and diagnostics with the Weizmann Institute. "We signed an agreement for at least 3 years, and we have already brought several of the institute's technologies to the company for examination," says Ed Michael, executive vice president, Diagnostic Products at Abbott.

"We are very enthusiastic about the potential of the Weizmann Institute," says Jim Sullivan, divisional vice president, neuroscience discovery. "We gave guidance to the scientists about the fields that interest us, with the intention of starting small and letting the relationship build up.

*Which fields are you interested in?*

Sullivan: "The Weizmann Institute has expertise in several growing areas in the drugs sector. For example, cancer, Alzheimer's, schizophrenia, and kidney diseases. Another field that interests us is pharma combined with diagnostics, for example, drugs for specific target groups, with the segmentation being done by a diagnostic test; drugs the dosage of which is set through a test; imaging capabilities that make it possible to plan administration of a drug more precisely. Companies that enable us to direct drugs to inaccessible parts of the body, such as to the brain, also interest us."

Michael: "We are looking for cheaper methods of diagnosis. That could benefit developing countries, and also facilitate carrying out examinations at home instead of going to hospital. We have already received from the Weizmann researchers several proposals for methods of biological processing that could assist in this area."

*Is there close cooperation between your diagnostics and pharma divisions?*

Michael: "We are two separate divisions that work together quite a lot. Sometimes, the various departments also collaborate with parallel departments in other organizations. So, for example, we received approval for a Pfizer drug combined with a diagnostic test of ours. If our pharma department isn't hurt by it, I see no problem with that."

*How do you build relations with other companies, some of which are much smaller, and have different corporate cultures?*

Sullivan: "Sometimes, smaller entities are frightened of us because we are so big. Some of them have never seen so many lawyers in one room. To remove the barriers at the start, it's a good idea to begin with relations between scientists, and bring on the bureaucracy afterwards."

Michael: "Our relationship with Starlims is an excellent example of success in this area. The company operates from Israel, but we have expanded its activity, and we intend to expand it further."

*What is the regulatory and economic environment like in the US today?*

Michael: "Regulatory hurdles have become tougher, and together with the cost and the uncertainty in many fields, a situation has come about in which new products aren't developed at all."

Sullivan: "Nevertheless, we have seen that when we bring breakthrough innovation, suddenly the FDA does help us. For example, we recently proposed a drug with the potential of raising the chances of a cure and considerably shortening the duration of the disease in Hepatitis C. FDA responded positively, because they saw the potential benefit."

*How have developments in the digital world in recent years affected the pharmaceutical industry?*

Michael: "Collaboration within and between companies is simpler. As far as the connection with the consumer is concerned, social media are a real risk and a minefield. You have to be careful when you provide information to people. We'd like to enable consumers to get in touch with other patients like them, with doctors, and with us. We have thought about this a great deal in recent years, and we

continue to think.

Sullivan: "Abbott has about 7000 scientists and engineers around the world. One of the areas we have worked on lately is to create free cooperation between them. Today, they can ask a question and hear each other's opinions. One reason we bought Starlins was that their products make such collaboration possible."

*In your view, is radical change required today in the structure of pharmaceuticals and diagnostics companies in order to maintain innovation?*

Sullivan: "The current development process is too long and too expensive. You have to think hard about the way you do research, which is why cooperation with academe, such as the Weizmann Institute, and with young companies, is so important for us."

#### **Medical Nutrition, Not Food Additives**

Medical nutrition is one of the fields that set Abbott apart, and it is growing. Israeli consumers perhaps know the baby food compound Similac, and perhaps also a recently launched product in the same area, PediaSure, a dietary supplement for children who are selective eaters.

The idea for a product like PediaSure grew out of another Abbott product, Ensure, which is an enriched drink for the elderly and infirm, and which has sales of \$1 billion. Ensure exemplifies the complexity of medical nutrition. There is a version sold direct to the consumer and marketed like any consumer product, but also a product for hospitals designed for feeding through a tube. The team responsible for the product has to develop expertise in both areas.

Other medical nutrition products that demonstrate the potential of the field are special drinks and foods for cancer patients that take account of the effect of treatment on the stomach and the appetite, and of nutritional insufficiencies that arise; products for improving cognition in conditions such as Alzheimer's and schizophrenia; special food for kidney disease patients; and special food for patients at risk from contamination.

*How do you make the consumer distinguish between medical nutrition and food additives?*

Sullivan: "The regulatory environment in food is developing rapidly, and we are waiting to see that will happen in this area. It could be that it would be a good idea if there were regulation on these products requiring those who sell them to demonstrate that the product is effective."

Published by Globes [online], Israel business news — [www.globes-online.com](http://www.globes-online.com) — on 7 February 2012

[www.weizmann.org.il](http://www.weizmann.org.il)

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**Andromeda Announces Phase III Clinical Study With DiaPep277(R), a Novel Imm**

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CMTX - Tue Nov 22, 09:38AM

**DiaPep277(R) Demonstrated a Significant Preservation of C-peptide Levels, a Marker for Assessing Insulin Secretion by Pancreatic Cells**

**Higher Proportion of Patients Maintained Adequate Diabetic Control Defined as Serum HbA1c Levels Equal or Less Than 7%**

YAVNE, Israel, Nov. 22, 2011 (GLOBE NEWSWIRE) – Andromeda Biotech Ltd. announces initial results from a pivotal phase III clinical study. The 24-month study was randomized, placebo-controlled, designed to assess the safety and efficacy of DiaPep277(R), a novel immunotherapeutic agent for the treatment of newly diagnosed patients with Type 1 Diabetes (T1D). The results from patients who were treated with DiaPep277(R) show that the study has met its primary endpoint, defined as the change from baseline in C-peptide levels at the end of the study. Significant preservation of C-peptide levels, a marker for assessing endogenous insulin secretion by pancreatic cells, was demonstrated in patients treated with DiaPep277(R) compared to the placebo arm. The decline in C-peptide levels was more pronounced in the placebo arm than in the treated group. The difference between the arms reached 0.949 nmol/L/20 minutes, (p=0.0374). This difference reflects a relative preservation of 23.4% compared to placebo. Evaluation of the primary endpoint was performed on patients in the modified ITT population who have at least one measurement post baseline.

The study also achieved a key secondary endpoint, showing that a greater proportion of DiaPep277(R) treated patients maintained good diabetic control compared to the placebo, measured by HbA1c levels equal or less than 7% at the end of the study (45.5% versus 35.7%, p =0.035). Initial safety data also indicate that DiaPep277(R) was well tolerated. No major differences in drug-related adverse events were reported between the treatment and placebo groups.

Additional analyses of clinical, efficacy and safety data from this study are ongoing. A second confirmatory, global Phase III study with DiaPep277(R) is currently being conducted at about 120 medical centers in the USA, Canada, Europe, Israel and Argentina. Completion of patient recruitment for this study (450 patients) is anticipated by the first half of 2012.

Teva Pharmaceutical Industries Ltd. (Nasdaq:TEVA) took an equity position in Andromeda following interim phase III study results, and has an exclusive worldwide license to the DiaPep277(R) product.

Prof. Itamar Raz, Head Diabetes Unit, Department of Medicine, Hadassah University Hospital, Jerusalem, Chairman of the Scientific Steering Committee of the study notes that: "We are very pleased with these top-line results, which indicate an important breakthrough for medical science in the area of immune therapy for patients with Type 1 Diabetes. Preservation of the endogenous insulin secretion, which was corroborated by the clinical outcome of improved control of Hb1Ac, may fulfill the current vast unmet medical need in this field."

Dr. Shlomo Dagan, CEO of Andromeda commented, "We are very excited about the prospect of DiaPep277(R) bringing new hope to newly diagnosed type 1 diabetes patients and their families, especially after other potential late stage products failed to show significant efficacy in immune intervention."

**About the Study**

The phase III clinical study included 457 newly diagnosed Type 1 Diabetes patients aged 16-45, randomized into two study groups in a 1:1 ratio. The trial was conducted in 40 medical centers in Europe, Israel and South Africa. All patients recruited to the study received daily insulin therapy adjusted to their daily blood glucose levels. In addition, patients who were randomized in the treatment group were injected subcutaneously with 1 mg of DiaPep277(R) once every three months for two years. Subjects were evaluated for efficacy, defined as the ability to preserve insulin secretion, using the glucagon stimulation test and the mixed meal tolerance test. The target population for efficacy included subjects who entered the study according to the protocol inclusion and exclusion criteria and received at least 1 dose of study medication (modified ITT population), and have at least one measurement post baseline (338 patients, equally divided between the treated and placebo arms). Other clinical endpoints included glycemic parameters such as HbA1c, insulin daily dose requirement and the number of hypoglycemic events. Clinical and safety parameters were evaluated every three months throughout the two years of the study.

**About DiaPep277(R)**

DiaPep277(R), a unique peptide of 24 amino acids derived from the sequence of the human heat shock protein 60 (Hsp60), was invented by Prof Irun Cohen and his team at the Weizmann Institute of Science. The peptide acts by modulating the immune system, thus preventing the destruction of pancreatic cells that secrete insulin, and preserving their natural function. Treatment of T1D patients with DiaPep277(R) may have several medical benefits including

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slowing the deterioration of the disease, improved metabolic control, reduction of daily insulin dose requirements, and reduction of diabetic complications.

To date, there is no therapy able to slow the progressive destruction of insulin secreting pancreatic beta cells in T1D. Initially, DiaPep277(R) is targeted to treat newly diagnosed T1D adult patients with residual insulin secreting cells. Additional target populations include newly diagnosed children with T1D, patients with a high risk of developing T1D, and T1D patients with slow progressing disease.

About Andromeda

Andromeda Biotech Ltd., a subsidiary of Clal Biotechnology Industries Ltd. (TASE:CB1) is focused on the development of an innovative treatment for autoimmune diabetes. Andromeda's DiaPep277(R), currently in Phase III Clinical Studies, is a novel therapeutic approach to treat T1D.

For more information about Andromeda Biotech please visit our site: (www.andromedabio.com)

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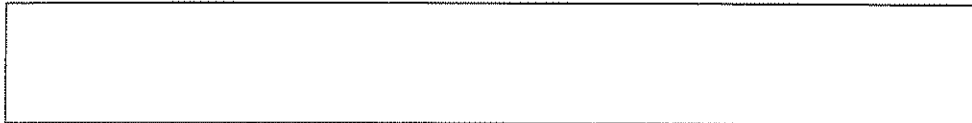
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