

# HIV Protein Key to AIDS Vaccine Development

In a finding that could have profound implications for AIDS vaccine design, researchers led by a team at the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health (NIH), have generated an atomic-level picture of a key portion of an HIV surface protein as it looks when bound to an infection-fighting antibody. Medical News Today says unlike much of the constantly mutating virus, this protein component is stable and—more importantly, say the researchers—appears vulnerable to attack from this specific antibody, known as b12, that can broadly neutralize HIV.

"Creating an HIV vaccine is one of the great scientific challenges of our time," says NIH Director Elias A. Zerhouni, M.D. "NIH researchers and their colleagues have revealed a gap in HIV's armor and have thereby opened a new avenue to meeting that challenge."

The research team was led by Peter Kwong, Ph.D., of NIAID's Vaccine Research Center (VRC).

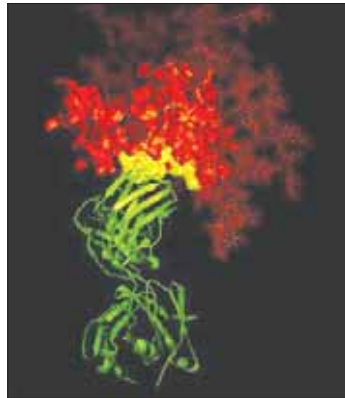
Their paper appears in the February 15 issue of *Nature* and is now available online.

"This elegant work by Dr. Kwong and his colleagues provides us with a long-sought picture of the precise interaction between the HIV gp120 surface protein and this neutralizing antibody," says NIAID Director Anthony S. Fauci, M.D. "This finding could help in the development of an HIV vaccine capable of eliciting a robust antibody response."

For years, AIDS vaccine developers have been stymied by the seemingly unlimited ways HIV eludes natural and vaccine-induced immune defenses.

In 1998, Dr. Kwong and colleagues published the first X-ray snapshot of the core of HIV gp120 as it attaches to a cellular receptor known as CD4. That image gave researchers a glimpse of some sites on the virus that could be targets of drugs or vaccines, but it also revealed the extent of HIV's overlapping defenses.

An effective HIV vaccine likely needs to induce antibodies that can sense and destroy multiple HIV



3-D X-ray crystallographic image showing the broadly neutralizing antibody b12 (green ribbon) in contact with a critical target (yellow) for vaccine developers on HIV-1 gp120 (red).

strains. Scientists have sought such broadly neutralizing antibodies by studying the blood of people whose immune systems appear to hold the virus at bay for long periods of time—b12 is one of these rare, broadly neutralizing antibodies.

"One of our primary goals is to develop HIV vaccines that can stimulate

broadly neutralizing antibodies," says Dr. Nabel. "The structure of this gp120 epitope, and its susceptibility to attack by a broadly neutralizing antibody, shows us a critical area of vulnerability on the virus that we may be able to target with vaccines. This is certainly one of the best leads to come along in recent years."

## Stem Cell May Cure Deafness

Stefan Heller's dream is to someday find a cure for deafness.

As a leader in stem cell-based research on the inner ear at the Stanford University School of Medicine, he's got a step-by-step plan for making this dream a reality.

"Everyone asks, 'How long before we do this?'" said Heller, PhD, associate professor of otolaryngology, whose accent still bears the trace of his native

Germany. "I tell them the devil is in the details."

According to *Science Daily*, Heller's vision is to develop a variety of possible cures for deafness. For the past year and a half, since coming to Stanford from Harvard, he's been focused on two paths: drug therapy—which could be as simple as an application of ear drops—and stem cell transplantation into the inner ear to remedy hearing loss. Currently he's working

on perfecting the steps toward eventual stem cell transplantation into humans, with the goal of first curing deafness in mice within the next five years.

"This is promising because it means the genetic program for regeneration exists somewhere in the vertebrate family," Heller said. "We know there is an unknown signal to regenerate that we could use, but we first have to find it."

Heller gained interna-

tion attention in 2003 for identifying stem cells that reside within the inner ear. Since then, his research has focused on using these stem cells to regenerate the critically needed hair cells in the inner ear.

For some people with genetically caused hearing disorders, he explained, no drug is likely to help. "For them, stem cell transplantation may be the answer," he said.

## Most Premature Baby Set for Home

A baby girl said to have spent the shortest time in her mother's womb is to be released from the hospital in Miami where she was born.

Amillia Taylor is believed to be the first baby to have survived following a gestation period of less than 22 weeks, BBC reports.

She weighed a mere 10 ounces (284 grams) at birth on 24 October.

Doctors generally consider that babies born weighing less than 14 ounces (400g) at birth stand no chance of survival.

At the time of her birth at the Baptist Children's Hospital last October, Amillia measured 9.5in (241mm). She spent a little under 22 weeks in her mother's womb, a world record according to the University of Iowa which keeps track of premature babies born throughout the world.

Initially, doctors held little hope for her survival. Amillia has experienced respiratory problems, a very mild brain haemorrhage and some digestive problems, but doctors now say her "prognosis is excellent".

Her parents named her Amillia—which means resilient in Latin, a fighter and hardworking—to reflect her survival against the odds.

"It was hard to imagine she would get this far. But now she is beginning to look like a real baby," said Sonja Taylor, Amillia's mother.

She said the worst thing had been not being able to hold her baby for more than six weeks after she was born.

On Tuesday, Amillia is going home after spending



Feet of Amillia Taylor in doctor's hands.

nearly four months in the hospital's neo-natal intensive care unit where her every move was monitored 24 hours a day.

Doctors say she still will have to be monitored closely after her release, requiring asthma medication and extra oxygen for months to come, as she still weighs less than 4lb 6oz (2kg).

Amillia's survival demonstrates the dramatic advances in neo-natal care in recent years, correspondents say.

## Surprises From Sun's South Pole

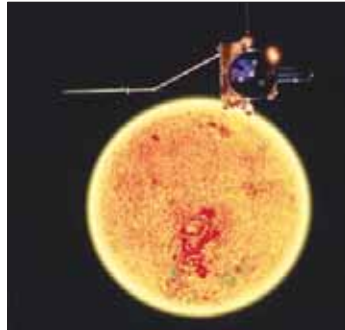
Although very close to the minimum of its 11-year sunspot cycle, the Sun showed that it is still capable of producing a series of remarkably energetic outbursts—ESA-NASA Ulysses mission revealed.

In keeping with the first and second south polar passes (in 1994 and 2000), the latest high-latitude excursion of the joint ESA-NASA Ulysses mission has already produced some surprises, *Science Daily* says.

In mid-December 2006, although very close to the minimum of its 11-year sunspot cycle, the Sun showed that it is still capable of producing a series of remarkably energetic out-

bursts. The solar storms, which were confined to the equatorial regions, produced quite intense bursts of particle radiation that were clearly observed by near-Earth satellites.

Surprisingly, similar increases in radiation were detected by the instruments on board Ulysses, even though it was three times as far away and almost over the south solar pole. "Particle events of this kind were seen during the second polar passes in 2000 and 2001, at solar maximum," said Richard Marsden, ESA's Ulysses Project Scientist and Mission Manager. "We certainly didn't expect to see them at high latitudes



A joint ESA/NASA mission, Ulysses is charting the unknown reaches of space above and below the poles of the Sun.

at solar minimum!" Scientists are busy trying to understand how the charged particles made it all the way to the poles.

"Charged particles have to follow magnetic field lines, and the magnetic field pattern of the Sun near solar minimum ought to make it much more difficult for the particles to move in latitude," said Marsden.

One of the puzzles remaining from the first high-latitude passes in 1994 and 1995 has to do with the temperature of the Sun's poles. When Ulysses first passed over the south

and then the north solar pole near solar minimum, it measured the temperatures of the large polar coronal holes.

"Surprisingly, the temperature in the north polar coronal hole was about 7 to 8 percent lower compared with the south polar coronal hole," said Professor George Gloeckler, Principal Investigator for the Solar Wind Ion Composition Spectrometer (SWICS) on board Ulysses.

When they fly, insects use their vision for piloting, just like human pilots. The electric signals from their fanned eyes travel through specialized neurons to stimulate the wing muscles, which let the insects correct their flight and avoid crashes. Could these same neurons be used in a sort of "automatic pilot"?

This is what Nicolas Franceschini, Franck Ruffier and Julien Serres have just shown, *EurekAlert.com* reported. These biorobotics specialists from the Movement and Perception Laboratory in Marseille, France have revealed an automatic mechanism called the "optic flow regulator" that controls the lift force. The researchers obtained these results by modeling the overland flight navigation of insects using a captive flying robot micro-robot that can reproduce much of the mysterious natural insect behavior.

## Video Game Skills Can Enhance Surgeons' Performance

In a study involving 12 surgeons and 21 surgical residents, video game skill was correlated with laparoscopic surgery skill as assessed during a simulated surgery skills course, according to a report in the February issue of *Archives of Surgery*, one of the *JAMA/Archives* journals.

James C. Rosser Jr., M.D., of Beth Israel Medical Center, New York, and colleagues asked 33 surgeons (21 residents and 12 attending physicians) about their video game-playing habits, then assessed their performance at the Rosser Top Gun Laparoscopic Skills and Suturing Program, a one-and-a-half day course that scores surgeons on time and errors during simulated surgery drills. During the study, conducted from May through August 2002, the surgeons also played three video games for 25 minutes while the researchers assessed their gaming skills, *EurekAlert.com* reports.

Of the surgeons who participated in the study, 15 reported never playing video games, nine reported playing zero to three hours per week, and nine reported playing more than three hours

per week at the height of their video game playing. "Surgeons who had played video games in the past for more than three hours per week made 37 percent fewer errors [in the Top Gun course], were 27 percent faster and scored 42 percent better overall than surgeons who never played video games. Current video game players made 32 percent fewer errors, were 24 percent faster and scored 26 percent better overall than their non-player colleagues," the authors write. Those in the top one-third of video gaming skill made 47 percent fewer errors, performed 39 percent faster and scored 41 percent better on the overall Top Gun score than those in the bottom one-third.

"Training curricula that include video games may help thin the technical interface between surgeons and screen-mediated applications, such as laparoscopic surgery," the authors conclude. "Video games may be a practical teaching tool to help train surgeons."

Meanwhile playing new style computer games can help people burn up significant amount of calories, research has found.

Computer games consoles that require players to use body movements to control the action could help shift 27lb (12.25kg) a year.

The researchers compared activity levels during gaming and found more active forms of gaming increased energy expenditure to a level which could help lose weight, BBC says.

Lead researcher Professor Tim Cable said: "Through our testing it is clear that the motion sensor-controlled console can make an impact on a child's heart rate, energy expenditure and the amount of calories burned."

Professor Cable said active consoles could provide a means of motivating children who are less active.

Based on the average gaming week of 12.2 hours, this translates to a potential 1,830 calories burned per week.

Heart rates were also much greater when using the active console, reaching values of 130 beats per minute.

But he added: "Parents should encourage other physical activities and outdoor pursuits in order for their children to lead well-balanced lives."

## Organic Molecules Convert Heat To Electricity

Engineers report successfully generating electricity from heat by trapping organic molecules between metal nanoparticles.

According to UPI, the University of California-Berkeley scientists say the achievement might eventually lead to the development of a new energy source.

The researchers said their discovery marks a milestone in the quest for efficient ways to directly convert heat into electricity. Currently, about 90 percent of the world's power generation involves burning fossil fuels to create heat, often in the form of steam that spins a turbine that, in turn, drives a generator to

produce electricity.

"Generating 1 watt of power requires about 3 watts of heat input and involves dumping into the environment the equivalent of about 2 watts of power in the form of heat," said Professor Arun Majumdar, principal investigator of the study.

"If even a fraction of the lost heat can be converted into electricity in a cost-effective manner, the impact it would have on energy can be enormous, amounting to massive savings of fuel and reductions in carbon dioxide emissions."

The study by Majumdar and former post-doctoral researcher Sung-Yeon Jang appears online in the journal *Science Express*.

## Is There a Pilot in the Insect?

How does a tiny creature like a fly or a bee, with a brain the size of a pinhead, manage to make such a magnificent job of controlling its flight, and avoid crashing to the ground?

Today it is known that the sensory motor prowess of these flying miniatures depends on the nervous system, made up of between one hundred thousand and one million neurons. When an insect, bird or pilot flies over land, the image of the ground below sweeps from front to back across the central part of the visual field, creating an "optic flow", which is defined as the angular speed at which the ground contrasts move past.

Adjusting the speed/altitude ratio means that the insect has no need to measure either its speed or its altitude.

Behind this astonishing behavior, hidden in the insect's cockpit, are movement detector neurons that act as optic flow sensors.

The optic flow regulator helps explain how an insect manages to fly, even in unfavorable wind conditions, without measuring its ground height, groundspeed or descent speed, in other words without using any of the usual aircraft onboard flight aids like radar, GPS, radioaltimeters and variometers. An insect brain wouldn't cope with these cumbersome, heavy, energy-consuming devices.

This important work shows that this new science called biorobotics, that the team from Marseille started in 1985, is important both for fundamental and applied research. The method consists in using robotics models to test biological principles that are perceived only vaguely at the outset.