# Columbia Science Review

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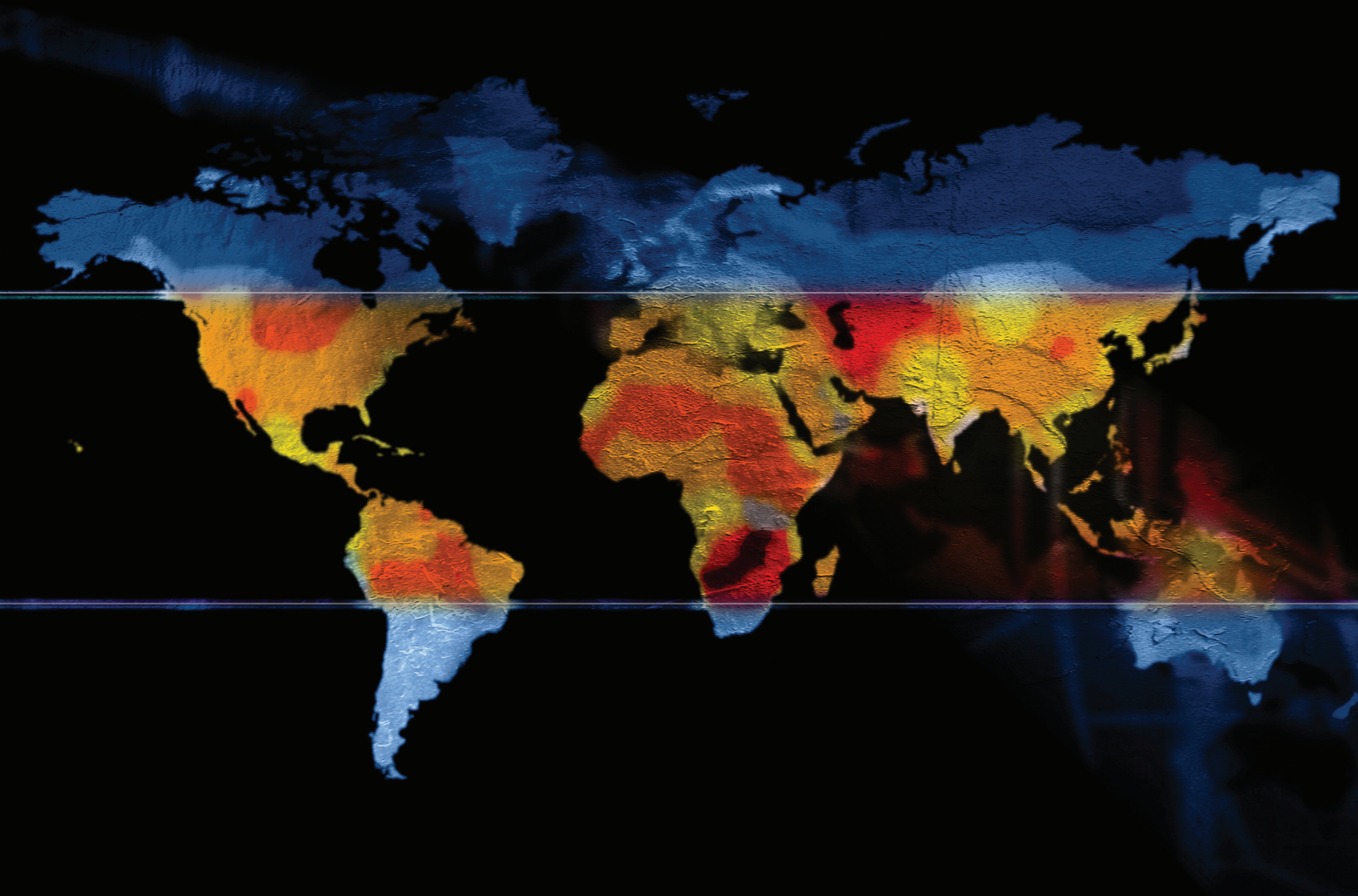

Inside:

## The Columbia Science Review

The Columbia Science Review strives to increase knowledge and awareness of science and technology in Columbia community, by presenting engaging and informative approaches to contemporary science and technology that include, but are not limited to:

- Exploration into contemporary issues of science, including research, policy, and opinion.
- Features on current faculty research.
- Opportunity for students to publish their scientific research.

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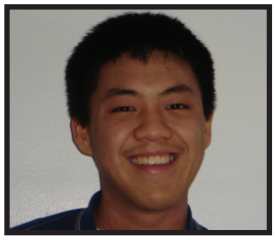
Shelly Zhu is a freshman in Columbia College, possibly majoring in psychology. She currently serves as the Chair of Reviewers for CSR.

Sweta Agrawal is a sophomore in Columbia College majoring in Neuroscience. She loves to experiment on brains. In particular, she hopes to someday be a university professor working on glial cells or the science of smell. Until then, she'll settle for working in Dr. Siegelbaum's lab, analyzing dendritic trafficking.

Umara Saleem is a senior Psychology major and Biology minor at Barnard College. She conducts research in the Department of Genetics and Development at the Columbia Medical Campus. To her, science exploration is both a passion and a hobby. Her article on the "Medicinal Properties of Orchids" is on page 26.



Mason Jiang is a freshman at the Fu Foundation School of Engineering and Applied Sciences, studying Applied Physics.

Ying Li is a freshman from Hong Kong thinking about majoring in Neuroscience. She also enjoys eating tropical fruit.

Duncan Kluwak is a junior in the Fu Foundation School of Engineering and Applied Sciences. He is majoring in Mechanical Engineering with a minor in Economics.

Sara Stream is a freshman in Columbia College. She has written an article for the AMSA Bioethics Newsletter and one for the Special Features section.

Stanimir Rachev is a junior in Columbia College, majoring in Biochemistry. His interest in the life sciences was catalyzed by a course he took freshman year after having been seriously involved with Physics in high school. His first acquaintance with climate change was through a scientist he knows at home, who is studying the influence of the Sun on planetary atmospheres.

# Call for Articles

## *Columbia Science Review*

*Columbia Science Review* (the *Review*) is a peer-reviewed publication of Columbia Science Review. The *Review* is published twice a year in full color, read by the general public, including Columbia students and faculty members. The *Review*'s primary goal is to present science and technology to everyone in a lively and accessible manner. The *Review* features a number of different types of articles of varying focus and depth:

- **Features** describe a scientific issue or discovery in logically and thoroughly. provide background information for the reader before thoroughly exploring different viewpoints, cornerstones and breakthrough researches on the subject.
- **Research Reports** summarize student research projects, emphasizing the logical approach and conclusions typically found in introduction, results, and discussion sections of a full research paper. Details on the materials and methods are written in a digest form.
- **News Scoops** describe current news and/or recent discoveries in science, focusing on the prospects of the key topics in the future world.
- **Faculty Profiles** report the life and research of a faculty member in Columbia. Interview your favorite Columbia professor and discuss his or her research, current issues in his or her field, or his or her life in general.
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- **Special Features** present scientific facts and news in succinct and eyecatching format. This includes factoids and short news report on scientific issues.

The content and the style of an article manuscript determine its format. Custom formats are accepted for the submitted articles that are not fitting to the above categories.

Columbia Science Review takes great care to ensure professional levels of scientific accuracy and integrity, so the authors are expected to present appropriate citations for the editorial board and the readers. Also, the authors are strongly encouraged to submit supplementary materials such as photographs, diagrams, or graphical presentations of supporting data.

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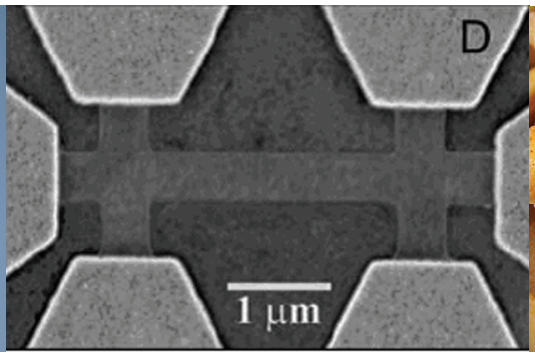
# Columbia Science Review






# Columbia Science in the News

by Sara Stream

Amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig's disease, results in the death of motor neurons, which leads to decreased voluntary muscle activity. As ALS progresses, muscles that do not receive messages from the brain weaken and begin to twitch as they are wasting away. When muscles in the diaphragm and chest wall fail, individuals die of respiratory complications. In 2002, Columbia Health Science researchers used embryonic stem cells from mice to identify the cells that differentiated into motor neurons. First, the Columbia scientists stimulated embryonic stem cells to develop them into motor neurons. They found 30% of the cells had developed into motor neurons. In addition, the researchers devised a method of genetic tagging, allowing them to identify the cells that differentiated into motor neurons. Dr. Hynek Wichterle, of the Columbia research team, inserted these motor neurons into a chick embryo's spinal cord and found that they behaved as normal motor neurons. This discovery signified that embryonic stem cells could develop into and function as the motor neurons that are destroyed by ALS.


photo by Daniel Brujis

In 2005, President Bush vetoed a congressional bill aimed at providing federal funding for stem cell research. In response to this veto, the privately funded Project ALS/Jenifer Estess Laboratory for Stem Cell Research was formed in May 2006. Columbia University researchers and clinicians joined with Project ALS in this laboratory that focuses on stem cell research involving ALS and other motor neuron diseases. The laboratory is located in New York and allows Columbia's researchers, as well as researchers from other New York based institutions, to study embryonic stem cells without government interference. Dr. Thomas Jessell serves as the research advisor, while Dr. Hynek Wichterle and Dr. Christopher Henderson, both of whom serve as senior scientific advisors, lead the Columbia University research team. The ultimate goal of the researchers is to develop stem cell transplantation methods that will either cure or treat individuals with ALS and other neurodegenerative diseases, such as Parkinson's disease and Alzheimer's disease. Approximately 30,000 individuals in the US currently are living with ALS and approximately 5,600 individuals are diagnosed with ALS each year. Most die from respiratory failure within 3 to 5 years after the onset of symptoms. The Columbia University researchers' stem cell research provides new hope for effective treatment and a possible cure for ALS.

**Works Cited**

House OKs Stem Cell Research Bill, Time Magazine, 1/11/07 http://www.time.com/time/nation/article/0,8599,1576894,00.html

Project ALS Opens Privately-Funded Stem Cell Research lab, Columbia Motor Neuron Center press release, June 2006 http://columbiamnc.org/pdf/news/PALS_press_release_june06.pdf

Custom-made Motor Neurons, Susan Conova, Columbia University Health Sciences, 2002 http://www.cumc.columbia.edu/news/in-vivo/Vol1_Iss15_sept25_02/index.html

About ALS, ALS Association, last updated 2004 http://www.alsa.org/als/default.cfm?CFID=3296118&CFTOKEN=292143

Amyotrophic lateral Sclerosis Information page, National Institute of Neurological Disorders and Stroke, last updated November 30, 2006 http://www.ninds.nih.gov/disorders/amyotrophiclateralsclerosis/amyotrophiclateralsclerosis.htm

# What is Next...

by Jonathan L. Mo

Harvard educated physician Michael Crichton is one of the most noted modern day science-fiction authors, as well as a proponent of controversial scientific opinions in his own right. Best known for his novels *Jurassic Park* (1990) and *Andromeda Strain* (1969), he is also the creator of the television series *ER*.

Recently, Crichton made news in the scientific community with his book *State of Fear* (2004) in which he presented, via both a fictional story and his trademark afterward author's comments, a critique of the current "debate" surrounding global warming and climate change. Many people felt he sought to weaken the scientific argument supporting the dangers of human-caused global warming, and that he attempted to use his scientific background as

a vehicle to discredit true climate scientists. When he gave testimony before Congress requesting that climate science be required to show more specific proof for its claims, he was decried by many in the scientific community for purposely damaging a true scientific argument through both his fictional stories and his comments to the public and the government.

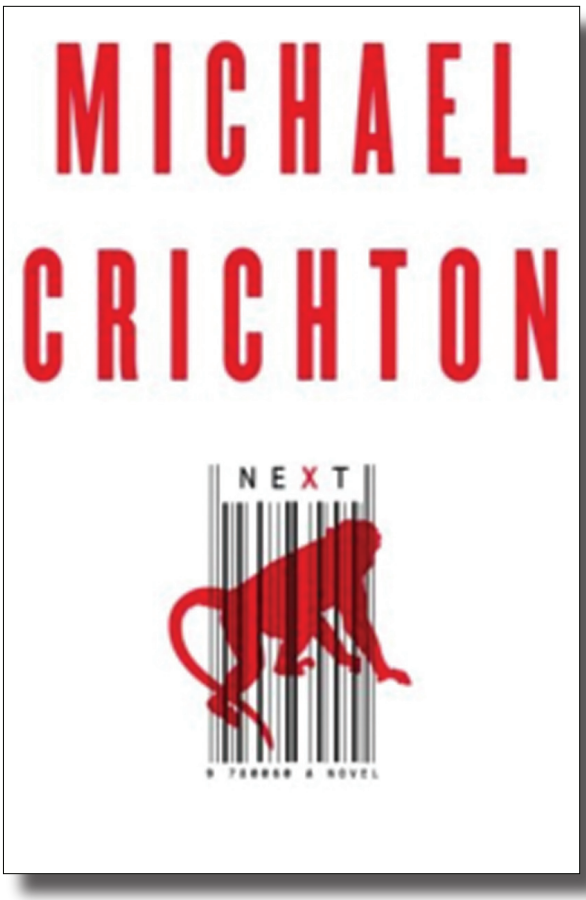
Even as early as Jurassic Park, Crichton's formula has always seemed akin to that of Mary Shelley's *Frankenstein*, full of warnings and moral questions about the future of unregulated scientific advances. It was perhaps this controversial attitude to his "techno-thriller" novels, along with a very rapid storytelling pace and a meticulous attention to scientific detail, even when fictional, that led to his great novelistic success. Indeed, having read all of his writing, including those few works of non-fiction, I must admit, his work is highly impressive, particularly because so few authors write truly in-depth science-fiction, where true science is so unbelievably well blended with fiction.

But unfortunately, his latest endeavor is severely lacking the aforementioned elements of his former success. *Next*, published in 2006, concerns modern genetics, the field he has been most associated with given his success with *Jurassic Park* and *The Lost World* (1995). Crichton, as usual, critiques genetic research, warning us about the control of current biotechnology and research involving genetic science.

His warning is perhaps merited; biotechnology is often reputed as one of the most nascent, yet fastest growing, areas of scientific research, and one of the most controversial. He essentially makes the point that unregulated genetic research and legal ambiguities have the potential to allow corporations, governments and institutions to not only own and patent human genetic material, but also create genetic hybrids. Yet besides this simple warning about an altogether complicated problem, the fictional story itself is poorly crafted. The twisted plot abounds with so many different subplots and their own hosts of characters that one might want to diagram the story to keep track of all of them. However, while the events discussed are clearly negative, *Next* is in no way a thrilling read. There is nary a thrilling moment in this book, leading the reader to strongly question its claim as a "thriller." The few plot twists confuse the story rather than enrich it, and the dialogue simply lacks all emotion.

The numerous chapters, often quite brief, follow no less than seven subplots, and in the end they are resolved rather unsatisfactorily, a *deus ex machina* that, while not surprising for Crichton readers, in this case fails because of the complexity of the plot. All the while I was under the impression that a great concluding symposium of the characters and subplots would have saved the novel from mediocrity, but such a Dickens-esque consolidation did not occur. Rather each complicated subplot is resolved independently, with a few of them tying together rather weakly as the story wraps up. Once it's over, the reader realizes that not only are there very few of the thrilling or disturbing conclusions that Crichton is rather known for, but that there was little conflict to begin with, meaning there is little to resolve. The message imparted at the conclusion of almost every other Crichton science-fiction work has always been a powerful one, a true warning about science, and those who would seek to rush its advance, or to utilize it for their own corrupt agendas. At the end of *Next* though, one does not get this sense. Since Crichton does not develop an impending sense of danger or scenes of horrible science gone awry, he has little material with which to conclude. The novel then becomes fundamentally flawed, and while certainly entertaining at times, not very satisfying in its conclusions.

That being said, Crichton's attention to scientific detail is well recognized, as usual. It is nice to know he is reliable in some sense at least, even if he could not deliver his usual exciting plots. This novel's science though, is not nearly as complex as that of say *Timeline* (1999), my personal favorite, or as detailed as that of *Airframe* (1996). Nevertheless, the science does not save the book, making it instead rather disappointing since one can tell they are reading Michael Crichton, but are looking for his usual storylines only to find them absent.




On the bottom line, I would say that as a huge long-time fan of Crichton's work and the films based on his novels, *Next* is certainly the worst of them. It has a mess of characters, conflicts, and interconnections that hardly comprise a meaningful plot, and it necessarily concludes in a twisted, unsatisfactory way. While the scientific aspects are characteristically well developed, once one reads the author's message, which contains his brief warnings about biotechnology gone astray, one wonders why they didn't just read that and skip the novel altogether, since it does little to impress upon the reader the true urgency and threat posed by such science Crichton seems worried about.

I would still recommend the book to anyone who is a Crichton fan, and who has already read all of his other novels. It is worth reading solely to appreciate his other masterpieces. If you are a newbie to Crichton, I personally recommend *Timeline, Jurassic Park, State of Fear* and *The Great Train Robbery* (1975). Other than that, one can only wait and hope that his *next* book will be better than *Next*.

*The novel has a companion website that is satirically meant to resemble the website of a fictional biotechnology firm:* **http://www.nextgencode.com/**

# Columbia AMSA Bioethics Newsletter Submissions

## New York Attempts to Ban Trans Fat

*by Sara Stream*

Trans fat results when hydrogen is added to vegetable oil, creating partially hydrogenated oil. Hydrogenation and trans fats are important to the food industry because they increase the shelf life and flavor stability of foods such as vegetable shortening, margarine, cookies and snack foods. Although the food industry benefits from the use of trans fats, they are harmful to humans. Trans fats raise low-density lipoprotein (LDL) levels, referred to as "bad cholesterol." Increased consumption of foods with trans fat can lead to the risk of coronary heart disease. Since January 1, 2006, the FDA has required trans fat contents to be included on all food nutrition labels, allowing people to make healthy choices when purchasing and consuming packaged food. One of the main sources for trans fat, however, is oil that is used to fry and bake food in restaurants.

Recently, the New York City board of health has proposed a ban on trans fats in all restaurants within New York City. The board believes that the ban will decrease deaths due to heart attacks, and furthermore will increase the overall health of New Yorkers. The ban also aims to decrease the burden on taxpayers to support treatment for obesity and heart disease. Dr Walter Willett, a leading nutrition researcher at Harvard University, believes that this proposed ban in New York could prevent 500 deaths a year. Yet, opponents of the ban point out that many New Yorkers have been consciously consuming less trans fat and that banning it in restaurants would not make a significant impact on overall health. Many consumers are opposed to this ban because they see it as the government interference with daily lifestyles and personal decision-making. Opponents would rather be aware of the

presence of trans fats and be able to make their own choices concerning consumption. A public hearing is scheduled for October 30 and a vote in December will decide whether this proposal will be passed.

**Works Cited**

Baron, Mike. "Trans Fat Ban." The Post Chronicle October 19, 2006 http://www.postchronicle.com/news/original/article_21245098.shtml

Mason, Michael. "A Dangerous Fat and its Risky Alternatives." New York Times October 10, 2006. http://www.nytimes.com/2006/10/10/health/nutrition/10cons.html?ex=1161403200&en=c5363db168cb6eb4&ei=5070

"Revealing Trans Fats, US Food and Drug Administration." FDA Consumer Magazine, September 2003. http://www.fda.gov/fdac/features/2003/503_fats.html

Wood and Hefler, Sam and Jan. "The Trans fat is in the fire." Philadelphia Inquirer October 13, 2006. http://www.philly.com/mld/inquirer/news/local/states/new_jersey/15745397.htm

## The Risks of Egg Donation

*by Jennifer Gillman*

In recent years, the demand for donated ova used by infertile women as well as stem cell researchers, has increased. Researchers are currently developing a new cloning technique called somatic cell nuclear transfer, which replaces the nucleus of the unfertilized egg with that of a body cell. Due to the high demand and the scarce number donors, renewed controversy has come up regarding the health risks associated with the drugs used for multiple egg extractions (Norsigian, 6).

In order to have the donor produce numerous egg follicles, she is first required to take a drug such as Lupron, which temporarily halts the production of eggs, prior to hyperstimulation. Although the FDA has approved Lupron, it has not been approved for the specific use in the egg extraction process. There is a long list of possible side effects associated with this drug including headaches, nausea, depression, and amnesia. Other drugs taken to stimulate the ovaries could cause Ovarian Hyperstimulation Syndrome, a condition that leads to the development of ovarian cysts and fluid build-up in the body. Although this condition may be rare, it can be potentially fatal (Norsigian, 6-8).

Many women who undergo these procedures aren't adequately informed about these potential risks. Some studies suggest that the fertility drugs may cause cancer (Papadimos 56). In order to verify such results, researchers have to study the long-term effects of this cocktail of drugs.

In addition to the issue of many participants not completely understanding the possible risks, when egg donation programs provide large monetary incentives for their donors, they compromise the policy of informed consent. As a result of aggressive egg donor recruitment strategies, many advertisements in magazines and

newspapers are aimed at healthy college students. With women facing financial problems, such as high tuition debts, their need for cash could undermine their concerns about the health risks involved in donating their eggs (Papadimos 56).

**Works Cited**

Norsigian, Judy. "Egg Donation Dangers." Council for Responsible Genetics. September 2005, 18.5, 6-8. 20 October 2006. <http://www.gene-watch.org/genewatch/articles/18-5Norsigian.html>.
Papadimos, Thomas J. and Alexa T. Papadimos. "The Student and the Ovum: The Lack of Autonomy and Informed Consent in Trading Genes for Tuition." Reproductive Biology and Endocrinology. 12 July 2004, Volume 2, 56. 19 October 2006. <http://www.rbej.com/content/2/1/56>.

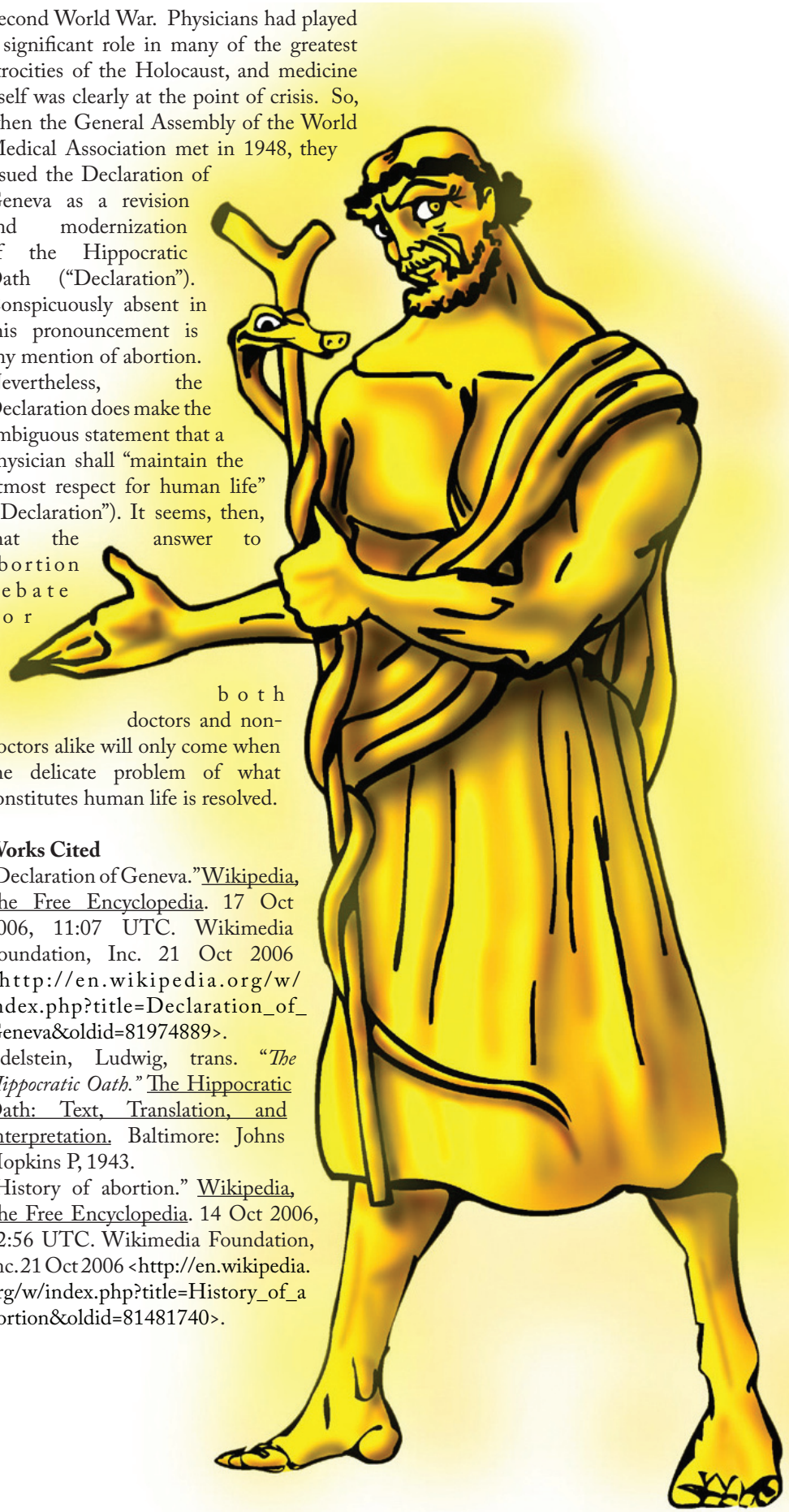
## Hippocratic or Hypocritical: Medicine Struggles with Its Roots Over Abortion

*by Joseph Villarin*

For most lay people today, Hippocrates is remembered as the legendary father of medicine who sensibly charged physicians with a moral prerogative to "do no harm." What the majority of the public does not realize, however, is that the old Greek had much more to say than matter-of-fact aphorisms; he also touched on issues that have become highly controversial in modern times, including the subject of abortion. In fact, the masterwork among Hippocrates's ethical instructions, which we know as the Hippocratic Oath, puts forward a bold and clear position: a doctor must "not give to a woman an abortive remedy" (Edelstein).

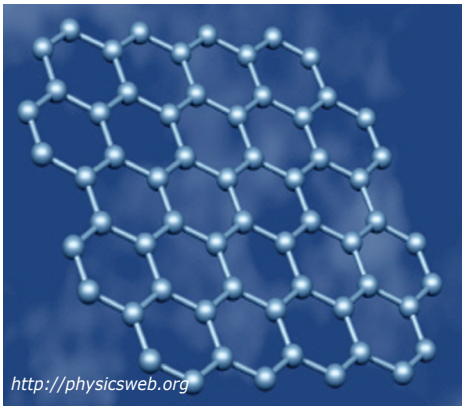
And, for two millennia, the abjuration of abortion stood firm as Hippocratic philosophy remained dominant in the Western world. The major shift amongst medical professionals towards a pro-choice position only took place in the last century. Legal precedents for abortion began in the 1920s and 1930s, during which time the Soviet Union and Germany decriminalized abortion, and, similarly, abortions in the specific case of rape were permitted in Britain ("History"). Hippocratic philosophy was falling out of step with modern medical practice.

The catalyst for decisive change in medical ethics came in the form of the Second World War. Physicians had played a significant role in many of the greatest atrocities of the Holocaust, and medicine itself was clearly at the point of crisis. So, when the General Assembly of the World Medical Association met in 1948, they issued the Declaration of Geneva as a revision and modernization of the Hippocratic Oath ("Declaration"). Conspicuously absent in this pronouncement is any mention of abortion. Nevertheless, the Declaration does make the ambiguous statement that a physician shall "maintain the utmost respect for human life" ("Declaration"). It seems, then, that the answer to abortion debate for both doctors and non-doctors alike will only come when the delicate problem of what constitutes human life is resolved.



**Works Cited**

"Declaration of Geneva." Wikipedia, The Free Encyclopedia. 17 Oct 2006, 11:07 UTC. Wikimedia Foundation, Inc. 21 Oct 2006 <http://en.wikipedia.org/w/index.php?title=Declaration_of_Geneva&oldid=81974889>.
Edelstein, Ludwig, trans. "*The Hippocratic Oath.*" The Hippocratic Oath: Text, Translation, and Interpretation. Baltimore: Johns Hopkins P, 1943.
"History of abortion." Wikipedia, The Free Encyclopedia. 14 Oct 2006, 22:56 UTC. Wikimedia Foundation, Inc. 21 Oct 2006 <http://en.wikipedia.org/w/index.php?title=History_of_abortion&oldid=81481740>.




**The structural scheme of a single graphene layer with hexagonal cells**

# Peeling the Layers: A Look at Single Carbon Planes

by Mason Jiang

If you pick up a full deck of playing cards, you hold 52 individual layers of cards in your hand. If you then deal out 51 of those cards, one layer at a time, from top to bottom, you will unsurprisingly end up with an individual playing card. The simplicity in this scenario fools no one, but amazingly, researchers recently found that this elementary principle can produce a single layer of carbon atoms called graphene. Described by Professor Andre Giem's group, which first prepared it in 2004 at the University of Manchester (UK), "Graphene is a monolayer of carbon atoms packed into a dense honeycomb crystal structure that can be viewed as an individual atomic plane extracted from graphite."[6] At this atomic thickness, measurements lie in the range of 3 to 4 Angstroms, about 250,000 times smaller than the thickness of this page! Isolating a material so unimaginably thin, strong, (due to the stable hexagonal cells of carbon atoms patterning the graphene), and electrically conducive, becomes very fascinating to scientists, especially those hoping to apply these properties to high-speed electronics and sturdy materials. As Geim optimistically puts it, graphene "is full of surprises and shows far greater promise than one could reasonably hope for in a new experimental system."[3]

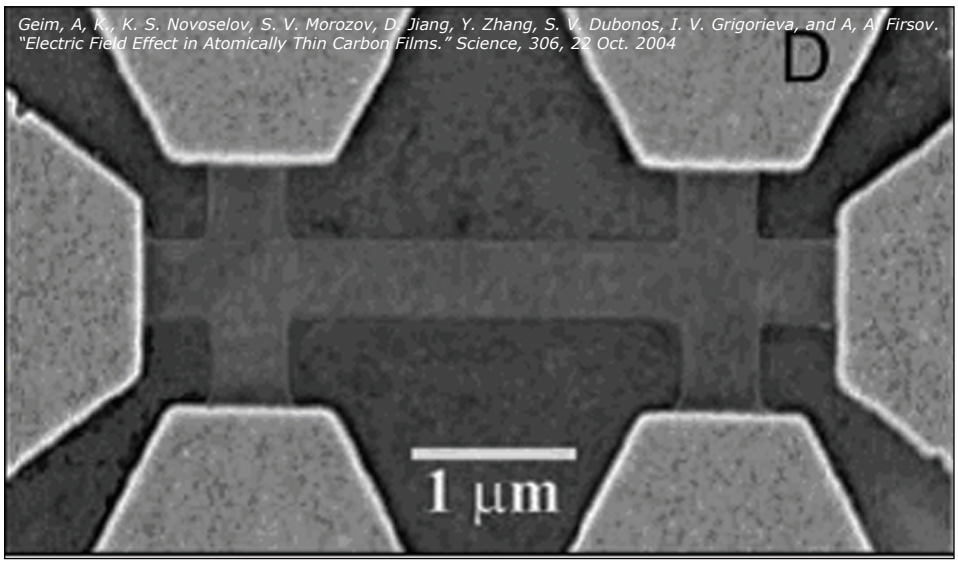
**The Simpler, The Better**

The unique structural aspects of graphene endow researchers with much excitement about future practical applications. At the same time, much of the interest generated by this extraordinary material evolves from its "bench-top" methods of preparation. In fact, the initial preparation of graphene does not stray too far from the aforementioned playing card analogy. Professor Geim's group first published a copy of its innovative techniques in isolating graphene through a supplement to one of its papers.

Geim's group began with widely available pieces of highly-oriented pyrolytic graphite (HOPG), a pure form of graphite without other substances mixed in, as is the case with pencil lead.[5] Taking HOPG, the group subsequently etched a pattern of uniform square bumps, called "mesas," and then covered the sample with a photoresist layer meant to aid in the chemical portion of the patterning process. Ensuing baking of the entire HOPG sample forced the mesas to stick to the photoresist layer and allowed the group to mechanically "cleave" the mesas off for the following step, definitely a most exhilarating one and encapsulating some of the most interesting characteristics of graphite.

For some background, graphite is very stimulating in structural terms. Quite distinctive of graphite, the hexagonal cells that strongly bond carbon atoms in each layer of the material eventually force graphite to, rather than connect its individual layers with strong covalent bonds, actually hold each layer together with significantly weaker Van der Waals forces. In effect, this makes graphite fragile between layers and causes the slippery feeling induced when rubbing pencil lead between your fingers as carbon atomic planes easily slide past each other.

With this principle in mind, Geim's group then applied it to shrink the HOPG mesas previously formed. Interestingly enough, the group used ordinary scotch tape and repeatedly peeled off layers of graphite from the mesas until little HOPG was left on the photoresist. As the group then wanted to examine the thin and nearly visible graphite flakes but without the photoresist, they placed the entire sample in a strong solution of acetone, which pulled the flakes off and left them floating in the acetone. To capture




**A scanning electron microscope capture of an experimental device made of graphene strips by Manchester University**

the tiny flakes and place them on a surface capable of closer inspection, it was apparent to the group to dip silicon wafers with thick silicon oxide layers on top into the solution and pick up the thin graphite. After using ultrasound cleaning to remove the larger flakes on the graphite-populated silicon wafers, the group was ready to narrow down the samples.

For the purpose of viewing very tiny samples, it is natural to rely on the aid of microscopes. To start, the group used optical microscopes to purely identify "graphitic films thinner than 50 nm." Typically films this size are not visible in direct lighting, but on top of violet-blue silicon oxide surfaces, the films tend to shift the color of the surfaces to longer wavelengths, thus creating a reference color for the graphite flakes. This means that thicker pieces of graphite on the surface shift the color of the silicon oxide to bluer shades. So under an optical microscope, one can see where flakes of different sizes lie. For Geim's group, graphite flakes of interest were very thin and extremely close to the original color of the silicon oxide surface. The faintest graphite flakes found could then potentially be characterized by monolayer thickness and identified as graphene. As Geim observed, these "graphene films [were] no longer visible even via the interference shift as it becomes too small." Upon pinpointing and marking potential pieces of graphene on the sample, the group proceeded to take advantage of the highly versatile atomic force microscope (AFM). Arguably the most remarkable feature of the AFM is its ability to detect very weak deflection forces between its own probe and a sample under investigation in order to map out the surface of the sample and create a topographic image. For Geim's group, the AFM was key for not only identifying pieces of graphene through the AFM's capacity to measure vertical features in a sample, but also for creating vivid images of graphene. Eventually, the group used the AFM to discover actual graphene flakes and confirmed that they were indeed monolayers of graphite by measuring that the thickness of those flakes were around 3 to 4 Angstroms, in agreement with "the interlayer distance in bulk graphite [at] 3.35 Angstroms" and ideal for both experimentation and proof-of-principle tests.

The method discussed here served merely as a starting point for other researchers interested in exploring graphene. As more experimentalists recreated Geim's method with their own trials, more efficient techniques soon sprouted. For instance, one interesting process introduced by a pioneering group from Georgia Institute of Technology led by Professor Walt de Heer exhibits the heating of silicon carbide wafers to "drive silicon atoms from the surface, leaving a thin continuous layer of graphene."[1,9] Another, more recent method, devised by a group from Northwestern University led by Professor Rodney Ruoff, features a more chemical approach in which "converting graphite into graphite oxide in an aqueous solution" leads the "bulk graphite [to be] completely separated into single sheets" through repelling forces.[4,8]

While it is apparent that future methods will become even more systematic, efficient, and prolific, Geim's group's original process still stands out for its sheer simplicity. Whereas other techniques rely on a thorough understanding of chemical interactions and behavior and often involve longer processing, this pioneering process requires minimal technical knowledge in its practice. To be able to isolate a material, so promising in its uses and characteristics, with such relative ease reinforces the interest on graphene and prompts more independent research. It is this first method that opened the doors to more detailed and technical studies on the features of graphene.

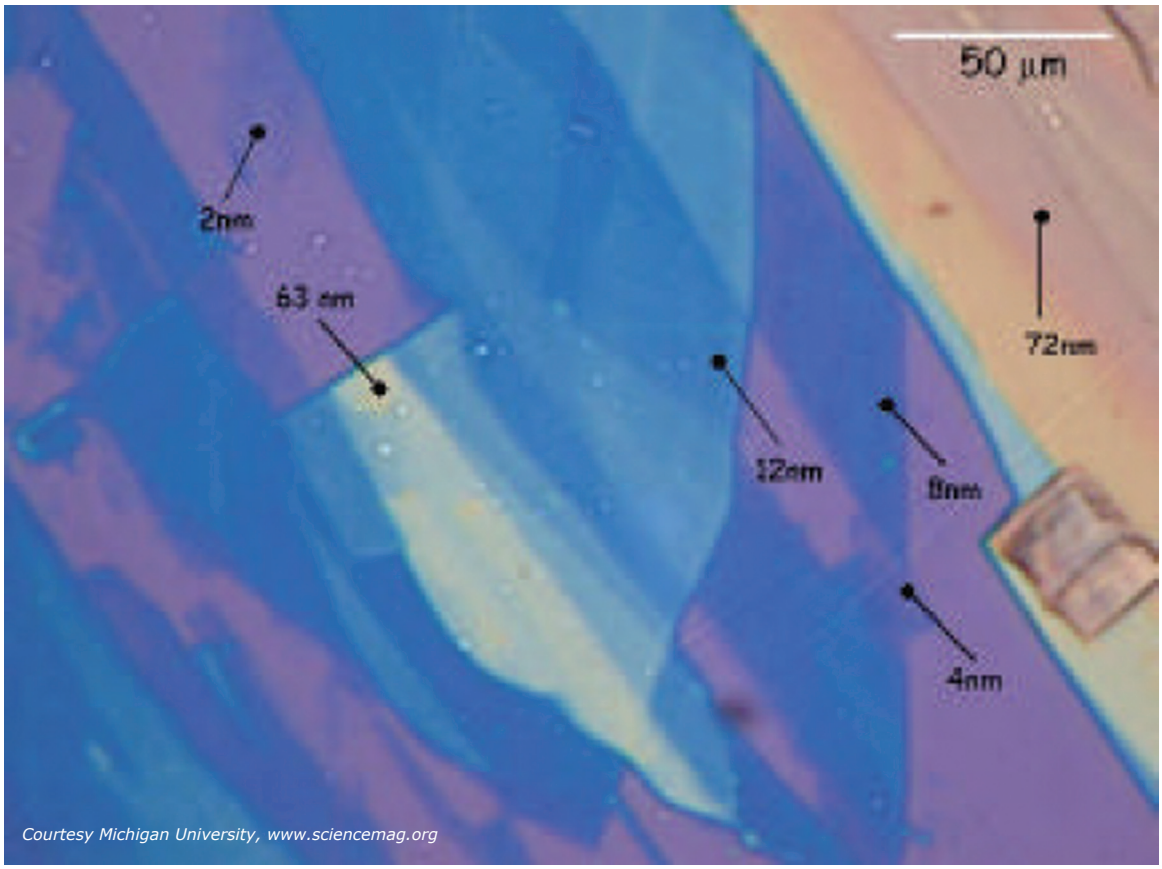
**An Electric Highway**

As astonishing as the structure of graphene has proven to be, it would not mean much without its equally exciting characteristics. Since the isolation of graphene, Professor Geim's group, a group from Columbia University led by Professor Philip Kim and Professor Horst Stormer, and Professor de Heer's group have all had major contributions to current experimental knowledge about the material.

To begin, when Professor Geim's group at the University of Manchester established graphene, it did so with the hopes of having "the ability to control electronic properties of a material by externally applied voltage" in mind.[5] Consequently, Geim's team ran many experiments in order to determine exactly how graphene, an inherently good electrical conductor, behaved with an applied voltage. Geim's group's experiments provided amazing observations describing how electrons travel through graphene. First, the group found that with graphene, not only do electrons move quickly through the material, which is the case with many other conductors, but they actually "mimic relativistic particles with zero rest mass and have an effective 'speed of light' c [effective] = $10^6$ m/s," just 300 times slower than the speed of light in a vacuum.[6] This means that these electrons, given the technical term "massless Dirac fermions" by Geim to indicate their distinct relativistic properties, tend to move through graphene with behavior comparable to waves, rather than the behavior of typical particles. Through this comparison, it is highlighted that electrons in graphene do not lose energy, but rather they move undisturbed, as if with no mass, allowing for far greater speeds than the standard in other materials. In addition, Geim's group found that "graphene's conductivity never falls below a minimum value…even when concentrations of charge carriers tend to zero." A testament to graphene's exclusive electrical properties, Geim stated, "this is completely counterintuitive because in all other systems, the conductivity disappears if no charge carriers are present."[3] The idea of having a constantly conductive material becomes understandably amazing in applications.

Although Geim's Manchester group provided the first clues into the mystery of graphene, much research was still needed. Following Geim's initial efforts, a group led by Professor Philip Kim and Professor Horst Stormer of Columbia University soon conducted similar experiments to explain why electrons in graphene exhibit such distinct conduct.[10] Initially running experiments, which confirmed the results reached by Geim's group, the Kim/Stormer group later discovered further information regarding the peculiar behavior of electrons traveling in graphene. First, the group found that electrons in graphene obey the rules of the quantum Hall effect, meaning that when electrons are exposed to high magnetic fields, they move only in designated quantum routes. Instead of moving in continuous motion, electrons actually "jump" from one location to another, resulting in very quick movement. Building on this point, the Kim/Stormer group then determined that electrons in graphene follow a phenomenon called "Berry's phase," explaining that with the condition of an electron moves in a complete route in a high magnetic field, its wavefunction will rotate a full 180 degrees.

This translates to the idea that electrons in graphene will scatter backwards less and spend more time moving forward to their desired destinations. In effect, this finding paid tribute to the aforementioned quantum nature of the electrons in graphene, and helped to explain why those electrons could move as if they were massless without losing energy. The quantum tendencies of electrons in graphene now clarify much about the substance's unique properties.




**An optical photo of graphite over a wafer with a silicon oxide layer. One can assume the relative thickness of each graphite flake by judging its color**

While many of the fundamental characteristics of graphene can be attributed to the work of the groups from Manchester and Columbia, much of the current movement towards applications in graphene has stemmed from the labor of Professor Walt de Heer's group at Georgia Tech. A long-time researcher of carbon nanotubes, de Heer took the discovery of graphene as a serious step towards the applications often dreamt of - using more efficient and less restrictive nanotubes.[1,9] Through their studies, de Heer's group especially found interest in that, abiding by "quantum confinement…graphene ribbons act as electron waveguides." Explaining, "The width of the ribbon controls the material's band-gap," de Heer's team highlighted the ease with which electron mobility could be manipulated in graphene. Along with the previously mentioned properties of graphene, de Heer's group's findings paved the way for many promising technologies.

**Striving for Quickness and Strength**

The advantages that graphene can bring to the world of technology are endless to say the least. From applications in microelectronics to tough polymeric materials, graphene will indubitably become a larger focus in the research of scientists in the near future. Building directly off of graphene's unique characteristics, though, many researchers have already devised potentially impacting technological ideas.

For one, graphene's very robust structure has generated speculation that the material can be used as the basis for "incredibly strong, flexible, and stable materials" in the future.[7] Because graphene planes are the results of many carbon atoms bonded together in established honeycomb structures, but only in one atomically thin dimension, they enjoy the privilege of being strong yet elastic at the same time. This quality is quite comparable to the behavior of a single sheet of paper in which trying to rip it in half by pulling on its ends in opposing directions will prove to be very difficult, but allowing it to flop around vertically is without effort. The aforementioned group from Northwestern University led by Professor Ruoff "believes [graphene], which is light but stiff and tough, could be used to make fuselages for aircraft…and potentially in paint and coatings" based on these properties.[4]

Beyond its use in materials, graphene has even bigger promise in the field of microelectronics. One specific example, which has excited many researchers with the prospect of having electrical devices operate at substantially higher speeds, is the "ballistic transistor," a considerable upgrade from the current transistor, allowing extremely quick electrical flow.[7] A transistor is a small electronic device typically made of semiconductor material that functions to change, amplify, or oscillate the flow of current in electronics and computers. Usually in semiconductor transistors, electron movement is functional, but not completely efficient. For instance, through the various semiconductor materials, usually silicon and germanium, currently used for transistors, electrons often experience frequent collisions, which cumulatively impede their movements. In addition, due to the structural natures of most semiconductors, transistors can only be made to a certain size before utility is completely lost. Professor Geim prophetically stated, "As the semiconductor industry is nearing the limits of performance improvements for the current technologies dominated by silicon, there is a constant search for new, nontraditional materials."[5] The versatility of graphene comes at this crucial point of transition. First, both graphene's innate structure and excellent conductivity, allow it to be molded into

smaller than conventional transistors capable of performing all of the functions of traditional transistors. Already, this makes graphene-based transistors more efficient purely due to size since "smaller transistors mean the distances electrons have to travel become shorter, meaning faster speeds."[7] To add to this size adjustment, the realization that electrons move through graphene as if they are massless and wave-like also results in faster speeds. Because electrons in graphene possess this quantum nature, they face minimal resistance as they move. This means that the electrons collide far less frequently than in semiconductor transistors and lose very little energy as a result. Interestingly, Professor de Heer's group has already built an "all graphene planer field-effect transistor"[9] in order to demonstrate the potential of such a device. However, research is still necessary to fully exploit this amazing application. If transistors made of graphene can be effectively produced for mass usage, then future electronic devices will truly be ballistic. As simple as graphene's nature tends to be, it contains a plethora of breakthrough characteristics and possibilities.

**Works Cited**


Berger, Claire, Zhimin Song, Xuebin Li, Xiaosong Wu, Nate Brown, Cecile Naud, Didier Mayou, Tianbo Li, Joanna Hass, Alexei Marchenkov, Edward H. Conrad, Phillip N. First, and Walt A. De Heer. "Electronic Confinement and Coherence in Patterned Epitaxial Graphene." Science, 312, 26 May 2006: 1191-1196.

Biello, David. "Graphite Found T Exhibit Quantum Effects." Scietific American 10 Nov. 2005. 12 Feb. 2007 <http://www.sciam.com/article.cfm?articleID=00033D41-7354-1372-B35483414B7F0000>.

Dume, Belle. „Electrons Lose Their Mass in Carbon Sheets." Physics Web 9 Nov. 2005. 12 Feb. 2007 <http://physicsweb.org/articles/news/9/11/6/1>.

Dume, Belle. "New Look for Graphene." Physics Web 20 July 2006. 12 Feb. 2007 <http://physicsweb.org/articles/news/10/7/8>.

Geim, A, K., K. S. Novoselov, S. V. Morozov, D. Jiang, Y. Zhang, S. V. Dubonos, I. V. Grigorieva, and A, A. Firsov. "Electric Field Effect in Atomically Thin Carbon Films." Science, 306, 22 Oct. 2004: 666-669.

Novoselov, K. S., A. K. Geim, S. V. Morozov, D. Jiang, M. I. Katsnelson, I. V. Grigorieva, S. V. Dubonos, and A. A. Firsov. "Two-Dimensional Gas of Massless Dirac Fermions in Graphene." Nature, 438, 10 Nov. 2005: 197-200.

"Radical Fabric is One Atom Thick." BBC News 22 Oct. 2004. 12 Feb. 2007 <http://news.bbc.co.uk/2/hi/science/nature/3944651.stm>.

Stankovich, Sasha, Dmitriy Dikin, Geoffrey Dommett, Kevin M. Kohlhaas, Eric J. Zimney, Eric A. Stach, Richard D. Piner, Sonbinh T. Nguyen, and Rodney S. Ruoff. "Graphene-Based Composite Materials." Nature, 442, 20 July 2006: 282-286.

Toon, John. "Carbon-Based Electronics: Researchers Develop Foundation for Circuitry and Devices Based on Graphite." Georgia Tech Research News 14 Mar. 2006. 12 Feb. 2007 <http://gtresearchnews.gatech.edu/newsrelease/graphene.htm>.

Zhang, Yuanbo, Yan-Wen Tan, Horst L. Stormer, and Philip Kim. "Experimental Observation of the Quantum Hall Effect and Berry's Phase in Graphene." Nature, 438, 10 Nov. 2005: 201-204.

# Egypt Veiled From the Truth: HIV in a Muslim Context

by Marina Zeltser

A 39-year old man, unmarried, was hospitalized because of fever and cough for more that six months. Then, he was moved to another hospital and was diagnosed with pulmonary tuberculosis and bronchopneumonia. He was treated with ethambutol, rifampicin and antibiotic, but the medicine did not reduce his fever and cough. A hematologist suspected AIDS, and the result of a blood test was positive. Anti-retroviral and anti-fungal drugs were added to the treatment. After 21 days of hospitalization, the patient was able to go home. His family did not come to the hospital to pick him up for a week because they were afraid that they could get AIDS from him. In another case, the patient's family built a wall inside of their house as a barrier, as they thought that was the best way to prevent them from getting AIDS. In a third case, the patient's wife rented a separate house for herself, also to prevent getting AIDS. (Djoerban, Zubairi. Nenden)


**A sunset view of Cairo, Egypt**

The above example was taken from a report on the stigmatization of HIV infected people, presented at the Jakarta HIV/AIDS Regional Workshop of Islamic Religious Leaders in 1998. The stories epitomize the widespread ignorance that exists about both HIV transmission and diagnosis. Despite common misconception, AIDS cannot be transmitted by casual contact associated with sharing a home. Infection is spread only through sexual intercourse, blood, or prenatal transmission. The evident ignorance of people towards the thriving HIV epidemic is a major challenge to its eradication. Strategic actions must be taken to improve societal knowledge of modes of transmission and protection and to provide proper support and medical care to HIV-positive patients.

The global evolution of the public approach to HIV/AIDS over the past 20 years has proven that the spread of HIV can be slowed and that the debilitating effects of the disease can be minimized. The world's model of epidemic overturn is Thailand's battle against HIV/AIDS, where aggressive anti-HIV policies have reduced the number of new infections from 140,000 in 1991 to 21,000 in 2003. Initial response to HIV in the 1980s was that the epidemic would not significantly spread in Thailand because "Thai-to-Thai transmission is not in evidence." In keeping with this view, the government spent only $180,000 on HIV prevention in 1988, primarily for the testing of all foreigners before being admitted to the country. It is not uncommon for countries to cast off the blame for HIV infection on foreigners, but in Thailand, the government eventually took matters into their own hands, choosing to confront HIV as a national problem.

In 1991, with new Prime Minister Anand Panyarachun, AIDS prevention and control became a national priority, and policy makers began to take a deep interest in battling HIV head on, rather than casting it off as a foreign phenomenon. The budget for AIDS prevention was increased almost 20-fold to $44 million in 1993. A massive public information campaign was launched to air anti-AIDS messages every hour on the country's 488 state-owned radio and television stations. Repressive polices like the mandatory reporting of the names and addresses of AIDS patients were repealed to protect these people. In addition, every school was required to teach AIDS education classes. Most importantly, a '100% condom program' was instituted to enforce consistent condom use in all commercial sex establishments, Thailand's highest-risk group.

According to a study of HIV/AIDS in MENA, Carol A. Jenkins writes, "societies cope with HIV and prevent its spread best where governments are open about the issues, provide information and services, and partner with organizations representing affected communities." In Thailand, the government did just that. They became open to discussion about HIV, and partnered with the media, the schools, and with many other institutions to provide the population with accurate information from many angles.

One of the reasons that ignorance pervades Muslim societies is that governments unlike Thailand under Panyarachun's rule make it difficult to openly educate its people on the risks of such behaviors as extramarital sex, injecting drug use, and unprotected sex. In countries of the Muslim world, it is primarily the openness of the governments that needs to be targeted as a first step to addressing the HIV epidemic. We will consider Egypt

as a case study of the interactions between Muslim culture and a nation's HIV protection, highlighting the prevailing denial that sexual transmission of disease permeates devout Muslim societies, and observe the effects of Egypt's widespread hesitancy to publicly discuss HIV.

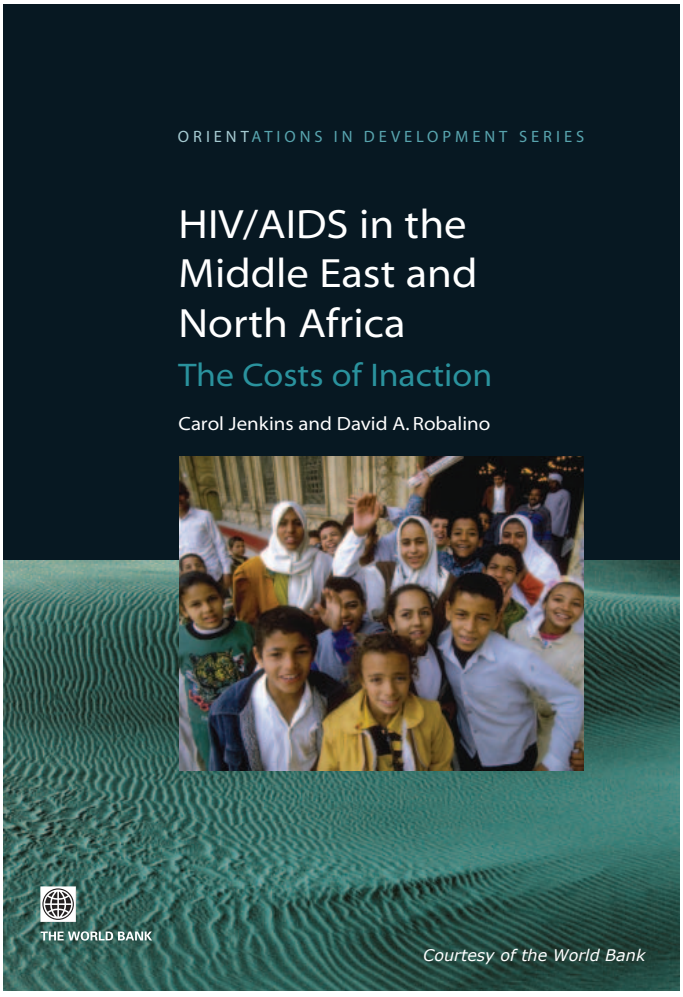
Because the state of Egypt has its government deeply rooted in Islamic Law, issues of homosexuality, premarital sex, adultery, and injecting drug use – all risk behaviors associated with HIV transmission – are prohibited by Islam, and thus they are shunned from public discourse. Due to social stigma surrounding these issues, few citizens are aware of how HIV is being transmitted through such behaviors, leaving marginalized populations stigmatized and made too fearful to come forward for help. While the current HIV prevalence rate is lower than 1% in Egypt's general population (UNAIDS), reporting is considered unreliable in this region because many Egyptians are afraid to get tested or are unaware that they could be at risk for HIV. As of December 2003, 1,838 cases of HIV/AIDS have been reported to the Ministry of Health and Population. However, at the end of 2001, experts (UNAIDS and the World Health Organization) estimated that Egypt has about 8,000 HIV-positive individuals. The stark difference between this estimate and the number of actual reported cases suggests that considerable obstacles to testing and to proper documentation exist.

National attitudes towards HIV/AIDS prevention may stem, in part, from the history of the HIV onset. In most Muslim countries throughout the Middle East and North Africa (MENA), the first cases of AIDS discovered in the mid-1980s were detected in hospitals among patients receiving blood transfusions. Screening of blood supplies in the early 1990s has nearly eliminated this form of transmission in Egypt, but the fact that the HIV virus may have been introduced to Egypt by imported contaminated blood has facilitated the Egyptian mentality that AIDS is a foreign disease and that the main means of transmission in the West – homosexual or extramarital sex and injecting drug use – do not exist in Muslim societies. A 1989 WHO Middle East Report states, "Islam often sets the boundaries of debate about AIDS and the sexual practices that spread it, especially in the conservative Gulf. Religious leaders and some governments portray AIDS as divine retribution for Western decadence, and urge strict adherence to Islam as the only means of prevention."

The early 1990s saw a steady increase in government response in Egypt, but this period was, of course, not free of social and religious hurdles. In 1992, the Egyptian AIDS Society was founded, the first nongovernmental organization in Egypt concerned with the prevention of HIV and support for AIDS patients. Since then, the government formed the Ministry of Health and Population, and within that ruling body, the National AIDS Program (NAP) was founded to handle HIV/AIDS prevention. In 1996, UNAIDS, the Joint United Nations Programme on HIV/AIDS, was formed to support HIV prevention and treatment in low- and middle-income countries, and since their inceptions, UNAIDS has played a major role in Egypt's response to the epidemic.

Despite the institution of new governmental infrastructures devoted to AIDS prevention, religious leaders and the media were still perpetuating major misconceptions throughout the population by the year 1998. That year, the first HIV/AIDS ASEAN regional workshop of Islamic Religious Leaders took place in Jakarta. During the workshop, leaders expressed their views and presented research on the HIV/AIDS problem. In his paper entitled Islamic Approach in combating HIV/AIDS, Zakiah Darajat writes, "The way of transmitting the virus mostly is through non healthy [bold added] sexual relationship, such as zina [fornication], liwath [homosexuality], and rape…Allah warned mankind not to go near by to zina…if any body can conduct himself and does not try to cross the forbidden borders made by Allah, it is a guarantee that the one will not be transmitted by the HIV/AIDS." Such a false statement, disproved by the scientific community and purported by a religious leader, has huge ramifications both as a reflection of popular belief and as an influential message that further spreads misconception. A similar message was conveyed in Al-Liwa-Al-Islami, the Egyptian weekly newspaper. Under the headline, "To Follow the Path of Islam is the Best Way Not to Get Infected," a reporter writes, "AIDS is God's punishment for all those who pollute the country with their sins."

Echoing the temptation to discount HIV as a foreign problem is the temptation to ignore the necessity for education. Some Muslim officials worry about education that promotes the use of condoms or that offering clean needles may condone and even encourage practices that the country holds sinful. Inevitably,




**The cover of a World Bank study about the spread of HIV in the muslim world**

this kind of hesitation leads to widespread ignorance. According to BBC Arab Affairs Analyst Magdi Abdelhadi, "the concept of safe sex is alien to this [Egyptian] culture, where sex per definition is safe, because it is between a husband and wife." Nasr Al-Sayyed, founder of the Cairo AIDS Hotline, confirms the lack of an understanding of safe sex: "If we go to universities and tell them that condoms can protect against infection, most students ask, What is a condom?"

While it is true that widespread adherence to Islamic tradition could mean that the disease will rarely pervade the general population, this false notion of Egypt being completely "immune" to HIV/AIDS leaves vulnerable populations in the shadows and without proper public support. The truth is that not all citizens of Egypt abide by Islamic Law. Theologian Farid Esack says, "I think the religious factor is overplayed in the low prevalence rate in Arab countries. Real Muslims are…having sex outside of marriage regardless of what the Q'uran says. And somebody has to deal with the real consequences." Similarly, Dr. Emanuel Kamel, medical director of Refuge Egypt, says, "Good Muslims, good Christians. Yes, our religion says no and no and no. But are we sure everyone is committed? ... HIV doesn't come to us. We go to HIV."

Underscoring this notion of denial to the spread of HIV in Egypt is the low HIV prevalence rate, which blinds officials to the need for intervention. In Egypt, this statistic is particularly misleading because HIV rates are highly concentrated in vulnerable populations. Such groups include commercial sex workers, men who have sex with men, injecting drug users, and people who have sex outside their marriages. These populations play a major role in Egypt; Cairo is known for its vibrant sex industry and high drug use, and Egypt has one of the largest sexually active gay communities in the Middle East. However, these activities are kept very private, and there is limited public knowledge of where they are and how they operate. Thus, high-risk groups are often difficult to target.

**Commercial Sex Industry**

In describing the commercial sex industry in Cairo, Karim el-Gawhary describes a summer season of established sex tourism: "Every year Gulf men revitalize the prostitution business in town…men straight from Riyadh, Jeddah or Kuwait City in their white dishdasha robes are sometimes solicited directly at the airport with offers of 'special furnished flats.'" These flats, usually rented out on a per-night basis, come complete with a prostitute referred to as a "housemaid," who can come at any time of the day or night. The enterprise relies on a series of private arrangements including a hush-money payment to the doorman and a commission for the flat-broker. El-Gawhary claims that "news of flats rented by the day or week spreads among the pimps, and the prostitutes stream in—like ants."

HIV transmission is rarely a consideration for prostitutes and their clients in these encounters: "Asked if most Gulf men use condoms, Aisha [a 20-year old prostitute in Cairo] burst out laughing. She herself gives no thought to the possible risk." Although these encounters clearly pose a great threat to the spread of disease, Egyptian authorities rarely intervene. El-Gawhary claims,"Egyptian authorities habitually close their eyes to it because of diplomatic embroilments…not to mention the lucrative prospects for hard currency." A representative of Egypt's vice squad declined El-Gawhary's request for any off-the-record commentary about Egypt's sex tourism industry. Some officials simply don't give credence to the existence of a sex industry in Egypt. Sausan al-Shaikh, the spokeswoman of the Egyptian AIDS Society, claimed that "illegal sexual encounters are not common, thanks to Islamic teachings." Clearly, denial is a major obstacle to overcome. If policy makers cannot acknowledge the presence of a commercial sex industry, they cannot effectively protect clients and workers from infection.

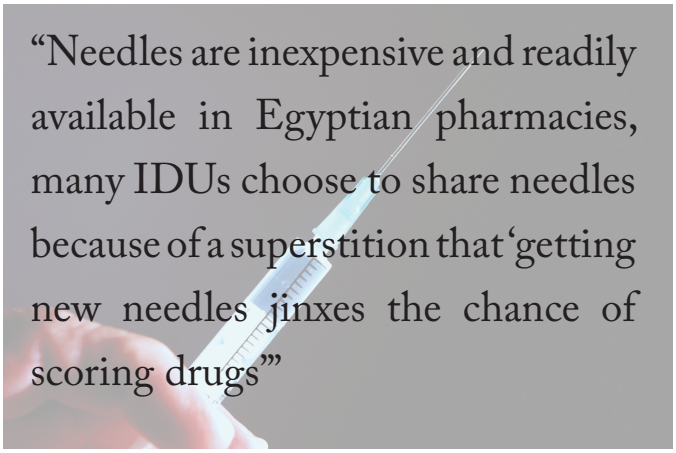
**Drug-Injecting Users**

Interviews and statistics reveal that drug-injecting users in Egypt are similarly at risk. Egypt has about a half million "hardcore" drug addicts, of which about 300,000 are drug-injecting users. Dr. Ehab Kharrat, who works with drug addicts in Cairo, found that even though syringes and needles are inexpensive and readily available in Egyptian pharmacies, many IDUs choose to share needles because of a superstition that "getting new needles jinxes the chance of scoring drugs." A UNAIDS survey indicated that more than half of IDUs had shared a needle within the past month, typically more than once. In 2004, Kharrat was asked to institute an HIV awareness program for drug users at Freedom. As of March 2005, 40 drug users have gone for anonymous testing, and Kharrat hopes to reach 5,000 more within the next 3 to 4 years. He indicates that the situation is escalating and will be difficult to control: "I'm pretty much scared that we're sitting on a ticking time bomb."

**Men Who Have Sex with Men**

Another group with concentrated HIV infection rates is homosexual men. In a small sampling of men who have sex with other men conducted by NAP in 1994, 67% of the men admitted to having more than five male partners concurrently, though only 21% ever used condoms, with fewer than 2% using them consistently. This group is at a very high risk for HIV infection, but more than any other group, homosexuals are extremely fearful of being tested for HIV. They are concerned not only with stigma associated with a potential positive diagnosis, but also that getting tested may publicly identify them as gay. In the above NAP survey, 30% of the men were married, perhaps to conceal their sexual orientation, and 44% were bisexually active, posing a threat of infection to their wives or female partners as well.

This fear of "coming out" in Egypt is a grave one, particularly since the "Queen Boat" incident in May 2001, when 52 gay men were arrested on charges related to homosexual sex at the Queen Boat, a floating discotheque along the Nile often frequented



by homosexual men. While under arrest, the men were beaten and tortured using electric shocks until they confessed guilt to the police. Within a week of the arrest, several Egyptian newspapers published the men's photos and places of employment, an act of public embarrassment, which would make it difficult for them to ever return to a normal existence within their communities and workplaces. While homosexuality is not explicitly outlawed in Egypt, the men in this case were accused of "practice of habitual debauchery," "contempt for religion," and "exploitation of Islam to promote deviant ideas." The trial mandated medical examination of the defendants to determine whether they had engaged in anal sex. "Egypt has not and will not be a den for the corruption of manhood, and homosexuals will not establish themselves here," said prosecutor Ashraf Helal, addressing the courtroom and a cage of defendants in September of 2001. At the conclusion of the trial, 29 of the men were acquitted, but the rest received jail sentences of up to five years. It is no surprise, then, that this case instilled deep fears in the gay community. "If the government wants this trial to be a deterrent, they will succeed," says a European diplomat monitoring the case. "This trial is sure to drive gay foreigners away and gay Egyptians underground."

**Refugees**

Another concern about possible increase in HIV infection in Egypt is the prevalence of HIV in the neighboring country of Sudan. Sudan accounts for more than 80% of all infections in North Africa and the Middle East. Although the country is presently war-ravaged and cross-border travel is limited, once the political situation is stabilized, cross-border travel may spread the virus – which afflicts 2.3% of Sudan's population – to neighboring Egypt and Libya.

At present, Cairo has an estimated 300 Sudanese sex workers. In addition, thousands of refugees from Sudan and other troubled African nations with high HIV rates flood the Egyptian borders seeking asylum. There are an estimated 50,000 African asylum-seekers in Egypt, of who about 64% have not been recognized with refugee status by the UN Refugee Office. Recognized refugees in Egypt who test HIV-positive stand an excellent chance of being resettled in a western country, where they are offered treatment for their infections. However, HIV-positive people who have not gained refugee status are not so lucky. "If you have a closed file and are diagnosed with HIV, then you are a real tragedy," said Refuge Egypt's medical director Dr. Eman Kamel. Because these people are illegally residing in Egypt, they are not offered any medication or other assistance. Unrecognized refugees who live without treatment may contribute to the further spread of HIV, but this population goes unnoticed in national records of infection rates.

"The number of people living with HIV in North Africa and the Middle East rose 13% in 2004 to an estimated 540,000 (0.3% of the population). Although that is low compared to the global average of 1.1%, this region has the world's third fastest rate of increase in new infections"

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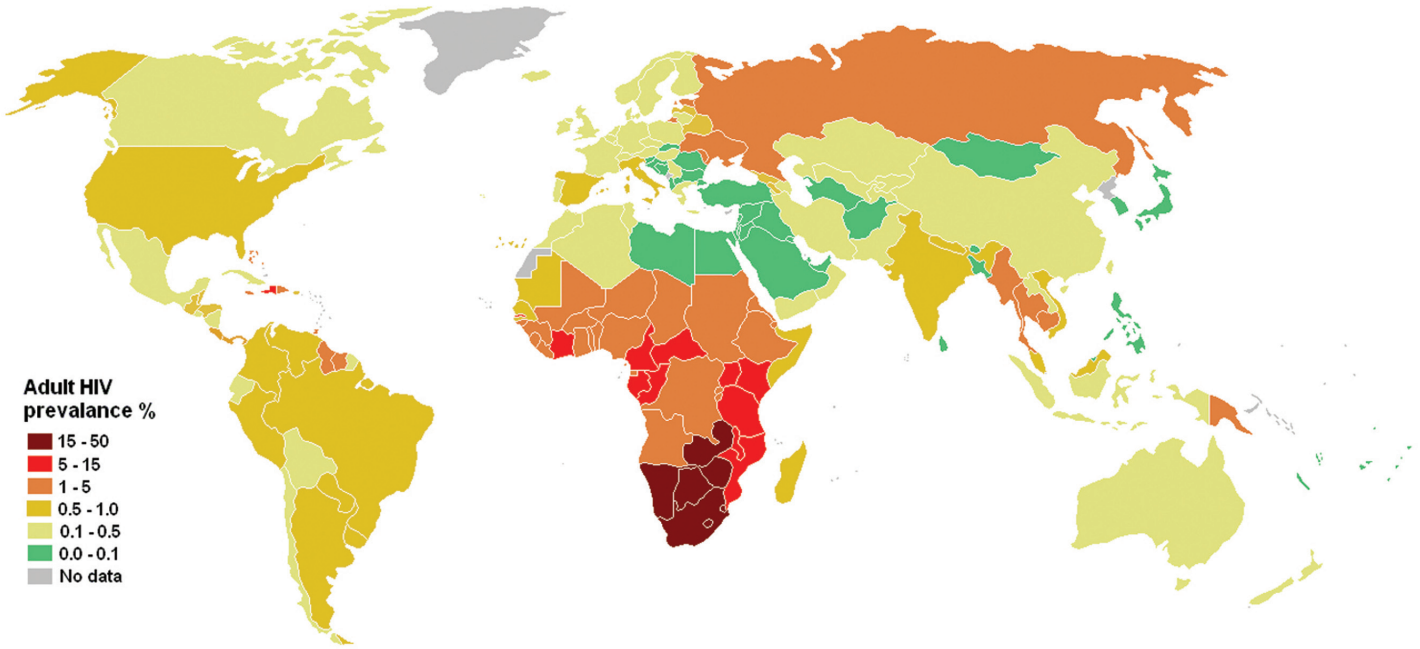
Each of these high-risk groups, although constituting a small percentage of the total population, poses a considerable threat to the spread of infection. The number of people living with HIV in North Africa and the Middle East rose 13% in 2004 to an estimated 540,000 (0.3% of the population). Although that is low compared to the global average of 1.1%, this region has the world's third-fastest rate of increase in new infections. And while risks are increasing, the health knowledge of the people is still limited. From 2002 to 2004, new infections have increased 26%. Once infection rates reach 5% of the population, it is believed that the virus starts to spread very quickly—increasing as much as tenfold in five years—as it did in southern Africa. "There is only a small window of opportunity to stem the tide of HIV/AIDS," says Khadija T. Moalla, UN Development Program coordinator in the region, on the need to act quickly to prevent further spread.

Recognizing the urgency of a possible epidemic, the United Nations Development Programme organized a more recent conference of religious leaders from both Muslim and Christian faiths to reach a consensus on the prevention and treatment of HIV/AIDS. The Cairo Declaration, a product of three days of heated discussion, was signed by 80 major Arab religious leaders from 19 nations, including Egypt. "The walls came down with a crack. It was amazing, in many ways a breakthrough…Shiites sat down with Sunnis, with Protestants and Catholics, which is not usual in our area of the world," said Ehab El Kharrat of the Kaasrel Dobara Presbyterian Church in Egypt.

The document these leaders generated shows evidence of a more progressive discourse on HIV/AIDS than in the past. The Cairo Declaration emphasizes basic human rights and freedoms of marginalized populations, "notwithstanding their situation, background, or medical condition." The documented recognition of illicit behaviors like commercial sex and homosexuality in Egypt is a revolutionary step in HIV prevention, and a written contract of commitment towards supporting such rights proves even more momentous. "Everyone started by trying to prove he is the most stern defender of virtue," El Kharrat continues, "but together, eyes were opened to new meanings of virtue, compassion…of action rather than silence."

Nevertheless, there is a sustained doctrinal tone, which implicates infections as occurring "according to God's sovereign choice." This point seems to mirror the idea of disease as a punishment from God, and aligned with this concept is an inherent discrimination: "Although we do not approve of such behaviors [homosexual sex, injecting drug use, etc.], we call on them [members of vulnerable groups] to repent and ask that treatment and rehabilitation programs be developed." The Cairo Declaration indicates that leaders are accepting more responsibility to take action, but they are inherently limited by their conservative beliefs in regard to how much support they can offer. Reluctance to broach taboo topics is still present in the




vague language of some statements: "We reiterate that abstinence and faithfulness are the two cornerstones of our preventative strategies but we understand the medical call for the use of different preventive means to reduce the harm to oneself and others." In effect, this conference espouses the true nature of the situation: progressive but contradictory in stance, and lacking in concrete initiatives.

In recent years, such conventions have become a common drive for HIV prevention initiatives, but effectiveness and outcomes of these meetings are not yet clear. In May of 2005, representatives of 12 Arab nations, including Egypt, met in Tunisia for a four-day conference on prevention of the spread of sexually transmitted diseases, including HIV/AIDS. The conference was arranged by the Federation of Family Planning and the United Nations to support heightened awareness of the prevention and treatment of STDs, and to break down taboos surrounding such discussion in Arab nations. In February of 2005, UNAIDS and the Jordanian government sponsored a three-day conference on the increasing incidence of HIV/AIDS among women. UNAIDS Associate Director, Dr. Suman Mehta, said that HIV/AIDS continues to be a problem among women because they have a lower social status than men, and they often experience rape or are unable to negotiate safe sex with their partners. As a result of these conventions, governments have been urged by health officials of the conferences to institute comprehensive sex education programs in schools. However, it will likely take years before an appropriate program is fully integrated into these countries to target regional problems and misconceptions.

Some of the most effective initiatives toward HIV prevention are those which offer affected individuals access to specific information and private, non-judgmental consultation. In 1996, the Ministry of Health established the AIDS Hotline in Cairo to answer any questions about HIV/AIDS and to direct at-risk people to anonymous testing. Within two years, the hotline had been called 17,000 times, with questions ranging from modes of transmission to places to get anonymous testing, safe sexual practices, contraception, and treatment. The implementation of such a service is a first step towards breaking social taboos surrounding these topics. Recent years have also shown that more and more confidential testing sites have opened up in Egypt, promising anonymity to patients who are worried about the powerful stigma attached to AIDS in this country. These sites not only provide an HIV Antibody Test, but also offer counseling sessions where people are provided with accurate information about the course of HIV and how it is transmitted. Such efforts will limit ignorance about HIV and also increase reporting so that institutions can more readily assess the HIV/AIDS situation.

However, the implementation of such programs cannot possibly eradicate the social complexities of seeking help about HIV in Egypt. Fears and stigma inevitably flood these establishments. "It's not anonymous [testing], don't believe that," warned one gay Egyptian who asked not to be named: "The first thing they do is call the cops." It is this panic which forces many affected people into hiding. One interview follows the story of an Egyptian gay man who wanted to track down an infected acquaintance to offer help. He couldn't find the man, and the man's family had no information as to his whereabouts. "Either they disappear or they stop having sex with people because they are too scared or the leave the country to get treated," he said. Besides, "it's becoming very, very difficult for any AIDS patient or HIV-positive person to go and seek medication [in Egypt]. There have been too many horror stories lurking around." Well-warranted, these fears of being publicly identified as HIV-positive can only be eliminated by a massive cultural revolution of attitudes towards HIV.

Conservative culture will likely continue to intensify the difficulty of properly educating the population. It is clear by the prevalence of at-risk groups that much of Egypt's modern society does not hold to conservative Islamic beliefs about sex and drug use. The stark increases in recent infection model those of previously epidemic-prone countries and suggests urgency for major action.

The only way to significantly reduce HIV prevalence is to eliminate the resistance to open public discourse. The successes of the anti-HIV campaign in Thailand demonstrate that aggressive interventions can reverse the spread of infection: "Every segment of Thai society played a role in AIDS prevention. Everyone was involved-from the medical community to teachers, to monks, to prostitutes and to drug addicts. The government committed funds for research and backed private organizations that attempted to spread the world about how to stop AIDS. "

A similar union of forces can prevent the oncoming epidemic in Egypt. Religious leaders, political officials, and the media need to cooperate with non-governmental organizations to educate the public on modes of transmission and safe alternatives to risk behavior. Mainly, this action needs to be on the level of public governance; in particular, this applies to societies whose governments are rooted in their religion because people can look to the government for not only a legal code of living, but also for a social code. Thus, the nature of legislation needs to be shifted to accommodate social realities, and in turn, this can lead to a transitioning of the mentality which forces the HIV-affected people in Egypt into fear and secrecy. Over time, even conservative populations can come to understand that HIV does not respect national boundaries—it is an epidemic for all of humanity.

**Works Cited**


1. Jenkins, Carol & Robalino, David. HIV/AIDS in the Middle East and North Africa. Washington D.C.:The World Bank, 2003.
2. Roesin, H. Runizar. Islamic Approach on HIV/AIDS: Report on the first HIV/AIDS ASEAN regional workshop of Islamic Religious Leaders. Jakarta: Indonesian Council of Ulama, Nov. 3 –Dec. 3, 1998.
3. Srikameswaran, Anita. "Egypt Confronting HIV." Pittsburgh Post-Gazette 15 March 2005.
4. Srikameswaran, Anita. "Egypt's fearful gays shy from HIV testing." Pittsburgh Post-Gazette 14 March 2005.
5. Srikameswaran, Anita. "Refugees see HIV as pass to treatment." Pittsburgh Post-Gazette 14 March 2005.
6. Srikameswaran, Anita. "Needle sharing by drug users dangerous sign." Pittsburgh Post-Gazette March 13, 2005.
7. "Compassion and AIDS in the Arab World." Al-Ahram Weekly, October 20-26, 2005 (Issue No. 765).
8. "Not just the Queen Boat." Al-Ahram Weekly , March 4-10, 2004 (Issue No. 680).
9. Abdelhadi, Magdi. "Egypt Faces up to AIDS." BBC News November 27, 2003.
10. El-Gawhary, Karim. "Breaking a Social Taboo: AIDS Hotline in Cairo." Middle East Report (Spring 1998): 18-19
11. Huxley, Christian. "Arab Governements Wake Up to AIDS Threat." Middle East Report (Nov-Dec 1989): 24-25
12. El-Gawhary, Karim. "Sex Tourism in Cairo." Middle East Report (Sept-Oct 1995): 26-27
13. Shannon and Pyle. "On The Origin and Diffusion of AIDS." Annals of the Association of American Geographers, Vol. 80, No. 2 (June 1990): 300-304
14. Ingram, Simon. "New HIV/AIDS counseling and testing centers open in Egypt." UNICEF Egypt, October 18, 2005.
15. Smucker, Philip. "A clash of cultures in Egypt." The Christian Science Monitor, September 18, 2001.
16. Lenton, Cliff. "Will Egypt escape the AIDS epidemic?" The Lancet, April 5, 1997. Cairo Declaration
17. "Arab Religious leaders convene to break the silence on HIV/AIDS and to define their role in an AIDS-free future" Cairo, December 11, 2004
18. "Arab Religious leaders agree unanimously to respond to HIV/AIDS by signing the progressive Cairo Declaration"
19. Howard, Susanna. "UN Seeks to 'Break the Silence' On AIDS in Africa and Mideast." The Wall Street Journal February 2, 2005
20. "The Lazarus Foundation: Egypt Country Profile. <http://hivafrica.org/egypt.html>
21. Kanabus, Annabel and Fredriksson, Jenni. "HIV & AIDS in Thailand" <http://www.avert.org/aidsthai.htm> Last updated July 26, 2005.
22. www.unaids.gov
23. http://www.usaid-eg.org/
24. http://www.who.int/countries/egy/en/


# Record Number of 30 Pandas Born in China in 2006

by Ying Li

Thirty of 34 panda cubs born by artificial insemination survived for a record number of panda births in 2006. This figure has increased the total number of pandas born in captivity to 217. The previous record for greatest number of births was 21 cubs in 2005.

Failed attempts to breed in Beijing and Shannxi province leaves the surviving 30 pandas around their native Sichuan province area. Seventeen were born at the Wolong Giant Panda Protection and Research Center, 12 at the Chengdu Research Base, and one at Chongqing Zoo.

The panda is one of the world's rarest animals, and experts estimate that around 1,600 live in the wild in China. Pandas have very low fertility because they are sexually inactive, making artificial insemination necessary for breeding in captivity.

photo illustration by Stephanie Sun

# Global Warning?

Photo illustration by Daniel Brujis

by Stanimir Rachev

Recently, global warming has become a topic of increased media attention and, even seeming personal experience. The release of the Working Group I Fourth Assessment Report of The Intergovernmental Panel on Climate Change followed a winter break in which those of us that stayed in New York experienced record-breaking temperatures. One could easily make the connection and conclude that this suspiciously warm weather was indeed a consequence of global climate trends. I would not be so quick to draw a link and will take a more skeptical view.

As a start, let's take apart the term "anthropogenic global climate change" that is what most people probably mean today by "global warming". First of all, climate is not weather, but is statistical description over a long enough period of time, a standard defined by the World Meteorological Organization being thirty years. It is a bit surprising then that predictions about climate get updated so often to be relevant to the current state of the climate system. A key conclusion of the above-mentioned report is that "*most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations*". [(1)] This might sound like a reiteration of an already-known truth, but how did we arrive at this truth? The human-made greenhouse gas emissions are probably the only fact beyond any doubt. Many Columbia College students that didn't sleep through the Frontiers of Science class might remember the graph of $CO_2$ concentration from Hawaii.

Yet, when it comes to temperature, and especially global averages, there is a lot of room for argument. The way raw data is handled can grossly influence the final result. Even the same result can convey a different impression upon visual presentation. And here a well-established phenomenon may be hidden from the unacquainted observer. The so-called "urban heat island effect" accounts for elevated temperatures in metropolitan areas as compared to countryside. It is however, dismissed as a negligible factor towards global warming by experts and probably rightly so. But let's look at it from the other side as an apparent consequence instead of a cause. In the minds of many policy-conscious city-dwellers, the warmer winters might present strong evidence to their agenda. Indeed, New York's mean temperature has risen about 5 degrees Fahrenheit in the last 120 years [(2)]. Albany has a more moderate increase of about 2 degrees. While the current direction of climatic trends is clear, there is significant local variability and even areas that became colder. There is also an idea well entrenched in the imagination of the public by poorly made Hollywood movies that somehow global warming is also the cause for cold weather where it happens. The confusion arises from the scientifically sound concept of an abrupt switch in the climatic mode of the planet, one that is speculated to arise as the melting of freshwater ice caps disrupts the ocean thermohaline circulation.

> Without questioning the integrity of the scientists involved, I simply can't believe that they can avoid bias knowing the source of their funds. Instituting the equivalent of double blind clinical trials seems quite necessary.

This particular example seems to be one of many scenarios that environmentalists and policy-makers use to scare the general population. While I do support their agenda, which is mostly to cut dependence on fossil fuels, I believe the science behind it is very dubious at best. Numerous computer models are trying to predict the temperature increase in the next centuries and the rise in ocean levels associated with it, but those models suffer from inherent

limitations. For a moment just consider a different problem of predicting the folding of a protein molecule from its structure. That is at the forefront of research and the current computer simulations are still orders of magnitude away from success. Now scale up to an incredibly complex system such as climate, and think if these models are reliable. In addition, all that they give as a result assumes certain parameters representing the different driving forces. The only control is that they fit within some very wide margin with data from the last century. There are simple high school physics experiments that would give misleading results under such wild means of extrapolation, let alone the whole climate system on Earth. One concept that often comes across in the frightening scenarios that we keep hearing is "feedback", the idea that small changes in some factor can be greatly enhanced. However, the natural driving force of solar radiation is just as relevant. But let's leave the distant future; even if the most pessimistic predictions are true, it is still a gradual process. Much closer to us are all the news reports of destructive hurricanes and tsunamis. Yet, despite media speculations, IPCC admits reluctantly that there is no significant correlation between those disastrous events and global warming

In summary, there are a couple of points I want to make even if my arguments won't dissuade the ardent environmentalist. Firstly, I am appalled at the abuses to the scientific method that constitute the expert panels drawing conclusions with such far-reaching implications into public policy. Without questioning the integrity of the scientists involved, I simply can't believe that they can avoid bias knowing the source of their funds. Instituting the equivalent of double blind clinical trials seems quite necessary. Secondly, as much as I trust science to lead humanity to progress, I always stand humble in front of nature and its dynamic forces. The idea of global warming is one that actually brings comfort to our minds, since it suggests that, despite the negative effect so far, we humans are in control and could, with good will, build our future in a predictable way. I really wish it was true, but I am not arrogant enough to accept it.

**Works Cited**

Intergovernmental Panel on Climate Change,
Climate Change 2007: The Physical Science Basis - Summary for Policymakers
United States Historical Climatology Network

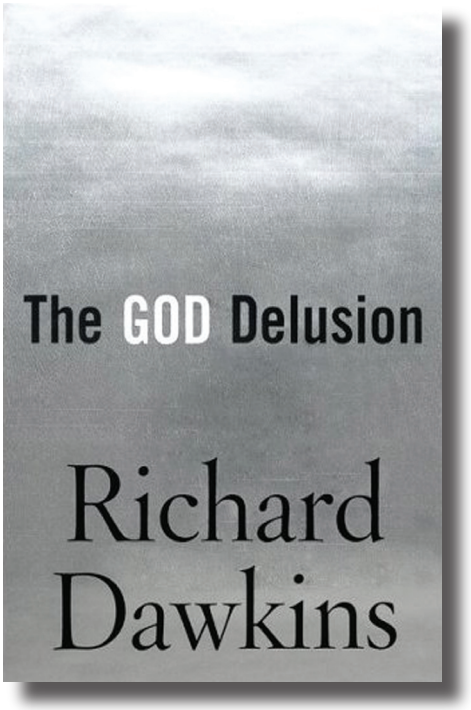
# Dawkins Picks Up Five Smooth Stones

by Duncan Kluwak

*The God Delusion* is not a polite book. Its author, the esteemed Oxford biologist Richard Dawkins, has written it with the explicit goal of ending faith in God. To this end, he discards the usual delicacy with which the issue of religion is handled, and subjects it instead to the rigors of scientific analysis. Essential to his argument is that the realms of religion and science are not mutually exclusive. Some will inevitably be offended by his conclusions, and especially by the way in which he supports them. Ultimately, however, Dawkins' offenses can be forgiven because of his passionate advocacy of rationalism, humanism, and science as forces of enlightenment.

Richard Dawkins is first and foremost a scientist, thus it is not surprising that he is most effective when discussing his area of expertise. He has spent a lifetime studying the intricacies of Darwinian natural selection, and his knowledge of the subject and the eloquence with which he discusses it are quite impressive. This becomes particularly important when Dawkins confronts the theory of intelligent design. Rationally and thoroughly, he explains why the argument of irreducible complexity is untrue. The eye is a commonly cited as an example of irreducible complexity, but with considerable care Dawkins provides a convincing explanation for its development over the millennia. His science leaves little room for argument.

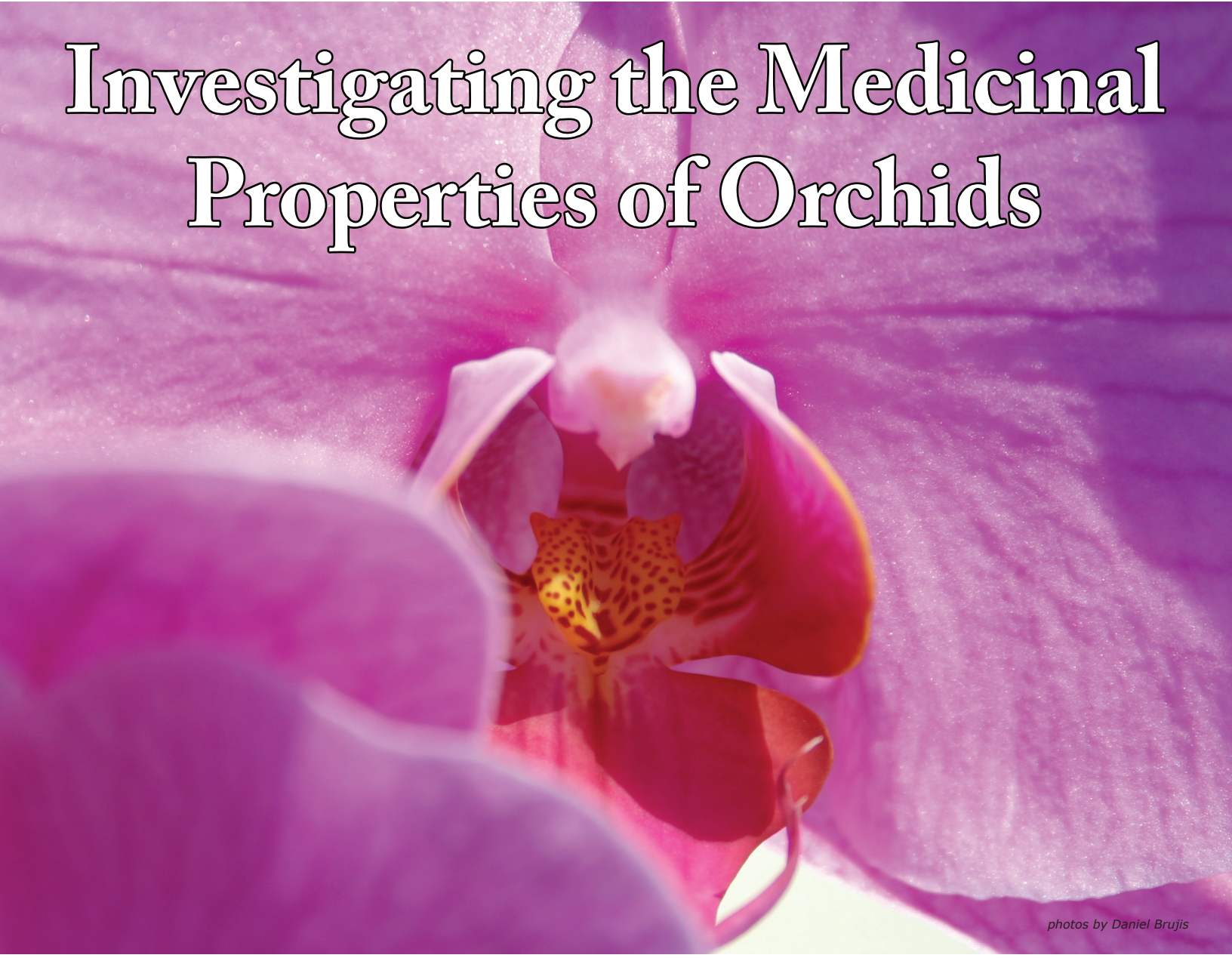
Dawkins' rhetoric, however, seems almost designed to invite confrontation. He has an unfortunate habit of quoting people directly, and then interpreting their words in wildly subjective ways. This severely undermines some of his most important points. Though Dawkins' writing is sharp and often funny, his absolute refusal to compromise over the validity of his central thesis (namely that "there is almost certainly no God") creates a tone that occasionally drifts from one of reasoned insight to one of outright anger. For example, repeatedly criticizing Mother Teresa, regardless of whether or not those criticisms are warranted, is in all likelihood not the best way to convince readers that a world without belief in God would be a better place.




What Dawkins does do remarkably well in *The God Delusion* is contend that science can not only objectively improve the overall condition of human life, but can also provide nourishment for the human spirit. Gaps in knowledge once filled by ignorance are being consistently replaced by science and eventually, he argues, there may be no room left for God. Dawkins may not resolve what will probably be an eternal debate. Nevertheless, as a concerted work of honest atheism *The God Delusion*'s light is sharply focused and shines brightly.

*The God Delusion*
406pp, Bantam, $27.00

# Investigating the Medicinal Properties of Orchids



photos by Daniel Brujis

by Umara Saleem

Lush, vibrant, and beautiful, your newly purchased orchid sits happily in your window. What you may not know is that orchids might one day be able to cure cancer, help in heart relaxation, or even be taken as an aphrodisiac, among many other uses.

Orchids, or as they are scientifically known, the *Orchidaceae*, compromise one of the largest families of flowers in the Plant Kingdom, with over 30,000 different species (Kong, 2003). Orchids were first noticed for their unusual reproductive organs (Bulpitt, 2005). The Greeks refer to testicles as *orchis*, and Theophrastus (372-286 BC), Aristotle's successor, named the orchid after that part of the male anatomy because the underground tubers of many European terrestrial orchids resemble a pair of testicles (Bulpitt, 2005). Recently, it was discovered via DNA analysis that the orchid family is part of the asparagus group, closer in kin to these vegetables than other flowering plants with which they had been placed before (Yoon, 2003). A particular detail about orchid pollen is that it is very delicate and leaves no fossil record. Thus, orchids have been mis-categorized several times before in history. Orchids have mostly been investigated by the Chinese, who were the first to describe the medicinal uses of orchids, as well as write books on them (Bulpitt, 2005). In one of the earliest records, Shen-nung, the "father of Chinese agriculture," described species of orchids in his 28th Century BC text *Materia Medica* (Bulpitt, 2005).

Orchid species are notable for their numerous medicinal uses and are used all over the world, especially in cultures such as those from East and South Asia that emphasize naturopathic medicine, which relies on the body's natural capacity to heal. Native Americans in North and South America have also used orchids in medicine, for example in the relief of mouth and gum sores, and curing eye infections (Kong, 2003). Cross culturally, the petals and the roots of orchids have been used most frequently. Interesting uses of these parts include the bulbs of the species *Diuris maculata* for emergency food, their dry tuber roots as an anti-aphrodisiac, and their petals as skin allergy soothers (Bulpitt, 2005). In another species, *Cyrtorchis arcuata,* the whole orchid is dried and powdered to treat diabetes; while leaves of the species *Bulbophyllum maximum* and *Tridactyle tricuspis* are used by the Malawi peoples in Southeast Africa to treat against sorcery and madness (Bulpitt, 2005).

Traditionally, orchids were used as a whole or part-wise in herbal medicine. With the advent of advanced biotechnology today, scientists can now isolate chemical components from an orchid's internal structures and specifically determine the functions of these organically synthesized molecules. Recent advances such as these are highly significant for medicine, because orchid molecules are found to have a role in reducing fevers, serving as anti-impotence aids, increasing the white blood cell count, curing eye diseases, treating fatigue and headaches, and most importantly, functioning as anti-cancer agents (Bulpitt, 2005).

In one study conducted in a botanical research institute in India, scientists evaluated the species *Vanda Tessellata* (figure 2) and discovered its role as a potent aphrodisiac and fertility booster. The species is grown in abundance locally, and also has a long history of use by the native population for its anti-inflammatory properties (Kumar, et al, 2000).

In the study, it was found that, compared to mice that had not been given an orchid extract, male mice that received it showed more mounting (sexually active) behavior, and the females paired with these mice gave birth to larger litters and more male offspring. As scientists increased the concentration of the serum, a direct relationship between these outcomes was observed. Perhaps these results can be extrapolated to humans and preliminary tests can be done to see if researchers can develop another drug like Viagra ®.

A study last year performed in Mexico on mice evaluated two complex organic chemicals from the orchid species *Scaphyglottis livida* as a potential relaxer of heart contractions caused by the excitatory hormone noradrenaline (Soto, E. S. et al. 2006). Results showed that both of the organic compounds, called Stilbenoids, inhibited aortic contractions provoked by noradrenaline, and caused vasodialation, the relaxation and widening of blood vessels in the body (Soto, E. S. et al. 2006). Again, the implications of these chemicals for usage in human models may be promising in cardiology, pending further examination.

Many studies have been conducted investigating the role of the promising chemical moscatilin, which is derived from the stems of the orchid species *Dendrobrium*; these species have been commonly used in traditional Chinese medicine as a tonic to maintain a healthy stomach, to increase body fluid, to reduce fever, and as a natural anti-platelet agent (Ho & Chen, 2003). It has also been demonstrated as a remarkable anticancer agent that has mutation-causing properties in cancer cell lines derived from different tissue organs (Kong, 2003). Moscatilin has been previously known to be a natural anti-platelet agent extracted from the stems of the flower (figure 3). Its anti-cancer effects were demonstrated in a Taiwanese study where 16 cell lines from different tissue origins, such as from the placenta, liver, lungs, stomach, and other organs, were used

and cultured with moscatilin (Ho & Chen, 2003). Mutagenic activity was displayed in the study, but not uniformly across cell lines; it was found that 100% of the lung, 75% of the stomach, and 0% of the liver carcinoma cell lines were responsive to the cytotoxic effect of moscatilin (Ho & Chen, 2003). It can be concluded from the study that the role of moscatilin from the Indian orchid does indeed expresses antiproliferative effects against various types of cancers, including those from choriocarcinoma (cancer of germ cells), lung cancers, and stomach cancers, but is ineffective against hepatocellular carcinomas (liver cancers) (Ho & Chen, 2003). This present study was especially crucial to Taiwan for many predominantly suffer from the evaluated cancers (Ho & Chen, 2003).

The different species of orchids also have been used in treatments of epilepsy, as sedatives and flavor enhancers, against flatulence, rheumatism, spasms, and everything from cramps to increased virility. (Kong, 2003). In Africa, an amulet made from the leaves of the species *Ansiella Africana* infused with a paste made from the bulbs of the same plant is even said to function as a short term contraceptive (Bulpitt, 2005).

In the past, orchids were used in crude form and as whole plant parts. Scientists can now localize a particular chemical and investigate that. Another point of interest is that almost all studies of orchids are being performed in East and South Asia and South America. Scientists are taking the medicinal history of these widely used plants in their abundant local environments and performing chemical assays on them. The United States, also, is slowly incorporating plant chemicals into its medical pharmacology. One prominent example is Taxol ®, a chemical derived from a Pacific Northwest yew, that is currently being used in the treatment of breast and ovarian cancer (Foster). In contrast to the US's slow incorporation of plant chemicals into its pharmacology, China leads in the use of medicinal plants as an important part of public heath care, where approximately 500 species are source plants for official drugs in the Chinese pharmacopoeia (Foster). Additionally, there are over 5,000 species used as traditional medicine or folk and local medicines in various parts of the country (Foster).

Herbal remedies are the most popular health supplements today. In 1994, The US Food and Drug Administration's Dietary Supplement Health and Education Act provided regulatory parameters for herb products in dietary supplements (Foster). Interestingly, in Germany, plant materials are labeled as drugs with detailed uses, side effects, dosage information, and a reasonable safety and efficacy based on historic use of the plant along with scientific facts (Foster). In the US, about 25% of prescription drugs sold contain at least one ingredient derived from a flowering plant, but this figure hasn't changed significantly since 1959 despite the fact that a few new drugs have come from plants since then (Foster).

Wouldn't it be revolutionary to find the cure for cancer in a dandelion growing in Central Park? Perhaps the US will one day expand its research field and open-mindedness towards plant pharmacology. Due to the incredible diversity of orchids, research on them is full of potential. Perhaps these medicinal orchids hold the key in the form of organic chemicals under investigation in international labs right now. So as you observe your pretty window orchid bloom through the seasons, keep in mind that the cure to a life-threatening disease may be right under your nose.

# Ill-Defined Biology in a Natural World: The Work of Professor Scott A. Snyder

by Shelly Zhu

If you go north on Route 80 into upstate New York and continue west, onto one of those burned-out stretches of arterial road that cut across the state, you pass patches of farmland, decrepit barns, Laundromats, diners, and miles of corn, until you reach the Canadian border. Here, at the edge of the country, lies the city of Buffalo, New York, home to the second largest population in the state of New York. Amidst the suburbs of this friendly city, named third cleanest in America, stands the first home of Professor Scott Snyder. Since his father first introduced him to a lab at the tender age of five, Snyder has made much headway into the pathways of chemistry. Today, aside from teaching as an assistant professor at Columbia University, Professor Snyder is working on research that is based on "ill-defined biology," synthesizing unique molecules obtained from different natural sources and trying to understand their biological mechanisms. Stated simply, Snyder's research seeks to elucidate what these natural chemicals do at the molecular level, to improve upon or change their behavior, and then, to find real-world applications for these chemicals, particularly as medicines. For example, Snyder is beginning a series of collaborations with labs in California and Boston to determine more specifically what chemical in red wine causes people to live longer. Another of his notable discoveries is his identification of the mode of action of toxins created by sea sponges, which might actually help to cure cancer in humans.

Although there is nothing remotely pompous about Snyder in person- he is modest and low-key- he is clearly a scientific genius with acuity of mind that can be easily discerned from the first few seconds of conversation with him. Sparsely decorated, his desk contains only a few textbooks and scattered papers, forcing one to look carefully in order to discover any insight into his inner self.

"I love to cook," he smiled, and leaning back in his arm chair in contemplation, he added, "and history. I definitely love history." When asked why history intrigues him so much, he stated simply, "History helps you understand the *origin* of an idea and what amount of travail led to the powerful tools that we have in science today."

If you ever take Professor Snyder's class, you will find him integrating history into all that he teaches, because it is important to him not only to know that theories exist, but also *why* they exist.

Besides the integration of history into the teaching of the sciences, Professor Snyder also prefers to tie in real-life situations. "Eyes always light up when I bring in current-day issues, such as the toxicity of Vioxx, into classroom discussion. This element is important because even if students are only interested in fulfilling their science requirements, they need to make informed decisions when voting as members of a democratic society, and a strong background in chemistry and the scientific issues of today will help them do that." Snyder's passion for chemistry can easily be traced back to his family. The elder of two sons, Scott Snyder was born to a pair of well-educated intellectuals, a biochemistry researcher and a math teacher. As a child, his father always let him play with the equipment in his lab, fostering in him an appreciation for the world around him.

"He let me touch beads of mercury," Snyder laughed. "At that time people didn't know of its dangers."

His mother, on the other hand, instilled in him the importance of precision and the idea "that if you're going to spend time doing it, do it right." Together, they showed him the importance of perseverance, a value that made key contributions to Snyder's later successes.

Having always been interested in the sciences, particularly chemistry, Scott Snyder knew what he wanted to do with his life at an early age. "Chemistry just made sense to me," he said, taking a sip from his cleverly designed beaker-shaped mug.

Helping to augment his incipient interest in science was an inspirational high school chemistry teacher, who showed him the fun in science.

"It was the class during the day that I most enjoyed going to," Snyder recalls.

Snyder's ambition and intelligence set him apart from his peers early on. Not only did he excel in his classes but also at the age of eighteen, he became one of the select few to compete for the honor of representing the United States in the International Chemistry Olympiad, perhaps the most prestigious high school competition in the field of chemistry. Every summer, the adolescent Scott could be found on the campus of SUNY Buffalo, where he worked as a volunteer research intern in a biochemistry lab. On those lazy summer days, Snyder toiled away indoors, working tediously to perfect his lab techniques.

After high school, Snyder continued to chase his dreams of success, pursuing a chemistry major at Williams College in Williamstown, MA. Here, he once again was blessed with an amazing faculty that supported him, challenged him and encouraged him to solve problems. Once again he immersed himself in the chemistry labs, this time exploring different aspects of the field, including its physical, organic, heterocyclic, and medicinal sub disciplines. During the summertime, Snyder continued to work as a research intern, this time for the Bristol-Myers Squibb Pharmaceutical Company (formerly known as Dupont-Merck). Recognition for his genius was quick to follow, as his work garnered him several publications and numerous awards, such as a Pfizer Summer Undergraduate Research Fellowship, the Barry M. Goldwater Fellowship in Science and Engineering, and a National Science Foundation pre-doctoral fellowship. He went on to earn his Ph.D. at The Scripps Research Institute in La Jolla, California, and did postdoctoral research as a National Institutes of Health fellow in the laboratory of a Harvard University Nobel Laureate.

What key traits contributed to his astounding success in chemistry? In addition to being well read and persistent, Professor Snyder believes that there are two primary qualities that all good chemists must possess.

"First, a chemist must have what are called 'good hands,' or the ability to execute an experiment properly." "More importantly thought," he continued, "is how you handle the first major problem you encounter in a research program, i.e. when your initial idea does not succeed. This moment is what makes or breaks a chemist. Some people become frustrated and simply give up. However, it is those who see this moment as an exciting challenge and fight to solve that problem who succeed."

Looking ahead, Professor Snyder is excited by what he envisions as the future of chemistry. He sees the future of synthetic chemistry as a "Star Trek" mission, one whose ultimate goal is efficiency, via an emphasis on one-step processing, 100% yield, and the elimination of waste. In this quest, he maintains, "We are, at best, Christopher Columbus."

He also envisions advances in nanotechnology and medicine, which will help scientists move way from the current one-size-fits-all medical paradigm in favor of a more personalized form of medical care in which each patient is treated based on his unique genetic makeup.

This future that Professor Snyder hopes for rests on the shoulders of the current generation of aspiring chemists for whom Professor Snyder has no shortage of advice.

"Try not to judge something from just one experience," he answered finally. "And enjoy the problem of having a difficult problem. Always be curious- never think any question is stupid. Always have belief in your own thoughts. Be willing to listen. And, most importantly, let the data give the answer, not you."

Though not all future chemists will be as successful as Professor Snyder has been, one hopes that they will share his boundless enthusiasm for the field. This enthusiasm is made abundantly clear when Snyder describes what it is that makes him love his job so much.

"It's the mystery [of it], combined with the unraveling of this mystery by figuring out what these chemicals in nature do. Couple that with the opportunity to teach the next generation of synthetic chemists and there is no better job on earth."

# Anti-Angiogenic Drugs: A Replacement for Chemotherapy?

by Srinivas Chivukula

Although the ultimate goal of all cancer therapy is to rid the body of malignant tumors, the side effects can be devastating. This is easily seen in chemotherapy. Since its inception, chemotherapy has been the norm, the most reliable cancer fighter. It works by killing rapidly dividing cells. The problem with it, however, also lies in this simplistic mode of action: rapidly dividing cells are not only found in tumors but also in parts of the body that are functioning normally, like bone marrow, hair follicles in the gastrointestinal tract, and the reproductive system organs. Rapid cell proliferation is seen in the mammary and prostate glands as well. In addition, rapid cell division is important in many healing processes throughout the body. Since chemotherapy targets all rapidly dividing cells and has no way of distinguishing healthy cells from cancerous cells, it can seriously harm the body. This article is a review of recent research on a mode of cancer treatment that evades the risks of chemotherapy: anti-angiogenic drug therapy.

In most cases, chemotherapy drugs are administered along with proper medication to ensure that the affected normal tissue's ordinary functioning is regained. However, sometimes the medications still fail to save the life of the patient. Even those who survive cancer often suffer from the negative effects of chemotherapy. People suffer symptoms such as mouth dryness, loss of hair, loss of appetite, and problems with sense perception, something that can be affected by malfunctioning cells. Some people, for example, think pepper tastes sweet because of impaired taste receptors on the tongue after being treated with chemotherapy. One of the more complicated and devastating side effects of chemotherapy is impaired memory and/or cognitive ability. This is often referred to as chemo brain.

Tim Ahles, a researcher at the Dartmouth-Hitchcock Medical School, studied 57 people who underwent surgical treatment for cancer and 71 who underwent chemotherapy. Through a standardized test conducted 5 years later, he showed that those who underwent chemotherapy exhibited greater brain damage when compared to those who were treated with surgery. This finding clearly demonstrates the negative effects of chemotherapy on the brain. Ahles confirmed that this brain damage was not related to depression but rather, has an important biological component. His recent research suggests that people with a particular gene are more likely to suffer cognitive defects in response to chemotherapy. According to Christina Meyers, a professor of neuropsychology at the M.D. Anderson Cancer Center in Houston, TX, brain chemotherapy causes the cancerous cells to release cytokines, which enter the brain and impair cognitive functioning. Interestingly, in treatment, chemotherapeutic drugs also release these cytokines. It is the cytokines that need to be eliminated. Sedatives and steroids given along with the drugs only exacerbate the situation, making cognitive impairment even worse.[1]

## Angiogenesis and Tumor Growth

Given the potential damage that chemotherapy can cause, it is no wonder that several other modes of "cell assassination" have come into play. One such mode of treatment is anti-angiogenetic drug therapy. Angiogenesis is a physiological process by which new blood vessels develop from preexisting vessels. This is similar to neovascularization, or the formation of functional microvascular networks with red blood cell perfusion,[2] and to intussusception, or the splitting of blood vessels to form new ones.[1] Angiogenesis is a vital physiological function, mostly because it allows body growth, whether in the cervix after regular menstrual cycles, in the embryonic stage where it gives rise to stem cells, or in adults where it helps heal wounds. In certain cases such as fetal development, it is the sole source of growth. Because it feeds rapidly dividing and growing cells, cancerous cells use angiogenesis in their own growth and replication processes.

Cancerous cells divide in an uncontrolled fashion and group together to form tumors. There is a high rate of mutation in tumors, and particular DNA mutations in cancerous cells modify cell nature in a manner similar to that shown by Lederberg et al. in the famous Lederberg Replicating Experiment.,[3] giving these cells resistance to drugs and therapies. Once these tumors transgress the primary immune system's defense mechanisms, they begin to develop into larger tumors. This growth is allowed because of the formation of their own new blood vessels. This is how angiogenesis allows the spread of cancer. Through continued blood vessel formation, the small cluster of cells grows into a much larger tumor. This is made possible by nutrients such as growth factors like

the Vascular Endothelial Growth Factor (VEGF) which is secreted by the tumor itself. The newly-formed blood vessels serve a double purpose: they both feed the tumor nutrients and secrete waste materials to the outside of the tumor.

Once the tumor grows in size, individual cells also begin branching out of the tumor. They travel through the blood stream, and the lymph, and dock at different sites in the body. Here, they anchor and again begin to divide and form new tumors called secondary tumors. This process of breaking off and spreading to other parts of the body is called metastasis. The original tumor is now called a primary tumor. Recently, tumors are considered as mosaic vessels, being comprised both of tumor cells, and of endothelial cells.

**Anti-Angiogenesis and the New Drugs**

Research has shown that tumor cells, when subjected to therapy like chemotherapy or radiation therapy and because of their genomic instability, adapt quickly to the changed environment. Since tumors allow for mutations to occur to their own DNA, they can develop resistance to the drug being used. Anti-angiogenetic drugs such as Herceptin (Trastuzumab), which target endothelial cells as opposed to tumor cells, have proven to be more effective. it has been found to be more productive to use therapy, whether chemo or radiation or the latest drugs like Herceptin (Trastuzumab), which is anti-angiogenic in nature, targeted at endothelial cells rather than the tumor cells. Angiogenesis is carried out by these endothelial cells. There are several stages in the development of endothelial cells that, when impeded by antiangiogenesis, can prevent proliferation of the tumor.

According to the American Cancer Society, this new technique of anti-angiogenesis is a safer technique than chemotherapy. The society explains simply, "Anti-angiogenesis is a form of targeted therapy that uses drugs or other substances to stop tumors from making new blood vessels. Without a blood supply, tumors can't grow."[4] But currently, Herceptin is the only drug on the market which has FDA approval.

"Herceptin is a therapy for women with metastatic breast cancer whose tumors have too much HER2 protein. For patients with this disease, Herceptin is approved for first-line use…as a single agent for those who have received one or more chemotherapy regimens." the Herceptin website says, of what it is. The drug, today can be used to treat people with excessive quantities of any protein and not just HER2. [5]

Conclusion

Although anti-angiogensis is still in development as a treatment strategy, it has great potential for future cancer treatment. Anti-angiogenesis boasts fewer side effects and a less risky mode of treatment. Anti-angiogenetic drugs pose no risk of chemo brain and subsequent brain damage or of the Alzheimer's that almost always follows such brain damage. As research goes on, maybe the best thing we can do is to urge all cancer patients not to give up hope. Perhaps the savior is on its way!

**Works Cited**

1 http://dartmed.dartmouth.edu/summer05/html/disc_chemobrain.php

2 "Neovascularization." Wikipedia, The Free Encyclopedia. 17 Nov 2006, 23:03 UTC. Wikimedia Foundation, Inc. 10 Jan 2007 <http://en.wikipedia.org/w/index.php?title=Neovascularization&oldid=88515274>.

3 This experiment showed that bacteria develop resistance to antibiotics such as penicillin, when exposed to antibiotical environments for prolonged periods of time.

4 http://www.cancer.org/docroot/eto/content/eto_1_4x_what_is_antiangiogenesis_therapy.asp

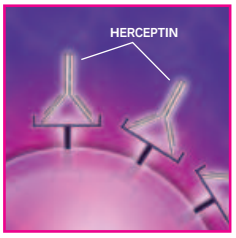
5 http://www.herceptin.com/herceptin/docs/Herceptin_Tearpad.pdf

## HOW DOES HERCEPTIN WORK?

Based on preclinical research, HERCEPTIN is proposed to have up to 3 different types of activity.

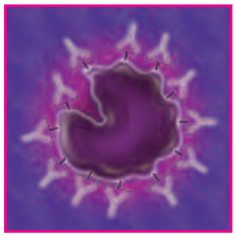

**1. May block tumor cell growth**

HERCEPTIN binds to HER2+ cancer cells and may block them from dividing and growing.




**2. May target the cell for destruction by the immune system**

HERCEPTIN attaches to the HER2+ cancer cells and may signal the body's own immune system to destroy the cell.



**3. May work with chemotherapy**

Along with chemotherapy (paclitaxel), HERCEPTIN may work to destroy HER2+ cancer cells.

*Diagram courtesy GeneTech, inc.*

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