UK Libel Law: Suppressing Science?
Jenny Molloy

An increasing opposition movement to current UK libel law is building from many quarters, not least the scientific community. While libel law exists to prevent reputations in the UK being wrongly defamed, some recent cases have centred around claims made by science writers, doctors and scientists regarding the efficacy of medical treatments and the conduct of clinical trials.

Possibly the most high profile case has been that led by the British Chiropractic Association against journalist Simon Singh, over an article in The Guardian newspaper in which he described chiropractic treatment of illnesses such as asthma and colic with spinal manipulation as ‘bogus’ and based on insufficient evidence. Following a High Court appearance, Justice Eady ruled that Singh had implied that the BCA were knowingly dishonest, a decision that Singh appealed [1].

Further cases, which are in some ways more worrying, have involved a radiologist, sued by GE Healthcare who claim he accused them of suppressing information about an injectable contrast agent, which, he claimed at a conference, had caused side effects in his patients [2]. Another medical doctor, Dr Peter Wilmshurst, was sued by a heart implant manufacturer, after giving an interview at a conference in which he made some critical comments about data resulting from research on the implant [3].

In UK libel law, cases are cheap to bring to court and expensive to defend, with the onus firmly on the defendant to prove that their statement or claim was accurate. Cases are readily accepted even with minimal links to the UK itself [4]. The case against Wilmshurst was brought by a US company regarding a report in a US magazine about comments at a US medical conference. Several columnists have commented on the chilling threat and risk of libel cases, which causes writers to water down articles or publishers to avoid printing critical material [5].

This climate of caution and fear is due to the hugely expensive cost of defending a libel claim in the UK; a staggering 140 times the cost of an average case on the Continent [6]. For many defendants this is too high a price to pay. A libel case against science author Ben Goldacre, which he eventually won, cost The Guardian over £500,000 to defend [7]. It comes as no surprise that some American publications are considering restricting access from the UK, and the US congress are passing laws to prevent US citizens being sued for libel in British courts [4].

While the right of individuals and organisations to defend their reputations against dishonest claims is vital, it should not impede frank and critical discussion of scientific methods and claims, nor be nearly impossible to defend. As Dr Wilmshurst states: “There is a fundamental principle of science at stake here. People have to be free to challenge research.” [8]. Change is on the horizon, but despite pressure from groups such as Sense About Science, thousands of petition signatures [9], and ongoing reviews by the UK government, the slow process of law reform may leave scientists and academic critics vulnerable for some time to come. Let us hope that authors and scientific publications are willing to stand up for free speech, even in the face of legal threats and an unfair financial cost for defending that right.

People have to be free to challenge research

References:

Jenny Molloy is a third year studying Zoology at Corpus Christi College. She was formerly President of The Triple Helix Cambridge.
UK Science: How do you justify “Blue Sky” research?

Adam Esmail

If you are a Physics student and have been interested in research as a career, then you would have been gravely disappointed at the funding cuts that the Science and Technologies Facilities Council (STFC) have introduced. Studentships and professorships in Physics and Astronomy will be cut by 25 percent and grants will be cut by 10 percent [1]. Funding will be withdrawn from over 25 international projects, which include ALICE - the detector at CERN), the Cassini-Huygens mission studying Saturn and the UK Neutrino factory - a planned particle accelerator that could help physicists understand the nature of one of the most mysterious particles [2]. The total reduction in research and development (R&D) in particle physics, nuclear physics, astronomy and space exploration is £115 million over five years. These savings will clear the £40 million deficit in its current budget and will help financial stability in the future [1].

Naturally, if science funding has to be cut due to such difficult economic circumstances, then the last area of research to face such cuts would be those that seem to have an impact on overall society, such as stem cell research or renewable energy. Reducing funding from curiosity-led - or “blue sky” - research, such as High Energy Physics and Astronomy sounds like the most logical option.

This is what the British Government decided and the STFC approved. Lord Drayson, the Science and Innovation Minister, said that the cuts demonstrated that there were “real tensions” in having large international projects under a single research council, leading to “grants being squeezed by increases in costs of the large international projects which are not solely within their control” [3]. Many scientists have shown their disapproval at the new funding scheme: David Evans, head of the ALICE research group at Birmingham University, said that the project was “relatively inexpensive” at £500,000 per year and called the decision “crazy” seeing that the experiment is already built [3]. William Gelletly, a nuclear physicist from the University of Surrey, has commented on the fact that nuclear physics will face a 50 percent reduction over the five years, compared with particle physics and astronomy which are seeing smaller cuts of 5% and 10% respectively. Gelletly has said that his fields “is not well known in the STFC” and that the STFC needs urgent reform [3].

But how do physicists and astronomers justify to the research councils that using public money to fund such large projects is actually worthwhile for the future? Michael Sterling, chair of the STFC, has said that “tough choices” had to be made and the decision has not been taken lightly. The £2.4 billion spending plan still includes other major projects such as the three other LHC detectors and the LIGO Dark Matter Research Labs [1,2]. Yet, there is a feeling among the scientific community that pulling projects will result in the UK lacking in influence in science internationally and more studentships and technological discoveries would be made abroad [4]. Scientists should challenge the Government in their commitment in funding scientific research. For example, Professor Brian Cox, fellow of the University of Manchester, has used his Twitter feed to engage a debate on the issue. He firmly believes that the Government have failed to support University research and scientific development and that grants to international projects should be decided by a specialist body alternative to the STFC [5].

Drayson said he will work with Sterling to find a better resolution in February 2010 [3]. Hopefully by then, research fellows and other prominent scientists will have convinced politicians that it is necessary to fund research and development sufficiently enough for the UK to remain influential in the blue sky areas of research and to provide enough studentships and research grants to do so.

Adam Esmail is a second year studying Physical Natural Sciences at Fitzwilliam College. He is currently the Managing Editor of The Triple Helix Cambridge.

References:

© 2010, The Triple Helix, Inc. All rights reserved.
If you were offered a pill that would improve memory and concentration, would you take it? If the drug had no adverse side effects, then the discussion becomes an argument of fairness: would using the drug in order to outperform others be considered cheating? When Major League Baseball outfielder Barry Bonds broke the home run record, many critics suggested that an asterisk be placed next to the new record indicating that Bonds had taken performance-enhancing drugs. Would people suggest placing asterisks next to Nobel Prize winners’ names to indicate the use of drugs that enhance cognitive abilities? Although the fairness of using of cognition-enhancing drugs for nonmedical purposes is suspect, there is no doubt that use of these drugs is rising. To ensure that these drugs are safe for consumption, regulation must be implemented.

Nootropics are drugs that enhance cognition, meaning the brain processes that underlie mental activity such as attention, perception, learning, memory, language, planning and decision-making [1]. For people who suffer from neurological and psychiatric disorders, nootropics can improve quality of life. However, according to a report by the Academy of Medical Sciences, non-prescription use of nootropics by healthy people is becoming increasingly widespread [1]. Off-label usage is particularly rampant in academic circles, where selective pressure for high performance is causing some to seek a competitive edge [2]. According to an informal survey conducted by Nature on its readers, one in five scientists and other professionals—out of 1,400 surveyed—admit to using drugs such as methylphenidates (Ritalin or Concerta), Modafinil (Provigil), and beta-blockers to improve their performance at work [3]. According to the Nature survey, the two most commonly used nootropics in academia are methylphenidates and Modafinil. These drugs were developed by pharmaceutical companies and certified by the FDA to treat symptoms of attention-deficit hyperactivity disorder and sleep disorders, respectively. Methylphenidates such as Ritalin are amphetamine-like drugs that improve attentiveness and focus; Modafinil is a popular drug reputed to offer similar benefits without the undesirable side effects, such as needing to make up for lost sleep in “sleep rebound” or developing tolerance for the drug [4]. According to several studies, Modafinil was shown to reduce fatigue while improving motivation, reaction time, and vigilance [5, 6]. These observed benefits translate to increased productivity and more time that can be spent in the laboratory or cramming for exams. While Modafinil is approved to treat narcolepsy and other sleep disorders, Cephalon—the pharmaceutical company that markets Modafinil—reports that as much as 90 percent of its sales come from people who are using it “off-label” to stay awake for long stretches of time [7].

Many people use Modafinil to enhance cognition and wakefulness, but is this a potentially harmful misuse of an otherwise beneficial drug? What remains unclear is the definition of “abuse” in this context. For example, caffeine has been shown to provide temporary improvements in vigilance, learning, memory, and mood [8]. Caffeine is used worldwide to increase productivity because it staves off sleep. Despite
the benefits that caffeine confers, most people would not equate caffeine with other performance enhancing drugs such as steroids.

As brain-boosting drugs become more sophisticated, however, when do we declare that a substance has entered the domain of cognitive steroids? Not surprisingly, there are already people in the sports industry who disapprove of wakefulness- and concentration-boosting drugs. In 2004, the World Anti-Doping Agency added Modafinil to its list of prohibited drugs [9]. If a sports watchdog organization deems Modafinil unethical in athletic settings, should it also be unethical in academic settings? Increased use of nootropics in general could raise the standard for “normal” academic performance and, as a result, lead to an “achievement gap” between those who can obtain these medications and those who cannot. Because so many cannot afford or access the drugs, using nootropics to gain a competitive advantage is an inherently unfair practice.

With increased use lies the possibility of developing a severe psychological dependence on these drugs. For example, students may begin to believe that the only way they can maximize their academic performance is by taking daily doses of a nootropic. They may become reluctant to stop taking the drug for fear of losing their perceived gain in intellectual function. Here, the use of cognitive enhancers poses not only an ethical problem but also a practical one. Using drugs to boost one’s productivity may prove useful in the short run, but if one becomes dependent on the drug, then both the financial burden of continual self-medication as well as the psychological dependence may not be worth the short-term gain.

Psychological dependence at the individual level can also lead to dependence at the societal level. In a pharmaceutical race to become the best and brightest, everyone may become pressured into consuming nootropics. Workers who see their colleagues taking nootropic pills may feel compelled to take these drugs so they do not lag behind in productivity. Parents may also feel that their children will be at a disadvantage if they are not taking cognition-enhancing drugs. Although the long-term effects of methylphenidates on children are not well-documented, many researchers agree that methylphenidates do have long-term consequences on normal-functioning brains [10, 11, 12].

Due to the possibility that nootropics can harm young and developing brains, protective measures should be taken to prevent the unnecessary medicating of children. According to an article by Mark Henderson, science editor of The Times, “more formal laws may be required to prevent coercive use of such drugs… by parents or teachers who want their children to perform better at school” [13]. But how the government should enforce such laws remains unclear.

While no student, physician, or scientist should require an exogenous substance for his or her mental creativity and performance on the job, there will undoubtedly be people who do use nootropics regularly to boost their cognitive function. Therefore, nootropics should be regulated like any other medicinal drug in order to lessen the likelihood of abuse and harm.

Currently, drugs are developed and labeled for a specific disorder, and non-prescription usage goes largely unchecked [14]. The current “wink and nod” acceptance of off-label usage by the general public is unwise, as it provides little opportunity to assess risks. Right now, “we simply do not know what the long-term effect of the use of such drugs in healthy populations will be,” a British Medical Association report concludes [15].

The risks are not limited to chemical toxicity; there may be secondary hazards associated with nootropics’ intended purpose. For example, drugs that increase wakefulness sap necessary hours of sleep from their users, leading to disorientation, impaired judgment, and increased risk-taking that result from prolonged insomnia [16]. Such drugs make users believe that they need less sleep, but in reality people still need seven to nine hours of sleep every day, as recommended by the National Sleep Foundation [17]. Despite the urgent need for testing and risk assessment, it is possible that regulation of nootropics may not be implemented until a sleep-deprivation-induced accident, whether behind the wheel or on the operating table, occurs. A much healthier approach would be to accept the fact that cognitive enhancers might one day be widely used, determine which age groups
to thoroughly assess effects and side-effects, and then use these results to label drugs that are offered for public consumption. In short, nootropics should be explicitly labeled as cognition-enhancers and subject to rigorous testing as well any other FDA-regulated drug.

Of course, pharmaceutical companies have already picked up on the demand for nootropics. There are certainly potential profits in repackaging certain drugs so that they are marketed as cognition enhancers. However, before doing so, they must again go through testing to earn the FDA seal of approval. Many pharmaceutical companies are currently conducting research on the cognition-enhancing properties of drugs that are approved for other purposes.

Cephalon recently sponsored a study that assesses the memory-enhancing properties of its product Modafinil. Amy DiCamillo, who heads the Cephalon-sponsored study, presented a poster on this topic at the 2008 Society for Neuroscience annual meeting [18]. Her study specifically evaluated whether Modafinil improves short-term and working memory in rats.

In addition to recycling old drugs, pharmaceutical companies are also beginning to investigate and develop novel compounds that will enhance cognition. Abbott Laboratories sponsored an animal-based study on the effects of a novel H3 receptor agonist on learning and memory, and it will not be long before testing moves from animal studies to human-based clinical trials [19]. Eventually, drugs whose primary purpose is cognitive enhancement may be manufactured for public consumption.

From an ethical standpoint, the use of nootropics for gaining an academic advantage is inherently unfair. How-ever, there will always be people who have no qualms about taking nootropics to get ahead. Because a market for these drugs exists, the same kind of FDA regulation that is applied to all other medications should be applied to nootropics as well. Regulation places responsibility on drug companies so that their products are rigorously tested to protect the public’s health. This way, nootropic usage can become mainstream in a safe and regulated manner. The development of cognition-enhancing pharmaceuticals is moving forward at an incredible pace—yet ethics still has to catch up and define the boundaries between “fair” and “unfair.” Despite the opposition to tampering with the brain in a way that confers unnecessary advantages, nootropics are here to stay.

Theresa Lii is an undergraduate student at Brown University.

References:

© 2010, The Triple Helix, Inc. All rights reserved.
Thailand’s 100 percent condom campaign has been heralded as a major success in achieving a lasting reduction in HIV infection rates across the country [1]. The government’s prevention program began in 1991, targeting schools, the media, the workplace and brothels, which were believed to be at the epicenter of the epidemic. Overall HIV prevalence peaked in 1995 at over two percent but has since decreased to roughly 1.4 percent—around 610,000 people.

In the midst of the widespread success of the Thai government’s 100 percent condom campaign, an alarming trend has emerged. HIV prevalence has increased among pregnant women, who are the only demographic to experience a rise in infection since the campaign began. Pregnant women’s rates of infection jumped significantly from 0.2 percent in 1990 to 1.2 percent in 2005 [2]. Unfortunately, the increased prevalence of HIV among pregnant women in Thailand is consistent with a worldwide trend. Globally, young women are 1.6 times more likely to have HIV/AIDS than young men [3]. In South Asia, the risk factors associated with HIV/AIDS include poverty, early marriage, trafficking, sex work, migration, gender discrimination, and violence [2]. In addition to these factors, studies show that women are at risk for HIV because of the sexual behavior of their partners [4]. One study in particular noted that HIV prevalence in pregnant women increased consistently in Bangkok from 1991 to 1996, and the only identifiable risk factor for 52 percent of women was sex with their current partners [3]. In other words, it seems that husbands are infecting their wives after contracting HIV themselves from premarital or extramarital relationships.

The burden of HIV infection for pregnant and married women presents a major challenge as far as interventions are concerned. Experts fear that the 100 percent condom campaign, which so successfully reduced HIV prevalence in the general population and among sex workers in the 1990s, will not be as effective in preventing infection among married couples, who are less likely to use condoms during sex [6]. For those working to stop the HIV epidemic in Thailand, the question has become, how can married and pregnant women—those whose infection rates are currently on the rise—be the target of an HIV prevention campaign? After all, the only “risky behavior” that these women exhibit is unprotected marital sex—an all-around conventional, ostensibly safe act.

It would seem that the most logical way to prevent pregnant women from contracting HIV would be to focus on the behavior of their male partners—namely, to discourage men from engaging in extramarital affairs, thereby lessening the risk of HIV transmission from mistress to husband to wife. However, the Thai government has traditionally avoided any public health campaigns that target male behavior and has instead redirected these efforts to exert pressure on women in increasingly innovative and insidious ways.

In the late 1980s, when Thailand’s HIV outbreak began, the commercial sex industry was identified at the core of the epidemic. The 100 percent condom campaign specifically targeted female commercial sex workers, many of whom worked in bars that were known to double as brothels, despite the fact that prostitution is technically illegal in Thailand. The HIV prevalence among these “bar girls” peaked in some areas, such as Chiang Mai, at a shockingly high twenty-five percent. As a result, government officials distributed a supply of free condoms to the bar owners, insisting that all “bar girls” use them during sex acts performed with male clients. In order to enforce this procedure, undercover government officials went to brothels posing as clients. According to a Joint Report by various UN agencies, the World Health Organization (WHO), and the World Bank, the focus on brothels as hotspots of HIV infection “has been highly successful” and “Reported condom use in brothels increased from only 14 percent of sex acts in 1989 to over 90 percent by 1994” [1].

The Thai government’s focus on brothels as hotspots of HIV infection effectively decreased HIV prevalence, but...
testing to be a violation of global human rights. Additionally, this type of testing and coerced partner notification may lead to both physical and emotional domestic violence (Phanuphak P, Director, Thai Red Cross AIDS Research Center, interview, 2008 June).

Like female commercial sex workers, pregnant women carry an inequitably heavy burden in the fight against HIV. When hospitals administer involuntary HIV tests to pregnant women, they strip pregnant women of their right to confidentiality, while sparing men from shared responsibility in HIV prevention.

The effects of globalization in modern-day Thailand are promising in terms of the HIV/AIDS epidemic. Young Thai men are increasingly monogamous and are less likely to visit commercial sex workers than their fathers and grandfathers were. Therefore, their sexual networks are less exposed to the risk of HIV transmission [6]. Also, young women in Thailand are more likely to attend school than they were twenty years ago. They enjoy the educational opportunity that permits increased financial and social autonomy and affords them more power to avoid the poverty and dependence that can lead to high-risk sexual behavior and increased risk of HIV infection.

Increased prevalence of HIV in pregnant women. Reproduced from [8]

In order to address the disturbing reality of increasing infection rates among pregnant women and to alleviate the excessive burden that women bear with respect to HIV, the Thai government can support equitable policies consistent with these globalization trends. By instituting voluntary HIV testing and counseling for both partners during pregnancy, supporting domestic caregivers, requiring universal education for young people, and criminalizing violence against women, the Thai government can promote shared responsibility between men and women for HIV prevention. Also, by legalizing commercial sex work, the Thai government can ensure that female commercial sex workers have access to health care and other legal protections that allow them to work more safely.

When women and men share the burden of HIV, including prevention, testing, partner notification, care, and support, not only will women's infection rates decrease, but the HIV/AIDS epidemic will begin to lose its overall momentum. ■

Sarah Schoenbrun is an undergraduate student at Brown University.

References:
The advent of ecotourism in recent years has had a huge impact upon the economies of tropical nations as well as the mindsets of tourists [1]. At first glance, the idea of ecotourism seems to have no down side. The International Ecotourism Society (TIES) describes ecotourism as “responsible travel to natural areas that conserves the environment and improves the well-being of local people” [2]. In regards to the ecological aspect of this definition, ecotourism is often viewed as the green alternative to traditional travel, which is typically associated with pollution and habitat degradation [3].

The definition given by TIES is broad yet points ecotourism in a direction that is strikingly different from traditional tourism in its regard to the environment. Many ecotourism programs donate a portion of the cost of the trip to offset various unavoidable ecological costs. This is seen in the purchasing of carbon credits to offset the pollution of jet aircraft, or using tourists’ money to buy and preserve forest near the area that the tourists are exploring. Ecotourism at the core also involves practicing a low impact form of traveling that often does not allow for many of the comforts to which typical American tourists are accustomed. Ecotourists are focused on experiencing nature as it was before human development caused a drastic change to the environment of this planet. As such, for a tourist to truly qualify as eco-friendly, he or she must forgo comforts such as automobiles and indoor plumbing.

“Ecotourism is viewed as a green alternative.”

This is where ecotourism agencies may run into a situation that will set the principles of ecotourism against the desires of a mostly urban cliental desiring to experience nature. These tourists often have little knowledge of surviving in the wilderness where they will find the natural beauty they seek. This paradox has led to a new form of human development in the rain forests of Central America. Where the forests were once leveled to make way for cattle and crops, now they are being encroached upon by world class resorts that use the proximity of a tropical rain forest as an additional draw for clients. These resorts sometimes provide a large portion of the income for small native communities near rain forests that were once sustained by farming. As these programs grow and develop the areas around forests, the question is often posed: do ecotourism programs that lead to urbanization truly follow the requirement of TIES to “conserve the environment”?

This urbanization through ecotourism is displayed in the small town of Monteverde in the mountains of Costa Rica. This small community has grown at a tremendous rate over the past 15 years due mainly to the growth of a local ecotourism industry. The area that surrounds Monteverde is composed of a significant amount of primary tropical cloud forest, one of the rarest and most delicate ecosystems found in Central America [4]. As the levels of ecotourism increased in the area, there was a higher demand for paved roads and larger resorts to house the thousands of Ecotourists per month that would travel from around the world to simply walk through these forests.

While this growth did not clear large tracks of land as was done in the past, there was still a significant level of fractionization of the surrounding forests as well as a greatly increased number of private and industrial vehicle traffic. Forest fragments are formed when a portion of cleared area (usually a road) effectively separates one part of the forest from another. The continuity of tropical forest has been linked strongly to the maintenance of species richness and diversity [5].

A recent study conducted in the forests in and around Monteverde used the relationship between forest trees in fruit and their dispersers (e.g., birds, bats, other mammals) to gauge the impact of ecotourism driven urbanization upon forest health [6]. Symbiotic relationships such as this have been used previously as a gauge for the health of that particular portion of the ecosystem [7,8]. The study determined that, overall, the symbiotic relationship between trees and the birds and other animals that distribute their seeds is significantly and negatively affected in forest fragments that are not connected to a continuous forest [6]. In fact,
the percentage of fruit removed from trees in continuous forest was nearly double the amount removed in forest fragments that had been isolated by ecotourism growth. This disruption of an important trophic interaction may have a strong impact upon the stability of the forests that are being fragmented [1]. Because of the amazing levels of diversity and concentration of species in these tropical forests, much specialization has evolved. As relationships between species are disrupted, it is frighteningly easy for species to fall into extinction, further threatening the stability of the local ecosystem [9].

While this is only one example, it prompts important questions about the long term impact of ecotourism in tropical forests. The situation in Monteverde shows that even the supposedly “green alternative” to traditional tourism may still have a direct impact upon the health of the forests that are exposed to new tourists. It is important to realize that the modern way of life that developed nations are accustomed to over the past century is blatantly damaging to the ecosystem of these tropical forests. This is evident in many aspects of modern life, from driving automobiles to using artificially manufactured detergents to wash clothes. Once this recognition is made, it is essential to find a way to limit the impact of all human activity upon forests.

Several theories have been proposed to increase forest stability in the face of human interaction. One such theory proposes that greenways or forested corridors that connect forest fragments could be constructed to provide some connection between forest fragments and continuous forests [10]. While this has been implemented successfully to some extent in North America, the vast amount of species diversity and richness that is prevalent in Central America may not allow for such impressive results.

It is apparent that the only way to truly preserve the delicate tropical forests of Central America is to leave them alone entirely or experience them in the ways that humans would have thousands of years ago. While ecotourism provides a lower impact upon the environment than other forms of vacation, it does not solve the problem. This utterly unrealistic expectation of total human removal is rather representative of the dilemma facing conservationists around the world. It is a fact that humans have changed the face of the planet and will continue to change it in the future. In light of this, it is important to be realistic and realize that there is a certain level of environmental degradation that is inevitable [11].

With this in mind it is important to note that ecotourism and other “eco-friendly” pastimes bring attention to the issue of continuing human impact upon the environment. However, they do not provide a solution to the problem. As in Monteverde, ecotourism gone awry may even be contributing to the problem. As ecotourism grows, it is important for tourists and tourism providers to understand that no matter how lucrative it may become, the goal of ecotourism is not to make a profit, but conserve the environment and provide for the local people. It is this level of constant awareness that will allow ecotourism to do the most good, while keeping the environmental harm to a minimum.

Dominic Derenge is an undergraduate student at Arizona State University.

Can tourists really limit their impact on tropical forests? Reproduced from [14]

References:
The trade of wild primates, or bushmeat, for the purpose of consumption has increased exponentially over the last decade, most notably in Central and Western Africa. Close contact with these animals poses a threat to both human and primate health. This phenomenon has originated from deforestation by timber industries, easing access to natural habitats, as well as the growth of a large human population deficient in dietary protein [1]. Hunting as a traditional practice of subsistence has been replaced by a lucrative industry that is fueled by increasing demand from both domestic and international markets. From spotlight hunting for nocturnal creatures, to guns for long range attack, techniques have been developed to give the hunter an unprecedented advantage and to greatly improve yields and devastate the forests [1].

"The hunter [has] an unprecedented advantage."

With recent changes in environment and limited access to provisions, many new communities are turning to bushmeat as a last resort. For example, inhabitants in the vicinity of the coast have depended on successful fish harvests for employment and income, but facing low harvests has caused them to seek alternatives. The fish market in Western Africa is characterized by unpredictability, as the annual harvests have fluctuated from 230,000 to 480,000 tons in the past thirty years with as large as a 24% deviation between successive seasons [2]. Justin Brashares from The Berkeley Institute of the Environment examined thirty years of local fish market sales and pricing data from Ghana, finding a strong correlation between the fish supply and the consumption of bushmeat. The amount of fish per capita has decreased since 1970 despite the expanding harvests, due to a threefold increase in size. The annual bushmeat trade within the region of Ghana alone is estimated at 400,000 tons [2]. Still, the figures below illustrate the native preference for fish, as the hunting of bushmeat decreases when the fish supply is sufficient. Overall, there has been a 50% decline in fish biomass in the offshore waters surrounding the coast of Africa, and this decrease is proportionally met by an increase in mammal biomass consumed [2].

The most damaging consequences of these unsustainable activities include the loss of biodiversity in tropical hotspots, as well as the risk for viral transmission from wild primates to humans. Many tropical zones that are home to rich levels of biodiversity are the same regions with the highest human population growth rates, averaging 3.1% each year [3]. In the past, habitat destruction has been considered the leading cause of species extinction across all of the continents, as fragmented habitats failed to provide the resources necessary to support the contained species. Amidst the conflict in Africa, in particular, European powers and multinational companies have found it easy to take advantage of the cheap land, and continue to divide forests with their access roads and factories. While deforestation is still a serious problem, it was not until 2001 that the International Union for Conservation of Nature (IUCN) disclosed the severity of the impact of the bushmeat trade on extinction rates.

"In Asia, 71% of species are hunted unsustainably, and 68% in Africa."

The IUCN Red List of Threatened Animals has shown an increased danger for mammal populations, most significantly in the primate order. Their research has shown that in Asia, 71% of species are hunted unsustainably, 68% in Africa and 40% in Latin America [3]. And since 1970, the loss of biodiversity in tropical African regions has been quantified...
by the 76% decline in biomass of 41 mammal species [4]. Scientists argue that the world is currently experiencing the sixth mass extinction event in history, and these statistics support the hypothesis that wildlife populations are being decimated even faster than their habitat can be torn down.

Another problem that compromises the health of the African community is the increased human contact with primates, putting both groups at risk for the communication of new diseases. Empirical evidence has demonstrated a growing threat for new viruses to make the jump from simian to human, just as HIV resulted from the zoonosis of Simian Immunodeficiency Virus (SIV) from chimpanzees and sooty mangabeys to humans. In 2002, a random sample of 1,100 villagers in Cameroon were examined and ten of the subjects (1%) were found to have antibodies to Simian Foamy Virus (SFV), which was previously thought to only infect primates [5]. All of the infected subjects had either worked in the bushmeat market or had kept primates as pets. While SFV does not cause disease, these antibodies serve as a marker that transmission is possible, and even likely. Through habitat encroachment, humans are challenging the natural gap between man and primate, jeopardizing biodiversity and putting both groups at risk.

African communities are hesitant to accept these findings, as they claim that bushmeat has been a part of their diet for thousands of years, while the AIDS pandemic has only recently developed. In response to this defense, it has been determined that “contained exposure to small indigenous pockets of SIV” have occurred throughout this history, but spread has been prevented due to the historic isolation of villages [1]. Today the interactions between wilderness, rural, and urban locations facilitate the proliferation of an emerging infectious disease. Eighty percent of these EIDs can be attributed to human-primate contact, including the Ebola virus that began in Sub-Saharan Africa and spread to Indonesia and the Philippines [6].

While the bushmeat trade has been made illegal in most parts of Africa, the economic incentives of the multi-million dollar industry have taken priority over the observance of conservation and health policies. The international market plays a significant role in the demand for bushmeat, especially in ethnic open air markets and the exotic restaurant industry in big cities where customers are willing to pay elevated prices. Thousands of pounds of bushmeat are smuggled into the US each month, with an average of a few hundred pounds being confiscated through K9 teams and X-ray machines in customs each day [7]. In 2002, congress called for programs promoting internal awareness of this crisis as well as the instatement of strict trade barriers with Africa, with adverse publicity exposing the source of this exotic meat. However, the inhibition of the international market will not alone resolve the issues facing Africa, and solutions must be offered from within. Strategies to manage the domestic problems must offer alternative sources for income and meat consumption by exploiting indigenous resources, such as

© 2010, The Triple Helix, Inc. All rights reserved.
 Communities must also be educated about the damage they are inflicting on their forests, as well as on their health, so they may elect to change their eating habits and participate in recovery efforts.

Doctor Anthony Rose, founder of the Bushmeat Crisis Task Force in Washington D.C., has participated in on-site research at logging camps in Africa and has presented the steps that he took to help an ex-hunter in Cameroon, Joseph Melloh, transform a town’s business of bushmeat and logging into one of conservation and tourism. Two communities in the surrounding area worked together to care for the forest and invest in gorilla research, using this resource to generate a more consistent source of income without a loss to biodiversity [7]. Similarly, the Communal Areas Management Program for Indigenous Resources (CAMPFIRE) encourages the population of Zimbabwe to exploit its unproductive land by using their natural reservoir of elephants, buffalo, and lions to attract international trophy hunters. To ensure the safety of the animal populations, The Department of National Parks and Wildlife Management have set quotas on the sustainable harvest of elephants, a population that has recently doubled in size. In its 18 years of operation, the families participating in CAMPFIRE have increased their household income by 15-25% [8]. Still, this program is met with criticism by some Western NGOs, but it is a safe and dependable alternative to aggressive hunting and unhealthy consumption of wild animals.

Curtailing the increased volume of bushmeat trade is vital to both wildlife and human populations around the world. Efforts to halt the damage being performed depend on the support from developed countries, first in the rejection of bushmeat within their borders and then in the search for sustainable alternatives for protein and income. Successful policies must unite the traditional values of the villages and the modern needs of the community. If this market can be controlled and appropriate dietary substitutes can be found, these tropical hotspots may avoid further extinctions and villages may still escape the transmission of deadly viruses, such as HIV.

Claire Daniels is an undergraduate student at University of California, San Diego.

References:
[12] Baby Cherry Crowned Mangabey by Keven Law. Flickr under CC-BY-SA. Available from: http://www.flickr.com/photos/66164549@N00/2675015360/
How do we get sick? Touching an infected door handle, walking through tick-infested areas, and kissing a sick person can spread viruses and bacteria, which use their own DNA or RNA to multiply within the body and cause infectious diseases. However, recent research has revealed a completely different type of disease transmission mechanism. Certain diseases, termed transmissible spongiform encephalopathies (TSEs), spread via a tiny molecular agent that rapidly causes brain tissue wasting and death. This agent is the prion, a protein without nucleic acids that replicates by conferring structural changes onto host tissue [1,2]. Moreover, its unique replication process may provide shocking clues about the nature of the brain and the function of human memory.

In the 1960s, in the wake of the DNA revolution led by Francis Crick—a co-discoverer of DNA's molecular structure—many scientists claimed that the entire phenotype of a living being could be traced to the double helix. Information, they believed, was transcribed from DNA to RNA and translated into proteins, the molecules responsible for the characteristics of living things. Additionally, most scientists believed that the active form of a protein was wholly and exclusively dependent on its primary structure, that is, the precise chain of amino acids formed in translation. As Crick stated regarding the irreversibility of translation, “Nature could not proceed in another way” [1]. This became the “Central Dogma” of biology. Since then, however, much research on TSEs has disproven Crick’s conjecture: infectious proteins, too, can be self-replicating [1,2].

By the early 20th century, scrapie, a neurodegenerative disease in sheep marked by the infected animals’ devastating habit of wool scraping, threatened to ruin European farmers. This prompted scientific inquiry into the epidemic. Initial hypotheses implicated a diverse range of molecules, from polysaccharides and lipids to virus-like agents. However, as the incubation time of TSEs is frequently measured in years [3], a viral mode of infection was virtually ruled out [1]. But, hindered by their complete faith in the Central Dogma, scientists had difficulty considering the notion of a protein-only pathway. The mathematician J. S. Griffith proposed three potential mechanisms for scrapie in a 1967 paper, adding that “there is no reason to fear that the existence of a protein agent would cause the whole theoretical structure of molecular biology to come tumbling down” [4]. Still, it was not until 1982 that Griffith’s ideas were seriously considered; in the interim, proposed mechanisms of replication—viroids, DNA complexes, membranes—were all associated with nucleic acids in one way or another, consistent with Crick’s Dogma [1].

In 1982, Stanley Prusiner published the first of many papers that would revolutionize the field and later earn him a Nobel Prize [2]. Affirming that scrapie was not caused by a known agent, he named the structure “prion,” denoting “proteinaceous infectious particle.” Nevertheless, Prusiner was not immediately certain whether or not the prion contained a nucleic acid; considering a self-replicating protein, he believed, was “heretical” [1]. Fortunately, for Prusiner, “heretical” did not mean “impossible.” Two years later, he published theories of two potential methods of prion replication. The first of his propositions was that the prion protein, PrP, stimulated DNA transcription, causing further PrP production. Prusiner’s second idea stipulated that the conformation of infectious PrP served as a template for the formation of new PrP molecules—without any involvement of nucleic acids [5]. Incidentally, these hypotheses mirrored two of the mechanisms that Griffith proposed seventeen years earlier [4].

Much evidence from PrP studies from the 1980s favored the latter of Prusiner’s hypotheses. Indeed, PrP-coding mRNA was found to exist in infected mice in equal quantities as in uninfected mice, revealing that PrP was a naturally-found protein in mammals [5]. Furthermore, animals that lacked the normal PrP protein (PrPC) were unaffected by the “infectious” form of the protein, PrPsc [6,7]. Examining the two forms of the protein revealed no differences in primary structure, suggesting that the only difference was conformational [8]. Together, this evidence formed the basis of the modern hypothesis of the prion. PrPsc, an insoluble and protease-resistant conformation of the prion protein, replicates by converting naturally occurring PrPC molecules [7]. As such, prions present a major challenge to
the Central Dogma as it was understood by Crick and his colleagues [2].

The structure of the prion protein has been conserved throughout evolution, allowing TSEs to occasionally cross between different species [7]. Such was the case when bovine spongiform encephalopathy (BSE) sickened upwards of 150 people in Britain who had consumed prion-infected beef [9]. Cases of the human analogue of BSE, called Creutzfeldt-Jakob disease (CJD), are still reported on a sporadic basis. Due to its long incubation time and the possibility of transmission via blood transfusion, future epidemics of CJD still threaten Western Europe and North America [10].

Still, fewer than two percent of all CJD cases are acquired. The vast majority, eighty-five to ninety percent, of CJD cases are spontaneous (sCJD). These are often accompanied by a homozygous valine or methionine codon on chromosome 20 [11]. Symptoms of TSEs vary depending on the specific PrP strain of the organism [7]. Likewise, each subtype of PrPSc carries slight differences in symptoms or timeframe of disease, although most result in rapidly progressing dementia and death within months of onset. One extremely rare form of CJD, called VV1 (valine-valine), is distinguished by the gradual onset of dementia and atypical brain scan presentations [11]. Additionally, vCJD (variant CJD, the type associated with BSE transmission) has been shown to uniquely induce abnormal excitation in the hippocampus [12]. These examples illustrate that even within a single animal species, variations in prion structure can account for clinically dissimilar cases.

Prions have also been linked to Alzheimer’s disease. In both Alzheimer’s and CJD, insoluble amyloid aggregates gradually destroy brain tissue. Although some correlation between the development of Alzheimer’s and CJD may be attributed to age [13], studies have shown a link between the prion polymorphism (homozygosity for methionine) and Alzheimer’s [14]. Experiments have shown that levels of PrPc tend to be inversely correlated with those of amyloid peptides, and that PrP-null mice exhibit deficits in spatial learning and a generally decreased resistance to stress [15]. PrPSc infection in mice also dramatically increases amyloid formation [16]. Consequently, Baier et al. hypothesize that CJD causes an increase in amyloid plaques due to a loss of function of the prion protein, suggesting that the cellular prion protein may reduce amyloid buildup and combat Alzheimer’s [6]. However, a more recent study surprisingly indicated just the opposite, showing that PrPc binds to an amyloid intermediate and thus obstructs synapse strengthening and memory formation. In mice lacking PrPc, as well as the sponge-like lesions characteristic of CJD. Reproduced from [25]
those given an anti-PrP<sup>C</sup> antibody, these interactions do not occur [17,18]. Such contradictory findings about the role of the prion protein form the crux of the current debate. According to a leading researcher, “The fact that prions are sometimes beneficial and sometimes detrimental...is at the heart of their biology — ... they present a sort of betting strategy, where in some circumstances it’s good to be in the prion state and in some cases it’s not” [19]. Thus, although the link between PrP<sup>C</sup> and Alzheimer’s is uncertain, prions present a significant potential for understanding, and eventually treating, Alzheimer’s and other neurological disorders [18].

Following evidence that prions can be beneficial in the struggle against Alzheimer’s, some research has shifted away from examining TSEs and towards understanding the normal function of PrP<sup>C</sup>. Curiously, PrP in the mammalian brain is concentrated at synapses and plays a role in the homeostasis of copper [20]. Since anomalous copper concentrations have been associated with Alzheimer’s and Parkinson’s, and appear to block synaptic strengthening in the rat hippocampus [21], a memory-related function is clearly suggested. PrP<sup>C</sup> appears to moderate activity of the NMDA receptor, which allows Ca<sup>2+</sup> entry into neurons and is thought to play a role in memory [15,22]. Evidence that memory mechanisms make use of prions came with structural studies of CPEB, a protein that influences long-term memory by inducing mRNA transcription and synaptic strengthening. One of the conformations of this protein is structurally similar to PrP, in addition to exhibiting an environment-dependent form of replication identical to that in prions (as opposed to Mendelian heritability) [6]. Because of this evidence, some have suggested that prion conformational flips may be the “switch” governing memory formation [23], a very intriguing conjecture.

In biology, a practical way to study the function of a structure—a gene, an ion channel, an organ—is to deactivate it. In this case, it appears that nature’s random mutations provided scientists with just this type of experiment. Not three decades have passed since Prusiner named this mysterious infectious particle, yet in this short time span, the prion has acquired the potential to revolutionize molecular biology. In 1982, prions were considered just infectious particles in isolated populations; today, they are not only key molecules in mental illnesses but also candidates for significant and surprising roles in the function of the human brain and the mechanisms of memory.

**David Koren is an undergraduate student at Brown University.**

---

**References:**


Albert Mitchell, a cook at Fort Riley’s Camp Funston in America, felt unwell on the night of March 10 1918 due to a bad headache, a runny nose, and a sore throat. The next morning, he was simply too sick to cook breakfast for the men. The doctor informed him that plenty of bed rest was all that he needed. The symptoms seemed to be those of a particularly bad cold. By lunchtime, 107 soldiers were sick, and by the end of the week the disease had immobilized 522 men. The camp set up emergency hospitalization tents but was simply unequipped to deal with either the volume or the rate of infection. On March 30, the chief medical officer sent a frantic letter to the army Surgeon General begging for aid [1]. The disease in question was a new strain of influenza. The situation did not improve. An old wives tale spread around the country that told of three women who sat down to play bridge. By morning, all were dead. Funerals lasted no more than fifteen minutes as the work of morticians and gravediggers became lucrative [2]. Although an extreme portrayal of the virus, the tale highlights the unprecedented virulence of the 1918 H1N1 strain of influenza. Given the speed with which it swept through the human population, what technological and immunological responses saved the human population from annihilation? And with the developments of the 20th century, will the human population be better equipped to deal with new forms of the influenza virus?

A first wave of the pandemic struck in the late spring of 1918, followed by a much stronger surge in the autumn [3]. Descriptions of symptoms were consistent with those of normal flu, including dizziness, weakness, and joint pain followed soon thereafter by sneezing and then by vomiting, diarrhoea, constipation, and “mental psychoses” [4]. Perhaps most startling to clinicians was the virus’s predilection for young and healthy individuals. Given the emphasis of medicine as a diagnostic science, treatment was focused primarily on pain management—aspirin, epinephrine, and salicin—along with plenty of bed rest [5]. Although discussion was circulating amongst academics, the use of nascent immunological techniques was limited. O’Malley and Hartmen, two practicing scientists, did suggest the use of the serum (the liquid component of clotted blood that contains antibodies) from convalescing patients in order to protect the general population [6]. Another team of scientists, Ross and Hund, proposed that the only effective solution would be to “…neutralize or render the intoxicant inert.” [7] The concept of neutralising a “toxin” represented the highest level of scientific thinking available at the time. Although they did not succeed with their proposed serum, within two years, the population began to exhibit a potent immune response to the virus, resulting in a much milder annual seasonal flu virus based upon the H1N1 strain.

Seasonal influenza and the available resources to stave off infection have undergone an elaborate dance of genetic adaptation as each attempts to stay one turn ahead of the other. Medical advances, improved public health, and the introduction of drugs have lessened the effects of flu with each subsequent pandemic. Pharmaceutical companies have flooded the market both as a means to manage pain and to provide antivirals. Antihistamines, combination drugs, and a variety of folk remedies all profess to provide a panacea for seasonal flu. Recent studies have shown that the most commercially successful antivirus drug, Tamiflu, has now lost effectiveness against 99.6% of all strains of influenza [8]. Unlike pandemic influenzas, these seasonal bugs affect high-risk groups such as pregnant women, elderly persons, and those individuals with compromised immune systems. Changes in seasonal flu viruses are caused by minimal mutations, termed “genetic drift.” [9] The potency of these viruses has decreased over the years not only as a result of increased public health awareness but also due to the evolutionary advantage of less virulent strains. In other words, viruses with the greatest transmissibility, (i.e. those that are pathogenic but do not kill their hosts as readily), are more likely to survive within the human population.

By contrast, pandemic successors of the 1918 influenza virus are noted for their high levels of mutability. Unlike with seasonal flu viruses, pandemic successors are those viruses that have undergone major changes in their genome, otherwise known as genetic “shift” [9]. These “shifts” occur in the genes that code for the surface proteins neuraminidase (NA) and hemagglutinin (HA) (although the term global pandemic is usually reserved for shifts in the HA protein) [10]. The mechanisms by which the flu virus jumps between species are unknown, but the variation in the DNA sequences encoding for the two surface proteins NA and HA suggest a means by which flu has continued to thwart the immunity of the human population for over 90 years. With over 144 possible combinations, genomic reassortment and genetic
drift have clearly facilitated the adaptation of the viral genome [10]. In addition, the ability of the influenza virus to move in and out of animal populations (aviary and mammalian) has led to the three-hybrid form of flu known colloquially as “swine flu.” [10]

The 2009 swine flu virus first garnered attention in Mexico City in the spring of 2009, although it is not entirely clear where the flu originated [11]. The genetic similarity to a strain of influenza commonly found in pigs led to the colloquial nomenclature. Individuals over the age of 60 have been surprisingly resistant to the bug with young, healthy adults likely to be affected. In addition, while those in high-risk groups (such as pregnant women and those with pre-existing conditions) have indeed been hit the hardest with the effects of the virus, many young, healthy individuals with no pre-existing conditions have been severely compromised [12]. This contrasts starkly with seasonal flu, which tends to affect the very elderly or the very young. Given the affinity of swine flu for the young and the healthy, the risk for mutation or increased pathogenesis has led to heightened wariness amongst health authorities and world leaders. Treatment of influenza falls into three categories: antivirals, vaccines, and antibiotics for pneumonia. The last of these treatments is not in as precarious a situation as the first two. As regards current flu antivirals, “swine flu” has shown no resistance whatsoever to most of these drugs. Unfortunately, these antivirals have also conferred limited to no protection upon the human population. One exception is the drug commonly known as Tamiflu, but in Wales at least, five cases of person-to-person transmission of a Tamiflu-resistant strain of the pandemic virus have emerged [13]. In the United States and in the UK, another emergency antiviral named peramivir has emerged. Peramivir acts in a more potent manner than Tamiflu, but it should be noted that this is not a vaccine - a common misinterpretation. It has instead been seen to be effective in some severe cases of swine flu [14,15].

The risk of mutation given such factors as ease of movement and increased size in the human population is significant. As a result, there has been much emphasis on vaccine development—both in the media and at a national level—to stem the spread. Although a novel vaccine has indeed been produced, its effectiveness has yet to be tested on the wider population, and initial results in the 2009-2010 flu season have shown severe side effects [16]. Nevertheless, the current flu is mild enough in most cases that bed rest, fluids, and modern health and sanitation practices have been able to certainly contain the mortality rate to well below the 2-5% exhibited in the 1918 flu pandemic [1,17].

“Swine flu” has fully demonstrated its ability to affect the human population in the short term as it moved from Mexico to the United States and then spread globally, targeting all age and risk groups. As has been shown by the 1918 flu pandemic, for “swine flu” to optimise its potency, it must adapt a mechanism of moving in and out of the human population to be both transmissible but mild. It is this evolutionary preference for a balanced tug of war
A transmission electron micrograph of a swine flu virus. Reproduced from [21]

References:

match that will perhaps lead to a continued and elaborate dance between the H1N1 influenza virus and the drugs developed to combat it. Humans will once again have to evolve both the technology and immunological responses to the new wave of “swine flu” in preparation for a potentially severe, clinically resistant form of the virus. This necessity is embodied in the last December 1918 edition of the Journal of the American Medical Association, which called for the global community to turn away from the carnage of World War I and instead devote itself “to combating the greatest enemy of all - infectious disease.”

Kate Wiles is a first year studying Natural Sciences at Trinity College.
Although science has always been performed by a very small subsection of the public, science communication with the ‘educated layman’ has a well-established history [1]. Its importance is outlined by Thomas and Durant in nine key benefits [2]. These include; benefits to science, as the taxpayer often funds scientific research; benefits to democratic governments and national economies; and benefits to the individual, as some sense of scientific process is necessary in the modern technological world. Indeed, physics education benefits “all sections of society… the specialist… the skilled worker… the citizen … [and] the individual” [3].

Science communication takes many different forms. The formal education of science is a mandatory part of the National Curriculum in the UK until the age of 16. Television has proven itself a powerful vehicle for presenting the public with science in an intriguing, sensationalist fashion, whilst scientific journals present cutting edge research more formally and ‘popular science’ books and magazines seek to make scientific theories technically accessible and interesting to all. Many of these have been written on topics such as Einstein, specifically his work in relativity, and more recent theories like string theory. Famous scientists, notably Feynman and Hawking, have themselves written books for the layman. There have been best-selling books targeted at a wider audience, which aim to install a basic scientific literacy in the reader. These include A Brief History of Time, A Short History of Nearly Everything, and recently, The Trouble in the reader; perhaps the most famous example of this is in The Ascent of Man, Bronowski standing in the pools of water at Auschwitz, imploring that we “must cure ourselves of the itch for absolute knowledge and power”. The audience is no longer objective about the subject and its implications.

Television also often adopts a sensationalist approach to science communication. As the number of television sets in the UK has risen to over 60 million today, with the average daily viewing time of 3:36 hours, inaccessibility has become less of a problem for this powerful vehicle for dissemination of scientific ideas [6].

In fact, science documentaries have a long-standing history on television. In 1952, Science Review became the first of this kind and was watched by over 10% of the population. The Sky at Night was first presented in 1957 by Patrick Moore and still takes the same format today. It is now Britain’s longest running programme and appears to have conquered one of the main issues facing the science communicator: the interest of the audience. Not only does popular science need to be at a technical level that is accessible to the public, it also needs to excite their curiosity. Moore attributes the success of The Sky at Night to the fact that “astronomy is a fascinating subject. You look up… you can’t help getting interested and it’s there” [7]. Given also the amount of competition in the television industry, it comes as no surprise that of primary importance for modern scientific documentaries is the entertainment value. Colourful computer-generated particles, battlefields, drum-rolls and emotive story lines are all for the audience’s enjoyment.

Other documentaries have been less successful than The Sky at Night in keeping with their original format. After several attempts to modernise its format, Tomorrow’s World was cancelled in 2003 due to falling ratings; the number of...
viewers had dropped from 10 million at its peak of popularity in 1980’s to 3 million by 2002. The programme’s original presenter, Raymond Baxter, responded to the show’s cancellation, “There’s a thing in broadcasting… where you have to change things. If it ain’t broke, don’t fix it” [8]. The format of Horizon also changed in the early 90’s to adopt a narrative format, much like many other modern documentaries. A problem is posed at the start, and solved within the hour. The scientist becomes idolised as the “genius in our story” [9]; the narrator takes the audience on a journey in which ultimately the mystery is always solved. Gregory and Miller argue in Science in Public that “the overriding social message of science on television is that scientists always solve the problem” [10]. This is completely incompatible with the actual scientific process, which involves high-powered theory and slow, precise experiments. Hypotheses are tried, tested, disproved and another one conjured. Results are even stumbled upon in the search of something completely different. Indeed, many scientists believe there is no reason we should be able to answer every question about the universe. This has little impact on accurately conveying scientific theories, but severely limits the layman’s understanding of the scientific process.

New Scientist came under criticism from readers over an article, featuring Roger Sawyer’s controversial “emdrive”, an engine with no moving parts, which generates “thrust purely from electromagnetic radiation”. Many readers wrote in to argue that this engine as described contravenes one of physics most fundamental theories, the conservation of momentum. Sawyer replied, “the emdrive concept is clearly difficult to comprehend without a rigorous study or the theory paper.” This clearly exemplifies the conflict between making scientific writing both accessible and accurate. These problems are not limited to the written media. The Horizon ‘Parallel Universes’ documentary begins with the narrator stating, “everything you are about to hear is true. At least, in this universe it is.” Although this assertion immediately engages the audience, it is rather inconsistent with the scientific process of doubt.

To combat the problems facing science communication, organisations exist to encourage scientists themselves to get involved in public engagement. The Engineering & Physical Sciences Research Council (EPSRC) offer “Partnership for Public Engagement (PPE) Awards” to help fund scientists who communicate research to the public. The Royal Society provides courses in communication skills and media training, and also offer prizes for popular science books.

In a 2006 survey [11], which examined the views of scientists with regard to public engagement, 74% had taken part in at least one science communication activity within the past year, a 18% rise since 2000. Of the “no activity” subgroup, 53% stated they would like to spend more time with the public and only 6% “just did not want to” get involved in any public engagement. These are very positive statistics and show scientists’ appreciation for the importance of communication. However, 64% said the need for time researching was stopping them getting more involved. This is an unfortunate conflict with no simple solution. Yet, “researchers are the best people to promote research” [12] and should therefore spend as much time as possible in public engagement.

The consequences of science can be incredible.

One of the benefits to science communication is that many research projects receive their funding from the public. It is therefore very much in the direct interest of the scientist to let his/her work and its importance be known to as many people as possible. However, the scientist must also appreciate the wider benefits of science communication. Indeed, they must be trusted members of society as the consequences of science can be incredible; the atomic bomb, climate change and nuclear energy. It is important that these areas are particularly well understood so that informed democratic decisions can be made collaboratively, between scientists and the public.

Oliver Pike was a fourth year studying Physics, and has now graduated.

References:
ReSTART seems to be just like any other residential treatment centre – located near Seattle, USA, it offers psychotherapy, exercise, counselling and other treatments to overcome addiction [1]. But there is one difference: ReSTART treats Internet Addiction Disorder (IAD), defined as the pathological use of the internet to the extent that it interferes with the functioning of normal life [2].

The term IAD was coined as early as 1995 by Ivan Goldberg. Though first meant in jest, the term has now spread and recent studies in China and Taiwan claim to identify IAD in 10.6% and 5.9% of college students respectively. [3] [4] There are also now a multitude of support groups such as the Centre for Internet Addiction Recovery, which offers self-help articles, self-assessment and counselling from a psychiatrist. [1] A similar service can be found at the Computer Addiction Study Centre at the McLean Hospital in Belmont, USA. [5]

Despite this, there is still much debate whether IAD should be recognised as an official pathological condition by the American Psychiatric Association. This would then include IAD in the 2012 edition of the Statistical Manual of Mental Disorders, hence making it valid for treatment insurance. Supporters of the notion argue that IAD symptoms mirror that of other compulsive disorders such as drug addiction: excessive use, often accompanied by time distortion; withdrawal symptoms when access is denied; increasing tolerance, requiring greater exposure to obtain the same effects; and negative repercussions from the activity, including social isolation. [6] The significance of this discussion is illustrated by a case recently taken to court, where an IBM employee maintained that he was being illegally terminated on the grounds of using online sex chat rooms at work. As a sufferer of IAD, he argued, he had a right to protection from the Americans with Disabilities Act. [7]

Sceptics of IAD however raise the question: “is the Internet addictive, or are addicts using the Internet?” [8] IAD may not be a condition per se, but merely another manifestation of existing disorders. In a study at the Centre for Internet Addiction Recovery, some 50% of reported cases of IAD are known to have previous histories of addictive behaviour. [9] In addition, problems arise over the specific definition of IAD: one can have a pathological obsession with a specific aspect of the Internet, such as viewing pornography or online gambling, but that does not make the Internet itself addictive. [10] Such people are arguably addicted to those activities anyway and the Internet just happens to be another, easy medium in which they can pursue their obsessions. Wrongly ascribing the source of patients’ addictions could have serious consequences on their potential to recover.

Regardless of the justifiability of IAD as an official pathology, it cannot be denied that the Internet is holding an increasingly prominent place in our lives. What makes the Internet so compelling to us? Perhaps one of the most elegant theories is that based on Maslow’s hierarchy, which lays out the human ‘needs’ from the fundamental to the more spiritual. [11] Psychologists, such as Dr John Suler, postulate that we need to satisfy them all for a holistic mental welfare; when one seeks the Internet to compensate for the deprivation of some of those needs in real life, it turns into obsession. [12] The transient satisfaction that one gets from such obsessions can then act as reinforcers, which further exacerbate the behaviour.

Maslow argues the most basic needs requiring fulfilment are physiological, particularly sexual desire. Cybersex is easily accessible, anonymous and medically safe; people can therefore be more open and experimental, protecting their real life social status if it all goes wrong. Indeed, 1 in 5 people seeking IAD treatment claim involvement with inappropriate sexual activities online, including pornography and explicit cybersex. [13]

Above lies the need for human contact. Humans have an intrinsic need for a sense of belonging; we seek out social recognition to affirm our sense of self. The unique aspect of the Internet compared to other addictive substances is that it is primarily a social interaction platform, providing a low-risk and minimal-pressure way to establish relation-
The 10 warning signs:

- Being preoccupied with thoughts about the internet while offline.
- Spending more and more time online to achieve satisfaction.
- Being unable to control time spent online.
- Feeling restless or irritable when trying to cut down online use.
- Going online to escape problems or relieve feelings, e.g. depression, guilt.
- Lying to conceal extent of internet use.
- Jeopardising relationships, work etc.
- Spending too much money on online fees, yet keep coming back.
- Having withdrawal symptoms when offline, e.g. irritability.
- Staying longer than originally intended.

Source: Dr. Kimberley Young, Centre for Internet Addiction Recovery

References:


[15] North T. The Internet and Usenet Global Computer Networks; An investigation of their culture and its effects on new users. 1994


© 2010, The Triple Helix, Inc. All rights reserved.

Those who become addicted are more likely to be predisposed to other addictive behaviours

truly, pathologically addicted? Though the distinction appears to be more in the shades of grey, Suler’s integration principle provides one possible definition: “Internet use becomes pathological when it is dissociated from in-person life.” [17] Healthy Internet users can use the Internet as a creative outlet, a mode of self-expression enriching and supplementing their real life. With addicts, their life diminishes into the addiction rather than being integrated within it – it becomes a mode of escapism that substitutes their life. Thus, recovery from addiction is only possible when one releases their needs and anxieties that they had locked away in the obsession, and integrates their psyche as a synergistic whole. A more empirical approach may utilise our understanding of other addictions: the World Health Organisation defines ‘addiction’ to drugs and alcohol as “[being] dominated by substance use to the virtual exclusion of all other activities and responsibilities. The term addiction also conveys the sense that such substance use has a detrimental effect on society, as well as on the individual.” [18] The parallels between the two approaches are clear.

The consensus in the psychological world therefore appears to be ambivalent: while the Internet provides opportunity for addiction, those who become addicted are more likely to have already been predisposed to other addictive behaviours. The Internet appears to simply be another medium through which people can express themselves, and the satisfaction they gain from doing so can, as with most pleasures, lead to excesses. So even if you compulsively check our email and Facebook every time you wake up in the night, you’re not necessarily an internet addict – yet!

Junko Takata is a second year studying Biological Natural Sciences at Downing College.
On the 27th February 2004, 14-year old Stefan Pakeerah from Leicester was brutally murdered by 17-year old Warren Leblanc. According to Stefan’s mother, Leblanc was obsessed with the game “Manhunt” [1], where the main theme is to execute your enemies as gruesomely as possible [2]. This has been one of many opportunities for the mainstream media to be critical about violent games, especially those which encourage the user to commit immoral acts [3]. Politicians have also intervened, most notably British MP Keith Vaz, who is well known for his stance against violent video games, especially Manhunt. In November 2009, he said that he was “absolutely shocked” by the level of violence in the recent hit release “Call of Duty: Modern Warfare 2” [4]. In Germany, ministers have agreed to prohibit the production and distribution of all video games which depict killing or cruel acts towards humans [5].

However, has a causal link yet been proven between playing violent games and an increase in violent attitudes in children? Can behavioural psychology measure such aggression and explain how violent video games influence such behaviour?

There have been many studies on the effects of playing violent games, some which show minimal effects and others that show increased aggression and feelings of hostility [6]. The methods used to measure these effects have involved either monitoring aggressive behaviour during or after short-term violent gameplay, or conducting mass surveys in schools and correlating long term violent game exposure with antisocial attitudes. Studies vary in how they carry out their experiments, surveys or statistical analyses, producing many different conclusions.

One psychologist, Dr. Craig A. Anderson, from Iowa State University, has undertaken many studies into the effect of violent video games on aggressive behaviour and cognition in children and adolescents. An example of the psychological tests that Anderson and his colleagues use to measure the short-term effects of violent game exposure is to have subjects play their assigned game for the same length of time, allowing the subjects to play another computer game where they send noxious noise blasts to other people playing in the same game. The louder the noise blast the subject sent, the more aggressive their behaviour is considered to be. Anderson claims that the results of his studies since 2001 all support, beyond reasonable doubt, a causal link between exposure to violence and increases in aggression and feelings of violence and hostility in children and adolescents [7]. Another psychologist, Dr. Jeanne B. Funk from the University of Toledo, makes a similar conclusion that “support continues to grow for the contention that exposure to violent video games is associated with increased aggression and lower empathy” [6]. In 2005, the American Psychological Association (APA) suggested that a link between violent computer games and aggression may surpass that between aggression and televised violence [8].

On the other hand, not all studies have shown such clear links. Cheryl Olsen and Lawrence Kutner, directors of the Havard Medical School Centre for Mental Health and Media, have published their findings in their latest book. They carried out their research by distributing surveys in schools and holding focus groups with school children who played violent video games regularly. Their study refuted any link between violent video games and violent behaviour. They did, however, find that boys who played M-rated games were twice as likely to be in trouble at school (such as being in physical fights or damaging property), and girls were four times as likely to do so. Even so they insist that “violent video game play is normal for young teen boys” and “most young teens who play M-rated games (restricted to ages 17 or older) do not have problems” [9].

John L. Sherry, of Michigan State University, found that the effect of violent video games was greater for older subjects and decreased as playing time increased [10]. In 2007, the American Sociological Association published a report claiming that there is no link whatsoever between violent video games and aggressive behaviour, stating that “excluding a host of other factors may make it seem that a
There needs to be more effective research before anyone can say whether a link exists.

Once studies have been carried out, behavioural scientists try to figure out a psychological mechanism – that is, a way of explaining how something affects the way we behave or think - for the effect of exposure to violent games. This way, there can be an explanation into how and why violent media affects consumers.

Anderson claims that his findings support his mechanism known as the “General Aggression Model” (GAM). The model claims that violent games make players develop behavioural scripts - a sequence of events of how people should behave in various circumstances (e.g. in a restaurant) - that are related with aggressive and antisocial connotations, such as fighting with school friends. Then short-term exposure to violent games would cause physiological arousal and impulsive action causes the player to “run” the script – this is known as “priming” [13].

However, Sherry states that his meta-analysis (2001) is inconsistent with GAM, since such theories would predict a larger effect size with children, as they are at the stage when they are actively learning new scripts, whereas adults will require “re-programming” over previous scripts [10]. Naturally GAM does not fit in with those studies which find no link between violent gaming and violent activity in the real world.

Another alternative theory, known as catharsis, suggests that people might be taking violent aggressive outlet in violent games. This would imply that aggression would decrease during violent video gameplay[14]. Anderson and Funk have both concluded that their research evidence disproved this hypothesis [6,7]. However, Sherry (2007) found in his meta-analysis that catharsis could not be ruled out completely and that more work was needed [10]. In Kutner and Warner’s study (2008), two thirds of boys and almost half of the girls said that they played games to “help them relax”, and around half of the boys played them to get their anger out [9], which shows some support for the catharsis hypothesis. According to another psychologist, Christopher J. Ferguson (2009), few studies have assessed catharsis properly, since they have not controlled for prior emotional states [14].

Clearly there is no consensus concerning the mechanism or even existence of a causal link. Most recent studies show that any link is minimal. Only Anderson and Funk remain adamant that there is some link, but Anderson has been criticized for not citing other studies which oppose his theory[14], and by researchers Block and Crain (2007) for improperly calculating data [15]. Even after all of this research, there are many questions that remain unanswered. For example, do experiments which test for aggression, like those Dr. Anderson carries out, relate to the violence we see portrayed in the media? It also seems that the question of whether games cause violent behaviour, or whether those who are more aggressive are inclined to play such games, has not been fully addressed. There needs to be more effective research before anyone can explicitly say that a link exists or not. For example, J. B. Funk suggests that using functional MRI (fMRI) in the laboratory could measure effects from specific experiences by examining how violent video games affect certain parts of the brain [6].

Until then, what can parents and politicians do? They should note that there has been research into the benefits of playing such video games. Playing first person shooter games has been shown to improve eyesight [16]. Kutner and Olsen discuss many advantages, like providing a source of self-esteem and opportunities to practise planning and decrease reaction times [9,11]. Many adolescents play violent video games, regardless of the age restrictions, and parents should be less worried by the media sensationalism.

The lack of conclusive research may leave this problem unresolved, but an open verdict is not a justification for overly restricting game content, which is seen as the only solution for some such as the German Government. Only after gaining hard evidence should governments and policymakers be confident enough to act. This is a difficult goal to achieve, but with persistence from behavioural scientists, it can be done.

Adam Esmail is a second year studying Physical Natural Sciences at Fitzwilliam College.

References: