

which has a course in forensic biology and toxicology. Forensic entomology is potentially useful in cases of child neglect (Benecke & Lessig, 2001) and neglect of the elderly (Benecke *et al.*, 2004), in addition to cases of murder.

Similarly, palynology, the analysis of pollen and spores in criminal investigations, can complement forensic DNA by either proving or disproving that people or objects were in a particular place in a certain time-frame. In some cases, pollen evidence can link a person with a precise location, although more often it may be a broad region covering many square kilometres. Although it is reported to have been used as early as 1959, palynology first came to public prominence by its absence in the double-murder trial of O.J. Simpson in 1995. Testimony suggested that the murderer probably hid in the bushes outside the Simpson home, in which case pollen from nearby flowers could have brushed off on the assailant's clothing. If this had been discovered and tested, a pollen fingerprint might have helped to establish Simpson's innocence or guilt. He was acquitted in 1995, although he was later found liable in a civil trial.

Palynology was used in another infamous case involving a boy—christened Adam by UK police—whose torso was found in the Thames River in London in September 2001. Although the boy was found in a body bag without head, arms or legs, his African origin suggested that he might have been the victim of a ritual killing. The first clues came from analysing the pollen contents of the boy's digestive tract. Spores from plants like alder—common in the UK—were found in the lower intestine, suggesting that Adam had been in the country for at least three days. This started a large-scale investigation, and subsequent analysis of Adam's mitochondrial DNA and the mineral content of his bones led police towards his origins in Nigeria. So far, his killer has not been identified.

Similar to entomology, forensic pollen analysis involves carefully sifting through evidence, as the nature of the pollen and its method of dispersal are important factors. One particular strength of palynology is that it can associate objects and people with places. It has been used, for example, to identify fake paintings. Dirt and dust trapped between a picture frame and canvas contain pollen and spores that accumulate while the picture is being painted and indicate where this took place. If this is a location where the

One particular strength of palynology is that it can associate objects and people with places

artist was known to not have been at the time, it suggests the work is a fake.

At present, forensic entomology and palynology are mainly confined to serious crimes in which death has occurred. In the case of DNA analysis, cost and lengthy testing times have also confined its application to serious crimes. But for DNA this could change soon. "These techniques are likely to shift down to general property crime," said Barton, assuming that the police want to investigate such crimes thoroughly.

This requires more people trained in forensic science. Although there has been a recent boom in the number of both forensic-science undergraduate courses and students, doubts persist whether these courses produce people with the combination of scientific, legal and investigative skills required by police forces and testing laboratories, or to become a consultant. "These graduates are often trained as chemists with forensic science as an attractive and popular alibi," said Pierre Margot, director of the School of Criminal Sciences at the University of Lausanne, Switzerland. He contends that it is counterproductive to dress chemistry up in trendy clothes to attract young people into science. Instead, forensic courses should be

multidisciplinary, albeit with chemistry and biology having an important role.

At Murdoch University, students are encouraged to take double or even triple degrees combining two science majors, such as biomedical science and molecular biology with a minor in criminology, Barton explained. According to Olivia Corcoran, senior lecturer in forensics at the University of East London, UK, good forensic-science graduates will find a growing range of job opportunities outside pure science: "With good analytical skills, graduates can apply to pharmaceuticals, food industry labs, consumer watchdog associations, and so on." Although the allure of high-profile criminal cases makes forensic-science courses attractive, the bulk of the field will lie in the realm of less serious crimes or other analytical applications.

REFERENCES

- Benecke M, Josephi E, Zwiheoff R (2004) Neglect of the elderly: forensic entomology cases and considerations. *Forensic Sci Int* **146S**: S195–S199
- Benecke M, Barksdale L (2003) Distinction of bloodstain patterns from fly artifacts. *Forensic Sci Int* **137**: 152–159
- Benecke M, Lessig R (2001) Child neglect and forensic entomology. *Forensic Sci Int* **120**: 155–159
- Stern C (1943) The Hardy–Weinberg Law. *Science* **97**: 137–138

Philip Hunter

doi:10.1038/sj.embor.7400669

Bioethics for the world

UNESCO's Universal Declaration on Bioethics and Human Rights has far-reaching goals, and has met with widespread opposition

In 2003, the member states of the United Nations Educational, Scientific and Cultural Organization (UNESCO; Paris, France), which bills itself as a 'laboratory of ideas' and a 'standard-setter', decided to develop a global statement on bioethics. After only two years of negotiations, the participating committees presented the final Universal Declaration on Bioethics and Human Rights (UDBHR) to UNESCO's General Assembly for approval (UNESCO, 2005). The first such document to set global standards in biological and

medical ethics, the Declaration has met with opposition and displeasure, particularly as it merges bioethics with human rights—topics that some would prefer to consider separately.

Many ethicists, particularly from southern-hemisphere countries, consider the UDBHR to be an important document that will upgrade the quality of research globally and promote high ethical standards in many nations where no standards exist at present. But many critics think that the Declaration is at best a toothless

statement of vague principles, and at worst a potential source of mischief that will harm research and public health efforts. Furthermore, critics maintain that by issuing guidelines for bioethical questions, UNESCO has stepped beyond its field of expertise and its mandate.

According to Henk ten Have, Director of UNESCO's Division of Ethics of Science and Technology, the rationale for a declaration was a clear lack of bioethical guidelines in developing countries—of more than 190 United Nations (UN) member states, only about 50 have national bioethics committees. “Three-quarters of all our members don't have a national bioethics committee, so there's no body to advise the government what to do in this area,” said ten Have, who trained as a physician and philosopher. The UDBHR would fill this void—indeed, UNESCO is not a newcomer to bioethics, having made its mark with the Universal Declaration on the Human Genome and Human Rights in 1997 (UNESCO, 1997).

With a push from Latin American and Baltic countries, the emphasis of the Declaration shifted from focusing purely on bioethics to including human rights. Many of the developing countries with no articulated bioethics, let alone human-rights infrastructure, saw a crying need for bioethics steeped in human rights. At a 2005 debate on the UDBHR in Paris, France, before the Declaration was adopted, “There was an impassioned plea from an Argentinian who said, ‘Referring to bioethics without human rights is not bioethics,’” recalled Michael Yesley, former coordinator of the US Program on the Ethical, Legal and Social Implications of the Human Genome Project, and now retired. This quote captured the spirit of a new movement to merge bioethics and human rights, Yesley said. This emphasis of the UDBHR “won't add very much to what they have in Europe. But if you go to other countries where human rights are contested all the time, and there is not a very well developed structure to debate ethical issues, it will give the bioethics principles more clout,” ten Have said.

The UDBHR presents 15 principles, including respect for human dignity, human rights and fundamental freedoms, and the priority of individual interests and welfare over the interests of science and society (see sidebar). Mónica

Serra, a bioethicist and forensic dentist at São Paulo State University, Brazil, is full of praise. “The UDBHR has the broadest scope of any other bioethics document that existed before it,” she said. “It is the first international bioethics text adopted by governments that commits governments ... to establish ethics committees and to promote bioethics education.” Serra, who served as a consultant for UNESCO's Ethics Education Program, but was not involved with the UDBHR, said the inclusion of social responsibility in the document, including access to healthcare and essential medicines, is an example of an innovation that reflects the needs of developing countries.

Not everyone agrees. George Annas, a health law expert at Boston University (MA, USA) and co-founder of Global Lawyers & Physicians (also in Boston), a non-governmental group promoting bioethics internationally, does not think the UDBHR is necessary. He believes the landmark Universal Declaration of Human Rights (UDHR; United Nations, 1948) covers all the issues raised by the new declaration and acts like a treaty, in contrast to the largely aspirational UDBHR. “As daunting and discouraging as many contemporary challenges are, especially those related to global terrorism, the international research in genetic engineering and human cloning, and the provision of basic healthcare to everyone, the Universal Declaration of Human Rights really does provide the world with an agenda and a philosophy,” he said.

... the Declaration has met with opposition and displeasure, particularly as it merges bioethics with human rights...

Similarly, Richard Ashcroft, Head of the Medical Ethics Unit at Imperial College in London, UK, is unimpressed by the UDBHR. “I don't think the document will do significant harm. But I don't think it will do any important good either,” he commented. “I do think that merging bioethics and human rights is not just worthwhile, it is essential. But I am not convinced that the UNESCO document does manage to merge these two discourses.” For one thing, it is not clear what constitutes human rights, he said, and their scope

remains controversial—for instance, whether embryos have human rights. “Whereas human-rights debates normally take a legal form, bioethics arguments tend to take a philosophical form, so they argue in different and sometimes conflicting ways,” Ashcroft added. “Human-rights statements are positive declarations of what is obligatory, whereas bioethics documents are frequently exploratory or speculative in nature, arguing about what may or may not be permissible or necessary.”

...many critics think that the Declaration is at best a toothless statement of vague principles, and at worst a potential source of mischief...

UNESCO's new declaration is an improvement over both the UDHR and existing bioethics regulations because it addresses new issues, ten Have maintains. “The Universal Declaration of Human Rights had been adopted long before the development of bioethics. Bioethics emerged specifically because of the emergence of life sciences and the increasing power of medicine. It is necessary to specify the human rights in specific bioethics principles in order to give guidance in the area of medicine and healthcare.” He explained that globalization and internationalization of scientific research confront developing countries with new ethical problems, citing a widely debated incident in the mid-1990s when US researchers studied vertical transmission of HIV using a placebo-control group in Africa (Lurie & Wolfe, 1997). Such research would not have been allowed in the USA where effective but costly therapy is available. Serra also added that the UDBHR would overturn such double standards in research by promoting the concept of transnational reviews involving ethics committees in all of the countries involved.

It is not surprising that the UDBHR addresses both bioethics and political components, given its development process. The birth of the Declaration was a dance between government and bioethics groups within the UNESCO Bioethics Programme, and involved the International Bioethics Committee

THE PRINCIPLES OF THE UNIVERSAL DECLARATION ON BIOETHICS AND HUMAN RIGHTS

Article 3: Human dignity and human rights

1. Human dignity, human rights and fundamental freedoms are to be fully respected.
2. The interests and welfare of the individual should have priority over the sole interest of science or society.

Article 4: Benefit and harm

In applying and advancing scientific knowledge, medical practice and associated technologies, direct and indirect benefits to patients, research participants and other affected individuals should be maximized and any possible harm to such individuals should be minimized.

Article 5: Autonomy and individual responsibility

The autonomy of persons to make decisions, while taking responsibility for those decisions and respecting the autonomy of others, is to be respected. For persons who are not capable of exercising autonomy, special measures are to be taken to protect their rights and interests.

Article 6: Consent

1. Any preventive, diagnostic and therapeutic medical intervention is only to be carried out with the prior, free and informed consent of the person concerned, based on adequate information. The consent should, where appropriate, be express and may be withdrawn by the person concerned at any time and for any reason without disadvantage or prejudice.
2. Scientific research should only be carried out with the prior, free, express and informed consent of the person concerned. The information should be adequate, provided in a comprehensible form and should include modalities for withdrawal of consent. Consent may be withdrawn by the person concerned at any time and for any reason without any disadvantage or prejudice. Exceptions to this principle should be made only in accordance with ethical and legal standards adopted by States, consistent with the principles and provisions set out in this Declaration, in particular in Article 27, and international human rights law.
3. In appropriate cases of research carried out on a group of persons or a community, additional agreement of the legal representatives of the group or community concerned may be sought. In no case should a collective community agreement or the consent of a community leader or other authority substitute for an individual's informed consent.

Article 7: Persons without the capacity to consent

In accordance with domestic law, special protection is to be given to persons who do not have the capacity to consent:

- (a) authorization for research and medical practice should be obtained in accordance with the best interest of the person concerned and in accordance with domestic law. However, the person concerned should be involved to the greatest extent possible in the decision-making process of consent, as well as that of withdrawing consent;
- (b) research should only be carried out for his or her direct health benefit, subject to the authorization and the protective conditions prescribed by law, and if there is no research alternative of comparable effectiveness with research participants able to consent. Research which does not have potential direct health benefit should only be undertaken by way of exception, with the utmost restraint, exposing the person only to a minimal risk and minimal burden and if the research is expected to contribute to the health benefit of other persons in the same category, subject to the conditions prescribed by law and compatible with the protection of the individual's human rights. Refusal of such persons to take part in research should be respected.

Article 8: Respect for human vulnerability and personal integrity

In applying and advancing scientific knowledge, medical practice and associated technologies, human vulnerability should be taken into account. Individuals and groups of special vulnerability should be protected and the personal integrity of such individuals respected.

Article 9: Privacy and confidentiality

The privacy of the persons concerned and the confidentiality of their personal information should be respected. To the greatest extent possible, such

information should not be used or disclosed for purposes other than those for which it was collected or consented to, consistent with international law, in particular international human rights law.

Article 10: Equality, justice and equity

The fundamental equality of all human beings in dignity and rights is to be respected so that they are treated justly and equitably.

Article 11: Non-discrimination and non-stigmatization

No individual or group should be discriminated against or stigmatized on any grounds, in violation of human dignity, human rights and fundamental freedoms.

Article 12: Respect for cultural diversity and pluralism

The importance of cultural diversity and pluralism should be given due regard. However, such considerations are not to be invoked to infringe upon human dignity, human rights and fundamental freedoms, nor upon the principles set out in this Declaration, nor to limit their scope.

Article 13: Solidarity and cooperation

Solidarity among human beings and international cooperation towards that end are to be encouraged.

Article 14: Social responsibility and health

1. The promotion of health and social development for their people is a central purpose of governments that all sectors of society share.
2. Taking into account that the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition, progress in science and technology should advance:
 - (a) access to quality health care and essential medicines, especially for the health of women and children, because health is essential to life itself and must be considered to be a social and human good;
 - (b) access to adequate nutrition and water;
 - (c) improvement of living conditions and the environment;
 - (d) elimination of the marginalization and the exclusion of persons on the basis of any grounds;
 - (e) reduction of poverty and illiteracy.

Article 15: Sharing of benefits

1. Benefits resulting from any scientific research and its applications should be shared with society as a whole and within the international community, in particular with developing countries. In giving effect to this principle, benefits may take any of the following forms:
 - (a) special and sustainable assistance to, and acknowledgement of, the persons and groups that have taken part in the research;
 - (b) access to quality health care;
 - (c) provision of new diagnostic and therapeutic modalities or products stemming from research;
 - (d) support for health services;
 - (e) access to scientific and technological knowledge;
 - (f) capacity-building facilities for research purposes;
 - (g) other forms of benefit consistent with the principles set out in this Declaration.
2. Benefits should not constitute improper inducements to participate in research.

Article 16: Protecting future generations

The impact of life sciences on future generations, including on their genetic constitution, should be given due regard.

Article 17: Protection of the environment, the biosphere and biodiversity

Due regard is to be given to the interconnection between human beings and other forms of life, to the importance of appropriate access and utilization of biological and genetic resources, to respect for traditional knowledge and to the role of human beings in the protection of the environment, the biosphere and biodiversity.

(Source: UNESCO, 2005)

(IBC), the Intergovernmental Bioethics Committee, representatives of non-governmental organizations, the UN Inter-agency Committee on Bioethics, representatives of national bioethics committees, government experts and other groups. As ten Have said, "What we do in UNESCO is try to link, let's say, the scientific expertise with the political decision-making. We have, I think, the best experts in bioethics in the International Bioethics Committee ... But the member states have to adopt the text. The government experts involved in the second stage of the process will have their own political agenda." In the end, he said, it is all part of the art of political negotiation and compromise to make the final text of the Declaration palatable to all governments.

"The UDBHR has the broadest scope of any other bioethics document that existed before it"

However, Udo Schuklenk, co-editor of the journals *Bioethics* and *Developing World Bioethics* and chairman in bioethics and public policy at Glasgow Caledonian University, UK, criticized the inclusion of politicians who are untrained in medical ethics. "The bottom line is that when they were finally finished with the document, it was then passed onto politicians—government-appointed bioethics 'experts' who are not experts at all as far as I'm concerned. And surprise, surprise, because these people are not experts in bioethics, they actually made that document a human-rights document," he said. "The United Nations being the United Nations, human rights is the end-all of anything to do with ethics. So the result was that any other approach to ethical thinking was basically taken out of the document." Similarly, Ashcroft thinks the UDBHR is limited by the fact that it formulates principles to which all UNESCO states could eventually agree. "The document looks like a powerful international consensus about bioethical issues, until you read it, and realize that after all the horse trading and debate, not much is left, and many people or indeed many countries would feel that a stronger statement is necessary," he said. "If so, what force does this document have in international relations or law?"

In reality, the UDBHR will not prevent or avert ethical lapses or wrongdoing, such as those committed by South Korean stem-cell researcher Hwang Woo Suk. Although the Declaration calls for independent and multidisciplinary ethics committees, the South Korean national bioethics committee overseeing Hwang's research contained no ethicists and only people related to the political system, according to ten Have. But Matti Häyry, a bioethics and law professor at the Institute of Medicine, Law and Bioethics at the University of Manchester, UK, commented, "Any set of ethical guidelines for research would have prevented [this scandal], if it were the case that regulations or declarations can prevent dubious actions. This is not the case. We can only condemn actions after the fact by reference to them and possibly punish the wrongdoers."

Several ethicists also criticized UNESCO for not joining forces with the World Health Organization (WHO; Geneva, Switzerland) and its ethics chief Alexander Capron. John Williams, speaking personally and not in his capacity as Director of the Ethics Unit of the World Medical Association (Ferney-Voltaire, France), maintains that UNESCO infringed on the WHO. "The WHO clearly has a mandate to work on health issues, and bioethics is certainly central to health issues. So there is at the very least a shared or joint mandate," he said. "This would seem to mean that the WHO should have been closely involved in the development of any declaration on bioethics. This doesn't seem to have been the case."

...globalization and internationalization of scientific research confront developing countries with new ethical problems...

In response to a request for comments on the final text of the Declaration, Capron referred to a WHO analysis of an earlier draft in 2004, which stated that the proposed Declaration "weakens human-rights obligations" and was overly broad and imprecise about stating human-rights principles and norms. The analysis

also criticized the absence of any monitoring and reporting provisions, necessary to detect violations. Although the final version of the Declaration contained some changes, Capron commented by e-mail that, "Some of the basic concerns obviously continue to be relevant."

As ten Have said, "It is perfectly clear that Mr. Capron is contesting that we are working in this area, but I think if you understand the system, it's not up to us to make this kind of decision; it's up to the member states." For this very reason, he said, the Declaration has authority, because it is backed by the governments represented through UNESCO: "The Chinese government, the Indian government, the US government have all agreed on the same set of principles."

Although the UDBHR technically has no legal authority, it is not unusual for such statements to become incorporated in national legislation and court rulings. Schuklenk worries that the Declaration could be transformed—"without much reflection"—into public policy in the developing world. "What eventually sneaks its way into legislation and regulation, once it comes to the crunch, will go to the ends of the world and affect millions of people," he said. Furthermore, he criticizes UNESCO for not identifying universal ethical principles but instead reflecting Western societies' values by holding up individual rights and autonomy. "This is clearly an individualistic document, with little about responsibilities to the community."

Schuklenk is troubled, for instance, by Article 4 of the UDBHR, which states that "...direct and indirect benefits to patients, research participants and other affected individuals should be maximized and any possible harm to such individuals should be minimized." This sounds nice in theory, he said, "but as not all study participants benefit from research, this Article could make randomized clinical trials impossible to conduct." Likewise, Schuklenk criticized Article 3, which states that, "The interests and welfare of the individual should have priority over the sole interest of science or society." He said, "With the UNESCO Declaration, we couldn't quarantine people because it would interfere with individual liberties. The article is simply saying, for example, that your interest in taking a flight

Although the UDBHR technically has no legal authority, it is not unusual for such statements to become incorporated in national legislation and court rulings

to Los Angeles has priority over the interests of society to protect itself from an ensuing epidemic that could potentially kill millions of people. That's ludicrous." He expects that policy-makers in the developed world will ignore the UDBHR, but contends that problems could emerge in the developing world.

Serra, however, does not see any major roadblocks for clinical research put forward by Article 4. "Declarations cannot exhaustively cover all possibilities," she said. And Article 27 foresees that domestic laws can overrule the Declaration's principles in the interest of public health or the protection of rights and freedoms, ten Have pointed out.

Overall, however, ten Have believes that the UDBHR is "a helpful instrument to call attention to bioethics". Advocates of bioethics in underdeveloped countries can push for change, he said, pointing out that many of their governments have already endorsed the Declaration. According to Serra, many critics are overlooking the potential good that could come from the Declaration: "The UDBHR has the stature of a UNESCO document, a fact that, by itself, gives weight, importance and respect. Despite a few shortcomings, the UDBHR will help states to establish guidelines, and help people to reflect about ethical values. This shall contribute to a better world."

REFERENCES

Lurie P, Wolfe SM (1997) Unethical trials of interventions to reduce perinatal transmission of the human immunodeficiency virus in developing countries. *N Engl J Med* **337**: 853–856

UNESCO (1997) *Universal Declaration on the Human Genome and Human Rights*. Paris, France: UNESCO

UNESCO (2005) *Universal Declaration on Bioethics and Human Rights*. Paris, France: UNESCO

United Nations (1948) *Universal Declaration of Human Rights*. New York, NY, USA: United Nations

Howard Wolinsky

doi:10.1038/sj.embor.7400670

Mind–body research moves towards the mainstream

Mounting evidence for the role of the mind in disease and healing is leading to a greater acceptance of mind–body medicine

The commonsense notion that 'too much stress makes you sick' might hold more than a grain of truth. The second of two large-scale epidemiological and medical studies among civil servants in the UK, known as the Whitehall studies, found that workers in low-level jobs, in which they have high stress and little autonomy, have more than twice the risk of developing metabolic syndrome—a precursor of heart disease and diabetes—compared with employees in higher-level jobs (Chandola *et al*, 2006). The first Whitehall study showed that people from this group are also more inclined to die prematurely than colleagues who do less menial, higher-level work. In these studies, stress is defined as a high level of demand, a low level of control and little support from co-workers or supervisors. By measuring heart rate, and cortisol and adrenaline levels, researchers also found that stress affects the autonomic nervous system and neuroendocrine function (Chandola *et al*, 2006; Bjorntorp, 1991; Brunner *et al*, 2002). Other recent research showed that acute and chronic psychological stress, related to low socio-economic status, can increase the risk of heart attack by increasing circulating levels of platelet–leukocyte aggregates (Brydon *et al*, 2006). A study from the University of Utah (Salt Lake City, UT, USA), first presented at the American Psychosomatic Society meeting in March 2006, showed that hardening of the arteries is more frequent in wives when they and their husbands express hostility during marital disagreements, and more common in husbands when they or their wives act in a controlling way (Smith *et al*, 2006).

Although the understanding that emotions affect physical health dates as far back as the second-century physician Galen and the medieval physician and philosopher Moses Maimonides, modern medicine has largely continued to treat the mind and body as two separate entities. In the past 30 years, however, research into the link between health and emotions, behaviour, social and

economic status and personality has moved both research and treatment from the fringe of biomedical science into the mainstream. "According to the mind–body or biopsychosocial paradigm, which supercedes the older biomedical model, there is no real division between mind and body because of networks of communication that exist between the brain and neurological, endocrine and immune systems," said Oakley Ray, Professor Emeritus of Psychology, Psychiatry and Pharmacology at Vanderbilt University (Nashville, TN, USA).

The potential of stress reduction and social support as a therapeutic intervention became evident in the late 1980s during a study of women with breast cancer. David Spiegel, Director of the Psychosocial Research Laboratory at Stanford University (CA, USA), wanted to determine whether women with metastatic breast cancer who participated in supportive–expressive group therapy had better quality of life and symptom control than those who received only medical treatment. To his and others' surprise, not only did the women have better quality of life and less pain, but they also lived significantly longer (Spiegel *et al*, 1989).

These unexpected findings triggered a large body of research into mind–body interventions—such as group therapy, stress-reduction techniques and cognitive-behavioural therapy (CBT)—and whether they can affect survival and pain in cancer, AIDS and bone-marrow transplant patients, with findings split between positive and negative for life expectancy (Kissane *et al*, 2004; Goodwin *et al*, 2001). A main focus of research is the relationship between stress and cardiovascular disease, asthma,

"...there is no real division between mind and body because of networks of communication that exist between the brain and neurological, endocrine and immune systems"