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Ethics and accuracy in scientific researches with emphasize on

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A b s t r a c t : Research is one of those highly complex and subtle activities that usually remain quite unformulated in the minds of those who practise them. This is probably why most scientists think that it is not possible to give nay formal instruction in how to do research. Additionally, training in research must be largely self-training, preferably with the guidance of an experienced scientist in the handling of the actual investigation. Scientific research, which is simply the search for new knowledge, appeals especially to people who are individualists and their method vary from one person to another. A policy followed by one scientist may not be suitable for another, and different methods are required in different branches of science. However, there are some basic principles and mental techniques that are commonly used in most types of investigation, at least in the biological sphere. Honesty and morals are the first step in all scientific researches and a researcher must consider it in all stages of a scientific work. The role and importance of accuracy and honesty in taxonomy and systematic is more than other biological sciences. For having the honesty in scientific researches, learning the principals of ethics is needed for all the researchers and students. Therefore, this paper deals with the ethics in science and technology and also important comments on taxonomy.

K e y w o r d s : Ethics, Accuracy, Science, Technology, Taxonomy.

Introduction

Living in a world in which all forms of life are interdependent, we recognize that human activity since the scientific revolution now threatens the future of life on the planet. This threat stems in part from reckless exploitation of the earth's resources and massive pollution of the biosphere by humankind, exacerbated by rampant militarism. To help solve these problems, scientists and scholars, and all those concerned with the welfare of life on earth, need to unite in a world-wide moral community, in which considerations of beneficence and justice at a global level are fundamental. We recognize that knowledge gives power; that power tends to corrupt and may be used for dangerous and destructive purposes; and that consequently scientists and scholars, who share the privilege of participating in the advancement of knowledge, many under the shelter of academic freedom and in the tradition of open publication, have a particular responsibility to society for the effects of their work. All should make a determined individual and collective effort to foresee the implications and possible consequences of their scholarly and scientific work, and avoid studies that are likely to harm the quality of life.

Science is that domain of human activity for which all kinds of formal stereotypes, dogmatic rules, authoritative instructions act as especially dangerous poison – but nevertheless it is nowadays dominated by stereotypes, dogmas and directives. Whether submitting a grant proposal, defending a doctoral dissertation, or attempting to publish a paper in an obligatorily "peer-reviewed" journal, we must be aware that any deviation from the current fashion, i.e., adoption of somewhat unorthodox assumptions, application of a less familiar method, original interpretation, let alone presenting an unpopular subject or non trite form of presentation, drastically decreases the likelihood of success. One of the particularly "unshakeable" axioms is "exact demarcation of aims and unequivocal formulation of the problems to be solved" as a necessary precondition of effective work, although in fact excessive "exactitude" and "univocality" are neither needed nor even advantageous – to the contrary, except for some very narrow questions (which, however, rarely occur separately, usually appearing as particular aspects of broader research programs), are in most cases decidedly harmful!

There are genius with a flair for research will not benefit from instruction in the methods of research, but most would be research workers are not geniuses, and some guidance as to how to go about research should help them to become productive earlier than would if let to find these things out for themselves by the wasteful method of personal experience. Claude Bernard, the greatest French physiologist, said: "Good methods can teach us to develop and use to better purpose the faculties with which nature has endowed us, while poor methods may prevent us from turning them to good account. Thus the genius of inventiveness, so precious in the sciences, may be diminished or even smothered by a poor method, while a good method may increase and develop it. In biological sciences, the role of method is even more important than in the sciences because of the complexity of the phenomenon and countless sources of error."

The object of taxonomy is the almost unimaginably diversified world of living creatures: the studies comprise the entire process from meticulous analysis of intra- and interpopulational relations to the, resisting any schematic approach, final synthesis in the form of a natural classification. Neither the methods of research nor the results seem unusually attractive to society (fascinated by technological gadgets and "sensations"). Practical applications are rarely the direct effect of work, and still less frequently appear within a short time; all this (and many other factors) makes this branch of science especially susceptible as well to all kinds of bureaucratic restrictions, formalisms and authoritative regulations (WHEELER 1995).

Many scientists (and still more non-scientists), fascinated with the achievements of present-day technology, begin to consider them the panacea that will solve all problems, making traditional, "non-modern", tools and methods of taxonomic work outdated and superfluous. This is especially the case at the stage of interpretation, when with increasing frequency the computer has been treated not as an aid for the scientist's brain, but as a substitute allowing (or even coercing) one to switch the brain off. A computer evaluation of computer analysis based on models selected by the computer and statistics calculated by the computer, providing – in many instances unquestionably useful – preliminary material for considerations involving all the other available evidence, has been instead attributed the status of the Revealed Truth relieving the author from the necessity of thinking.

Ethics

The history of ethics exhibits many different approaches to securing an objectivist ethics. Besides traditional theistic-based approaches, there have been attempts which seek to establish some objective foundation (usually in practical reason or human interest) that is independent of, but which can be used to generate, or involve, an ethical outlook. Another less direct approach has taken the form of attempts at elaborating points of advantageous comparison between ethics and some other discipline, like the natural sciences for instance that is determinately objective. The strategy of the moral realist differs from these approaches by its insistence on the independent existence of a moral reality that determines the truth. Our aim in moral deliberation, according to the realist, is to discover, or come into contact with, this aspect of reality. It is this element which marks out moral realism in the pursuit of objectivity in ethics.

Aristotle considered ethics to be a practical science, i.e., one mastered by doing rather than merely reasoning. Further, Aristotle believed that ethical knowledge is not certain knowledge (such as metaphysics or epistemology) but is general knowledge. He wrote several treatises on ethics, including most notably, Nichomachean Ethics, in which he outlines what is commonly called virtue ethics. Aristotle taught that virtue has to do with the proper function of a thing. An eye is only a good eye in so much as it can see, because the proper function of an eye is sight. Aristotle reasoned that man must have a function uncommon to anything else, and that this function must be an activity of the soul. Aristotle identified the best activity of the soul as eudaimonia: a happiness or joy that pervades the good life. Aristotle taught that to achieve the good life, one must live a balanced life and avoid excess. This balance, he taught, varies among different persons and situations, and exists as a golden mean between two vices – one an excess and one a deficiency (KNIGHT 2007).

The study of ethics generally is guided by certain presuppositions. Among the main presuppositions are these. First, we are more or less rational beings, capable of understanding the world. Second, we can act on the basis of what we understand. Third, our actions can serve a purpose we can make a difference. Ethics itself can be divided into subfields. *Normative ethics* is the study of rightness in action, and goodness in states of affairs. *Descriptive ethics* is the study of opinions or beliefs about normative ethics. The third subfield, *metaethics*, studies the meanings and presuppositions of moral theories and moral language and asks what it would be like to justify a moral theory. In effect, then, where normative ethics is the enterprise of formulating theories about what is right and good, metaethics steps back to study normative ethics itself (SIMPSON 1961; MAYR 1969). There are certain ethical considerations which are generally recognized among scientists. One of the most important is that, in reporting an investigation, the author is under an obligation to give due credit to previous work which he has drawn upon and to anyone who has assisted materially in the investigation. This elementary unwritten rule is not always followed as scrupulously as it should be and offenders ought to realize that increased credit in the eyes of the less informed readers is more than offset by the opprobrium accorded them by the few who know and whose opinion really matters. A common minor infringement that one hears is someone quoting another's ideas in conversation as though they were his own.

A serious scientific sin is to steal someone's ideas or preliminary results given in the course of conversation and to work on them and report them without obtaining permission to do so. This is rightly regarded as little better than common thieving and have been heard a repeated offender referred to as a "Scientific bandit". He who transgresses in this way is not likely to be trusted again. Another improper practice which unfortunately is not as rare as one might expect, is for a Director of Research to annex most of the credit for work which he has only supervised by publishing it under joint authorship with his own name first. The person whose name is placed first is referred to as the senior author, but senior in this phrase means the person who was responsible for most of the work, and not he who is senior by virtue of the post he holds. Most directors are more interested in encouraging their junior workers than in getting credit themselves. We do not wish to infer that in the case where the superior officer has played a real part in the work he should withhold his name altogether, as over-conscientious and generous people sometimes do, but often it is better to put it after that of the younger scientist so that the latter will not be overlooked as merely one of "and collaborators". The inclusion of the name of a well known scientist who has helped in the work is often useful as a guarantee of the quality of the work when the junior author has not yet established a reputation for himself. It is the duty of every scientist to give generously whatever advice and ideas he can and usually formal acknowledgment should not be demanded for such help. We find sometimes that what we have thought to be a new idea turns out not to be original at all perhaps by referring to notes which we ourselves made on the subject some time previously. Incomplete remembering of this type occasionally results in the quite unintentional annexing of another person's idea. An idea given by someone else in conversation may subsequently be recalled without its origin being remembered and thus be thought to be one's own.

Complete honesty is of course imperative in scientific work. As CRAMER (1896) said: "In the long run it pays the scientist to be honest, not only by not making false statements, but by giving full expression to facts that are opposed to his views. Moral slovenliness is visited with far severer penalties in the scientific than in the business world."

It is useless presenting one's poor work in the most favorable light, for the hard facts are sure to be revealed later by other investigators. The experimenter has the best idea of the possible errors in his works. He should report sincerely what he as done and, when necessary, indicate where mistakes may have arisen.

If an author finds out he cannot later substantiate some results he has reported he should publish a correction to save others either being misled or put to the trouble of repeating the work themselves, only to learn that a mistake has been made.

When a new area of investigation is initiated by a scientist, some people consider it courteous not to rush in to it, but to leave the field to the originator for a while so that he may have an opportunity of reaping the first fruits. Personally we do not feel the need to hold back once the first paper has been published. Hardly any discovery is possible without making use of knowledge which is today available. Science could never have been expanded if scientists did not pool their contributions. The publishing of experimental results and observations so that they are available to others and open to criticism is necessary for advancement of knowledge.

Secrecy is contrary to the best interest and spirit of science. It prevents the individual contributing to further progress; it usually means that he or his employer is trying to exploit for their own gain some advance made by building on the knowledge which others have freely given. Much research is carried out in secret in industry and in government war departments. This seems to be inevitable in the world as it is to-day, but it is nevertheless wrong in principle. Ideally, freedom to publish provided only that the work has sufficient merit, should be a basic right of all research workers. It is said that occasionally, even in agricultural research, results may be suppressed because they are embarrassing to government authorities. This would seem to be a dangerous and short-sighted policy.

Personal secrecy in laboratories not subject to any restrictions is not infrequently shown by workers who are afraid that someone else will steal their preliminary result and bring them to fruition and publish before they themselves are able to do so. This form of temporary secrecy can hardly be regarded as a breach of scientific ethics but, also understandable, it is not commendable, for free interchange of information and ideas hasten the advance of science. Nevertheless information given in confidence must be respected as such and not handed on to others. A traveling scientist visiting various laboratories may himself be perfectly honorable in not taking advantage of unpublished information he is given, but may inadvertently hand on such information to a less scrupulous individual. The traveler can best avoid this risk by asking not to be told anything that is wished to be kept confidential, for it is difficult to remember what is for restricted distribution and what is not.

Even in the scientific world, unfortunately, one occasionally encounters national jealousies. These are manifest by lack of appreciation or acknowledgement of work done in other countries. Not only is this to be deplored as a quite indefensible breach of ethics and of the international spirit of science, but it rebounds on the offenders, often to the detriment of themselves and their country. The person failing to appreciate advances in science made elsewhere may be left in the backwater he deserves, and he shows himself a second-rate scientist. Among the great majority of scientists there exists an international freemasonry that is one of the main reasons for faith in the future of mankind, and it is depressing to see this marred by petty selfishness on the part of a few individuals.

The cooperation between the specialists, teams, countries, etc., is absolutely necessary. The saving of own data is not pleasant. A scientist who is working on any topic should try to contact more other persons, whose data can be used for its work and surely everything depends on communication (open communication=better work). The keeping of the data, saving "in own shell", can close to such person the doors for other cooperation in the future. Cooperation on preparing of manuscript is close connected with the previous sentences. Some scientists prefer a single work. Yes, they can do perfect job, of course. But each author must to think, what should be better for the result of his effort: to do single job containing his own opinions only or to do job together with one, two, or more persons, and prepare the paper as compilation of more opinions? It is very, very difficult and the consequent big problem. The author used some data, notes or opinions of his colleague; and what to do? Include him into the author team? Or just put his name into the acknowledgement. The line between these two variant is very fragile… Everything depends on the senior author. It is a big dilemma: three persons as co-authors, and four other in the acknowledgement. Is this adequate or not? The persons in the acknowledgement should to feel to be umbrage. This is a high ethic in science, mainly for the senior author!

Obligatory peer reviewing is one of the most worshipped fetishes – or, if one prefers, Sacred Cows – of present-day science: slogans preaching the enormous importance of this procedure to "guarantee high standards" of published works have been repeated again and again to the point of boredom, but without any *serious* [*i.e.* not restricted to repetition of slogans] substantiation of its positive role (from time to time appearing timid voices to the contrary are either – in most cases – ignored, or put off with one more triteness). There are some questions which would be nice to have answered in a non-slogan (i.e. supported by facts) form: Is the procedure of "peer reviewing" *truly efficient* in elimination of worthless works? Is it *really efficient* in improving valuable contributions? Is it not possible to achieve these results *without* "peer reviewing"? Is the occasional publication of erroneous results or worthless conjecture *more harmful* than *rejection of a scientifically important* one? What is the more harmful aspect of the circumstance which so troubles the author of one of the above citations (that "you can get almost anything into print if you go far enough down the ranks of journals"): the occasional appearance of poor quality papers (in the "top-ranked" periodicals they are also not so rare...), or rather the fact that you often *must* "go far enough down the ranks of journals" to publish a paper more or less faithfully presenting the views of the *author* (who signs it and is responsible for its content and form) rather than those of an anonymous (at least to the reader) editor and/or reviewer? And most importantly, are the supposed benefits *really not too extravagantly disproportionate to the costs*. These benefits, as well those measured in dollars as – especially – are as follows: the time wasted by the author, reviewer and editor; the creation of the opportunity for dishonest "tripping" and/or usurping the results of the other's work; the discouragement from bold, unfashionable, innovative methods and original interpretations in favor of "orthodox" stereotypes; the muffling discussions and confrontation of views (it is difficult to fruitfully discuss with a "sniper" shooting from behind the fence of anonymity, even if – what happens rather rarely... – he/she is willing to venture to discussion...); the abating or even fully suppression of the author's feeling of responsibility for the content and form of the papers published under his/her name.

Taxonomy

Taxonomy is the base of biological science. The science of naming things is called taxonomy and though it can become quite complicated the basics are easy to understand. Taxonomy is the base of systematic, and the systematic is the main goal of zoology and botany. The "science taxonomy" defines the laws of systematic and in absence of this science, the systematists will be confused. Note also that identifying, describing and naming things, i.e. assigning them to particular groups is taxonomy, while arranging those groups in a coherent order which reflects their evolution and relatedness is classification. Another word is Systematics which may be defined as the study of the diversity of organisms and the way they relate to each other, modern Systematics is called Phylogenetic Cladistics and has a whole set of special rules telling you how to do it properly. Cladistics is a good, but young science and like all tools its usefulness reflects the understanding in the mind of the person using it, i.e., not all the results that people using cladistic analyses come to are equally reliable (MAYR 1942; MINELLI 1991).

Taxonomic paradigms have changed several times during the history of taxonomy, yet a single nomenclatural system, socalled Linnaean, has remained in force all along. It is theory-free regarding taxonomy as it relies on ostensional allocation of nomina to taxa, rather than on intensional definitions of nomina (e.g., “phylogenetic definitions”).

Nomina are not descriptions, definitions or theories but simple labels designating taxa. Both for theoretical and practical reasons, this system should be maintained for the allocation and validity of nomina under a cladistic taxonomic paradigm. Whereas taxa can be cladistically defined by *apognoses* or *cladognoses*, nomina should remain attached to taxa through onomatophores, combined in some cases with a Principle of Coordination. Under such a system, the allocation of nomina to taxa is automatic, unambiguous and universal, and nomenclature does not infringe upon taxonomic freedom. However, to avoid misunderstandings and to solve some current problems, the current *Code* of zoological nomenclature should be improved in several respects. The distinction should be made clear between *taxonomic categories*, which have biological definitions, and *nomenclatural ranks*, which do not, as they give only a position in a nomenclatural hierarchy: if used consistently under a cladistic paradigm, they simply allow to express hypotheses about successive branchings and sistertaxa relationships. Taxa referred to a given rank in different groups cannot therefore be considered equivalent by any biological criterion. The nomenclatural rules should cover the whole taxonomic hierarchy, which is currently not the case in zoology. The recent strong increase in the number of higher taxa which results from cladistic analyses may quickly lead to chaos and problems in communication if the nomina of these taxa continue to be based on personal tastes and opinions. There is an urgent need for the zoological *Code* to cover these nomina with automatic and stringent rules leaving no place to subjective interpretation. Just like for those currently covered by the *Code*, the status of these nomina should be established in their first publication (*nomenclatural founder effect*). The *Code* should be protected against alternative nomenclatural systems by rejecting as unavailable all nomina and nomenclatural acts published without respecting the basic Linnaean system of nomenclatural hierarchy of ranks (MARGULIS & KARLENE 1998; LUBISCHEW 1966; MAYR & ASHLOCK 1991; ICZN 1999). The below statements from several authorized taxonomists define the importance of taxonomy.

An ancestral taxon is a species that gave rise to at least one new daughter species during speciation, either through cladogenesis or reticulate speciation. By cladogenesis we mean speciation that results in two or more branches on the phylogenetic tree where there was only one branch before. By reticulate speciation we mean the establishment of a new species through a hybridization event involving two different species. A species that emerged from cladogenesis has one ancestral species but a species emerging from reticulate speciation has two ancestral species. In the phylogenetic system, only species can be ancestral taxa. Groups of species are specifically excluded from being ancestral to other groups of species or to single species. The biological rationale for this distinction is clear; there is an array of processes termed speciation that allow for one species to give rise to another (or two species to give rise to a species of hybrid origin), but there are no known processes that allow for a genus or a family to give rise to other taxa that contain two or more species ("genusation" and "familization" are biologically unknown). Thus, each monophyletic group begins as a single species. This species is the ancestor of all subsequent members of the monophyletic group.

HENNIG'S (1966) concept of 'holomorphology' celebrated the long-established practice of taxonomy as a field capable of synthesizing evidence from all relevant comparative sources (e.g. Simpson, 1961). Hennig taught us that what matters is not the source of data, but rather how the data are analysed and whether special similarities are differentiated from raw overall similarity. The potent implications of Hennig's theories have yet to be fully realized. Rather than welcoming the input of credible data from all sources, we have allowed technology and political correctness to drive the field towards one source of data and away from analytical methods that are consistent with Hennig's theory of special similarity. Both are to the detriment of taxonomy.

Taxonomy is at the same time the most elementary and the most inclusive part of zoology, most elementary because animals cannot be discussed or treated in a scientific way until some taxonomy has been achieved, and most inclusive because taxonomy in its various guises and branches eventually gathers together, utilizes, summarizes, and implements everything that is known about animals (SIMPSON 1945).

It is perhaps too early to arrive at a definitive taxonomy that will encompass all possible ethical, legal and social issues that may arise. However, it is possible to devise a taxonomy based on experience with organ transplantation and on experience with introduction of new technologies generally. Addressing these issues in a constructive way will enable this emerging field to progress rapidly (since the need for it is enormous already and is growing rapidly, and there may be indications for various forms of RM that we have not yet imagined today) while we minimize or manage any associated risks and uphold generally accepted societal values (UNESCO 2006).

Taxonomy is a science that is most explicitly and exclusively devoted to the ordering of complex data, and in this respect it has a special, almost a superscientific place among the sciences (SIMPSON 1961).

What I think must be avoided is, on the one hand, the pecking order in taxonomy that believes, for example, that cladistic analysis of a group is better than the description of new species and on the other hand the belief that only "applied taxonomy" should be supported strongly. In short, there must be a rejection of the idea that taxonomists and taxonomy can be considered only as a tool for allied sciences, rather than a discipline in its own right (SLATER 1984).

The most important contributions to systematics and ecology during the last two centuries, from Richard Owen and Charles Darwin to J.B.S. Haldane and Ernst Mayr, were made by scientists who studied specimens (STUEBING 1998).

Governments spend hundreds of millions of dollars on systematic studies of stars, but merely a trifling particle of these sums devote to systematic studies of Nature on the Earth (LEAKEY & LEVIN 1999).

Many taxonomists find it possible to produce their most important syntheses and monographs only once freed from the constraints of regular employment (NEW 1999).

I know of a few "very modern museums" which have become so over-staffed with theoretical systematists or molecular biologists that even basic identifications of major groups of plants and animals cannot be done! (NG 2000).

Taxonomy is a science and not a created (stable) frame of reference (KRELL 2004).

There are already too few high-quality international journals willing to publish basic taxonomic research, in spite of the fact that the description and conservation of biodiversity is greatly dependent on such studies (SLUYS et al. 2004).

Regardless of how much information in museums is databased or how many specimens are scanned and high-resolution images posted to the World Wide Web, the ultimate value of collections resides in specimens (WHEELER 2004).

Major reason that museums are not doing well today is that they have increasingly distanced themselves from their taxonomic roots (WHEELER 2004).

The fact that knowing all of Earth's species requires a large number of scholars is a reason to educate and employ taxonomists, not an argument to abandon scholarship in favor of theoretically vacuous technology (WHEELER 2004).

Considerable effort and money will be spent in digitizing images of type specimens. The rationale will be that this will make material readily available worldwide. It will be a spectacular failure, for no image can substitute for looking at the real object (YOCHELSON 2004).

At all stages (e.g. collecting efforts, sorting specimens, curating collections of vouchers, providing names), the construction of a centralized DNA-based system of identification would depend in part on the expertise of 'non-DNA' taxonomists (DAYRAT 2005).

A group of entomologists from a university in Eastern Europe was trying to develop a molecular profile of different populations [of] some dangerous groups of mosquitoes, especially those responsible for dengue fever. ... The intrepid team of researchers was taken to jail in handcuffs while working on Palawan ... Their ambassador had to travel down from Jakarta to secure their release. They left behind 22 vials of dead mosquitoes in alcohol – which presumably now are in the "black museum" of the environment department as a major triumph. At the same time Manila was plastered with posters on how to kill as many mosquitoes as possible in dozens of ingenious ways ... to save species is to study them closely .... (LARSEN 2005).

New idea that DNA barcoding can replace normal taxonomy for naming new species and studying their relationships is worse than bad, it is destructive (WILL et al. 2005).

In all molecular systematic studies, the strength of interpretation relies on comparative morphological data to make biological sense (HUYS et al. 2006).

The taxonomic literature ages … slowly … Moreover, … is large and diffuse and a much greater fraction is potentially relevant compared with most sciences. A taxonomist cannot just ignore a paper published in an obscure journal in an unfamiliar language as other scientist might be tempted to. A description anywhere is a taxonomic hypothesis that needs to be considered (GODFRAY et al. 2007).

Inquiries based on careful examination of museum skins spawn many unexpected and unanticipated surprises long after the specimens themselves are added to the museum drawers, ranging from delineation of new species or even new genera, to documentation of phenotypic change in short timeframes, to comparison of toxin levels over time (KANNAN 2007).

By ignoring the traditional jobs of taxonomy (describing and corroborating species and characters, making species identifiable, providing informative names and predictive classifications, and continually exploring biological diversity at and above the species level) it is only a matter of time until untested species, outdated names, or unimproved classifications lead to mistakes of enormous cost. A misidentified disease vector or pest species at a port of entry; conflated species with similar barcode genes but significantly different attributes; use of name that no longer reflects an accurate understanding of natural patterns; or misidentification of a study organism can contribute to decisions with disastrous consequences in applied or experimental biology. Must we witness such disasters before restoring support and resources in to taxonomy? (WHEELER 2007).

When the greatest taxonomic institutions support molecular genetics, conservation, and ecological studies at the expense of taxonomy, what are others to think of the importance of the latter? If taxonomy is not important enough for us to make our own top priority, why should any agency or individual seriously entertain supporting it financially? (WHEELER 2007).

I want to emphasize that taxonomists should be proud of their support of such important disciplines as ecology and conservation biology. However, the best taxonomy is done for its own sake. It follows that the best taxonomic services are spin offs of taxonomy done for its own sake (WHEELER 2007).

In the midst of a biodiversity crisis … we should make species exploration, discovery and description an extremely high priority. We should make the growth and development of natural history collections as comprehensive evidence of species and clade diversity a high priority. And we should make the practice of taxonomy according to its very best theories and methods a mandate … Instead funds flow to the latest molecular techniques that we seem to do only because we now can, not because they offer improved estimates of species or reference systems (WHEELER & VALDECASAS 2007).

Systematic work that does not rely on museum specimens to verify or falsify the identities of the taxa studied is not science (WINSTON 2007).

Taxonomists are cheap dates. That might seem to be a good thing, but trends in academic science have gone in the opposite direction. Laboratory space and jobs go to those who can bring in the largest grants, those which will result in the greatest amount of overhead or profit returned to the university (WINSTON 2007).

Real taxonomy is and has always been focused as much upon character analysis and evolution as upon the discovery of species and reconstruction of relationships. With the grand challenge questions of taxonomy unanswered (CRACRAFT 2002; PAGE et al. 2005), we need to return to the core strengths of taxonomy, including explicit studies of characters. For the purpose of cladistic analysis, we simply need data that can and are analyzed appropriately to reveal cladistic (as opposed to phenetic) patterns. In the context of cladistic analysis, molecules and morphology are just data, nothing more, nothing less. We need the best data we can have, and should not seek to homogenize the activities of those who gather it. Whether limited by talent, motivation, time or resources, many of us would prefer to focus on where our passions lie in order to make inspired contributions of the highest quality possible. For some of us, that means focusing exclusively on morphology or molecules or ontogeny or fossils. What matters is that as much data as possible are available; let us not confuse the need for taxonomy to have multiple data sources with an expectation that the full range is generated by each taxonomist.

The discipline of taxonomy stands apart from the many fields of functional or general biology (NELSON & PLATNICK 1981). It has taken centuries to refine the theoretical and epistemological justifications and assumptions of taxonomy; these advances should not be sacrificed on the altar of political correctness and modernity, in order to receive acceptance from experimental or molecular biologists. Students can be trained in a matter of months to sequence DNA proficiently and, if they generate large enough sums of external funding, can become celebrated as ‘good’ systematists. Morphologists must be educated over a period of years to work to high levels of excellence; they must master, in many cases, centuries of existing knowledge, a vast and technical vocabulary of terms required to discuss precisely complex characters and their component parts, understand intimately the theory behind concepts such as homology and synapomorphy as well as their use in a particular taxon, demonstrate a critical 'eye' capable of recognizing significant patterns of similarities or differences, learn to use alternative data sources as independent tests of sameness, and know how to collect, prepare, dissect and illustrate or image specific parts in a way that records and communicates complicated bits of visual knowledge. We do not suggest that there are not excellent molecular systematists that go far, far beyond the rote generation and analysis of data caricatured above; there are, and they deserve the same respect and support as good morphologists. The problem today, however, is not that they are denied stature and resources, it is that they alone receive them within systematic biology at the great detriment of the general reference system and growth of knowledge of morphology in particular. What is interesting at the heart of taxonomy is understanding the patterns of origin and diversification of complexity, not merely enumerating 'species' about which nothing is known concerning their structural uniqueness or relationships. Unless we support adequately the many facets of taxonomy, we impoverish our science to the point of undermining its importance. More importantly, unless we recognize that taxonomy is non-experimental (it cannot be commingled with, for example, ecology or population genetics) and that it is not subject to the same statistical tools appropriate to tokogenetic systems (WHEELER 1995, 2004), we necessarily diminish its unique contributions to biology. Combining experimental and historical sciences can only result in a kind of undisciplined thinking that ignores the epistemic foundations of each discipline. The quality of taxonomy depends upon the recognition of and respect for the differences between taxonomy and experimental biology (WHEELER 2008a, b).

Taxonomist will consult the literature, the original description and those that follow. However, except in the case of common well-known species, specimens must be consulted, both those available at nearby museums and those that must be borrowed from more distance institutions to ensure that results are science, not fantasy (WINSTON 2007).

To 'simply' go to the field and collect specimens, study them carefully in the laboratory, compare them with collections, describe them, and publish their descriptions, taxonomy needs thousands of arms and brains (i.e. of permanent salaries). This is much more crucial for the discipline than computers, sophisticated techniques, molecular facilities, 'highly ranked' publications, and internet chats (DUBOIS 2008).

That "museum" collections (no matter whether "public" or private, under the only condition to be available for study to all interested biologists) provide the basis for all systematical, biogeographical or phylogenetical studies (and to a high degree for all the remaining branches of biology) seems so evident that I feel embarrassed to write about this: it is as if I would specially explain that there can be no archaeology without excavations, history without archives, or geography without maps... And nevertheless suggestions to restrict (or even almost totally wind up) them, or at least to make them accessible only or mainly in form of internet "databases", "digital" pictures etc., appear in increasing frequency. Simultaneously collecting, transport and exchange of botanical and zoological specimens encounter more and more numerous and drastic bureaucratic restrictions, respective institutions (museums) have no funds (and usually do not show particular interest) for this while "amateurs" are by any means impeded and discouraged from keeping collections or even forbidden to hold any! (HOLYNSKI 2008).

I strongly urge that, as taxonomy progresses into its next stage, what we might call the 'New Taxonomy' or 'Cyber-Enabled Taxonomy', that we use the emerging cyber-infrastructure to re-establish vibrant supplies of diverse data, especially morphology. Every taxon should have a 'knowledge community' of experts distributed around the world collaborating to contribute to the growth of knowledge of its species. Although taxonomists who wish to study more than one source of data should be free to do so, that should not be a mandate. It is through the full-bore, take-no-hostage approach to each discipline that the very best science will emerge. Taxonomy should be a transdisciplinary science, drawing the best from a wide range of researchers, not a concatenation of superficially practiced techniques by undisciplined investigators (WHEELER 2008a).

We need a taxonomy that integrates the expertise, diligence, knowledge, passion and talents of teams of specialists, each contributing something unique and excellent to collaborative studies of taxa. … If someone is a good collector and that is what he or she enjoys and excels at, then let us provide support for collecting. … If someone is interested in comparative morphology, then let us support him or her to be the best morphologist he or she can be, and not require a dilution of good morphology by prescribed molecular laboratory work. If another is interested in molecular techniques, then let us sustain that interest, and so forth. … Let us celebrate the diversity of interests and motivations ..., and not attempt to define what a good 'systematist' is (WHEELER 2008b).

The Evolution of Ethics attempts to construct a conceptual bridge between biology and human behavior by examining the cultural and biological feedback system that inspires the evolution of social rules. In theory, at the heart of developing ethical systems is a cybernetic process that arises between the interaction of biology and culture using the informational feedback between the two to further human adaptation and survival. Ethical systems evolve in response to the drive of the human species to survive. Not only do ethical systems evolve but also a whole array of related "rule systems" such as statutory laws, customs, and professional codes evolve along side ethical systems to facilitate human survival. Evolutionary ethics is a controversial subject. It is not philosophy, although it is assumed by many philosophers to be exclusively in their domain. Evolution, after all, springs from science and not philosophical speculation. In evolutionary ethics facts, observation and human experience are central to the reasoning ethics while the ethics of philosophy focuses on an analysis of ethical words, the properties of ethical language and questions of value and the like. Philosophy has had difficulty integrating fact, observation, and experience into its formal reasoning of its ethics. It has never been able to resolve ethical issues in a relevant and meaningful way, thus, it is time for ethicists to move away from philosophical language and towards a more scientific way of analyzing and describing ethics. Little work has been done to quantify ethics as science, but the evidence is there that the evolution of ethical systems can be quantified and expressed in understandable scientific terms. When certain behavioral actions produce reasonably predictable consequences you have the basis for science. The evolution of moral systems reflects an underlying social reality: that human action often inspire undesirable reactions that can be avoided given the guiding hand of evolving moral systems.

The Evolution of Ethics attempts to construct a conceptual bridge between biology and human behavior by examining the cultural and biological feedback system that inspires the evolution of social rules. In theory, at the heart of developing ethical systems is a

cybernetic process that arises between the interaction of biology and culture using the informational feedback between the two to further human adaptation and survival. Living systems of all descriptions have evolved both cooperatively and competitively for more than a billion years. Since biological systems have been intertwined for so long, a change in one system can cause a change in many others. In theory, these changes disperse through the environment like waves generated by an object hitting the surface of a quiet pond. Biological interrelatedness extends to human social systems as well, thereby imposing limits upon what people can reasonably do. Human beings are not at liberty to do as they wish because personal actions often inspire consequent reactions and sometimes overreactions that need regulating by way of laws and morals. This regulation affects individuals as well as large groups. An example of this might be seen in the careless use of fluorocarbons that thin the ozone layer, allowing harmful radiation to reach the earth and threaten the survival of all humans and organisms. Such a dangerous situation forces humans to choose between doing what they freely wish to do (risking pain, suffering, and death in the process) or setting limits on their behavior. The demonstrable effects of pollutants on people appear to force the formation of laws and enlightened moral attitudes that discourage the practice of releasing dangerous chemicals into the atmosphere. These kinds of laws cannot be said to have emerged from some abstract philosophical theory of right and wrong. Instead, they appear to have evolved from real life situations in which human beings are forced to adapt to threatening circumstances in order to maintain their health and quality of life.

Morality is sometimes viewed in a negative context because it is associated with self-serving political and religious causes. In spite of this fact, the imposition of rules in the main does not lower the quality of human life. To the contrary, carefully laid out rules have the greater potential to improve its quality. Broadly imposing guidelines through the promotion of statutory laws as well as moral, manner, and customary rule systems, redirect social priorities in an efficient way. In turn, there is an increase in societal organization and efficiency that enhances cultural peace, prosperity, and productivity. Social evolution in this light acts as an extension of the same biological processes observed in lower organisms where it appears that tight hierarchical organization and efficient survival strategies further the life of many types of organisms.

In theory, nature provides human beings with the means to motivate themselves and create great things by giving them passion and sensitivity. At the same time, it appears to endow them with an extraordinary intelligence to limit the excesses of their emotions. Unfortunately, while people strive to be rational, their actions are still governed by strong emotions. When they respond to emotions that are a derivative of physiology, behavioral excesses inspiring a host of problems manifest themselves. When emotions run high, there needs to be some mechanism present to keep passions from getting out of hand and causing harm to people or the societies they have spent so many years building. In much the same way that circuit breakers in a house prevent an overloaded circuit from melting the wires and causing a fire, moral restraints naturally arise and intervene as reasons (or a reason) to break up the vicious circles of conflict that passions can produce. The emergence of moral laws and sentiments, shaping the course of history, is therefore an extension of human physiology that stabilizes relationships so that people grow and prosper instead of conflicting to the point of extinction.

There appears to be an impassable barrier between science and ethics. This barrier exists because science is based on absolute certainty, while ethics has no general basis at all. Science is also capable of advancement, where ethics is not because science can repair its mistakes through reason and experience. Ethics only collapses when its foundations are uprooted. Because of this inefficiency regarding the understanding of ethics it is necessary that we observe and study moral behavior from a scientific perspective. The understanding of ethics goes both ways though, in that morality needs to be looked at biologically and biologists need to explain their ethical views more philosophically.

William Lipscomb, 1976 Nobel-Prize-winner in chemistry, says that he "no longer put my most original ideas in my research proposals, which are read by many referees and officials. I hold back anything that another investigator might hop on and carry out. When I was starting out, people respected each other's research more than they do today, and there was less stealing of ideas". Rustum Roy, Professor of Materials Science at Penn State, himself an outspoken critic of some corrupt practices in modern science, used a press conference to announce a new method for making synthetic diamond, and justified that as "the only way to prevent . . . a small group of peer reviewers . . . [having] an advance chance to duplicate the work in their labs" (BORMAN 1992).

In the hurry to develop high-temperature superconductors (FELT & NOWOTNY 1992) "scientific results were announced first in the press to gain a few days on other groups. . . . [One researcher] applied for a patent [and then] submitted a paper containing two systematic mistakes making it useless to any reader. . . . [and gave] a press conference . . . announcing – without giving any detail – the discovery . . . . Only . . . at the latest possible date, did he send his corrections to the journal".

We hope you agree that all this is unpleasant, sleazy, and shouldn't happen. But does it have anything to do with the actual science? Does it really matter, who gets the credit, so long as science keeps progressing? We think it *does* matter – because science progresses with sound, reliable results *only to the degree that scientists are honest*. Most people think science gives trustworthy results because of "the scientific method": testing ideas by experiment and so either proving or disproving them. Isn't that what you all do? Experiment, and find out what's true and what isn't? But what if an experiment doesn't give the result you expected? What if it gives a result that you just *know* is wrong in some way? Don't you keep trying until you get the "right" result? Especially if you know that your boss is very sure that's what you should get? Isn't there the temptation to fudge a bit? Since you know what the right answer *ought* to be, why not just round the numbers off a bit?

Five principles for research ethics

Not that long ago, academicians were often cautious about airing the ethical dilemmas they faced in their research and academic work, but that environment is changing today. Psychologists in academe are more likely to seek out the advice of their colleagues on issues ranging from supervising graduate students to how to handle sensitive research data.

"There has been a real change in the last 10 years in people talking more frequently and more openly about ethical dilemmas of all sorts," she explains.

Indeed, researchers face an array of ethical requirements: They must meet professional, institutional and federal standards for conducting research with human participants, often supervise students they also teach and have to sort out authorship issues, just to name a few.

1. Discuss intellectual property frankly

Academe's competitive "publish-or-perish" mindset can be a recipe for trouble when it comes to who gets credit for authorship. The best way to avoid disagreements about who should get credit and in what order is to talk about these issues at the beginning of a working relationship, even though many people often feel uncomfortable about such topics.

"It's almost like talking about money," explains Tangney. "People don't want to appear to be greedy or presumptuous."

APA's 2002 Ethics Code offers some guidance: It specifies that "faculty advisors discuss publication credit with students as early as feasible and throughout the research and publication process as appropriate." When researchers and students put such understandings in writing, they have a helpful tool to continually discuss and evaluate contributions as the research progresses.

However, even the best plans can result in disputes, which often occur because people look at the same situation differently. "While authorship should reflect the contribution," says APA Ethics Office Director Stephen Behnke, JD, PhD, "we know from social science research that people often overvalue their contributions to a project. We frequently see that in authorship-type situations. In many instances, both parties genuinely believe they're right." APA's Ethics Code stipulates that psychologists take credit only for work they have actually performed or to which they have substantially contributed and that publication credit should accurately reflect the relative contributions: "Mere possession of an institutional position, such as department chair, does not justify authorship credit," says the 2002 code. "Minor contributions to the research or to the writing for publications are acknowledged appropriately, such as in footnotes or in an introductory statement."

The same rules apply to students. If they contribute substantively to the conceptualization, design, execution, analysis or interpretation of the research reported, they should be listed as authors. Contributions that are primarily technical don't warrant authorship. In the same vein, advisers should not expect ex-officio authorship on their students' work.

Psychologists should also be cognizant of situations where they have access to confidential ideas or research, such as reviewing journal manuscripts or research grants, or hearing new ideas during a presentation or informal conversation. While it's unlikely reviewers can purge all of the information in an interesting manuscript from their thinking, it's still unethical to take those ideas without giving credit to the originator.

Researchers also need to meet their ethical obligations once their research is published: If authors learn of errors that change the interpretation of research findings, they are ethically obligated to promptly correct the errors in a correction, retraction, erratum or by other means.

To be able to answer questions about study authenticity and allow others to reanalyze the results, authors should archive primary data and accompanying records for at least five years, advises University of Minnesota psychologist and researcher Matthew McGue, PhD. "Store all your data. Don't destroy it," he says. "Because if someone charges that you did something wrong, you can go back."

"It seems simple, but this can be a tricky area," says Susan Knapp, APA's deputy publisher. "The APA Publication Manual Section 8.05 has some general advice on what to retain and suggestions about things to consider in sharing data."

The 2002 APA Ethics Code requires psychologists to release their data to others who want to verify their conclusions, provided that participants' confidentiality can be protected and as long as legal rights concerning proprietary data don't preclude their release. However, the code also notes that psychologists who request data in these circumstances can only use the shared data for reanalysis; for any other use, they must obtain a prior written agreement.

2. Be conscious of multiple roles

APA's Ethics Code says psychologists should avoid relationships that could reasonably impair their professional performance or could exploit or harm others. But it also notes that many kinds of multiple relationships aren't unethical--as long as they're not reasonably expected to have adverse effects.

That notwithstanding, psychologists should think carefully before entering into multiple relationships with any person or group, such as recruiting students or clients as participants in research studies or investigating the effectiveness of a product of a company whose stock they own.

For example, when recruiting students from your Psychology 101 course to participate in an experiment, be sure to make clear that participation is voluntary. If participation is a course requirement, be sure to note that in the class syllabus, and ensure that participation has educative value by, for instance, providing a thorough debriefing to enhance students' understanding of the study. The 2002 Ethics Code also mandates in Standard 8.04b that students be given equitable alternatives to participating in research.

Perhaps one of the most common multiple roles for researchers is being both a mentor and lab supervisor to students they also teach in class. Psychologists need to be especially cautious that they don't abuse the power differential between themselves and students, say experts. They shouldn't, for example, use their clout as professors to coerce students into taking on additional research duties.

By outlining the nature and structure of the supervisory relationship before supervision or mentoring begins, both parties can avoid misunderstandings, says George Mason University's Tangney. It's helpful to create a written agreement that includes both parties' responsibilities as well as authorship considerations, intensity of the supervision and other key aspects of the job.

"While that's the ideal situation, in practice we do a lot less of that than we ought to," she notes. "Part of it is not having foresight up front of how a project or research study is going to unfold."

That's why experts also recommend that supervisors set up timely and specific methods to give students feedback and keep a record of the supervision, including meeting times, issues discussed and duties assigned.

If psychologists do find that they are in potentially harmful multiple relationships, they are ethically mandated to take steps to resolve them in the best interest of the person or group while complying with the Ethics Code.

3. Follow informed-consent rules

When done properly, the consent process ensures that individuals are voluntarily participating in the research with full knowledge of relevant risks and benefits.

"The federal standard is that the person must have all of the information that might reasonably influence their willingness to participate in a form that they can understand and comprehend," says Koocher, dean of Simmons College's School for Health Studies.

APA's Ethics Code mandates that psychologists who conduct research should inform participants about:

* The purpose of the research, expected duration and procedures.

* Participants' rights to decline to participate and to withdraw from the research once it has started, as well as the anticipated consequences of doing so.

* Reasonably foreseeable factors that may influence their willingness to participate, such as potential risks, discomfort or adverse effects.

* Any prospective research benefits.

* Limits of confidentiality, such as data coding, disposal, sharing and archiving, and when confidentiality must be broken.

* Incentives for participation.

* Who participants can contact with questions.

Experts also suggest covering the likelihood, magnitude and duration of harm or benefit of participation, emphasizing that their involvement is voluntary and discussing treatment alternatives, if relevant to the research.

Keep in mind that the 2002 Ethics Code, which goes into effect on June 1 this year, includes specific mandates for researchers who conduct experimental treatment research. Specifically, they must inform individuals about the experimental nature of the treatment, services that will or will not be available to the control groups, how participants will be assigned to treatments and control groups, available treatment alternatives and compensation or monetary costs of participation.

If research participants or clients are not competent to evaluate the risks and benefits of participation themselves--for example, minors or people with cognitive disabilities--then the person who's giving permission must have access to that same information, says Koocher.

Remember that a signed consent form doesn't mean the informing process can be glossed over, say ethics experts. In fact, the 2002 APA Ethics Code says psychologists can skip informed consent in two instances only: When permitted by law or federal or institutional regulations, or when the research would not reasonably be expected to distress or harm participants and involves one of the following:

* The study of normal educational practices, curricula or classroom management methods conducted in educational settings.

* Anonymous questionnaires, naturalistic observations or archival research for which

disclosure of responses would not place participants at risk of criminal or civil liability or damage their financial standing, employability or reputation, and for which confidentiality is protected.

* The study of factors related to job or organization effectiveness conducted in organizational settings for which there is no risk to participants' employability, and confidentiality is protected.

If psychologists are precluded from obtaining full consent at the beginning--for example, if the protocol includes deception, recording spontaneous behavior or the use of a confederate, they should be sure to offer a full debriefing after data collection and provide people with an opportunity to reiterate their consent, advise experts.

The code also says psychologists should make reasonable efforts to avoid offering "excessive or inappropriate financial or other inducements for research participation when such inducements are likely to coerce participation."

4. Respect confidentiality and privacy

Upholding individuals' rights to confidentiality and privacy is a central tenet of every psychologist's work. However, many privacy issues are idiosyncratic to the research population, writes Susan Folkman, PhD, in "Ethics in Research with Human Participants" (APA 2000). For instance, researchers need to devise ways to ask whether participants are willing to talk about sensitive topics without putting them in awkward situations, say experts. That could mean they provide a set of increasingly detailed interview questions so that participants can stop if they feel uncomfortable. Research participants have the freedom to choose how much information about themselves they will reveal and under what circumstances, psychologists should be careful when recruiting participants for a study, says Sangeeta Panicker, PhD, director of the APA Science Directorate's Research Ethics Office. For example, it's inappropriate to obtain contact information of members of a support group to solicit their participation in research. However, you could give your colleague who facilitates the group a letter to distribute that explains your research study and provides a way for individuals to contact you, if they're interested.

Other steps researchers should take include:

* **Discuss the limits of confidentiality.** Give participants information about how their data will be used, what will be done with case materials, photos and audio and video recordings, and secure their consent.

* **Know federal and state law.** Know the ins and outs of state and federal law that might apply to your research. For instance, the Goals 2000: Education Act of 1994 prohibits asking children about religion, sex or family life without parental permission.

Another example is that, while most states only require licensed psychologists to comply with mandatory reporting laws, some laws also require researchers to report abuse and neglect. That's why it's important for researchers to plan for situations in which they may learn of such reportable offenses. Generally, research psychologists can consult with a clinician or their institution's legal department to decide the best course of action.

* **Take practical security measures.** Be sure confidential records are stored in a secure area with limited access, and consider stripping them of identifying information, if feasible. Also, be aware of situations where confidentiality could inadvertently be breached, such as having confidential conversations in a room that's not soundproof or putting participants' names on bills paid by accounting departments.

*** Think about data sharing before research begins.** If researchers plan to share their data with others, they should note that in the consent process, specifying how they will be shared and whether data will be anonymous. For example, researchers could have difficulty sharing sensitive data they've collected in a study of adults with serious mental illnesses because they failed to ask participants for permission to share the data. Or developmental data collected on videotape may be a valuable resource for sharing, but unless a researcher asked permission back then to share videotapes, it would be unethical to do so. When sharing, psychologists should use established techniques when possible to protect confiden-tiality, such as coding data to hide identities. "But be aware that it may be almost impossible to entirely cloak identity, especially if your data include video or audio recordings or can be linked to larger databases," says Merry Bullock, PhD, associate executive director in APA's Science Directorate.

*** Understand the limits of the Internet.** Since Web technology is constantly evolving, psychologists need to be technologically savvy to conduct research online and cautious when exchanging confidential information electronically. If you're not a Internet whiz, get the help of someone who is. Otherwise, it may be possible for others to tap into data that you thought was properly protected.

5. Tap into ethics resources

One of the best ways researchers can avoid and resolve ethical dilemmas is to know both what their ethical obligations are and what resources are available to them.

"Researchers can help themselves make ethical issues salient by reminding themselves of the basic underpinnings of research and professional ethics," says Bullock. Those basics include:

*** The Belmont Report.** Released by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research in 1979, the report provided the ethical framework for ensuing human participant research regulations and still serves as the basis for human participant protection legislation.

Moreover, despite the sometimes tense relationship researchers can have with their institutional review boards (IRBs), these groups can often help researchers think about how to address potential dilemmas before projects begin, says Panicker. But psychologists must first give their IRBs the information they need to properly understand a research proposal.

"Be sure to provide the IRB with detailed and comprehensive information about the study, such as the consent process, how participants will be recruited and how confidential information will be protected," says Bullock. "The more information you give your IRB, the better educated its members will become about behavioral research, and the easier it will be for them to facilitate your research."

As cliché as it may be, says Panicker, thinking positively about your interactions with an IRB can help smooth the process for both researchers and the IRBs reviewing their work.

Science and scholarship depend on widely held values of integrity and honesty among those who advance knowledge in their respective fields. Without these values, the research enterprise becomes suspect, and its results are subject to mistrust. In a very real way, trust is based on a shared expectation of the respect for truth. Pressure to publish, financial gain from commercializing research discoveries, and technological advances in communication and investigation, among other factors, threaten to compromise ethical conduct in research and scholarship. The distinction between what is appropriate conduct and what is not has, in some cases, become increasingly blurred, and answers to ethical questions are not always clear-cut.

What do graduate students need to learn about ethics?

The history and values relating to research and scholarship social responsibility; reporting misconduct, authorship, plagiarism, peer review, intellectual property, conflict of interest, research data management, fiscal responsibility, environmental health and safety, animal subjects, human subjects.

Ideally, graduate students in all disciplines will be exposed to management of integrity in all of these areas, even though some topics may not be directly related to their chosen field of study. As responsible researchers, scholars and professionals, all students should have an understanding of these issues, even though students in different fields may find that these issues affect them differently.

Ethics of science and technology

Ethics of science and technology is the principal priority of the Social and Human Sciences Sector. UNESCO, as the leading international organization in the area of ethics aims to meet the moral challenges that are presented by scientific and technological innovations. New developments demand that we as human communities are innovative and at the same time take appropriate action to make sure that scientific and technological advances will be used to benefit humankind.

The rapid advance of science and technology is fascinating and continuously challenging our imagination and expectations, but our understanding of the ethical implications must be developed at the same time. Science and technology on the other hand can also give rise to fears and risks. When considering technological risks related with the environment and human and animal health, not only scientific and technological uncertainties are at stake, but also socio-economic and ethical concerns. In order to address these uncertainties, a systematic and intensive ethical analysis, involving not only scientists but also policy-makers and the general public is needed. A more informed debate can establish a bridge between science and society, also providing a reliable basis for political decision-making.

To understand the true biological, social and ethical impacts of modern science and technological application, we must view the present time in our evolution integrally and holistically. This means experiencing our present-time actions from environmental, personal and social perspectives. It also means learning to feel, sense, and think in new, and possibly unexpected, patterns by evaluating shortterm costs and benefits counter balanced by long-term survival implications. There are two overarching themes: a) to increase awareness of human reproduction by providing an integrated overview of current theories and principles of human reproductive function, and b) to explore the frontiers of science and technology as they relate to bioscience ethics. Basic topics include sexual differentiation, growth, maturation, the treatment and causes of infertility, parental behavior, neonate biology and aging. The effects of procreational biology on the foundation of human social structure are also examined. Issues as they relate to health include the biology of stress, diseases of adaptation, principles of toxicology and teratology, sustainable living and the environment.

Science and ethics: major challenges

UNESCO's activities in ethics of science and technology seek to place scientific and technological progress in a context of ethical reflection that is rooted in the cultural, legal and philosophical heritage of the Member States. With the advice of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), UNESCO assists Member States to address the moral concerns in connection to science and technology through providing expertise in a number of areas of applied ethics, such as:

● studies on environmental ethics and on clarification of the precautionary principle. They provide clear information and enable scientists and policy-makers to identify relevant ethical principles. Proposals are in development for a core curriculum in environmental ethics while existing programs have been collected in the database;

● studies on science ethics, in connection to possible misuse and dual use and in relation to existing codes of conduct for scientists;

● studies on the ethics of new and emerging technologies, such as space technologies and nanotechnologies in order to prepare policy-makers and the general public for future ethical debate;

● teaching of ethics, initiating and reinforcing educational activities and developing quality assessment systems in order to promote that young scientists and professionals are sufficiently trained in the ethical dimensions of their disciplines.

Educational resources are published (such as a manual on *Informed Consent*). An ethics teacher training course will be organized for the first time in November 2006.

Scientists, philosophers, lawyers, engineers, education specialists, policymakers, experts with the best reputation and expertise in their respective areas are regularly invited to assist UNESCO and COMEST in such efforts. They are helping UNESCO to identify the state of-the-art, the significant issues and potential international needs and activities in each area. Their proposals and conclusions, in a subsequent stage, are object of international consultations, starting with intensive discussions in COMEST, leading to advices and recommendations that will be submitted to the UNESCO governing bodies. The composition of these groups of experts takes into due account considerations of professional excellence, multi-disciplinarity, gender and regional distribution. The diversity of views is indeed the very raison d'être of COMEST. Any apparent difference between professionals with scientific training and those from the humanities or with philosophical background represents a healthy reflection of this diversity of views and an attempt to reconcile the different perspectives of scientific and philosophical approaches. Ethics of science will necessarily require intimate relationships with science itself, as expressed in a wellknown adagium: *"Science without ethics is blind, ethics without science is empty"*.

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Zusammenfassung

Forschung ist eine dieser höchst komplexen und subtilen Aktivitäten, die gewöhnlich kaum Gestalt in den Gedanken jener annehmen, die sie nicht ausüben. Dies ist wahrscheinlich der Grund warum die meisten Wissenschafter denken, dass es nicht möglich ist eine formale Anleitung zum Betrei-

ben von Forschung zu geben. Weiters muss Schulung in Bezug auf Forschung großteils im Selbststudium, vorzugsweise unter Anleitung von Wissenschafter, die in der Handhabe der unmittelbaren Untersuchung erfahren sind, erfolgen. Wissenschaftliche Forschung, die ganz einfach die Suche nach neuem Wissen ist, spricht vor allem Menschen an, die Individualisten sind, und deren Herangehensweisen von Person zu Person variieren. Eine Strategie, die von einem Wissenschafter verfolgt wird, muss für einen anderen nicht passend sein, und verschiedene Wissenschaftszweige erfordern verschiedene Methoden. Dennoch gibt es grundlegende Richtlinien und geistige Methoden, die üblicherweise in den meisten Untersuchungsarten zur Anwendung kommen, zumindest im Bereich der Biologie. Ehrlichkeit und Moral stellen den ersten Schritt in allen wissenschaftlichen Untersuchungen dar, und ein Forscher muss dies in allen Phasen einer wissenschaftlichen Arbeit bedenken. Die Rolle und Wichtigkeit der Genauigkeit und Ehrlichkeit in der Taxonomie und Systematik ist größer als in anderen biologischen Wissenschaften. Denn alle Forscher und Studenten müssen in der wissenschaftlichen Forschung ehrlich sein und die Prinzipien der Ethik erlernen. Aus diesem Grund behandelt diese Abhandlung Ethik in Wissenschaft und Technologie sowie wichtige Erläuterung zur Taxonomie.

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