Module 1.1: Workplace Ethics in Transnational Contexts

IDEESE Module 1.1
Workplace Ethics in Transnational Contexts

MJ Peterson
Version 1; Revised February 2008

Learning Objectives

Students will be able to:

1. Explain why scientists and engineers need to pay attention to the international context of their work.

2. Specify what additional considerations arise and what steps must be taken in transnational discussions of ethics in science and engineering fields.

Outline for In-class Discussion

I. The contemporary setting of scientific and technical work

A. Pose question: We often speak of living in a "globalized" world, which is a way of saying that there is now more interconnection among countries and their societies. What are the sources of this interconnection?

Students should be able to identify these. Ask for examples of each.

1. Increased volume and value of cross-border economic transactions

2. More rapid flow of information, ideas, and news

3. Increased travel and cross-border migration

B. Greater frequency and intensity of cross-border communication and collaboration among scientists and engineers.

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. "Roots of Interconnection: Communications, Transportation and Phases of the Industrial Revolution." International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

Ask students for examples.

C. Greater concern in all countries about the wider social implications of the results of scientific research and engineering projects.

Ask students for examples.

II. Bringing ethics to bear on transnational activity

A. Three possible responses

1. Apply ethics of own society to all activities of its members wherever the activity occurs.

2. Apply ethics prevailing in the society where activity occurs no matter who does it.

3. Develop ethical principles and rules common to all societies where the scientific or engineering work occurs.

Ask students to give examples of situations in which each choice was made, then about why they think that choice was made.

B. Differences between national and transnational ethical debate

Suggested Case Studies

Visit www.umass.edu/sts/ethics/cases.html to download these materials

"Bhopal Plant Disaster" International Dimensions of Ethics Education in Science and Engineering Case Study Series.

The Bhopal case is an in-depth study of the industrial accident at the Union Carbide factory in India that immediately killed 2,000 people, injured another 200,000 to 300,000 more, and immediately raised questions about plant safety and corporate responsibility around the world. Includes seven detailed appendices: A.) Chronology, B.) Stakeholders and Level of Responsibility, C.) Economic/industrial climate of India, D.) Union Carbide Corporation, E.) Issues in Chemical Processing, F.) Assessing Responsibility: The Legal/Regulatory System, G.) Assessing Responsibility: The Engineers and Scientists, and H.) Technical Expertise and Managerial Responsibility.

"Recruitment of Egg Donors by South Korean Stem Cell Researchers" International Dimensions of Ethics Education in Science and Engineering Case Study Series.

This case study examines the controversy surrounding Dr. Hwang Woo-suk's recruitment of egg donors for his team's stem cell research from 2002 through 2005. It explores the international dimensions of ethical standards, the political decentralization of global regulation, and the internationalization of science. Appendices include A.) a detailed chronology, B.) a suggested bibliography, C.) background on South Korean regulations, D.) background on International ethics standards.

Notes for Instructor

The three possible responses to bringing ethics to bear parallel the choices facing all forms of cross-border activity. They have been debated most extensively in matters related to activities of multinational corporations, a topic of IDEESE Module 1.2, and are also reflected in the rules of international law that define states' legal authority (jurisdiction) over the activities of private individuals, companies, and organizations.

International Law rules regarding criminal and civil jurisdiction are very similar. Both sets of rules suggest exercising jurisdiction in the following order: 1) territorial – the state where the activity occurs deals with any legal controversy arising from it, 2) nationality – the state where the person undertaking the activity that creates the controversy is a citizen or permanent resident deals with the legal controversies. In civil suits there is also a third possibility: private individuals and groups agree in contracts among themselves which state's law will apply in the event of a legal dispute. In criminal law, choices 1 and 2 are an order of priority. In civil law, they can be regarded as "default settings" operating in that order (if the state suggested by 1 does not act, the state suggested by 2 can step in), with choice 3 available as an override that individuals, firms, or organizations can adopt by agreement.

Ethicists often prefer a similar arrangement, recommending application of the ethics of the society where the activity occurs. When activity involves members of different societies whose ethical standards vary significantly, they often prefer applying whichever ethical standards impose greater obligations to consider and respect the needs and interests of others. Ethicists today are far more careful than were their predecessors in earlier centuries to make sure that they are not suggesting one society's ethical systems is generally superior to the ethical systems of the other society or societies because in the past such claims were used to justify conquest and imperialism. Much of the impetus behind ethicists' efforts to identify and build on commonalities in ethical systems or to develop new transnational ethical codes stems from concern to avoid a repetition of this experience – or even the milder variant of asserting superiority commonly called "cultural imperialism" (which does not involve conquest ad political rule) in which one society's standards are used to judge activity in another.

Recommended Readings for Students

For assignment prior to class discussion

1.) Roots of Interconnection: Communications, Transportation and Phases of the Industrial Revolution [included in this module]

2.) Transnational Aspects of Ethical Debate [included in this module]

3.) Multinational Corporations in Transnational Accountability [included in this module]

4.) Resolving Ethical Disagreements [included in this module]

5.) Case materials – vary according to case selection

Additional readings

1.) To explore Technology as a Physical-Social Network see: Sheila Jasenoff "Introduction" in Jasenoff, ed, *Learning from Disaster: Risk Management after Bhopal* (Philadelphia: University of Pennsylvania Press, 1994) (pp 7-8)

2.) To explore Physical Influences on the Use of a Technology see: George Basalla, *The Evolution of Technology* (Cambridge University Press, 1988) pp.7-11

3.) To use the Barbie Doll as an interesting example of outsourcing see: Richard J. Carroll, Desk Reference on the Economy (Washington, DC: Congressional Quarterly 2000), box on p. 249

4.) To examine conflicts of interest in biotech firms see: Michael J Werner & Elizabeth Price. "Managing conflicts of interest: a survival guide for biotechs." Nature Biotechnology. 25(2). Feb 2007.

Recommended Readings for Instructors

1.) Instructors new to ethics topics might find helpful the entries in Donald M. Borchert, ed., *Encyclopedia of Philosophy*, 2nd edition (Detroit: Thompson-Gale, 2006) on "Ethics" (v.3 pp. 379-393); "Ethics and Morality" (v.3 pp. 450-451); "Equality, Moral and Social" (v. 3, pp. 329-332); "Equality, Moral and Social [Addendum] (v.3 pp. 334-336) and "Feminist Ethics" (v. 3 pp. 578-581).

Resources Included with this Module

1.) Roots of Interconnection: Communications, Transportation and Phases of the Industrial Revolution

2.) Transnational Aspects of the Ethical Debate
   a. Transnational Aspects of Ethical Debate
   b. Resolving Ethical Disagreements
   c. Sources and Extent of Environmental Harm

3.) Multinational Corporations in Transnational Accountability

4.) Organizational Diagrams of selected Scientific Organizations

   a. International Council of Scientific Unions
   b. Typical National Academy of Sciences
   c. Relations among UN Educational Scientific and Cultural Organization (UNESCO), Intergovernmental Oceanographic Commission (IOC) , International Congress of Scientific Unions (ICSU) and Scientific Committee on Oceanographic Research (SCOR)
   d. Relations among International Telecommunications Union (ITU), Committee on Space Research (COSPAR), and IUCAF
   e. US National Academy of Sciences and National Research Council

5.) Examples of Collaboration

a. WFEO: Membership Categories
b. UNESCO: Description of Engineers' Work
c. WFEO: Model Code of Ethics
d. Standard Molecular Biology Nomenclatures

6.) In-Class Evaluation

IDEESE Module 1.1 Resources

Roots of Interconnection: Communications, Transportation and Phases of the Industrial Revolution

MJ Peterson
Version 1; February 2008

Transnational ethical conflicts are more frequent in the contemporary world and because of the greater interconnection among societies. Though scientists and engineers have maintained active contact with colleagues in other countries for centuries, until recent decades such contacts were limited to periods of study at a foreign university, occasional collaboration in labs or on projects, and exchange of research results through publication or presentation at conferences. As societies became more interconnected, the patterns of joint activity deepened. At the same time, the impacts of science and engineering were felt more deeply in society as the connections between basic science on one side and applied science, technology, and engineering of human-made structures became stronger.

Two sets of technological changes increased the possibilities for interconnection between societies by increasing the speed of and broadening access to communications and transportation. The changes in communication took hold more quickly, but both were important to increasing the possibility for interaction among members of different societies.

With invention of the telegraph in the 1840s messages could travel from point-to-point at the speed of shifting electrons rather than of galloping horses or relays of visual signals from tower to tower. Basic transmission time between Paris and London went from days (horses) or hours (visual relay) to minutes. However, the need to receive the messages in a special telegraph office, copy the text onto paper, and then either deliver the paper to the recipient or have the recipient come by to pick it up meant that total message time was longer for anyone who did not have a telegraph office on-site. Initially, telegrams were also expensive enough that their use was limited to government agencies, large business firms, and relatively wealthy individuals. Mass publics began to benefit from telegraphs in the 1860s and 1870s as newspapers expanded their use of telegraphic news services to get stories from distant locales. This roughly coincided with a further expansion of literacy and development (using steam driven presses) of newspapers inexpensive enough for lower middle class, worker, and small farmer households. These developments reinforced one another: without wider literacy fewer people would have an interest in newspapers but without lower prices the newly-literate would have less access to reading material.

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. “Roots of Interconnection: Communications, Transportation and Phases of the Industrial Revolution.” International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

Development of radio in the 1920s and television in the 1950s into mass media meant that audio and visual signals traveling through the air at the speed of sound could spread information to large audiences simultaneously. Governments, broadcasters, and equipment manufacturers all had reason to encourage purchase of radios and televisions, and the cost of basic radios or TVs was soon low enough for most households in industrial countries to have them. The smaller, more portable versions of the 1960s and 1970s made them widely available in developing countries as well. Yet, like newspapers, radio and television broadcasts were one-way media. The publisher or broadcaster could send messages to many people but individual readers, listeners, or viewers could only contact their fellow audience members through face-to-face conversation or the occasional publication of a letter to the editor in the newspaper or the inclusion of listener or watcher comments on the radio or television station.

Telephone services, which first emerged in the late 19th century and expanded considerably after World War I, allowed possessors of telephones to contact each other, but phone service remained fairly expensive,[1] available only to a minority of households even in the industrial countries until after World War II. In many developing countries, access to phone service remained extremely uneven through the 1980s. Only after 1990, as more governments realized the economic importance of extending phone service, and as satellite technology and then cellphones made it possible to connect users without building a nationwide wire network, did differences in access begin to narrow.

Yet, telephones (even cellphones) only link pairs or small groups of users; they do not provide a way for large numbers of people to communicate back and forth simultaneously. Such capability began to develop in the 1990s as the Internet emerged from being a small set of computer connections between specialized users in the USA and Western Europe to the vast world wide web of today. The Internet allows rapid communication among large numbers of users, whether they are accessing someone else's site, running their own site, reading or posting blogs, or interacting on social sites or chat rooms. The Internet has been a great leveler, allowing individuals and small groups the same possibilities of communicating open to governments and other large organizations. Wireless technologies can carry Internet data, though not at quite the same speed as broadband fiberoptic cables, and the same differences in access that affect telephones also affect the Internet.

Even in industrial countries, where Internet access is more widespread than in developing ones, newspapers, radio, and TV coexist with the Internet. Individuals move back and forth among the various media when seeking information. Thus, the older patterns of one-way distribution and of two or small group conversations coexist with the new Internet pattern of multi-party, multiple-direction participation coexist.

These advances in communication have sped up the transmission of new scientific and engineering knowledge, reducing the gap between what is known in the leading laboratories or research centers and what is known elsewhere. Videoconferencing over the telephone network, a merger of telephone and TV technologies made possible by replacement of copper wires with broadband fiberoptic cables, created some possibilities but these facilities were restricted to those who could afford the special equipment required. The addition of webcams to computers opened videoconferencing to anyone with access to the Internet and a computer with video capabilities. These are now sufficiently inexpensive that even

[1] Particularly long distance service. Correcting prices for inflation by using 1990 dollars, a three-minute call from New York to London cost $244.65 in 1030 and $188.51 in 1940, and $3.32 in 1990. R.J. Herring and R. E. Litan. 1989. *Financial Regulation in the Global Economy* (Washington, DC: Brookings Institution).

households can engage in videoconferencing; small labs, independent inventors, and individual engineers can certainly take advantage. The Internet has also changed scientific publishing. It offered the possibility of getting research results out to colleagues and the public more rapidly than was the case with traditional publishing. It also allowed more effective by-passing of peer review systems, with the potential of challenging the whole system. After some initial hesitations, the major journals accommodated the Internet by posting accepted articles online prior to or simultaneously with publication in the traditional hardcopy format and maintaining electronic archives of past issues.

Deeper collaboration among scientists and engineers in different countries was greatly facilitated by changes in transportation technology. In the 18th century a scientist visiting a colleague in another country had to travel overland in a coach, spending nights in Inns (sharing rooms and sometimes even beds with other travelers) and needing days or weeks to get to the destination. Journeys across a body of water required taking passage on a ship. This also involved rather cramped accommodations, but ships could travel more rapidly than coaches, and (seasickness aside) were more comfortable. Thus, scientists who lived in cities close to a port often preferred sea routes. In North America, for instance, more people traveled between Boston and New York by sea than over the always bumpy and sometimes impassibly muddy roads that would be traversed if going by land. Only with construction of a New York to Boston rail line in the 1800s did more people start going by land.

Application of steam technology to transportation in the 19th century increased the speed of travel and increased the size of vehicles, making trips both quicker and more comfortable. Opening of the major interoceanic canals – the Suez Canal in 1869 and the Panama Canal in 1915 – further reduced travel times at sea by replacing the long voyages around the tip of Africa or South America with shortcuts through the Mediterranean or Caribbean. The voyage from England to India, which had taken months in the 18th century, was reduced to weeks in the 19th. The Panama Canal shortened travel between Europe or the east coast of North America to the west coast of South America, or between Asia and the east coast of North America. It had less effect on travel between New York and San Francisco, because the Transcontinental Railroad completed the link between the two in 1867. It was the most dramatic railway project of its time, but was soon followed by other continental-scale efforts as well as further development of shorter railways between major cities. Railroads were the first technology closing the gap in speed between sea and land travel; motor vehicles would do the same, but not until paved highways were constructed in the 1920s and 1930s did motor vehicles become a viable form of long haul transportation.

Trains and steamships, particularly as they became larger and therefore capable of carrying more passengers, reduced the cost of travel to the point that large numbers of students and junior scientists – not just the well-established senior researchers – could afford to go further than immediately neighboring countries. The same increase in the capacity, applied to freight cars and freight-carrying ships, also reduced the cost of transporting goods over long distances, vastly expanding opportunities in international trade. Rather than being confined to relatively light and high-value goods, such as gold, ivory, spices, and porcelain, it was now feasible to ship grain, meat, and a much larger range of raw materials across oceans and continents. Today's long distance food trade is an elaboration on patterns developed in the 19th century, when bulk carriers allowed US and Canadian wheat to be sold in Europe more cheaply than European crops and refrigerator freighters allowed transport of meat (rather than live cattle) from Argentina to Europe.

Transportation speeded up yet again in the 20th century with development of aviation. The true revolution, the opening of air travel to wide sections of the population, came with development of jet aircraft. They could be made large enough and get from place to place quickly enough to bring the price of air travel down to levels making it available to most of the population in industrial countries and increasing fractions of the population in developing ones. Aviation now does for travel much of what the internet does for communications – make feasible a much thicker set of face to face interactions among participants from all continents.

While these developments in communication and transportation were expanding the possibilities of personal contacts around the world, changes in the patterns of economic activity that they helped encourage were creating a much denser set of economic transactions across national borders. The new communications and transportation technologies were both products of and contributors to the successive phases of the industrial revolution. They were more products of the first phase, the relatively small-scale hit-or-miss changes of the first phase, but contributed to the second, third, and fourth phases.

The first phase of industrial activity emerged in England, then spread to Belgium, the Netherlands, northern France, the northwestern German states, and the USA. In this phase, factories were relatively small and products developed through a process of trial and error in which the proprietor, skilled workman, or more specialized “mechanics” made incremental modifications to machinery, production processes, and product design. In many enterprises, manufacturing remained close to the word’s origin a combination of “hand” and “make” because cloth making machinery had to be tended closely and other production depended on considerable adjustment of parts to fit together. In society as a whole, the large numbers of these enterprises shifted the balance between urban and rural areas. In 1760, a bit more than 50% of the male workforce was engaged in farming and 25% in pre-industrial versions of goods production; in 1840 the proportions were reversed. Cities held 21% of the British population in 1760, and 48% in 1840. Though traditional craft production continued in building construction, furniture-making, tailoring, shoe-making, and gunsmithing, centralizing production in a factory with all the machinery run from a central power plant and workers’ hours of work, break, and home life determined by the factory whistle characterized the rising textile and iron industries. As new inventions followed, it became possible to produce a widening range of goods – including many that had not existed before – in factories. We are so accustomed to clothing factories today, that our images of clothing production often extend them back to the late 1700s; however, they were not really feasible until invention of sewing machines in the 1850s.

The second phase of industrial activity started in the mid-19th century, primarily in Germany and the USA, and was characterized by three developments: more conscious application of new scientific knowledge to process and product design, greater volume and economy of production through standardized parts and final products, and larger size of factories or other industrial plants. The German dye industry was the first to systematically apply scientific knowledge – in its case chemistry – to the development of new products. The brighter and more stable synthetic dyes it produced soon dominated the market, and synthetic dye manufacturers emerged in other countries as well. Similar efforts to search for and consciously apply relevant basic scientific knowledge also appeared in the steel industry, where chemists were hired to analyze the composition of newly-made steel, identify more reliable ways to eliminate impurities, and even develop new alloys that would strengthen the material, reduce its tendency to rust, or provide other desired characteristics.

The other significant technological development of this period, truly interchangeable parts, was less directly tied to science but did rest on advances in machine making, including use of harder, and therefore, more stable metals in machines. This production process is so familiar to us – it is our basic image of "manufacturing" – that the difficulty of making component parts to such close tolerances that an assembler can pick up any one of several parts in a bin, insert it in its proper place in the larger product, and be confident that the larger product will work reliably with the technologies of the early 19th century is obscured from view. Part of the reason craft workshops continued to dominate in so many areas was that production involved a lot of trimming and adjusting so parts would work together. Interchangeable parts eliminated that extra work, facilitated repairs, and also allowed using less skilled workers. Fully interchangeable parts were first developed in the USA, so their use was long known as the "American system of manufacturing."

Continuing technological development encouraged growth of larger factories, metal refineries, and textile mills. These larger facilities cost more, transforming the system of financing industry. In Britain and the USA, much of the finance came from factory owners and their friends or associates. In the 1830s the Belgian *Société Générale*, a government-backed investment bank provided much of the capital, and bank finance was so central to German industrialization in the later part of the 19th century that the tradition of including a bank representative on the board of directors became firmly established. The industrial combines (*zaibatsu*) that emerged in Japan in the late 19th century typically included a bank, which was expected to help finance the other affiliated companies when necessary. These differences established an enduring difference in management style between "Anglo-American," "European" (or "continental") and Japanese business management because the first were more accountable to shareholders and the shorter-term time horizons of quarterly reports than the latter two.

Though the first phases of the industrial revolution provided new ranges of goods, many of them remained beyond the reach of the working class. Though controversy about the impact of industrialization on workers and poor farmers continues, there is consensus that these groups did not share much of the gain in national and per capita income. Only with the second phase of the industrial revolution did the position of industrial workers begin to improve, and that was usually the result of government measures, such as Factories Acts regulating hours and conditions of work, wage laws, and government provided social insurance, brought about through pressure from the growing working classes (as in England) or through decisions by governments seeking to reduce support for the more radical socialist and syndicalist movements (as in Germany). A few, like Robert Owen in England and Fourier in France sought to organize industry in a cooperative fashion, but the hierarchical factory remained the main form of industrial organization. Individual manufacturers seeking to sell their goods at a profit had three cost-management strategies available – more efficient use of materials, more efficient production processes, and containing wages – and used all of them in varying degrees. The urge to contain wages was checked by the market in good times because an employer would have to pay attractive wages to recruit and keep workers, but not in bad, leading workers to suffer particularly sharply in economic slowdowns.

Early industrial goods were fairly simple; the buyer could usually evaluate their quality and understand how they worked on his or her own. By 1914, this was becoming less true, the average buyer could understand how electricity worked and what components were required to establish electric lighting, but could not evaluate the quality or safety of the wires and lighting fixtures. The same problem of evaluating quality was even more severe in areas of food and medicine, where the items came pre-packaged and could not be sniffed or tasted before purchase. Thus, buyers had to rely on reputation of the manufacturer, and find some way to distinguish the companies that cut too many corners on quality to compete on price from those that did not. Trademarks became important not just as advertising devices (though they were that) but also as signals to the consumer about the goods. Yet, trademarks were not a complete assurance. Even with the greater understanding germ transmission and good hygiene stemming from advances in medical sciences, food processing and drug manufacture often involved dangerous practices. As more people came to rely on pre-packaged foods and medicines, as well as on manufactured goods, government safety agencies, independent testing labs, and consumer organizations sought through legal regulations or privately issued standards to assure certain basic safety and quality levels. The challenges of doing so only increased with the later phases of industrialization.

The third phase of industrialization – the conscious combination of highly efficient mass production with mass sales of products – began with Henry Ford's decisions to design an automobile that could be produced at a price within reach of the middle class and to pay his workers a higher than prevailing wage. Though a staunch opponent of labor unions (part of the reason for high wages was to keep unions out of the factories) Ford articulated a vision of an industrial society that used large, highly organized assembly lines to produce a high volume of goods at prices most people could afford. He would make money not by selling some goods having a high profit margin to the wealthier strata but by selling large numbers of goods having a smaller profit margin to almost all. This combination of high production and widespread consumption existed in some areas before Ford, but his tireless advocacy of the idea helped it spread through much of the US economy by 1929 and into some European industries. Even the Soviet government embraced the basic high production/wide consumption idea, though did not put significant efforts into consumer goods production until the 1950s.[2]

By 1900 educated people in all parts of the world regarded industrialization with something they wanted themselves. Yet, countries beginning on the path of industrialization faced significant obstacles because well established firms had the financial resources, physical facilities, and know-how to out-compete newcomers. Industrialists and governments responded to the challenge in various ways. Some sought to develop through collaboration with established firms. Some lobbied for or were offered subsidies and tariff protection by the government. In adopting a Marxist Leninist programs, the Soviet Union took the process even further by establishing central planning and directing a massive industrialization. Russia had begun to industrialize before World War I, but the country was still primarily agrarian and rather backward technologically. The new Bolshevik rulers sought to prove that socialism would be a superior form than capitalism by demonstrating to the world that he determines that central planners could industrialize a country more quickly, more efficiently, and more effectively than in countries where private firms made the economic decisions, while also avoiding the severe exploitation of workers that had marked the earliest phases of Industrial Revolution.

Soviet industrial accomplishments between 1928 and 1940 were considerable and attracted attention around the world. The Soviet Union appeared to have avoided the worst of the great Depression and clearly held off Hitler's legions, so in 1945 its model appeared to be an effective alternative to capitalist industrial development. Simultaneously politicians, intellectuals, and labor movements in Western countries were modifying their own countries' economic organizations. The laissez-faire of the 19th century was replaced by a combination of the welfare state-- that is, using tax revenues and government programs of health insurance, old age pension, and unemployment compensation to provide everyone with a basic

[2] Even Marxist economists joined the analytical homage that refers to the mass production-mass consumption scheme of economic organization as "Fordism."

minimum standard of living – with a mixed economy – one in which the “key” industrial sectors would be operated by state-owned enterprises while others were left in private hands. The state-owned enterprises were expected to be models of good industrial relations between management and labor while providing society as a whole with goods and services at more reasonable cost because they would not insist on as high a profit margin as private investors and owners. In sum, whether led by a center party, a labor Party or a social democratic party, Western European countries transformed themselves into mixed economies that they hoped would combine the advantages of planning with private initiative while avoiding their disadvantages. Individually or together Soviet and Western European influences inspired governments of Latin America, Africa, the Middle East, and Asia to adopt similar systems in the expectation that they, too, could achieve rapid industrialization and allow their populations to enjoy the same material comforts enjoyed in the industrial West.

If the character of industry had remained what it was in 1945, a combination of mass production and mass consumption of goods based on late 19th and early 20th-century technologies, these centralized designs for catch-up would have been reasonably successful if competently administered. Administrative competence varied considerably, but an equally important factor in frustrating the plans – more important than the continued advantages help by established industries in global competition – was the transition to a fourth phase of industry. This phase consisted of massive change in the organization of service provision, office activity, and production brought about by the computer revolution. It started slowly in the late 1970s as computers became cheap enough for larger business firms to use on a regular basis, but gathered speed as the price and capacity of small computers continued down and dominated the economic scene by the mid 1990s.

In production, computer technologies allowed more precise machining or molding of parts as computer-driven robots replaced human operators; they also permitted shifting from long assembly lines making exact copies of one product to shorter production runs in which products could be differentiated by inclusion of different sub-assemblies or components or different casings. The initial result was “batch production,” assembly of sets of differentiated versions; the ultimate result was individualized assembly with each order given an assembly ticket and the parts tracked by bar codes. Though dreams of the “paperless office” have not yet been realized, computer-based systems do permit maintaining and using richer databases about customers, clients, and their likely needs.

In the 1980s, these new production and office systems were available only to fairly large firms because computers were expensive. As computer capacity increased and computer costs decreased, medium-sized and small firms were also able to take advantage of the new production and data management technologies. To do so, however, firms needed to have room to experiment. It is telling that Soviet analysts had some of the best insights into the likely consequences of what they called the “scientific-technological revolution” computers were producing, but the Soviet economy was unable to incorporate computer technology effectively. Some of the problem was political – the Soviet government was worried about letting people connect up and communicate through computers – but much of it was organizational. Companies in the West and the developing world also had trouble adjusting, and many once-famous firms disappeared because they could not make the transition.

The same changes in the relation between science and industry extended into the relation between science and warfare. The search for better weapons, tactics, and strategies in war is almost as old as war itself, and often attracted the best minds of the time. Until the 19th century, weapons development relied primarily on trial and error, typically featuring incremental changes except when a new type of weapon was introduced. Tactics and strategy, being matters of organization rather than making physical objects, could and often did feature larger change.

Development of industrial technologies for manufacturing, communications, and transportation transformed warfare in the 19th century. Canning of food (perfected during the Napoleonic Wars) and factory manufacture of weapons and equipment permitted supporting larger armies in the field, while the wealth generated by industrial activity expanded national tax bases sufficiently to support those forces. Steamships increased the speed, size, and gun-carrying capacity of warships while shifting naval concern from dependence on the winds to dependence on fuels and refueling stations. Railways permitted moving troops much more quickly, and armies soon learned to replace the physical conditioning once provided on the march with increased physical activity during training and drill.

The link between advances in basic science and development of new industrial technologies was extended to military technologies as well. Military medical units and individual weapons-makers were already drawing on scientific knowledge in the late 19th century, but this depended largely on decisions by individual units or firms. Systematic efforts by military high commands or high officials of defense ministries to coordinate use of scientific talent in development of weapons and equipment first appeared during World War I. Most of these efforts were wound up in 1918-19, and had to be reestablished in the mid-late 1930s as a new world war appeared more and more likely. Onset of the Cold War competition meant there was no comparable winding-up after 1945; rather, the existing military-science-industry connections were intensified in all the major military powers. The rush to develop nuclear weapons, which absorbed considerable resources in the USA, Britain, Germany, the USSR, and Japan alike, was not the harbinger of a new relation between science and military technology, though it did reveal more clearly than any other 20th century development, the vast capacities for destruction being developed as countries engaged in "total war" bringing their full productive capacities to bear in supporting vast armies and far-flung campaigns.

Military establishments were quick to realize the relevance of computers and information technology in planning, intelligence gathering and analysis, maintenance of command and communication, and locating enemies on the battlefield. Several information technologies, including early versions of the internet, satellite-based remote sensing systems, and satellite navigation systems, were developed for military use and then extended into civilian applications. Like society in general, militaries around the world face the challenges of effectively absorbing rapidly changing computer and information technologies.

<end>

IDEESE Module 1.1 Resources

Transnational Aspects of Ethical Debate

MJ Peterson
Version 2; February 2008

The terms “ethics” and “morality” used in their most general sense refer to the traditions of belief about right and wrong conduct that exist in the various societies of the world. The terms “ethical theory” and “moral philosophy” refer to philosophical discussions of ethics or morality intended to increase the logical coherence, precision, and real world applicability of the principles and maxims derived from those ethical or moral traditions.

Individual humans begin learning the rules for conduct that derive from the morality prevailing in their society even before they understand that there is a distinct category of rules called “ethical” or “moral” or how those rules differ in character from rules of law, etiquette, or everyday prudence. Children are told and encouraged to follow many rules, such as “keep your fingers out of the electrical outlets,” “look both ways before crossing the street,” “line up and wait your turn,” “don’t drop your candy wrapper on the sidewalk,” “say good morning to the bus driver when you get on,” “be nice to grandmother” and “tell the truth” without being told which of them are based on prudence, local law, etiquette, or ethics. As children develop towards adulthood, they begin to learn the differences, and come to understand that ethics and morality focus on the problem of acting in ways that are respectful of others and take their interests and needs into account. The growing children also begin to see that the individual ethical rules are not random maxims, but are shaped by a more or less coherent set of more general guidelines that have developed over the years in their society and are understood by everyone in it. Individuals make their own choices, but – even when they are rebelling against it – they are influenced by the ethics and ethical rules of the society in which they live.

Individuals vary considerably in the depth of their interest in thinking beyond rules to ethical theory and moral philosophy. Invariably following a rule requires very little thought; one simply asks whether the situation at hand is covered by the rule. If it is, one follows the rule; if it is not, one does not. However, many situations are not so simple that automatic rule following assures the best moral result. Almost no one gets through life without encountering ethical dilemmas, situations in which there are very good ethical reasons for undertaking each of two or more mutually exclusive acts. For most of the elderly, remaining in their own home or moving to a retirement community are mutually exclusive because they cannot afford to maintain two residences. Thus, the middle-aged children of an unsteady 90 year old still living in the house

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. “Transnational Aspects of Ethical Debate.” International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

where they grew up will feel the pinch of competing ethical principles when facing a decision about whether to encourage their parent to move to a retirement home. Living at home allows the parent to remain more autonomous. Yet, living in a retirement home affords the parent greater personal safety because others are around to help in the event of a fall or to undertake household tasks that have become too difficult for the 90 year old to accomplish alone. If the children truly respect their parent's autonomy, they will not want to force the parent into a retirement home, but if the parent's unsteadiness gets to the point of interfering with daily tasks they can't help feeling the parent would be safer there. They will seek to reduce the dilemma by trying to persuade the parent to move; if they succeed the parent will have made the autonomy-safety trade in an autonomous fashion. It is when the persuasion fails that the children really face the dilemma.

The toughest moral dilemmas arise when the good moral reasons for each alternative also include good moral reasons for avoiding the other alternative or alternatives. Psychologists are often faced with situations in which a patient utters threats to kill a particular person. Once the psychologist decides, after additional talking with the patient, that the threats are real – not just blustering talk that reduces frustration by allowing its expression in exaggerated form – the psychologist has to choose between violating rules of confidentiality to warn the person threatened or violating society's general ethical expectations that someone who knows of a murder plan should warn the victim and/or the police so the murder can be thwarted. The children of the 90 year old could deal with the tension by putting their parent in the center of the deciding process; here the psychologist is likely to be in the position of having to act on his or her individual judgment. Maintaining confidentiality carries a serious danger of allowing physical harm to a person; breaking confidentiality carries a real danger of eroding patients' confidence that psychologists will keep their secrets to the point they are less willing to seek treatment. Deciding which consideration should have been given greater weight in guiding the psychologist's conduct may seem easy afterward: if the murder occurs, it will be "obvious" to most people that safety should have prevailed over confidentiality.[3] However, the psychologist must decide before the results are known.

Most moral philosophy and ethical discussion assumes that everyone involved in or observing the situation shares the same broad values, expresses them in similar rules, and gives the values similar weight when balancing between competing rules. Ethical arguing becomes more complicated when different people maintain non-identical sets of values (for instance, individualists who emphasize autonomy and individual freedom and communitarians who emphasize membership in groups and allowing groups room to follow their way of life), express the same value in different rules (for instance, believe that humans have a right to life but disagree about abortion because some define "life" as beginning at the moment sperm and egg trigger the process of fetus development and others define it as beginning at the point a fetus could survive outside the womb), or maintain different hierarchies among values (for instance, a situation in which some regard privacy as more important than public access to information about past criminal records and others regard knowing the whereabouts of repeat pedophiles who have finished serving their jail terms as more important than privacy).

Ethical theory and moral philosophy have long faced the challenge of individual moral relativism – the claim that ethical and moral beliefs are a matter of individual choice because there is no way to prove that any

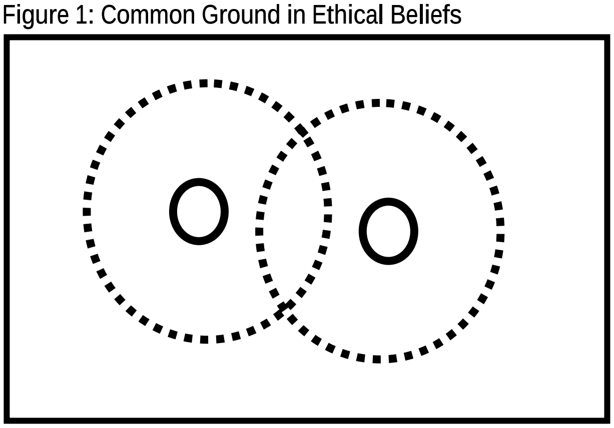
[3] "Most" because when the California Supreme Court was faced with this question in 1976, a majority of the judges ruled that the psychologist involved did have a duty to report but one dissented on grounds that public knowledge psychologists had a duty to report death threats would discourage people from seeking treatment. See Tarasoff v. Regents of the University of California, *California Reporter* vol. 131, p. 14 (1976).

one standard is superior to all others. In today's globalized world, ethical theory and moral philosophy also have to address the challenge of cultural moral relativism, the idea that the different ethical beliefs of the many societies around the world deserve equal respect whatever their content and whatever the content of the rules derived from them. Arguments in favor of cultural moral relativism start from the well-established observation that traditions of ethics and morality and the sets of rules derived from them do vary from one society to another. The next step in such arguments is to claim that no society has the right to criticize the ethics, or ethical rules of another because a.) there is no ethics or set of ethical rules shared by every society on Earth, b.) ethics and sets of ethical rules form organic wholes that can be understood, interpreted, and applied only in the context of the culture in which they developed, and c.) the right of self determination (codified internationally in the UN Charter, the Universal Declaration of Human Rights, and the International Covenants on Human Rights) means that each society possesses the right to follow its own traditions and ways of life.

One of the strongest arguments against cultural moral relativism claims there is a universal human nature or a universal set of human needs, which lead to adoption of similar basic moral values in all cultures. Adherents of this view further argue that most of what appear to be cultural differences in ethical systems are differences in how people interpret and apply these similar basic beliefs in particular situations. Rather than a "relativism of standards" in which different societies have different basic ethical beliefs, they see a "relativism of judgments" in which rules for and evaluations of conduct in particular situations differs.[4] This is simply an extension across societies of the relativism of judgments that appears even in a single culture, as in the abortion and privacy examples given earlier.

However, relativism of judgment does not prove the existence of relativism of standards. Inquiry must go beyond the differences in judgment and uncover, as much as possible, the more basic ethical beliefs and interpretations of those beliefs from which those judgments arise. Suppose, for the sake of continuing this discussion that relativism of standards does exist, either in all areas of life or in some areas. The existence of different fundamental standards might be thought to prevent members of two or more societies from having useful discussions and develop a reasoned consensus on how to proceed in a particular situation. Such claims ignore the pervasive relativism of judgments around the world, and the fact that different adherents of the same ethical standard may disagree on what to do. If we think of basic ethical beliefs as a small circle and the range of judgments they inspire as a larger one having the same center, it is entirely possible that the large circles of judgment extending beyond the small circles of basic principles will actually overlap. In that overlap adherents of different beliefs would find common ground for action in the world. (See Figure 1)

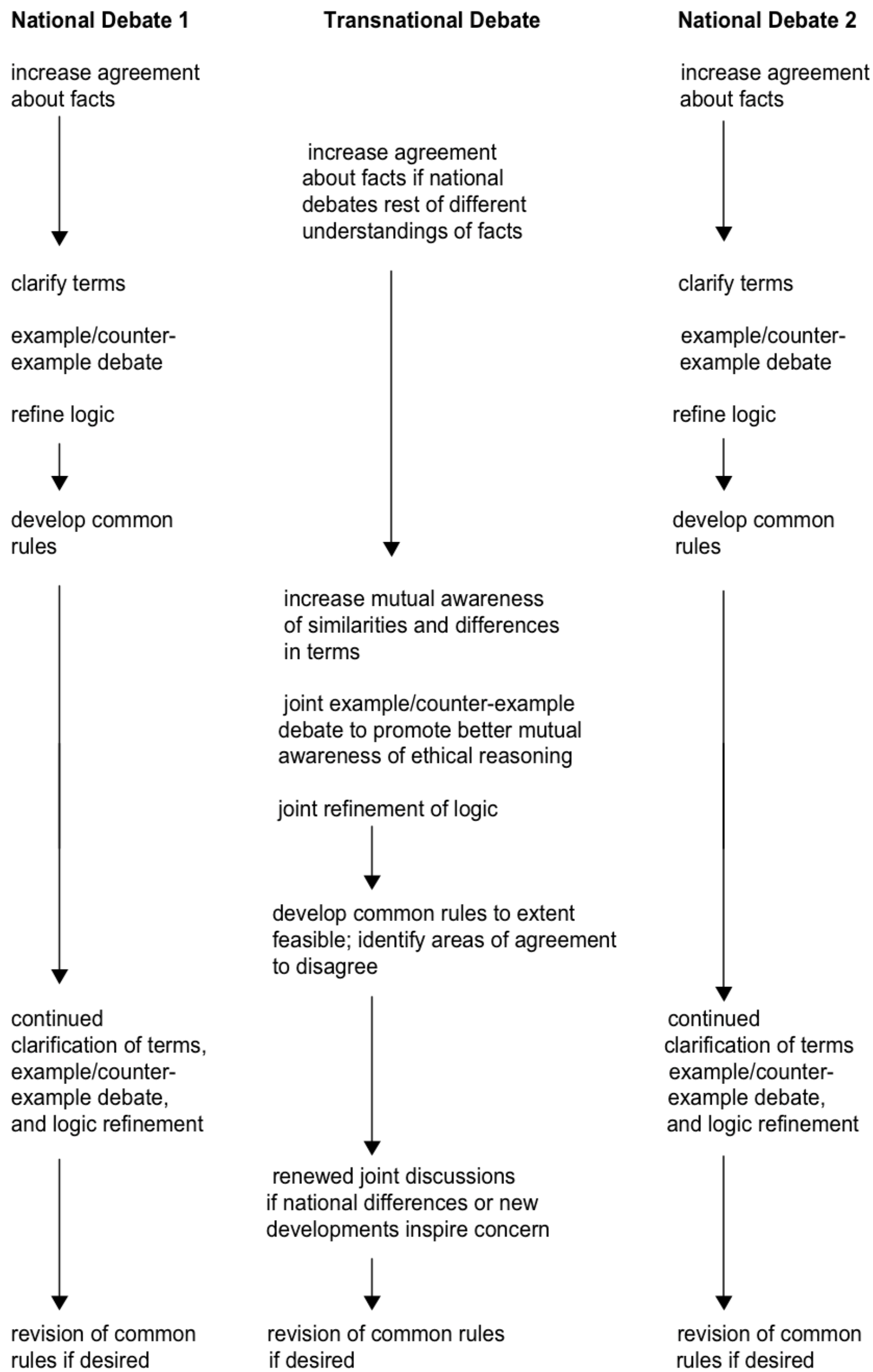
Figure 1: Common Ground in Ethical Beliefs



Invoking relativism of standards as a reason to forego moral debate also ignores the fact that

[4] Distinction used by Tom L. Beauchamp and LeRoy Walters, *Contemporary Issues in Bioethics* (4th edition. Belmont, CA: Wadsworth Publishing Company, 1994), p. 8.

Figure 2. National and Transnational Processes of Ethics Debates



people learn about and refine both their basic ethical beliefs and their particular ethical judgments by participating in or observing arguments. They may not converge on an identical way of handling the situation; they may have to develop a compromise. Yet, in process of discussion there will be a sifting of ethical claims and counterclaims in which some secure are accepted or at least considered as worthy of consideration by a larger number of participants than others. The more persuasive ones will become the focus of attention and the basis for compromises while the less persuasive ones will be set aside (not necessarily rejected for all time, just not used in discussion of how to handle this particular situation or type of situation at this time).

It should now be clear that the distinctive element of transnational ethical differences (see Figure 2) is the need to be particularly sensitive to the question of how far the differences of view expressed by participants depend on culturally-derived differences in judgments and/or standards. Whereas national ethical debates proceed against the background of a thick set of shared cultural references and practices, transnational ethical debates do not. Clarification of terms may have proceeded along different paths, making a literal translation of a phrase from one language into another misleading. The moral codes may be different in significant ways. The process of arguing by example and counter-example can be slowed down, though very likely enriched, by the different exemplary stories familiar in various cultures. These differences mean that participants in transnational ethical debates must be willing not only to hear the questions and explanations of others but to elaborate their own positions and explanations in ways that help participants from other cultures understand them accurately. This requires making one's own tacit assumptions explicit, something that can be difficult because the background knowledge provided by a culture is so taken for granted that a participant may have trouble bringing relevant parts into active memory where it is available for conscious expression. Yet, if enough participants make this effort the result will be a better informed debate all around even if in the end participants "agree to disagree"' and design a solution allowing divergent approaches rather than settling on a common one.

<end>

IDEESE Module 1.1 Resources

Resolving Ethical Disagreements

MJ Peterson
Version 1; February 2008

Resolving ethical disagreements in scientific, technical, and engineering fields is harder or easier depending on the state of the objective information and the quality of the ethical reasoning brought to bear. Objective information includes verifiable factual information about physical phenomena under discussion, the causal processes at work in producing an effect or outcome, and the positive and negative effects of allowing the phenomena to occur or persist. The resources of ethical reasoning include clarity in defining the terms used in moral argument, common moral guidelines, debate through example and counter example, and logical probing of the coherence of arguments.

Current controversies about such questions as the safety of introducing genetically modified organisms into nature, the safety of vaccines, the likelihood of H5N1 or some future strain of avian flu becoming contagious among humans and triggering a pandemic, or HIV treatments involve a mix of ethical and factual disagreements. Ending the factual disagreements does not guarantee resolution of all the ethical ones, because many ethical arguments do stem from differences of principle. However, working to develop factual knowledge sufficiently well proven to be accepted by many people with different ethical points of view would focus the ethical arguments differently. By reducing the extent of uncertainty about phenomena factual knowledge widely enough shared to set a common "baseline" for debate and narrows the range of plausible claims about the effects of doing or not doing, allowing or prohibiting certain types of conduct. In 1970 there was still honest disagreement about the impact of chloroflorocarbon (CFC) emissions on the stratospheric ozone layer, so arguments that costly policy measures (such as banning all uses of CFCs) must begin immediately were open to the reasonable objection that there is good reason to believe the benefits of the ban to society as a whole would exceed the costs that various members of society will have to bear to make the policy work. When consensus that CFCs were depleting the stratospheric ozone layer became very strong, proposals for costly policies were back on the table because the costs of failing to act appeared to be greater. This did not end arguments about what policy, creating what mix of costs for different individuals and groups, should be adopted, but it did remove "do nothing" from the list of ethically reasonable choices.

Getting consensus on the relevant factual knowledge may not be easy. First, physical facts do not announce themselves; the results of experiments must be analyzed and interpreted, and in interpretation there is wider or narrower leeway for reasoned disagreements among scientists. Second, processes of

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. "Resolving Ethical Disagreements." International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

interpretation are vulnerable to several forms of motivated distortion. Research institutes and industry often have incentives to downplay risks so they can proceed with experiments or bringing products to market. Activists often have incentives to exaggerate risks to broaden their own fame or attract donations needed to keep their organizations or activities alive. Individuals and groups may have strong ideological beliefs that make it difficult for them to accept facts that seem to undermine their ideologies. Desire for fame, grants, or other advantages may lead scientists into scientific fraud that, if undetected, skews understanding of the facts or makes more difficult the forging of scientific consensus on the facts. However, trying to secure consensus on facts is worthwhile for at least two reasons. First, some ethical disagreements are really disagreements about the need to act in a particular way at a particular time that can be resolved with consensus on the facts, as in the CFC debate noted earlier. Second, judgments about the relative weight to be given to competing values may depend on facts. A decision to “ration” access to an extremely expensive treatment that is the only currently-known way to prevent death from some rapidly-spreading antibiotic-resistant bacterial infections will inspire more challenge if the treatment has an 80% chance of working than if it has a 1% chance.

When consensus on the relevant facts (outcomes and causal mechanisms leading to them) does not settle a particular disagreement about how to act, the resources of ethical reasoning must be applied. While ethical theorists and moral philosophers tend to regard clarity in definition of terms as both desirable and helpful in resolving disagreements, acceptance of a common phrase may have the opposite effect if its meaning depends on other definitions over which there is no agreement. An advocate of clarifying terms might have been happy to see the “right to life” principle invoked in debates about abortion, but then dismayed because continuing, and unabridged differences in defining the moment when a human life begins have prevented convergence on a common set of ethical rules on the matter.

Clarity of terms is often assumed to be necessary for, or at least to facilitate, the development of common moral guidelines regarding some forms of behavior. However, students of law and politics know many examples of using consciously selected ambiguous terms to straddle a disagreement by allowing different participants to interpret the term in different ways. Proponents of “papering over” a disagreement with vague words and phrases are not giving up on their initial position; they are responding either to lack of highly persuasive factual knowledge that would settle arguments in favor of their proposal or to the difficulty of using currently available ethical arguments to persuade others to adopt a similar position at the moment. Creative ambiguity is generally an appeal to the future, with adherents of various positions expecting or hoping that new developments or the impacts of further activity will support adopting their recommendations later on. Thus, existence of a set of common moral rules is not necessarily a sign of common morality; it may be a tactical device for settling the questions that can be settled while continuing disagreement on others. The content of the rules reveals the areas of agreement and the areas of continuing disagreement.

Even when all the rules are clear and agreed, the existence of a set of common ethical rules does not end all ethical debate. Codes and standards are expressed in general terms, but applied in specific situations. Particular situations may well present complications that no one anticipated when writing the code. Thus, the process of applying ethical rules involves the same methods of debate through example and counter example or logical probing of the coherence of arguments that occurred when people developed the rules.

Debate through examples and counter-examples is a form of reasoning by analogy very similar to the sort of reasoning that goes on as lawyers and judges apply legal rules to disputes. Rather than focus on the internal coherence of the moral rules, arguing through examples probes the implications of the rules for the humans involved in or affected by some interaction. It promotes sensitivity to the wide variation in actual human behavior and interaction, and to the possibility that the consequences (good or bad) of some act or failure to act may be very different for different individuals or groups. Mixing lead into paint to improve its consistency and drying was a common practice until the connection between flaking paint and lead poisoning of toddlers became better understood. Though lead paint posed hazards of lead poisoning for everyone, adults need larger doses of lead to suffer noticeable symptoms and seldom eat flaking paint. Toddlers' greater sensitivity to lead and willingness to eat paint flakes meant they faced greater hazards. Since even adults would be healthier if lead were removed, prohibiting its use in paint became the accepted rule.

Debate through examples and counter-examples can bridge the divide between approaches to moral reasoning that evaluate conduct by the intentions of the doer and that evaluate conduct by the effects it has on others. Examples and counter-examples rest on interactions that can be retold in either summary or extended form. Particularly in extended form, they can provide reminders that there is enough slippage between intentions and results that a fully satisfactory ethical theory or moral philosophy needs to address both.

Logical probing of the coherence of arguments focuses on the internal consistency of ethical rules, of the premises on which they rest, and on the reasoning by which the premises are claimed to require acceptance of the rules. Objections to "therapeutic cloning" – the idea of cloning a person so that the clone can provide replacements for the person's poorly functioning organs – derive very clearly and logically from blanket objections to creation of living organisms "in the lab" rather than through natural reproductive processes. Many people who reject human cloning find it hard to accept using human embryos to create stem cells on logical grounds because they do not see any logical way to classify making stem cells and using them to "grow" organs as acceptable while classifying cloning and raising humans for the same purpose as unacceptable.

Though internal consistency is only one criterion of a good argument, ethicists and moral philosophers value it as a safeguard against inadvertent slippage. Pointing out inconsistency is a regular feature of ethical arguments even among members of the general public. In arguments over the death penalty, individuals who oppose abortion but accept use of the death penalty are often accused of logical contradiction, and anti-death penalty activists urge them to end the inconsistency by altering their views on the death penalty. The simpler version of this charge asserts that the right to life principle settles the question by requiring rejection of both. A more complex version acknowledges that other ethical values may be at stake as well, and its adherents would ask why an anti-abortion supporter of the death penalty believes the right to life should be weighed more heavily than other values at the start of life but not later on. Even in less charged ethical debates, probing the logical consistency of the reasoning behind existing or proposed ethical rules is another way of improving that reasoning.

Good ethical debate must bring the resources of both objective knowledge formation and ethical reasoning together to ensure that the situation in which the ethics will be applied is understood as accurately as possible and the ethical rules adopted based on thorough consideration of all the relevant ethical principles and stakeholder concerns.

IDEESE Module 1.1 Resources

Sources and Extent of Environmental Harms

MJ Peterson
Version 1; February 2008

The best method for addressing environmental harm depends on the nature of the source of the harm and the extent of its impact.

Sources of actual and potential harm can be classified into four types:

> Human point sources: the harm results from environmental pollution, which can be traced to one or a few large sources, such as chemical plants, nuclear power plants, or specialist laboratories.
>
> Human diffuse sources: the harm results from environmental pollution which can be traced to many small sources, such as individually-owned vehicles, individual farmers' over-use of pesticides, or households' depletion of peat or wood for use in heating or cooking
>
> Natural sources: the harm results from short or longterm natural changes that affect resource availability or overall population carrying capacity of an area, such as periodic flooding, an earthquake, or disruptions of fishing attributable to El Niños.
>
> Policy sources (sometimes called "structural sources"): harms resulting from activity permitted or encouraged by government policies, such as non-regulation of CO_2 emissions or permitting use of lead as an additive in gasoline (petrol).

Extent of the Impact of harm can be classified into four types:

> Focused: the harm is concentrated within a neighborhood or similarly small-scale area
>
> Local: the harm is concentrated in a particular city, metro area, or similarly sized locale
>
> Widespread: the harm affects a large region
>
> Global: the harm affects all of Earth

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. "Sources and Extent of Environmental Harms." Module 1.1: Workplace Ethics in Transnational Contexts. International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

Though human point sources and human diffuse sources can exist in more than one country simultaneously, they are national if the effects of each are focused or local. However, they can become cross-border if they occur close enough to a boundary between countries. Proximity means, for example, that Tijuana Mexico and San Diego California USA can suffer from the same local harms. Widespread harms are usually cross-border harms; and global harms are necessarily cross-border harms.

Effective handling of environmental harm requires taking both the type of source and the extent of effect into account. This table suggests the possible combinations of sources and harms by arraying sources – point (S), diffuse (sssss), nature (N), or policy (P) in the columns and geographical extent of effects – focused, local, widespread, or global – in the rows. In split cell columns, the left hand subcells show within-country combinations while the right hand subcells show cross-border possibilities with the dotted lines indicating the location of borders:

		type of source of harm							
		point		diffuse		nature		policy	
type of extent of harm	focused	S h	S …… h	sssss h	sssss …… h	N h	N : h : h :	P h	P ….. h
	local	S h	S …… h	sssss h	sssss …… h	N h	N : h : h :	P h	P ….. h
	wide-spread	S h	S …… h	sssss h	sssss …… h	N h	N : h : h :	P h	P ….. h
	global	S h		sssss h		N h		P h	

Actual harms can be within country and cross-border simultaneously, in which case effective handling requires simultaneous use of within-country measures and cross-border cooperation. Cross-border populations and governments experiencing harm are more likely to gain source country attention if the effects are also felt in the source country.

<end>

IDEESE Module 1.1 Resources

Multinational Corporations in Transnational Accountability

MJ Peterson
Version 1; February 2008

Much of the national and transnational effort to develop accountability in the development and application of science and technology focuses on multinational corporations (MNCs) because they are one of the primary channels for transnational diffusion and use of new developments in applied science, new inventions, and new technologies or combinations of technologies around the world. Contemporary multinational corporations consist of a "parent company" incorporated in one country and its local branch offices or subsidiary companies incorporated or registered under the laws of the country where they operate but controlled by the parent through ownership of the stock and provision of the top management personnel.

Before the 19th century most businesses were family ventures, and firms with extensive cross-border transactions often sent family members or close associates abroad to look after the firm's interests. MNCs in their current form developed only after the modern idea of organizing businesses as corporations – entities with a legal status separate from the people owning them – was adopted in the 17th and 18th centuries. The great European monopoly trading companies – such as the Dutch East India Company, the British East India Company or the French North America Company – were proto-multinationals: they maintained trading offices to buy goods in Asia, ran their own shipping fleets (opening their ships to others' cargos when space was available), and sold goods to customers in Europe. However, their offices were not established as separate companies elsewhere because corporate form had not been adopted in other parts of the world. The MNCs familiar today first emerged in the early 19th century. British banks and insurance companies had branches in the USA and South America by 1825, Swiss firms set up textile factories in southern Germany in the 1830s, British gold mining companies owned mines in Brazil before 1820, and British and American railway pioneers owned separate railroad companies in Central and South America in the 1850s. By 1914, there were several thousand manufacturing multinationals and hundreds of mining or plantation multinationals. The links between multinational firms and European colonial empire became close after 1870 because many of the banking and mining multinationals operated in their home country's colonies. Manufacturing multinationals developed a very different pattern, preferring to locate factories in other relatively wealthy countries where there was sufficient customer base for their products. Thus, the German firm Siemens und Halske opened a factory in Russia in 1855, while the US-based Singer Sewing Machine Company set up European production in Scotland in 1867. In 1914, the assets owned by multinational corporations comprised approximately one-third of all foreign investment in the world; the

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. "Multinational Corporations in Transnational Accountability." International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

other two-thirds was bank loans to foreign customers or investor purchases of bonds (also a form of loan) issued by companies or governments in another country.

19th century political conditions shaped the spread of multinationals in several ways. The idea of establishing state-owned factories was dormant at this time. The older royal arsenals and workshops of Europe were not the sources of industrial development, and British experience set up the model of privately owned firms leading the way. Direct colonial rule or indirect influence through the economic importance of European lenders and firms meant that the multinational corporation's home government could ensure favorable conditions for activity in most parts of the world. Manufacturers, who could have supplied foreign customers from their home country, often expanded to other relatively wealthy countries to get around tariffs by establishing factories that would count as "local producers." Critics of MNCs also arose in the late 19th and early 20th but, unlike today, focused on use of multinational operations to keep profits high through moves to low-wage areas rather than the impact of their day-to-day operations for people or the environment.[5]

The extent of multinational enterprise shrank between 1920 and 1945 under the impact of World Wars, which disrupted international trade and investment patterns, and the Great Depression, which reduced economic activity in general. Losses of foreign assets to the allies (for German companies) and to Soviet nationalizations (for Belgian and French companies) soured them on foreign investment. The Great Depression led to fracturing of the world into separate currency blocs which hindered international trade, and rising nationalism made foreign-owned companies targets in many countries. Companies still collaborated, but now preferred doing so through international cartels in which separate companies agree on pricing and division of markets among themselves rather than through direct ownership. Only in mining, where companies typically sought to integrate all phases of operation from initial extraction through processing, through sales of metals or materials to customers, did multinational organization persist at pre-1914 levels.

During the 1920-1945 period political conditions were also far less favorable to multinational firms. Governments sought to deal with the Great Depression through currency controls and higher tariffs, which made trade and investment difficult. Revolutionary governments in Mexico and Russia took over foreign-owned assets in mining, oil, railways, and (in Russia) manufacturing to make them into state-owned enterprises. The Mexican program of having state ownership of leading sectors foreshadowed many of the post-World War II policies in Western Europe and the Third World, and in rejecting investor claims to compensation for their property sounded theme of redress for prior exploitation by foreign-owned business that would be raised again in the 1950s and 1960s as the governments of as newly-independent former colonies in Africa, the Middle East, and Asia sought to escape foreign economic influence and direct their country's economy towards industrialization in their own way. However, Lenin and Stalin's program in Russia/the USSR attracted the most attention in the 1920s and 1930s because it was part of an effort to entirely replace private ownership and price-setting in markets with state ownership and central planning.

After a slow post-World War II start, the sustained growth of North American, Japanese, and Western European economies in the 1950s and 1960s created new opportunities for business. The governments of the leading Western industrial countries moved decisively to establish open international markets by

---

[5] Reformist and revolutionary Marxist forms of this argument appeared in John Hobson, *Imperialism* (1902) and V.I. Lenin, *Imperialism: The Highest Stage of Capitalism* (1917) respectively.

dismantling most of the protectionist measures adopted during the interwar period. This reduced the tariff-based motivations for MNC operations, but many companies still wanted to have production sites close to their customers. The combination of renewed MNC activity in industrial states and the reduction of MNC activity in developing states as many of the governments there nationalized the foreign mining, plantation, and railway firms established in the colonial era meant that in 1980 nearly two-thirds of total foreign direct investment was concentrated in the USA, Canada, and Western Europe.[6] Meanwhile, the Soviet government sought to develop a distinct socialist bloc economy through the Council for Mutual Economic Cooperation while the communists' 1949 victory in China closed another large part of the world to foreign companies.

The oil crisis-induced recessions of the early 1970s and early 1980s slowed economic activity, and with it MNC growth. Yet, some of the roots of later expansion of MNC activity were laid in this period. The American pattern of tighter coordination and global planning between parent company and subsidiaries was adopted by Western European and other MNCs. MNCs also became more willing to enter into joint ventures (co-owned firms) with governments or local investors, and many governments of developing countries became more willing to have manufacturing MNCs come into the country. The contrasting development performance of East Asian economies, with their government-encouraged policies of competing on global markets, over Latin American economies, with their continuing emphasis on replacing imports with locally made goods induced a broad rethinking of development strategy. This rethinking was reinforced as more data about Soviet and Chinese economic performance became available and indicated that central planners in both countries were finding it difficult to cope with the economic ramifications of the computer age.

Though the volume of international trade as a percentage of global production returned to 1914 levels by the mid 1970s, the value of all direct foreign investment did not reach its 1914 level of 9% of the value of annual world production until the late 1990s.[7] Only with the end of the Cold war and the opening of all parts of the world to foreign trade and investment did the level of MNC investment get back to what it had been. Yet, the distribution of activities was very different; MNCs were far more active in manufacturing and service industries than they had been in 1914, and less active in raw materials and provision of transportation or public utilities. The home countries of MNCs also became more diverse. In the mid-1960s, US firms made more than 80% of direct foreign investments.[8] More European companies took up multinational activity in the 1970s. In the 1980s Japanese manufacturers joined the older general trading companies in direct foreign investment, either to get closer to customers or to take advantage of lower cost labor in Southeast Asia. The more successful developing countries also became home to multinational firms of their own.

Although most people think of giant firms like Exxon, Royal Dutch Shell, Nike, or Nestle when they hear the term "multinational corporation," any business firm operating simultaneously in more than one country through its own subsidiaries or branches qualifies as an MNC. These subsidiaries might run their own factories, like Toyota USA's factory in California; they might operate retail stores, like London-based Body

[6] Dunning

[7] In 1992, the total equaled 8.5% of that year's world production. Jones 1996

[8] M. Wilkins. 1974. *The Maturing of Multinational Enterprise* (Cambridge, MA: Harvard University Press).

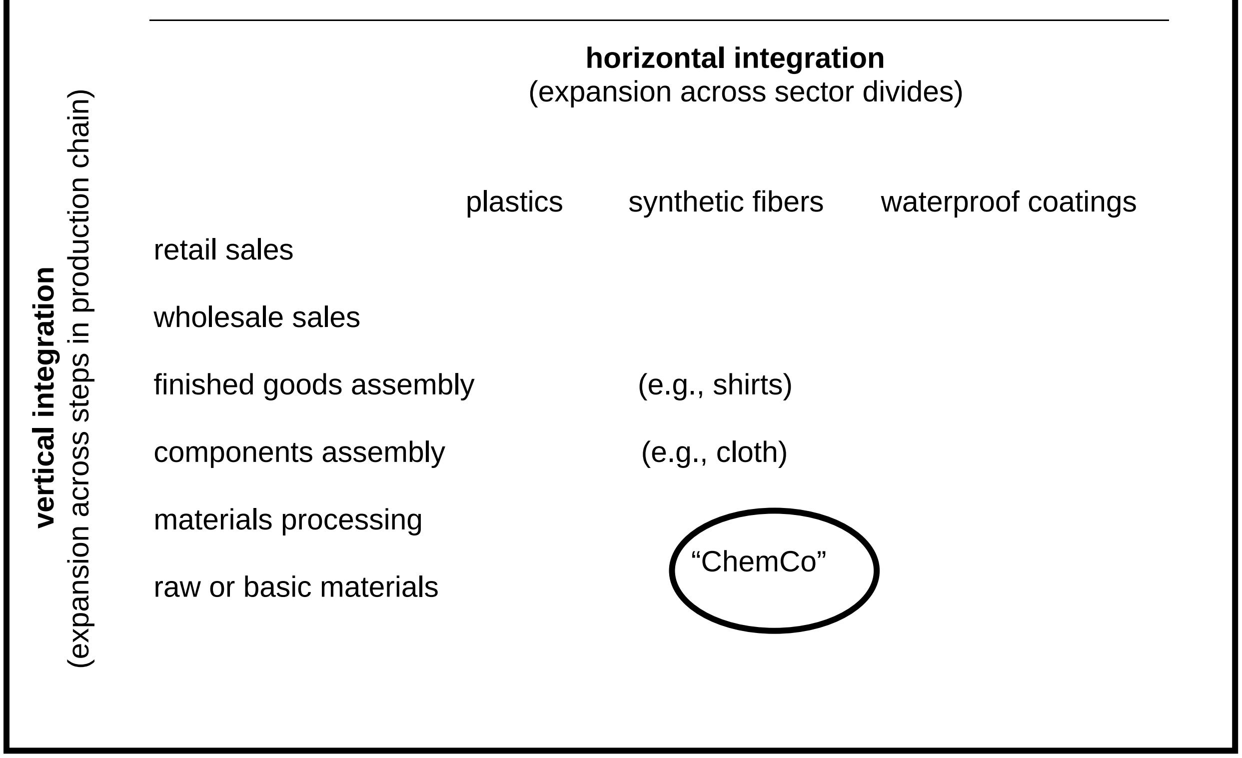
Shop's stores in major US cities; they might be franchise operations, like the many MacDonald's outside the USA, or they might be wholesalers abroad, like Coca-Cola's bottling companies. Though the largest MNCs have annual sales exceeding the gross national products of most countries of the world, others are fairly small firms that link some or all of the various segments of production (product design, materials acquisition, fabrication) and distribution (shipping, delivery to wholesale or retail customers) across national borders.

Though MNCs attract a lot of attention, it is important to remember that companies can engage in international trade and investment without becoming MNCs. Any company can buy materials or parts from suppliers in a different country, much as US bicycle makers buy derailleurs and other components from Shimano in Japan or Campagnolo in Italy. Any company can sell all or part of their production to wholesalers and retail customers in other countries or borrow money from a foreign bank. Yet, there is one pattern of trade between firms that seems to blur the distinction between MNCs and other firms. When the contracts between a firm and its suppliers include detailed specification of the type, design, and quality of goods to be produced, the line between dealing "at arm's length" with a different independent company and dealing "in house" with another branch of the same company breaks down. When the buying company is well-known and its brands are put on the goods, environmental, labor and other activists concerned about practices in the suppliers' factories often put pressure on the better known buyer to add stipulations about respect for labor rights or protection of the environment to the supply contracts.

MNCs (and business firms generally) want to operate in a cultural, social, economic, and political context that facilitates their activity and makes it easier (or at least no more difficult) for them to attain their goals. Whatever sort of good or service a company produces, its main goal is to earn profits by having an income from sales that exceeds its total expenses. This can lead to a narrow focus on the economic activity and the short to immediate term. Advocates of corporate social responsibility have urged companies to adopt a broader focus and a longer time horizon by adopting a "triple bottom line" concerned with people (respect for human rights and human dignity), planet (ecological sustainability), and profit (economic viability within the bounds of ethical conduct). Yet, profit remains the most important of the three for managers and investors because a company – whether behaving very ethically, very unethically, or somewhere in between – that does not earn more than it spends will not survive very long.

Any company – whether an MNC operating in several countries around the world or a locally-oriented firm – looking for ways to make additional money can look in three directions. It can continue with the same lines of business but expand their volume of production ("scale up") by adding new factories, hiring additional workers, and buying more materials and parts if there appears to be unsatisfied demand for the goods or services it currently provides. If there is not much additional demand, it can search "horizontally" or "vertically" for opportunities to earn more by integrating new activities into firm operations. Horizontal integration involves taking up opportunities in related lines of business. Thus, a chemical company initially producing plastics might decide that it can also produce synthetic fibers, or a beer brewer owning a large enough spring might decide to add bottled water to its product line. Vertical integration involves looking for opportunities along the production and distribution chain from acquisition of materials through sales to final users. Thus, a clothing company that initially bought cloth from textile manufacturers, made clothes, and then sold the clothes to wholesalers might decide to acquire its own textile factory, its own retail stores, or both. Whether and how far a company will go in vertical or horizontal expansion depends on its calculations of the net benefit. If it would cost a lot to extend activity to other products because the equipment is expensive or properly trained workers hard to hire and retain, or continuing in arm's length relations with suppliers and wholesalers looks more profitable than bringing those operations in-house, the company will keep to its current industry or place in the production and distribution chain. If however, activities in a related business or in a different part of the supply chain appear likely to enhance the firm's overall prospects, it will expand vertically or horizontally. The possibilities are outlined using a hypothetical chemical company in Figure 1.

Figure 1. Integration possibilities for hypothetical firm "ChemCo" currently producing synthetic fibers sold to textile makers



The relative benefits of expanding or contracting company activity change over time, giving actual MNC decisions a dynamic easily missed by those who believe that business always regards "bigger as better." In the 1980s, management experts who advised focusing on "core competencies" were claiming that companies would profit most if they limited their activity to the particular goods or services they could produce most profitably and sold off parts of the business doing other things. In biotechnology in the 1990s and 2000s, in contrast, many firms were busy expanding, either through buying other companies or entering into long-term contracts. There were so many mergers that one analyst predicted approximately half a dozen "food clusters" would dominate world processed food production within a few decades.[9]

[9] "A survey of agriculture and technology," *The Economist* 25 March 2000.

Businesses do not operate in a vacuum. Managers know that they face and must to some extent address the concerns of both internal and external stakeholders. "Internal" stakeholders are those inside the firm – owners (shareholders), managers, and workers. Until recently, particularly in the "Anglo-American" model of "shareholder capitalism," they received the most attention. Managers run the company as agents for the owners, and deal with workers as a distinct group – sometimes through labor unions and collective bargaining, sometimes not, but always in a context of laws and regulations on workplace safety, wages, hours, and related matters. "External" stakeholders are those outside the firm. For many, particularly advocates of the German "social market" model, the external stakeholders are residents of the communities in which the firm operates. They are certainly important as they will feel the effects of pollution or pollution-mitigation, firm hiring or firm layoffs, and the opening or closing of major production or distribution facilities employing large numbers of people. However, external stakeholders also include a firm's suppliers and customers, and the local, subnational and national governments of the countries where they operate. They, too, are affected by firm success or failure. As "corporate social responsibility" has become a more prominent concern, thinking about the needs of these various stakeholders has become more explicit.

Companies operate in societies where other members also want favorable conditions for their own activity and some protection from the impact of companies' activities on their own lives. Government regulation is a fact of social life, but it can protect as well as limit companies. Companies need secure rights of ownership and use over their property, access to materials and supplies, access to customers, and assistance in enforcing contracts and settling disputes. Yet, the kinds of regulation a particular company will accept – or even ask for – depends on the type of activity it undertakes. Fishing companies running factory ships on the world's oceans do not need exclusive rights to operate in a particular part of the ocean; what they want is permission to look for fish all around the ocean and clear property rights to their ships and the fish they catch. Oil and gas companies, in contrast, want exclusive rights to operate in a particular location because the pool of oil stays in one place and they have to build expensive equipment to get to the oil. If another company comes along and drills a well too close to the first, it could take away enough oil to keep the first from paying off its investment in the equipment; thus oil companies want protection against others setting up in the same place. Companies that have to spend a lot of money on product research and development want strong patent systems and other protection of intellectual property so they can sell enough of whatever they develop to recover their R&D costs as well as their production costs. In contrast, patents giving exclusive right to develop products from an invention are less important than the trademarks and brands that distinguish one company's goods from another's for companies using well-known technologies to produce everyday goods like towels, tennis balls, or hammers.

[Note to instructors: The following section is to be used when cases deal with biotechnology]

The particular dynamics in Biotechnology

Applying current scientific advances in chemistry, biochemistry, genetics, and requires particularly large amounts of R&D work, and companies operating in those areas want very strong protection of patents and trade secrets. At the same time, members of the public want strong assurance that any products allowed on the market will be safe for humans and animals and non-disruptive to the natural environment. The tensions between competing concerns can be seen very well in the relation among firms developing genetically modified plant or animal organisms, potential customers and others in society, and the government. For instance, developers of genetically modified (GM) plants begin with an idea and initially work on it inside enclosed laboratories. At this stage, regulators worry primarily about the safety of laboratory conditions for those working inside and the precautions taken in lab facility design and operation to ensure that what is inside stays inside. GM organism developers cannot go directly from lab testing to distribution of a new seed or plant stock; they need to grow the plant through more than one generation to assess how the modification affects the plant over time. Some of these growth experiments can occur in labs, but others can only be completed in outdoor fields. The move outdoors shifts the regulators' attention to the more difficult task of ensuring the lowest risk of contamination to nearby areas. Once the GM plant is proven stable and able to perform as expected in resisting pests, blight, drought, or other unfavorable conditions, the developer will want to introduce it to farmers and, through their crops, into the animal or human food supply. This shifts the regulators' focus yet again, to the safety of consuming the new variety of food. Each shift in focus expands the circle of people directly affected.

The changes in the circle of people affected and the focus of regulations is summarized in this table:

Stage of GMO development	Circle of affected parties	Focus of Regulations
First – turning idea into invention	Lab workers, immediate neighbors	Risk management
Second – turning invention into useful product	Lab and field workers, persons, animals, plants in locations close enough to be affected by escape of seeds or plant parts from fields used for outdoor trials	Risk management
Third – allowing new product to be sold	Production workers, product handlers, buyers/users, neighbors of users, ultimate consumers of products containing GM organisms	Risk Management Product Safety Safety of Use Facilitation of commerce

However, debate about the safety of a potential new product begins well before a company seeks permission to offer it for sale. Growing awareness development begins long before a product comes to market has led members of the public, particularly environmental and other activists skeptical of GM technology, to pay attention much earlier in the process.

In the lab development and outdoor trials phases, regulations address risk management. Decisions reflect not only the state of scientific and technological knowledge but also the level of public trust or distrust of genetic modification techniques and/or the motives of those engaged in developing them. Genetic modification in the 2000s is in some ways the chemicals of the 1980s – not only an area of disagreement about the best approach to the products themselves but also one of the major fields of contention between advocates and critics of private enterprise, market economics, and corporate activities. In the 1980s, several major chemical spills focused public attention on chemical companies of all sorts, from the largest MNC to the smallest local garage workshop; and large segments of the public became convinced that chemical companies were ignoring hazards, failing to inform government agencies or neighbors adequately of risks and response measures, and generally carrying on without proper regard for the safety and health of employees and neighbors. Seeking to avoid what many regarded as the “close the gate after the horse has bolted” character of chemical regulation, activists began efforts to de-legitimate GM foods in the eyes of the public before any had moved from lab to field trial. These efforts were greatly assisted by a political climate that emphasized human rights more strongly and was marked by a proliferation of environmental NGOs and social movements deeply skeptical of individual large corporations, oligopolistic industries, and governments’ ability or willingness to decree and enforce regulations industry opposes.

These efforts were most successful in Europe, where industry disarray combined with stronger countervailing influences from Green Parties and others led to adoption of a process focused regulatory approach based on stricter readings of the precautionary principle. As European realized the different balance of pressures in the USA was allowing industry more influence, European activists sought to promote wider adoption of similar views among US environmental and social activists. They and local GM skeptics had some success, but not enough to prevent adoption of a more end product oriented regulatory approach in the USA. This more permissive climate for initial experimenting and field trials then influenced the European arguments as European firms, now more united in their preferences and better organized for discussions with officials as policy is being developed, argued that the EU’s process oriented approach to regulation was leaving it at a competitive disadvantage with US and Asian firms.

If and when a GM plant or animal is permitted into general agriculture, regulation must also address product safety, safe usage, and facilitation of commerce. While product developers have the primary responsibility for product safety, even a safe product can pose hazards if used incorrectly, so users must be informed about safe uses, warned against hazardous ones, and informed of measures they can take should dangers develop. These, like risk management, address potential problems and avoidance of harm. Like risk reduction rules, these tend to be enforced through liability law and regarded by companies as a potential burden. Regulations facilitating commerce, such as creation and enforcement of intellectual property rights in GM organisms, and the range of market regulation measures that provide a stable context for taking out loans, securing insurance, and buying or selling, are regarded by companies as facilitators. Left to themselves (as guided by their need to make some profit so they can cover costs, repay lenders and provide returns for investors), most companies want regulations that facilitate commerce while leaving them wide latitude of discretion on risk management. Consumers also want a stable commercial climate, but insist increasingly on good risk management and consideration of the long-term environmental impact of GM products.

Thus the content and extent of government regulation regarding development and introduction of GM organisms depends on the balance between various social groups. Industry typically has several advantages in the political contest: the relatively large size of the benefits or losses they will experience from different types of regulation motivates them to get involved in the issue and the relatively small number of companies (typically in the hundreds if all firms are considered; less than 100 if only the big firms are considered) makes is relatively easy for them to organize industry associations for joint political activity. They typically prefer what political scientists call “insider strategies” for gaining influence – making presentations to individual legislators or other officials (“lobbying”) or supporting preferred candidates with campaign contributions. Segments of the public, whether focused on themselves as consumers, environmentalists, or some other group, usually have greater difficulty organizing because they are more numerous and typically enjoy relatively small gains or losses from different regulations. These barriers can be overcome through mass membership organizations and/or activist campaigns. Mass membership consumer or environmental organizations often engage in lobbying and encourage their members to support particular candidates. Activist campaigns, whether run by mass membership organizations or other groups, sometimes engage in “outsider strategies” as well as, seeking to influence political decisions through stirring up public controversy sufficient to make politicians and regulators pay attention and accommodate the concerns expressed.

Debates over GM organisms combine arguments about the application of a technology and the environmental impact of human activities. In both areas, appeals to scientific evidence are a typical part of the policy debate. Companies seeking permission to develop and then sell GM organisms and groups opposing development or sale (whether of all GM organisms or of a particular one) all appeal to laboratory and field studies of the safety and effects of GM organisms. Yet, none fully shares the commitment to rigorous methodologies, consciously seeking to prevent initial hypotheses and other beliefs from so dominating analysis that contrary observational data is ignored, and openness to correction that characterize the best scientific research. Many participants in the GM organisms debate let their prior assumptions about safety or danger of GM organisms color interpretation of data or selection of the particular studies to highlight and engage in a good deal of personal attack against those not sharing their views. Scientific expertise can be used to challenge the most exaggerated arguments for or against, and perhaps limit the impact of the personal attacks, but policy decisions will be driven mainly by social and economic concerns rather than science.

<end>

IDEESE Module 1.1 Resources

Diagrams of Scientific Organizations

MJ Peterson
Version 1; February 2008

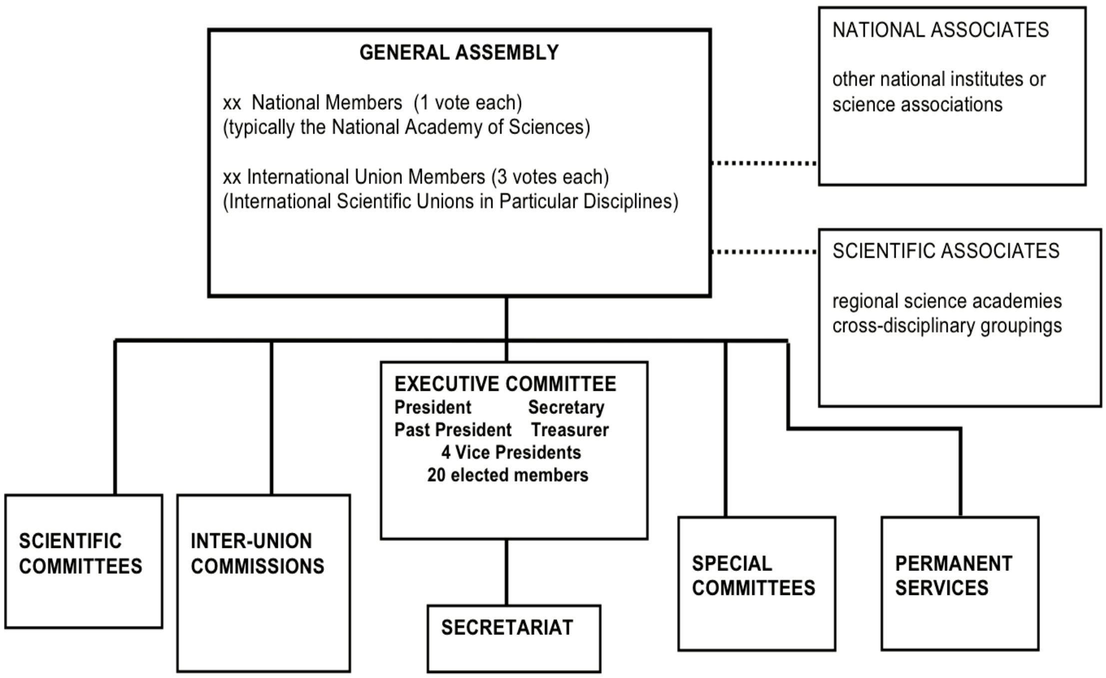
This section includes Organizational Diagrams of:

- International Council of Scientific Unions
- Typical National Academy of Sciences
- Relations among UN Educational Scientific and Cultural Organization (UNESCO), Intergovernmental Oceanographic Commission (IOC) , International Congress of Scientific Unions (ICSU) and Scientific Committee on Oceanographic Research (SCOR)
- Relations among International Telecommunications Union (ITU), Committee on Space Research (COSPAR), and IUCAF
- US National Academy of Sciences and National Research Council

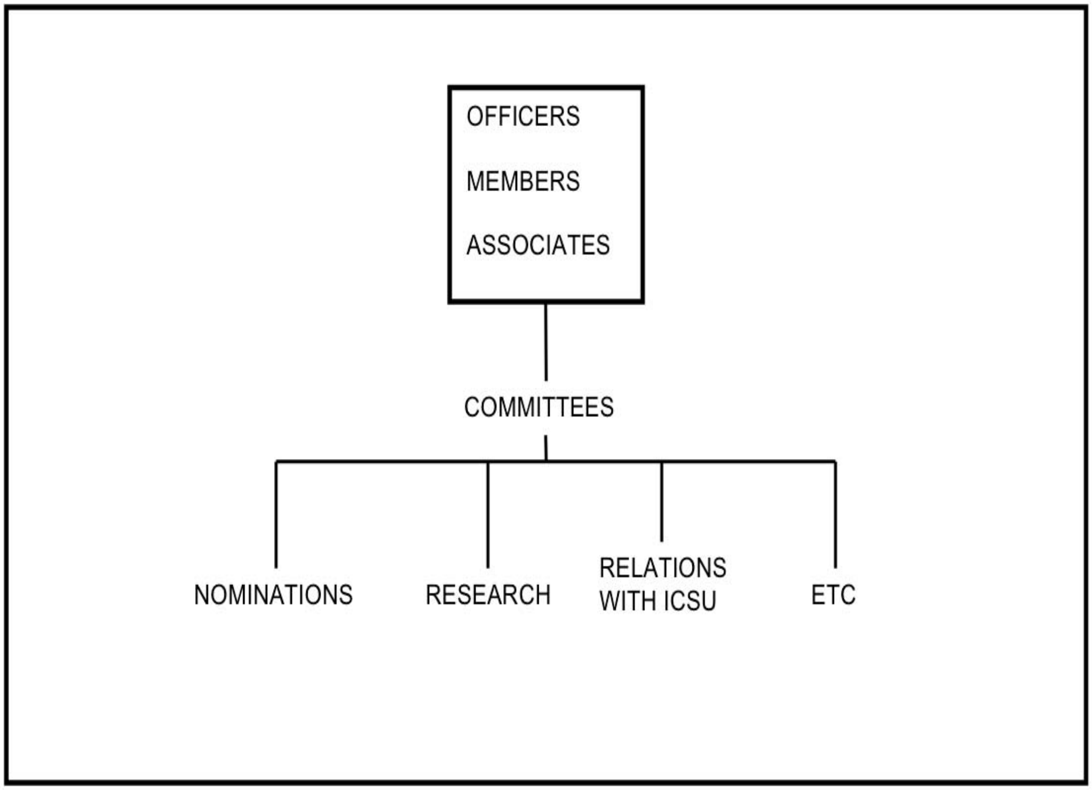
This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. "Diagrams of Scientific Organizations." Module 1.1: Workplace Ethics in Transnational Contexts. International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

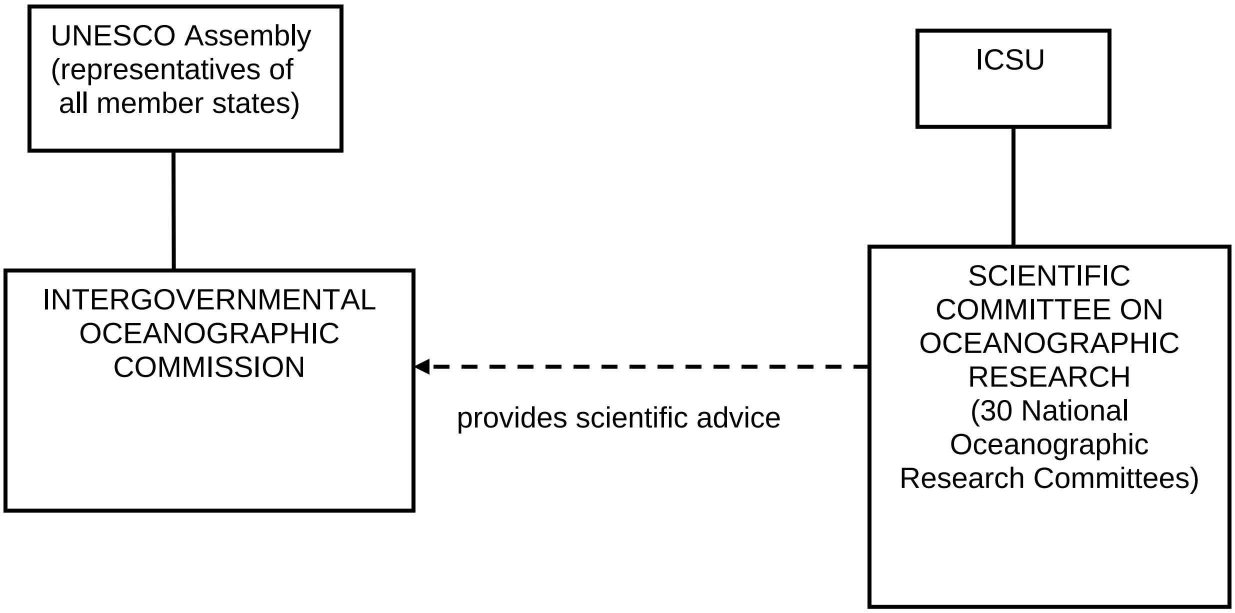
International Council of Scientific Unions



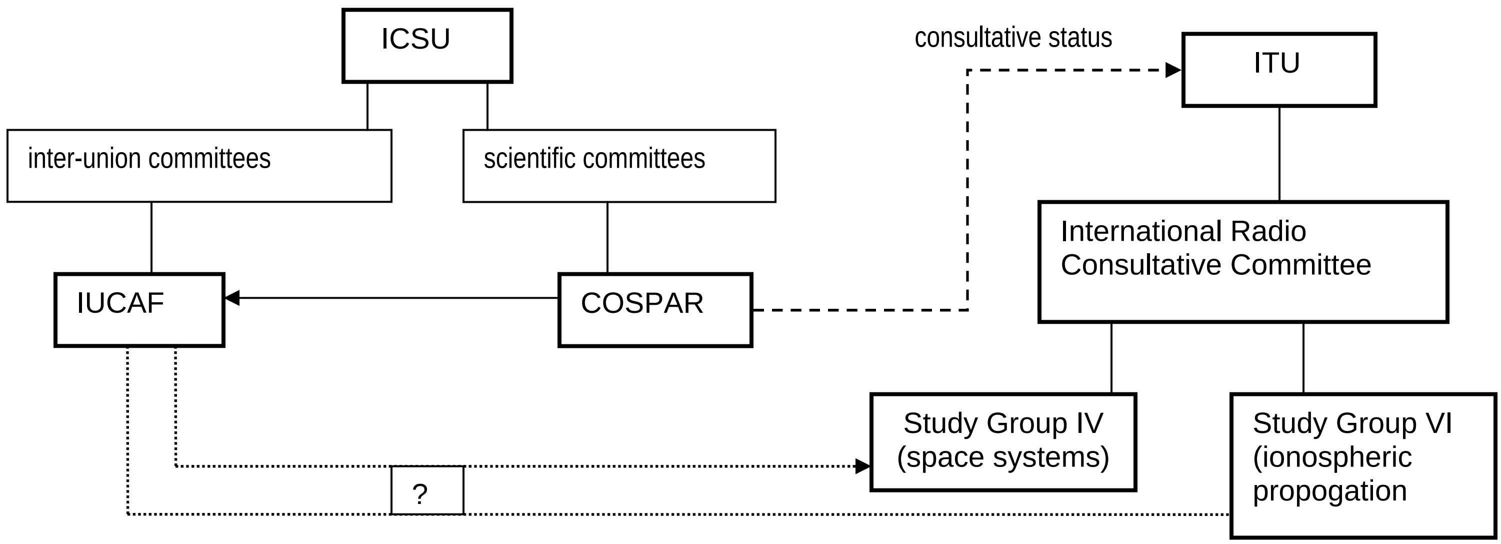
Typical National Academy of Sciences



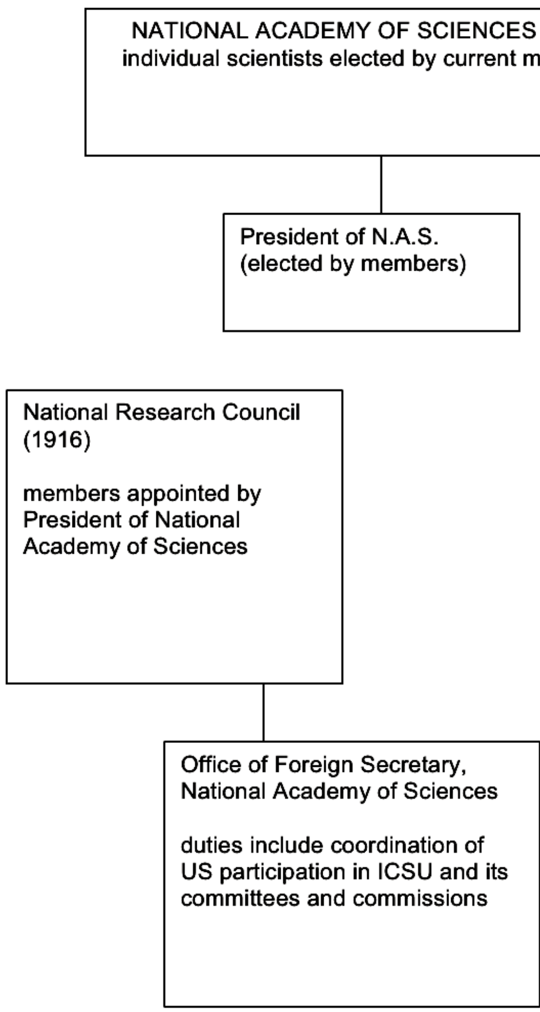
UNESCO, IOC, ICSU and SCOR



ITU, COSPAR, and IUCAF



US National Academy of Sciences and National Research Council



IDEESE Module 1.1 Resources

WFEO: Membership Categories

MJ Peterson
Version 1; from www.wfeo.org, February 2008

Executive Council Members

The Executive Council membership comprises the President, the President-Elect, the immediate Past President, four Vice Presidents directly elected by the General Assembly, six Vice Presidents who hold office by virtue of their election as chairmen of Standing Committees, the Treasurer, twelve representatives of the National, Regional and Affiliated members; and one representative of each of the Founder International Organizations. The Deputy Treasurer and the Executive Director attend but without voting rights.

Membership of the Federation

The Federation shall consist of National Members, Regional Members, Affiliated Members and International Members, which are the voting members; it also includes Technical Members and Corresponding Members, which have no right of vote. The Federation may have as associates, those who wish to be associated with the Federation, but are not part of the Federation.

National Member

A National Member shall comprise the National professional engineering organization or organizations within one country representing engineers engaged on a high level of technical competence according to that country's national standards.

Regional Member

A Regional Member shall comprise the National professional engineering organization or organizations constituted within a number of countries in a geographical region, each representing engineers engaged on a high level of technical competence according to the national standards of the respective countries or states, and where those national professional organizations were unable individually, to undertake the responsibilities of a National Member.

International Member

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: M.J. Peterson. 2008. "WFEO: Membership Categories." As cited in Module 1.1: Workplace Ethics in Transnational Contexts. International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

An International Member shall be a group of National professional engineering bodies organized on a regional or other international basis.

Affiliated Member

An Affiliated Member shall comprise the professional engineering organization or organizations existing in a special geographical area, each representing engineers engaged on a high level of technical competence according to the standards of that special geographical area.

Technical Member

A Technical Member shall be an international non-governmental professional organization devoted to activities in a particular area of engineering.

Associates

Associates shall be an Engineering organization, Corporate body or individual, who registers as such for the purpose of supporting the Federation, and receiving regular information on its activities. Associates are not Members of the Federation.

Corresponding Member

A Corresponding Member shall be a National professional engineering organization not able to participate fully as a national member, but wishing to participate by correspondence in the activities of the Federation.

<end>

IDEESE Module 1.1 Resources

UNESCO: Description of Engineers' Work

MJ Peterson
Final Version; revised February 2008

Excerpt from www.unesco.int; bold in original. Accessed 4 February 2008.

Engineers research, design, build and maintain the products, processes and infrastructure that surround and support us. **Engineering applications drive sustainable social and economic development** and are vital in addressing basic human needs, **poverty reduction**, sustainable development in such areas as water supply and sanitation, health, food production and processing, housing and construction, energy, transportation and communication, income generation and employment creation. **Engineering applications are also vital in emergency prevention**, response and **reconstruction** and bridging the knowledge divide. In most countries engineers are required to be accredited and registered in order to practice engineering. In order to practice engineering, engineers need to be aware of and follow technical and professional codes of practice. This includes codes of professional ethics.

<end>

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This case should be cited as: "UNESCO: Descriptions of Engineers' Work." As cited in M.J. Peterson. 2008. Module 1.1: Workplace Ethics in Transnational Contexts. International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

IDEESE Module 1.1 Resources

World Federation of Engineering Organizations (WFEO): Model Code of Ethics

By MJ Peterson
Final Version; revised February 2008

From www.wfeo.org, accessed February 2008

I. Broad Principles

Ethics is generally understood as the discipline or field of study dealing with moral duty or obligation. This typically gives rise to a set of governing principles or values, which in turn are used to judge the appropriateness of particular conducts or behaviors. These principles are usually presented either as broad guiding principles of an idealistic or inspirational nature, or, alternatively, as a detailed and specific set of rules couched in legalistic or imperative terms to make them more enforceable. Professions that have been given the privilege and responsibility of self regulation, including the engineering profession, have tended to opt for the first alternative, espousing sets of underlying principles as codes of professional ethics which form the basis and framework for responsible professional practice. Arising from this context, professional codes of ethics have sometimes been incorrectly interpreted as a set of "rules" of conduct intended for passive observance. A more appropriate use by practicing professionals is to interpret the essence of the underlying principles within their daily decision-making situations in a dynamic manner, responsive to the need of the situation. As a consequence, a code of professional ethics is more than a minimum standard of conduct; rather, it is a set of principles, which should guide professionals in their daily work.

In summary, the model Code presented herein expresses the expectations of engineers and society in discriminating engineers' professional responsibilities. The Code is based on broad principles of truth, honesty and trustworthiness, respect for human life and welfare, fairness, openness, competence and accountability. Some of these broader ethical principles or issues deemed more universally applicable are not specifically defined in the Code although they are understood to be applicable as well. Only those tenets deemed to be particularly applicable to the practice of professional engineering are specified. Nevertheless, certain ethical principles or issues not commonly considered to be part of professional ethics should be implicitly accepted to judge the engineer's professional performance.

Issues regarding the environment and sustainable development know no geographical boundaries. The engineers and citizens of all nations should know and respect the environmental ethic. It is desirable

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This should be cited as: “World Federation of Engineering Organizations (WFEO): Model Code of Ethics.” As cited in M.J. Peterson. 2008. Module 1.1: Workplace Ethics in Transnational Contexts. International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

therefore that engineers in each nation continue to observe the philosophy of the Principles of Environmental Ethics delineated in Section III of this code.

II. Practice Provision Ethics

Professional engineers shall:

- hold paramount the safety, health and welfare of the public and the protection of both the natural and the built environment in accordance with the Principles of Sustainable Development;
- promote health and safety within the workplace;
- offer services, advise on or undertake engineering assignments only in areas of their competence and practice in a careful and diligent manner;
- act as faithful agents of their clients or employers, maintain confidentially and disclose conflicts of interest;
- keep themselves informed in order to maintain their competence, strive to advance the body of knowledge within which they practice and provide opportunities for the professional development of their subordinates and fellow practitioners;
- conduct themselves with fairness, and good faith towards clients, colleagues and others, give credit where it is due and accept, as well as give, honest and fair professional criticism;
- be aware of and ensure that clients and employers are made aware of societal and environmental consequences of actions or projects and endeavor to interpret engineering issues to the public in an objective and truthful manner;
- present clearly to employers and clients the possible consequences of overruling or disregarding of engineering decisions or judgment;
- report to their association and/or appropriate agencies any illegal or unethical engineering decisions or practices of engineers or others.

III. Environmental Engineering Ethics

Engineers, as they develop any professional activity, shall:

- try with the best of their ability, courage, enthusiasm and dedication, to obtain a superior technical achievement, which will contribute to and promote a healthy and agreeable surrounding for all people, in open spaces as well as indoors;
- strive to accomplish the beneficial objectives of their work with the lowest possible consumption of raw materials and energy and the lowest production of wastes and any kind of pollution;

- discuss in particular the consequences of their proposals and actions, direct or indirect, immediate or long term, upon the health of people, social equity and the local system of values;
- study thoroughly the environment that will be affected, assess all the impacts that might arise in the structure, dynamics and aesthetics of the ecosystems involved, urbanized or natural, as well as in the pertinent socioeconomic systems, and select the best alternative for development that is both environmentally sound and sustainable;
- promote a clear understanding of the actions required to restore and, if possible, to improve the environment that may be disturbed, and include them in their proposals;
- reject any kind of commitment that involves unfair damages for human surroundings and nature, and aim for the best possible technical, social, and political solution;
- be aware that the principles of eco-systemic interdependence, diversity maintenance, resource recovery and inter-relational harmony form the basis of humankind's continued existence and that each of these bases poses a threshold of sustainability that should not be exceeded.

IV. Conclusion

Always remember that war, greed, misery and ignorance, plus natural disasters and human induced pollution and destruction of resources, are the main causes of the progressive impairment of the environment and that engineers, as an active member of society, deeply involved in the promotion of development, must use our talent, knowledge and imagination to assist society in removing those evils and improving the quality of life for all people.

Interpretation of The Code of Ethics

The interpretive articles, which follow, expand on and discuss some of the more difficult and interrelated components of the Code especially related to the Practice Provisions. No attempt is made to expand on all clauses of the Code, nor is the elaboration presented on a clause-by-clause basis. The objective of this approach is to broaden the interpretation, rather than narrow its focus. The ethics of professional engineering is an integrated whole and cannot be reduced to fixed "rules". Therefore, the issues and questions arising from the Code are discussed in a general framework, drawing on any and all portions of the Code to demonstrate their interrelationship and to expand on the basic intent of the Code.

Sustainable Development and Environment.

Engineers shall strive to enhance the quality of the biophysical and socioeconomic urban environment and the one of buildings and spaces and to promote the principles of sustainable development.

Engineers shall seek opportunities to work for the enhancement of safety, health, and the social welfare of both their local community and the global community through the practice of sustainable development.

Engineers whose recommendations are overruled or ignored on issues of safety, health, welfare, or sustainable development shall inform their contractor or employer of the possible consequences.

Protection of the Public and the Environment

Professional Engineers shall hold paramount the safety, health and welfare of the public and the protection of the environment. This obligation to the safety, health and welfare of the general public, which includes one's own work environment, is often dependent upon engineering judgments, risk assessments, decisions and practices incorporated into structures, machines, products, processes and devices. Therefore, engineers must control and ensure that what they are involved with is in conformity with accepted engineering practice, standards and applicable codes, and would be considered safe based on peer adjudication. This responsibility extends to include all and any situations which an engineer encounters and includes an obligation to advise the appropriate authority if there is reason to believe that any engineering activity, or its products, processes, etc. do not confirm with the above stated conditions.

The meaning of paramount in this basic tenet is that all other requirements of the Code are subordinate if protection of public safety, the environment or other substantive public interests are involved.

Faithful Agent of Clients and Employers

Engineers shall act as faithful agents or trustees of their clients and employers with objectivity, fairness and justice to all parties. With respect to the handling of confidential or proprietary information, the concept of ownership of the information and protecting that party's rights is appropriate. Engineers shall not reveal facts, data or information obtained in a professional capacity without the prior consent of its owner. The only exception to respecting confidentially and maintaining a trustee's position is in instances where the public interest or the environment is at risk as discussed in the preceding section; but even in these circumstances, the engineer should endeavor to have the client and/or employer appropriately redress the situation, or at least, in the absence of a compelling reason to the contrary, should make every reasonable effort to contact them and explain clearly the potential risks, prior to informing the appropriate authority.

Professional Engineers shall avoid conflict of interest situations with employers and clients but, should such conflict arise, it is the engineer's responsibility to fully disclose, without delay, the nature of the conflict to the party(ies) with whom the conflict exists. In these circumstances where full disclosure is insufficient, or seen to be insufficient, to protect all parties' interests, as well as the public, the engineer shall withdraw totally from the issue or use extraordinary means, involving independent parties if possible, to monitor the situation. For example, it is inappropriate to act simultaneously as agent for both the provider and the recipient of professional services. If client's and employer's interests are at odds, the engineer shall attempt to deal fairly with both. If the conflict of interest is between the intent of a corporate employer and a regulatory standard, the engineer must attempt to reconcile the difference, and if that is unsuccessful, it may become necessary to inform.

Being a faithful agent or trustee includes the obligation of engaging, or advising to engage, experts or specialists when such services are deemed to be in the client's or employer's best interests. It also means being accurate, objective and truthful in making public statements on behalf of the client or employer when required to do so, while respecting the client's and employer's rights of confidentiality and proprietary information.

Being a faithful agent includes not using a previous employer's or client's specific privileged or proprietary information and trade practices or process information, without the owner's knowledge and consent.

However, general technical knowledge, experience and expertise gained by the engineer through involvement with the previous work may be freely used without consent or subsequent undertakings.

Competence and Knowledge

Professional Engineers shall offer services, advise on or undertake engineering assignments only in areas of their competence by virtue of their training and experience. This includes exercising care and communicating clearly in accepting or interpreting assignments, and in setting expected outcomes. It also includes the responsibility to obtain the services of an expert if required or, if the knowledge is unknown, to proceed only with full disclosure of the circumstances and, if necessary, of the experimental nature of the activity to all parties involved. Hence, this requirement is more than simply duty to a standard of care, it also involves acting with honesty and integrity with one's client or employer and one's self. Professional Engineers have the responsibility to remain abreast of developments and knowledge in their area of expertise, that is, to maintain their own competence. Should there be a technologically driven or individually motivated shift in the area of technical activity, it is the engineer's duty to attain and maintain competence in all areas of involvement including being knowledgeable with the, technical and legal framework and regulations governing their work. In effect, it requires a personal commitment to ongoing professional development, continuing education and self-testing.

In addition to maintaining their own competence, Professional Engineers have an obligation to strive to contribute to the advancement of the body of knowledge within which they practice, and to the profession in general. Moreover, within the framework of the practice of their profession, they are expected to participate in providing opportunities to further the professional development of their colleagues.

This competence requirement of the Code extends to include an obligation to the public, the profession and one's peers, that opinions on engineering issues are expressed honestly and only in areas of one's competence. It applies equally to reporting or advising on professional matters and to issuing public statements. This requires honesty with one's self to present issues fairly, accurately and with appropriate qualifiers and disclaimers, and to avoid personal, political and other non-technical biases. The latter is particularly important for public statements or when involved in a technical forum.

Fairness and Integrity in the Workplace

Honesty, integrity, continuously updated competence, devotion to service and dedication to enhancing the life quality of society are cornerstones of professional responsibility. Within this framework, engineers shall be objective and truthful and include all known and pertinent information on professional reports, statements and testimony. They shall accurately and objectively represent their clients, employers, associates and themselves consistent with their academic, experience and professional qualifications. This tenet is more than 'not misrepresenting'; it also implies disclosure of all relevant information and issues, especially when serving in an advisory capacity or as an expert witness. Similarly, fairness, honesty and accuracy in advertising are expected.

If called upon to verify another engineer's work, there is an obligation to inform (or make every effort to inform) the other engineer, whether the other engineer is still actively involved or not. In this situation, and in any circumstance, engineers shall give proper recognition and credit where credit is due and accept, as well as give, honest and fair criticism on professional matters, all the while maintaining dignity and respect for everyone involved.

Engineers shall not accept nor offer covert payment or other considerations for the purpose of securing, or as remuneration for engineering assignments. Engineers should prevent their personal or political involvement from influencing or compromising their professional role or responsibility.

Consistent with the Code, and having attempted to remedy any situation within their organization, engineers are obligated to report to their association or other appropriate agency any illegal or unethical engineering decisions by engineers or others. Care must be taken not to enter into legal arrangements, which compromise this obligation.

Professional Accountability and Leadership

Engineers have a duty to practice in a careful and diligent manner and accept responsibility, and be accountable for their actions. This duty is not limited to design, or its supervision and management, but applies to all areas of practice. For example, it includes construction supervision and management, preparation of shop drawings, engineering reports, feasibility studies, environmental impact assessments, engineering developmental work, etc.

The signing and sealing of engineering documents indicates the taking of responsibility for the work. This practice is required for all types of engineering endeavor, regardless where or for whom the work is done, including but not limited to, privately and publicly owned firms, crown corporations, and government agencies/departments. There are no exceptions; signing and sealing documents is appropriate whenever engineering principles have been used and public welfare may be at risk.

Taking responsibility for engineering activity includes being accountable for one's own work and, in the case of a senior engineer, accepting responsibility for the work of a team. The latter implies responsible supervision where the engineer is actually in a position to review, modify and direct the entirety of the engineering work. This concept requires setting reasonable limits on the extent of activities, and the number of engineers and others, whose work can be supervised by the responsible engineer. The practice of a "symbolic" responsibility or supervision is the situation where an engineer, say with the title of "chief engineer", takes full responsibility for all engineering on behalf of a large corporation, utility or government agency/department, even though the engineer may not be aware of many of the engineering activities or decisions being made daily throughout the firm or department. The essence of this approach is that the firm is taking the responsibility of default, whether engineering supervision or direction is applied or not.

Engineers have a duty to advise their employer and, if necessary, their clients and even their professional association, in that order, in situations when the overturning of an engineering decision may result in breaching their duty to safeguard the public. The initial action is to discuss the problem with the supervisor/employer. If the employer does not adequately respond to the engineer's concern, then the client must be advised in the case of a consultancy situation, or the most senior officer should be informed in the case of a manufacturing process plant or government agency. Failing this attempt to rectify the situation the engineer must advise in confidence his professional association of his concerns.

In the same order as mentioned above, the engineer must report unethical engineering activity undertaken by other engineers or by non-engineers. This extends to include for example, situations in which senior officials of a firm make "executive" decisions, which clearly and substantially alter the engineering aspects of the work, or protection of the public welfare or the environment arising from the work.

Because of the rapid advancements in technology and the increasing ability of engineering activities to impact on the environment, engineers have an obligation to be mindful of the effect that their decisions will have on the environment and the well-being of society, and to report any concerns of this nature in the same manner as previously mentioned. Further to the above, with the rapid advancement of technology in today's world and the possible social impacts on large populations of people, engineers must endeavor to foster the public's understanding of technical issues and the role of Engineering more than ever before.

Sustainable development is the challenge of meeting current human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and, if possible, enhancing the Earth's environmental quality, natural resources, ethical, intellectual, working and affectionate capabilities of people and socioeconomic bases, essential for the human needs of future generations. The proper observance to these principles will considerably help to the eradication of the world poverty.

<end>

IDEESE Module 1.1 Resources

Standard Molecular Biology Nomenclatures

From International Union of Biochemistry and Molecular Biology website, www.iubmb.unibe.ch
Accessed February 2008

The International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Biochemistry and Molecular Biology (IUBMB) have established the IUPAC-IUBMB Joint Commission on Biochemical Nomenclature (JCBN) and the Nomenclature Committee of the International Union of Biochemistry and Molecular Biology (NC-IUBMB). A short outline on the purpose and aim of these Committees is outlined in the paragraphs below.

More detailed information and the recommendations for biochemical nomenclature including enzyme nomenclature can be found on the nomenclature website.

Purpose of the committees

The purpose of the committees is to facilitate communication of biochemical information by encouraging scientists to use generally understood terminology.

They make recommendations with this aim. The committees seek advice from experts in the diverse fields of biochemistry about matters where communication is difficult because of inconsistent practices. This is the starting point of most of the initiatives of the committees. The experts consulted include journal editors and database managers. For example, the recommendations for a Nomenclature for Incompletely Specified Bases in Nucleic Acid Sequences (1984) arose out of an attempt by an international group of experts to resolve the confusion that previously resulted from the existence of many different systems to represent combinations such as "G or C", which had been written in at least five different ways.

Origins

The present nomenclature committees were created by the International Union of Biochemistry (IUB; now the International Union of Biochemistry and Molecular Biology, IUBMB) and the International Union of Pure and Applied Chemistry (IUPAC) to replace the IUPAC-IUB Commission on Biochemical Nomenclature (CBN), which was discontinued in 1977. Formally there are two committees:

*JCBN, the IUPAC-IUBMB Joint Commission on Biochemical Nomenclature

This module was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.

This should be cited as: “Standard Molecular Biology Nomenclatures.” As cited in M.J. Peterson. 2008. Module 1.1: Workplace Ethics in Transnational Contexts. International Dimensions of Ethics Education in Science and Engineering. Available www.umass.edu/sts/ethics.

*NC-IUBMB, the Nomenclature Committee of IUBMB

With somewhat different terms of reference, JCBN is jointly responsible to both International Unions, and deals with matters of biochemical nomenclature that have importance in both biochemistry and chemistry. NC-IUBMB is responsible only to IUBMB and deals with matters of biochemical nomenclature that are more remote from the interests of chemists.

In practice there is considerable overlap in the tasks of the two committees and they always work and meet as a single body, with a common Chairman and a common Secretary. The present members are listed on the web. Unless otherwise indicated, therefore, the term "nomenclature committees" in this page refers equally to JCBN and to NC-IUBMB.

Procedures for establishing new recommendations

The initial recommendations for any topic are always prepared by experts in the subject area, but are subsequently studied by the nomenclature committees in an effort to harmonize them with recommendations in related areas of biochemistry, or indeed in chemistry and other disciplines. Although this step often appears unnecessary to experts in a restricted area of the subject, its importance emerges when one attempts to present information on a broader scale or to a broader audience. As an example, some years ago the nomenclature committees were asked to advise on some draft recommendations in which I (in ordinary roman type and without any qualifiers) was proposed as a standard symbol that could be used without definition for a particular immunoglobulin; they had to point out that this could only be acceptable in a very narrow context, as it would be confusing whenever the chemical symbol for iodine might be needed, or if the one-letter code for isoleucine and the symbol for ionic strength were also used (quite apart from confusion with the personal pronoun, as, for example, in "I mixed I with 131I-labelled thyroxine in a solution of I = 0.5 mol/l containing 5mM"). Further review is required after the nomenclature committees are satisfied with any recommendations, as the International Unions, which have ultimate responsibility for any publication, need to be satisfied that they represent the views of a broad range of experts. The actual review procedures of the two Unions differ somewhat, but their aims are the same, and they also have the additional consequence that preparing any document is inevitably slow. Even the most rapidly produced documents, such as the Nomenclature for Incompletely Specified Bases in Nucleic Acid Sequences noted above, which encountered no serious obstacles on the way to approval, typically take at least two years.

Connections with other bodies

There is inevitably some overlap between the work of the biochemical nomenclature committees and similar bodies in other disciplines, especially through IUPAC Division VIII, Chemical Nomenclature and Structure Representation. Many IUPAC nomenclature recommendations are available through the web. To avoid arriving at conflicting recommendations the nomenclature committees maintain close relations with such bodies (and during the existence of the present committees they have always included present or former members of CNOC among their members). Input from other committees concerned with biochemical nomenclature is always welcomed, and any such body interested in sending an Observer to meetings of JCBN and NC-IUBMB is invited to contact the Secretary, Dr. S Boyce.

Publication of recommendations

Apart from Enzyme Nomenclature, discussed below, recommendations of the nomenclature committees are published in the primary research literature. All JCBN recommendations are published in Pure and Applied Chemistry, and all JCBN and NC-IUBMB recommendations are currently published in the European Journal of Biochemistry, by courtesy of FEBS. Many documents appear also in other journals, and any journal wishing to republish a document can normally obtain reproduction-quality proofs from the European Journal of Biochemistry, to avoid the need for re-setting. However, it is not obligatory to use these proofs, and journals that prefer to set the type themselves may do so without any copyright complications. From time to time these documents are published together as a Compendium, Biochemical Nomenclature and Related Documents; the most recent edition was published by Portland Press for IUBMB in 1992 (ISBN 1 85578 005 4).

A list of JCBN and NC-IUBMB publications is available through the web, and the full texts of the following are also there. Others will be added as time permits.

[from separate Nomenclatures page of IUBMB website]

Apart from Enzyme Nomenclature, discussed below, recommendations of the nomenclature committees are published in the primary research literature. All JCBN recommendations are published in Pure and Applied Chemistry, and all JCBN and NC-IUBMB recommendations are currently published in the European Journal of Biochemistry, by courtesy of FEBS. Many documents appear also in other journals, and any journal wishing to republish a document can normally obtain reproduction-quality proofs from the European Journal of Biochemistry, to avoid the need for re-setting. However, it is not obligatory to use these proofs, and journals that prefer to set the type themselves may do so without any copyright complications. From time to time these documents are published together as a Compendium, Biochemical Nomenclature and Related Documents; the most recent edition was published by Portland Press for IUBMB in 1992 (ISBN 1 85578 005 4).

A list of JCBN and NC-IUBMB publications is available through the web, and the full texts of the following are also there. Others will be added as time permits.

Recommendation	URL
Amino Acids and Peptides	http://www.chem.qmul.ac.uk/iupac/AminoAcid/
Biochemical thermodynamics	http://www.chem.qmul.ac.uk/iubmb/thermod/
Branched nucleic acids	http://www.chem.qmul.ac.uk/iubmb/misc/bran.html
Carbohydrates	http://www.chem.qmul.ac.uk/iupac/2carb/
Carotenoids	http://www.chem.qmul.ac.uk/iupac/carot/
Corrinoids (vitamin B12)	http://www.chem.qmul.ac.uk/iupac/misc/B12.html
Cyclitols	http://www.chem.qmul.ac.uk/iupac/cyclitol/
Electron transport proteins	http://www.chem.qmul.ac.uk/iubmb/etp/
Enzyme kinetics	http://www.chem.qmul.ac.uk/iubmb/kinetics/
Enzyme nomenclature	http://www.chem.qmul.ac.uk/iubmb/enzyme/
EC 1 Oxidoreductases	http://www.chem.qmul.ac.uk/iubmb/enzyme/EC1/
EC 2 Transferases	http://www.chem.qmul.ac.uk/iubmb/enzyme/EC2/
EC 3 Hydrolases	http://www.chem.qmul.ac.uk/iubmb/enzyme/EC3/

EC 4 Lyases	http://www.chem.qmul.ac.uk/iubmb/enzyme/EC4/
EC 5 Isomerases	http://www.chem.qmul.ac.uk/iubmb/enzyme/EC5/
EC 6 Ligases	http://www.chem.qmul.ac.uk/iubmb/enzyme/EC6/
Folic acid	http://www.chem.qmul.ac.uk/iupac/misc/folic.html
Glycolipids	http://www.chem.qmul.ac.uk/iupac/misc/glylp.html
Glycoproteins	http://www.chem.qmul.ac.uk/iupac/misc/glycp.html
myo-Inositol numbering	http://www.chem.qmul.ac.uk/iupac/cyclitol/myo.html
Lignan Nomenclature	http://www.chem.qmul.ac.uk/iupac/lignan/
Lipid Nomenclature	http://www.chem.qmul.ac.uk/iupac/lipid/
Membrane transport proteins	http://www.chem.qmul.ac.uk/iubmb/mtp/
Multienzymes	http://www.chem.qmul.ac.uk/iubmb/misc/menz.html
Multiple forms of enzymes	http://www.chem.qmul.ac.uk/iubmb/misc/isoen.html
Nucleic acid constituents	http://www.chem.qmul.ac.uk/iupac/misc/naabb.html
Nucleic acid sequence (incompletely specified bases)	http://www.chem.qmul.ac.uk/iubmb/misc/naseq.html
Peptide hormones	http://www.chem.qmul.ac.uk/iubmb/misc/phorm.html
Phosphorus containing compounds	http://www.chem.qmul.ac.uk/iupac/misc/phospho.html
Polymerized amino acids	http://www.chem.qmul.ac.uk/iupac/misc/polypep.html
Polypeptide conformation	http://www.chem.qmul.ac.uk/iupac/misc/ppep1.html
Polynucleotide conformation	http://www.chem.qmul.ac.uk/iupac/misc/pnuc1.html
Polysaccharide conformation	http://www.chem.qmul.ac.uk/iupac/misc/psac.html
Prenol nomenclature	http://www.chem.qmul.ac.uk/iupac/misc/prenol.html
Pyridoxal (vitamin B6)	http://www.chem.qmul.ac.uk/iupac/misc/B6.html
Quinones with an Isoprenoid Chain	http://www.chem.qmul.ac.uk/iupac/misc/quinone.html
Retinoids	http://www.chem.qmul.ac.uk/iupac/misc/ret.html
Steroids	http://www.chem.qmul.ac.uk/iupac/steroid/
Tetrapyrroles	http://www.chem.qmul.ac.uk/iupac/tetrapyrrole/
Tocopherols (vitamin E)	http://www.chem.qmul.ac.uk/iupac/misc/toc.html
Translation Factors	http://www.chem.qmul.ac.uk/iubmb/misc/trans.html
Vitamin D	http://www.chem.qmul.ac.uk/iupac/misc/D.html

<u>Chemical recommendations of use to biochemists</u>

Bioinorganic glossary	www.chem.qmul.ac.uk/iupac/bioinorg/
Class names	www.chem.qmul.ac.uk/iupac/class/
Gold Book - chemical glossary	www.chem.qmul.ac.uk/iupac/bibliog/gold.html
Isotopic modification	www.chem.qmul.ac.uk/iupac/sectionH/
Medicinal chemistry glossary	www.chem.qmul.ac.uk/iupac/medchem/
Natural product nomenclature	www.chem.qmul.ac.uk/iupac/sectionF/
Physical organic chemistry glossary	www.chem.qmul.ac.uk/iupac/gtpoc/
Stereochemical terminology	www.chem.qmul.ac.uk/iupac/stereo/

If you want to search all these files, then two searches are needed. All those which start www.chem.qmul.ac.uk/iupac/ can be searched, and separately those which start www.chem.qmul.ac.uk/iubmb/ may be searched.

Enzyme Nomenclature
The continuous process of discovering new enzymes requires a somewhat different approach for their nomenclature and classification; this is probably the single largest task of the committees. The system used is to allot each enzyme a recommended name and number to allow it to be identified, and the list so obtained has been published at intervals. Its most recent printed edition is Enzyme Nomenclature, published by Academic Press for IUBMB in 1992 (ISBN 0-12-227164-5 hardback or 0-12-227165-3 paper). Several supplements have also been published. This list is now available on the web, at: http://www.chem.qmul.ac.uk/iubmb/enzyme/

Classified under:

EC 1 oxidoreductases
EC 2 transferases
EC 3 hydrolases
EC 4 lyases
EC 5 isomerases
EC 6 ligases

This site is searchable. It contains the recommended name and number of each enzyme. An increasing fraction of these entries have links to the specifications of the enzymes, allowing these to be obtained on screen. These specifications include links to other bioinformatic databases as well as references and comments on the nature of the enzymes. It includes all enzymes approved or updated since the 1992 edition of Enzyme Nomenclature.

It is perhaps worth noting, as it has been a matter of long-standing confusion, that enzyme nomenclature is primarily a matter of naming reactions catalysed, not the structures of the proteins that catalyse them. This has allowed assignment of newly-discovered catalytic activities before anything is known about the structures of the enzymes. The links to databases of genes and protein structure allow the relationships between functional and structural classifications to be more readily accessed. The system of naming enzymes in terms of reactions, rather than structures, is one that works far better for enzymes that act on relatively small molecules than for those that handle polymers. Because of this a rather different system is used for the nomenclature of peptidases.

Information about new enzymes or corrections to existing entries may be reported directly from these web pages or by using the form printed in the back of of the 1992 edition of Enzyme Nomenclature. Comments and suggestions on enzyme classification and nomenclature also may be sent to Dr S. Boyce, Department of Biochemistry, Trinity College Dublin, Dublin 2, Ireland, (E-mail: sboyce@tcd.ie). All new material is considered by the committees before approval. The work on enzyme nomenclature and its transfer to the web have been greatly facilitated by grants to K.F. Tipton from the European Commission (Framework 4 Programme) and the National Institutes of Health.

IDEESE Module 1.1 Resources

In Class Evaluation

Version 2; July 2010

Part 1: The following are some possible response you might have to the material in Module 1.1. Please circle the response that is closest to your thoughts after this module.

Key	
SA	Strongly Agree
A	Agree
UN	Undecided
D	Disagree
SD	Strongly Disagree

Statement	Your Response				
1. I now realize that there is a lot more communication and interconnectedness between countries than I realized.	SA	A	UN	D	SD
2. I do not think that it is very important for scientists/ engineers to pay attention to the international aspects of their work.	SA	A	UN	D	SD
3. I realize that my career will probably have some global or international aspects.	SA	A	UN	D	SD
4. I now realize there are more social implications related to my career than I thought about previously.	SA	A	UN	D	SD
5. I am more aware that the work I might do will involve ethical as well as technical choices.	SA	A	UN	D	SD
6. I am more aware now of the complications related to different ethical expectations in different countries.	SA	A	UN	D	SD
7. I feel there should be one set of ethical guidelines developed that could be used to guide the work of scientists/engineers, regardless of the country in which they work.	SA	A	UN	D	SD
8. I feel that each culture has its own ethical standards, and those standards should not be dictated by other cultures or countries.	SA	A	UN	D	SD
9. I think that ethical guidelines should be a part of international treaties.	SA	A	UN	D	SD
10. I think that it is sufficient for an international company to comply with each nation's ethical standards, independent of the location of the company's headquarters.	SA	A	UN	D	SD

Part 2: In this section, please identify one specific example that you remember as having the most impact on you. Please leave the line blank if nothing seems relevant.

1. Increased intercommunication that exists now between countries.

___

2. Social implications of work done by scientists and engineers.

___

3. Decisions about ethics in relation to different countries.

___

4. Any other specific ideas that were important to you from this module.

___

<end>

This was created by the International Dimensions of Ethics Education in Science and Engineering (IDEESE) Project at the University of Massachusetts Amherst with support from the National Science Foundation under grant number 0734887. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. More information about the IDEESE can be found at http://www.umass.edu/sts/ethics.