Commission on Science and Technology

Anita Butani
Undersecretary-General

Khurram Taji, *Chair*

The Ivy League
Model United Nations Conference
Nineteenth Annual Session

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ILMUNC 2003
The Ivy League Model United Nations Conference

October 13., 2002

Delegates,

Hello and welcome to the Economic and Social Council of the 19th annual Ivy League Model United Nations Conference! Over the past year, our staff has been hard at work writing background papers and planning events to bring you a smooth-running, dynamic, and fun conference. This year's Economic and Social Council is led by some of Penn's most experienced staff members, and covers topics that I hope you will find both pertinent and engaging.

To tell you a bit about myself, I am a sophomore from outside of Washington DC studying Management and Real Estate at the University of Pennsylvania. Between high school and college, I have participated in over twenty MUN conferences, in a variety of capacities both on staff and as a delegate. Outside of MUN, I work as a Team Advisor in the Management Department at Penn and I'm active in Penn's South Asia Society.

During conference, I will be working my hardest to ensure that your weekend is productive and stimulating, but it's up to you to truly capitalize on your ILMUNC 2003 experience. Research your country's position on the topics at hand, and be prepared to absorb yourself in intense and captivating debate. Over the course of the weekend, I would love to hear your feedback about the conference, so feel free to introduce yourself and tell me what you think. Between now and January 30th, if you have questions relating to ECOSOC or the conference in general, don't hesitate to email me at ecosoc@ilmunc.org. I look forward to hearing from you and meeting you soon!

Regards,

Anita Butani
Under Secretary General, Economic and Social Council
Ivy League Model United Nations 2003

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ILMUNC 2003
The Ivy League Model United Nations Conference

September 10, 2002

Dear Delegates,

I am excited to welcome you to the Commission on Science and Technology - a new addition to the Economic and Social Council for ILMUNC 2003! My name is Khurram Taji, and I am a junior at Penn, studying Computer Science Engineering with minors in Math and Economics. I am from Islamabad, Pakistan, but have spent a significant portion of my life in the inconspicuous city of Jubail, Saudi Arabia. Besides being a keen traveler, I am also an enthusiastic swimmer and tennis player.

I started Model UN in my freshman year and since then have served as Director for two prior conferences. My experience as a member of the dais staff has told me that the quality of a debate is generally defined by the research and negotiation skills that the delegates bring with them into the conference. I hope that in the weeks leading to the conference, you will take the opportunity to research the agenda topics and acquire an acute understanding of your country position. Keep in mind, that your country specific research is key to adding unique value to the committee and making the debates entertaining. The topics your directors and I have worked on are challenging, and should be viewed from a global perspective. I encourage you to have a look at the background papers as they are meant to enlighten you about the respective topics and define certain principles for you to follow during the course of the conference.

To this end, let me assure you that my staff and I will do our best to make this committee enjoyable and a lasting memory. If you have questions regarding ***anything*** - the conference, the committee, or Philadelphia - please feel free to contact me. I look forward to meeting all of you soon.

Sincerely,

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COMMITTEE HISTORY

Commission on Science and Technology

The Commission on Science and Technology for Development (CSTD) is a subsidiary body of the Economic and Social Council (ECOSOC). It was established in 1992 as a result of the restructuring and revitalisation of the United Nations in the economic, social and related fields. Through this restructuring, the General Assembly abolished the former Intergovernmental Committee on Science and Technology for Development (IGCSTD) and its subsidiary body, the Advisory Committee on Science and Technology for Development (ACSTD), created at the time of the United Nations Conference on Science and Technology for Development, held in Vienna in 1979, and replaced them by the CSTD.

In 1998, the Council, in a further review of all its functional commissions, decided to introduce a number of changes in its members*hip, focus and methods of work.*

The Commission met for the first time in April 1993 in New York, USA. Since July 1993, the UNCTAD Secretariat has been responsible for the substantive servicing of the Commission. The Commission has subsequently met in Geneva, Switzerland, at its second, third, fourth, and fifth regular sessions, in 1995,1997, 1999 and 2001, respectively.

The Commission was established to provide the General Assembly and the Economic and Social Council with high-level advice on relevant issues through analysis and appropriate policy recommendations or options in order to enable those organs to guide the future work of the United Nations, develop common policies and agree on appropriate actions.

In this context, the Commission acts as a forum for:

· the examination of science and technology questions and their implications for development;

· the advancement of understanding on science and technology policies, particularly in respect of developing countries and;

· the formulation of recommendations and guidelines on science and technology matters within the United Nations system.*

*From CSTD website,
www.unctad.org/stdev/un/uncstd.html

TOPIC ONE

Alternative Fuel Development

Introduction

The topic discussed in this background guide is of utmost importance to the welfare of our global community. It affects the most important facet of our lives: the air we breathe. Our dependence and substantial use of fossil fuels has led to the contamination and deterioration of our atmosphere, which jeopardizes our health and most importantly, those who will succeed us, our children. Today, we will look to establish a set of guidelines that will help replace the automobile's internal combustion engine with one that provides energy through more environmentally friendly means. Alternate sources of producing energy to the internal combustion engine include batteries, hydrogen, methanol, ethanol, and the sun. We must act soon to avoid potentially severe environmental and health consequences of continued use of fossil fuels.

Issue

The primary source of energy that our society uses today is derived from fossil fuels, which include coal, oil, and natural gas. There are three general costs that we pay to use these fossil fuels, which include obvious monetary costs and the not so apparent environmental and national security costs. The environmental costs include air pollution, global warming, acid rain, and water pollution which lead to serious health complications for humans and other organisms alike. The national security costs include necessary actions taken to protect foreign sources of oil.[1]

Since the non-monetary costs are indirect and difficult to determine, they have traditionally remained external to the energy pricing system and thus, are often referred to as externalities. And since the producers and the users of energy do not pay for these costs, society as a whole must pay for them. Therefore, this pricing system masks the costs of these externalities and allows damage to human health, the environment, and the economy.[2]

One of the largest impacts of fossil fuel combustion is global warming. When fossil fuels are burned, gases are emitted into our atmosphere. One of the gases that is released is carbon dioxide, which traps heat in our earth's atmosphere. The burning of these fossil fuels has resulted in more than a 25 percent increase in the amount of carbon dioxide in our atmosphere over the past 150 years. Climate scientists predict that if carbon dioxide levels continue to rise, the planet will become significantly warmer in the next century. An increase in our climate's temperature can have several impacts on the wellbeing of our environment. In coastal areas, the sea-level will rise due to the warming of the oceans and the melting of glaciers. This may lead to the inundation of wetlands, river deltas, and even populated areas. Also, altered weather patterns may result in more extreme weather events. Here, the agricultural industry would bear the heaviest burden due to the likelihood of more droughts.[3]

Air pollution, the contamination of the air we breathe, is another adverse consequence we face due to our consumption of fossil fuels. Clean air is essential to leading a healthy life for all organisms, especially humans. The combustion of fossil fuels releases quite a few pollutants that include carbon monoxide, nitrogen oxides, sulfur oxides, and hydrocarbons.[4]

Carbon monoxide is formed as a byproduct during the incomplete combustion of all fossil fuels. Exposure to carbon monoxide can cause headaches and place additional stress on people with heart disease. Cars and trucks are the primary source of carbon monoxide emissions. Nitrogen oxides appear as yellowish-brown clouds over many city skylines. They can irritate the lungs, cause bronchitis and pneumonia, and decrease resistance to respiratory infections. They also lead to the formation of smog. The transportation sector is responsible for close to half of the US emissions of nitrogen oxides. Also, nitrogen oxides and sulfur oxides are important constituents of acid rain. Acid rain has a variety of effects, including damage to forests and soils, fish and other living things, materials, and human health. In addition, fossil fuel use also produces particulates, including dust, soot, smoke, and other suspended matter, which are respiratory irritants.[5]

The production, transportation, and use of fossil fuels can also cause water and land pollution. Coal mining and accidents such as oil spills often leave areas of water and land uninhabitable for long periods of time.[6]

The third cost of fossil fuel consumption—or second externality—is the national security cost. Many nations depend on fossil fuels from outside sources. Therefore, to ensure their supply, they may be forced to protect the foreign sources of oil. The Persian Gulf War is a perfect example: U.S. troops were sent to the Gulf in part to guard against a possible cutoff of an important oil supply. Even though the war is now over, U.S. citizens are still paying for the expenses with their tax dollars. Most importantly, lives were lost to protect the supply of oil. This dependence on a foreign supply of oil also creates a danger of fuel price shocks or shortages if supply is disrupted.[7]

From acknowledging the problem at hand, as responsible nations, we must realize that it is time for us to reduce this dependence on fossil fuels. And from studying the problem we can come to the conclusion that an important place to start is in the reduction of fossil fuel use in the private transportation sector. Driving a car is the most polluting act an average citizen commits. Exhaust from all combustion engines combine to produce local adverse effects on the health of car users and all innocent bystanders. The reason for these adverse effects is due to the nature of exhaust released from the combustion of gasoline in our automobile's internal combustion engine. A short list of the pathogenic chemicals released in a car's exhaust include, carbon monoxide, nitrogen dioxide, sulphur dioxide, benzene, formaldehyde, polycyclic hydrocarbons and more. Not to mention the effects of the greenhouse gas carbon dioxide which is proven to have adverse effects on our global climate.[8] Thus, it is this committee's challenge to explore alternatives to the internal combustion engine and an eventual transition to alternatives.

History

Our atmosphere is something we have taken for granted in the past, but in the last forty years or so, scientists, elected officials, and the general public have begun to realize the effects of pollutants on the air we breathe. One of the places on this planet that is considered to be at the forefront of reducing air pollution and promoting cleaner technology is the state of California, in the United States of America. California's first step in fighting air pollution was in 1967 when its legislation formed the Air Resources Board (ARB).[9]

Since its formation, the ARB has outpaced the nation in fighting to reduce California's air pollution and prompting the development of new technology, especially in the automobile industry. In the 1970s, it was common to have over 100 Stage 1 smog alerts annually in the Los Angeles area. However, major efforts by the California ARB have led to a dramatic reduction in the state's air pollution. And they achieved this primarily by cutting the level of contaminants in automobile emissions. From 1995 through 1999, Stage 1 smog alerts in Los Angeles never exceeded 14 in one year. And there were no alerts whatsoever in 1999 and 2000.[10]

However, the ARB continues to place pressure on automotive industries and their engineers to develop even more efficient vehicles because California still faces persistent air pollution problems. More than 95% of Californians live in areas that fail to meet federal or state air quality standards and roughly 50% of smog-forming pollutants still come from gasoline and diesel-powered vehicles. Even though the vehicles sold in California are now 98% cleaner than their predecessors, population growth and increased driving still overwhelms their efforts to control pollution.[11]

In anticipation of this problem, the California Air Resources Board adopted the zero emissions vehicle (ZEV) program in 1990. The program required automakers to put small demonstration fleets of ZEVs and partial ZEVs (not pure ZEVs) on the road in the 1990s. However, by 2003 they are required to have at least 10% of their new car sales be ZEVs, and they continue increasing this percentage for future years. They regulate this program through a system of credits and incentives.[12]

Automobile manufactures try to meet the pure ZEV portion of their requirement using "full function" electric vehicles, City EVs, neighborhood electric vehicles (NEVs), or hydrogen fuel cell vehicles. On top of meeting modifications adopted by the Board on January 25, 2001, automakers are given further incentives to bring more ZEVs to consumers.[13]

In response to the ZEV regulation, automakers have put nearly 2500 battery-powered ZEVs onto California's roads. The regulation also spurred advances in natural gas and other alternative fueled vehicles, super-clean gasoline vehicles, and fuel cell vehicles powered by electricity created from pollution-free hydrogen.[14]

California is not mandating that every one of its citizens drive a ZEV, but they are trying to make it possible for consumers to have a clean air choice without affecting their mobility or lifestyle. EVs can be charged at work, airports, shopping malls, museums, baseball parks and many other places. Home chargers provide the convenience of charging overnight and eliminating trips to the gas station. Also, studies estimate that EV maintenance will cost 35 percent to 80 percent less than gasoline car maintenance. Electric motors have less moving parts, will typically live longer than conventional engines, and won't require oil checks and tune-ups.[15]

Of course EVs will cost a lot at first, as with any new technology. However, as this technology is produced and used, advances are inevitable along with reductions in cost. But in the meantime, California tries to stimulate the transition of this environmentally friendly technology through incentives and rebates that help consumers reduce initial EV costs.

Analysis: Solutions to Issue

Over 100 years have passed since the invention of the internal-combustion automobile. Since then, the number of automobile owners has risen to 5.5 billion people, with nearly 500 million cars. This automotive explosion has left more than half the big cities on the planet with carbon monoxide levels above safe tolerance limits. And every year we continue to build 50 million new cars.[16]

In one year, the average gas-powered car produces five tons of carbon dioxide, which slowly builds up in the atmosphere causing global warming. Every gallon of gasoline burned in an automobile engine sends twenty pounds of carbon dioxide, containing five pounds of pure carbon, into the atmosphere. Due to this, carbon dioxide levels have risen 25 percent above the levels they maintained during the last ten thousand years. Scientists predict that at our current rate of carbon dioxide production, average global temperatures will be raised two to six degrees Fahrenheit, which may cause our sea level to rise substantially by 2100.[17]

At the same time, the fossil fuel that these automobiles operate on is not an unlimited resource. As consumption continues to rise at almost 2 percent a year, oil production is predicted to peak around 2010. Meaning that if we don't find huge new deposits soon—which is unlikely—we're going to see sharply rising prices, shortages and economic disruptions.[18]

Due to these problems, the doors of innovation have swung wide open for the automotive industry. Not since the turn of the last century has there been so much opportunity for fundamental change. Competing technologies are once again vying for attention, though none of them have yet gained any significant market share. The fuel cell car and the gas/electric hybrid are two of the main different approaches to solving the looming automotive pollution crisis.[19]

The best automotive option for controlling carbon dioxide emissions would probably involve a car that utilizes fuel cells. A fuel cell is an electrochemical device in which the energy of a chemical reaction is converted directly into electricity. Unlike an electric cell or battery, a fuel cell operates as long as the fuel and an oxidizer are supplied continuously from outside the cell. Consequently, it does not run down or require recharging. Fuel cells have been around for awhile and have been used on spacecrafts for many years to power electric equipment.[20]

Most importantly, fuel cells convert fuel—hydrogen gas, methanol, or even gasoline—into electrical energy through a chemical process, without combustion. Therefore a car running on pure hydrogen would make it a zero emissions vehicle. No pollution would be released in the exhaust, just water vapor. Also, since the fuel in a fuel cell is converted directly to electricity, it can operate at much higher efficiencies than internal combustion engines, extracting more electricity from the same amount of fuel. The fuel cell itself has no moving parts, making it a quiet and reliable source of power.[21]

The development of fuel cell vehicles is currently viewed as a key element of a sustainable global energy strategy. Ultimately the fuel flexibility of FCV's will allow widespread displacement of combustion-engine vehicles of all types and a transition to renewable and nonpolluting resources to provide the hydrogen needed. Those future energy resources may include combinations of technologies such as solar and wind-based electricity for electrolysis as well as biomass-derived liquid fuels. The FCV's energy supply needs will also help build demand and economic justification for those renewable energy technologies, accelerating their R&D support, success, and adoption for uses far beyond transportation. Governmental assistance is likely to be needed to help overcome initial investment risks, and may be justified by long-term societal benefits. Some appropriate roles of the government include support for R&D, initial demonstrations, and early deployment of FCVs and their new infrastructure requirements. While tax incentives, energy policies, and other government incentives can support those early market-opening efforts, it is assumed that FCVs will compete on their own merits in the long term.[22]

Although the consequences of this technology require further study, the potential benefits of using fuel cells include:

- Reductions in local air pollution, groundwater contamination, and greenhouse gases;
- Improved public health and safety from reduced exposure to fuel and emissions dangers;
- Reduced vehicular urban noise levels and associated stress;
- Increased national energy security, and with some fuels, diversity;
- Possible personal gains in vehicle-related cost savings and convenience; and support and acceleration of the long-term trend toward a clean hydrogen and electricity-based economy.[23]

Another option to the singular internal combustion engine includes hybrid cars. Hybrid electric vehicles (HEVs) combine the internal combustion engine of a conventional vehicle with the battery and electric motor of an electric vehicle. This results in twice the fuel economy of conventional vehicles. Most importantly, this combination offers the extended range and rapid refueling of a conventional vehicle and the energy and environmental benefits of an electric vehicle.[24]

The reason for the invention of hybrid power systems was simply a way to compensate for the shortfall in battery technology. Current battery technology can only provide enough energy for short trips. However, if that battery-operated car had an onboard generator, powered by an internal combustion engine it would help the car make longer trips. We figured that if we were forced to deal with the current battery technology it would only be natural that we come up with more advanced technology that would make batteries provide more energy. However, after 20 years of study, it seems that hybrids might be a more viable and realistic solution.[25]

Sometimes, we need to pass up perfection for progress. Hybrid cars won't be prefect but they will definitely be more efficient cars that can make a huge difference to society in terms of environmental benefits and the serious deterioration of urban air. Use of HEVs will reduce smog-forming pollutants over the current national average. However, hybrids will never be true zero-emissions vehicles because of their internal combustion engine. But the first hybrids on the market will cut emissions of global-warming pollutants by a third to a half, and later models may cut emissions by even more. HEVs can be developed with several varied configurations. Essentially, a hybrid combines an energy storage system, a power unit, and a vehicle propulsion system. A hybrid's efficiency and emissions depend on the particular combination of subsystems, how these subsystems are integrated into a complete system, and the control strategy that integrates the subsystems. A hydrogen fuel cell hybrid, for example, would produce only water as a by-product and run at greater overall efficiency than a battery-electric vehicle that uses wall-plug electricity.[26]

Many hurdles, technical and political, exist to getting "clean cars" to the American consumer. But a combination of regulatory imperatives and environmental necessity is placing force on those individuals who have new innovative ideas to come forth and present them in our global marketplace.

Objective: Course of Action to Remedy Issue

Here are a few general questions that should in someway be answered in an effective resolution:

1. A nation must decide whether and which new technology it should advocate for the replacement of the internal combustion engine.

2. When it does so, whichever it may be, it needs to decide whether this technology should be implemented locally or globally.

3. How does it wish to promote this?

4. What kind of research should be conducted, how should it be funded, how long should it last and with what goals should it be established?

5. Also what mandates should be placed on automotive emissions? (i.e. California's Zero Emissions Mandate)

6. What roles should the United Nations, a nation's government and the corporate world play?

7. What changes in the current automobile society should be made to help facilitate a transition to cleaner exhaust emitting cars.

8. Should the contents of automotive exhaust be reduced to zero emissions or should some minimal level of containments be allowed into the atmosphere?

Please remember not to limit your ideas to these questions. Feel free to promote technologies, ideas and methodologies not mentioned in this background guide. Also, if you feel that there is no reason to be concerned you may be right but you need to do further research that proves your point. Further research is recommended for all delegates who wish to be influential in this all important committee assembly.

Bloc Positions

Industrialized Countries

These are the countries for which this transition is for the most part economically and technologically feasible. They will all benefit from the reduced or zero emissions provided by the new vehicles and since the market and technology is still young look for them to establish strong guidelines and incentives to adopt this technology in hopes of jumping ahead as one of the premier nations with the newest technology.

Third-World Countries

These countries will benefit from the reduced emission environmentally. However, for the most part it is just not economically or technologically feasible for them. Look for these countries to promote national guidelines for research and promotion, but not international ones that would affect then.

OPEC Nations and other Oil-Providing Nations

These nations will not favor the reduction in fossil fuel consumption for obvious economic reasons. Look for them to be obdurate about there position and convinced that the current situation is fine.

Conclusion

Distinguished delegates, you should be aware of what needs to be done now. Fossil fuels have led to the pollution of the very air we need every second to survive. The fact that we need to solve this is no longer a question. And the method by which we should do this is by replacing the automobile's internal combustion engine. So the question that remains and the reason for your attendance at this United Nations Conference is how and with what can this be done. What should our new source of energy be and how should we provide a means for this technology to be adopted into our society with the smoothest and fastest transition possible? Good Luck Delegates.

Endnotes

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TOPIC TWO

Potential Frameworks for Cooperation on International Cyber Security

Introduction

Towards the end of the last century, the post-industrial economy experienced phenomenal growth. The impetus was provided through the extensive use of the Internet, as it became accepted as a new means of communication both at the societal and business levels. E-commerce revolutionized the way businesses interacted, facilitated transactions in different financial markets, and is currently in the process of integrating world economies. To whatever extent cyberspace may have attained global acceptance, it has yet to reach its threshold stage, the point where its full potential can be exploited. It is not the slowdown in technological advancements that has hampered its development. Rather, it is the question of its level of security. The issue of cyber security has highlighted a fundamental glitch in this new medium. Gaps need to be filled quickly in order to protect global infrastructure systems such as telecommunications, financial services, and transportation networks. The future of innovations associated with cyberspace has now been put in doubt as the viability of online transactions is continuously questioned. As the Internet was a spin off from a US Military project, the US always had a technological edge in cyber security over other developed nations. In spite of its high-tech prowess, the US alone cannot combat this issue and neither can any other country do so individually. Cyberspace is a global medium and any significant advancements in such a medium can only be possible with the combined effort of all countries—developed and developing—working on the issue together with the same level of commitment. As the objective is to make Internet security more resilient at the global level, no country should be left in a cauldron of technological disparity. To successfully accomplish such a mandate, all countries will have to compromise in some way or the other. The best means of handling this issue by nations would be by constructing several frameworks which would best fit the missing puzzle needed to attain international cyber security.

Statement of the Issue

Most of what we do as a global community—our banking and finance, our electrical power, our telecommunications, our defense, our transportation systems—depend upon computers and computer controlled systems. By definition such systems are potentially vulnerable to destruction through new cracker tools and techniques. Thus, companies and governmental agencies are spending ever increasing amounts of time and money seeking to achieve information assurance or cyber security. The costs of such efforts are passed along to the consumer and taxpayer. Actually, the costs of not having security upgrades on computers are also passed along: in the considerable dollars it takes to restore systems crashed by crackers, in the cost of fraud when someone assumes another's identify using information stored on computers, etc. The costs can even be far greater: cities plunged into darkness, train derailed, even wars lost. Thus, there is and will continue to be an increasing focus on systems and procedures to safeguard our computers, the information that is on them, and the functions they control. In addition to being expensive, these measures may also result in inconvenience to the network computer user: you may have to change your password from time to time, to access some systems you may have to have a smart card, in some cases you may no longer be able to dial in from your laptop at home, to access some parts of the network you may need authorization from the systems administrator. In working on frameworks to safeguard government computers and in working with industries to help them protect their own systems, nothing must be done that erodes civil liberties or privacy rights or that encroaches on the sovereignty of nations. Indeed by seeking to secure government computers and urging private sector companies to protect theirs, we seek to increase privacy, to protect us all from both Big Brother and unauthorized Little Brothers who may crack into what we assume are privileged and protected files that may give anyone the insight of finding the flaws in global communication and thereby attacking it.

History

In 1957, the U.S. government formed the Advanced Research Projects Agency (ARPA), a segment of the Department of Defense charged with ensuring U.S. leadership in science and technology with military applications. In 1969, ARPA established ARPANET, the forerunner of the Internet.

ARPANET was a network that connected major computers at the University of California at Los Angeles, the University of California at Santa Barbara, Stanford Research Institute, and the University of Utah. Within a couple of years, several other educational and research institutions joined the network. In response to the threat of nuclear attack, ARPANET was designed to allow continued communication if one or more sites were destroyed. Unlike today, when millions of people have access to the Internet from home, work, or their public library, ARPANET served only computer professionals, engineers, and scientists who knew their way around its complex workings. Throughout the 1970s, developers created the protocols used to transfer information over the Internet. By the early 1980s, Usenet newsgroups and electronic mail had been born. Most users were affiliated with universities, although libraries began to connect their catalogs to the Internet, too. During the late 1980s, developers created indices, such as Archie and the Wide Area Information Server (WAIS), to keep track of the information on the Internet. To give users a friendly, easy-to-use interface to work with, the University of Minnesota created its Gopher, a simple menu system for accessing files, in 1991.

Although no one entity controls the World Wide Web, it is overseen by the World Wide Web consortium. However, it alone cannot impose laws that can curtail sensitive cyberspace security breaches. As the world has recently taken a revolutionary course by taking nearly everything but the kitchen sink online, individuals, organizations, and even nations are becoming more and more concerned about the risk level involved when private information flows over the Internet. While Internet security may have improved significantly over the past few years, it has not kept pace with the phenomenal expansion of the Internet, thereby leaving potential security loopholes susceptible to any sort of attack. One reason why the level of security has yet to impress upon anyone is because many governments have been working individually to tackle the issue. Before, when the Internet was in its nascent stages, it could be molded to the needs of whoever wanted to exploit it. Today, the Internet is a global medium, and therefore, it is futile to change any aspect of it without consultation and acceptance from others. Thus, the synergy that would evolve when all governments of the world work together on tackling this issue would be inconceivable.

In December 2000, a first-of-its-kind International Security Law Project was created, aiming to identify the measures taken by the governments in 52 countries across the world to combat information security. The report, entitled "Cyber Crime . . . and Punishment? Archaic Laws Threaten Global Information," looked at ten different types of cyber crime in four categories: data-related crimes, including interception, modification, and theft; network-related crimes, including interference and sabotage; crimes of access, including hacking and virus distribution; and associated computer-related crimes, including aiding and abetting cyber criminals, computer fraud, and computer forgery. Among some of the key findings: Thirty-three of the countries surveyed have not yet updated their laws to address any type of cyber crime. Of the remaining countries, ten have enacted legislation to address five or fewer types of cyber crime, and nine have updated their laws to prosecute against six or more of the ten types. Of those countries, only one, the Philippines, indicated that updated legislation is currently in place to prosecute a future perpetrator of all the types of crimes. In addition to highlighting the efforts of 19 countries that have partially or fully updated their criminal laws, the report also identifies efforts underway in 17 countries that have not updated their laws, including Cuba, Latvia, New Zealand, and Zambia.[1]

Analysis

With over 200 million users online on the Internet world-wide, electronic commerce now accounts for a growing proportion of world trade. The Internet business model, which gives suppliers direct access to customers and new levels of efficiency with less assets and lower management overheads, is being eagerly investigated by major corporations. The emergence of global networks has already begun to influence the way individuals interact with each other, how businesses conduct their affairs, and how governments provide services to their citizens. In a benchmark study, the Digital Planet revealed that total spending on information and communication technology (ICT) in 1999 exceeded U.S. $2.1 trillion, and is expected to exceed U.S. $3 trillion by 2003. The total value of Internet purchases in 1999 rose to U.S. $130 billion, a figure projected in the Digital Planet to reach $2.5 trillion by 2004. As with traditional commerce, electronic commerce requires trust across the whole spectrum of users and providers of services and goods. The radical changes brought about by the emergence of open networks will, in some instances, require modifications to the existing framework of rules to assure this trust. In some cases, new rules will be needed.[2]

Throughout history, business has set its own standard rules and practices through a variety of organizations to lower transaction costs, to avoid and resolve conflicts, and to create consumer confidence. Today's commercial transactions are governed by a mix of laws enacted by government and business self-regulatory mechanisms. Governments have long acknowledged the fact that a dynamic trading environment requires a cautious approach to regulation and thus, have traditionally welcomed business self-regulatory initiatives as the foundation of the rules governing commerce

The pace of change and the emerging state of electronic commerce has heightened the risks associated with premature or unnecessary government regulation. This has increased the responsibility of business to promote a trustworthy environment through self-regulation and technological innovation. Business has a strong market incentive to foster the empowerment of users, but can only make the necessary infrastructure investments if it can trust that governments will recognize and reinforce the leadership of business in responding to the highly dynamic nature of electronic commerce.

Whereas today's framework of rules for the old economy business model have been developed and refined over many decades in an organic fashion, the consensus for global rules for electronic commerce is to move quickly in reviewing how, where and when new rules are necessary. As these rules must take into account the constantly evolving and inherently international nature of electronic commerce, any changes should be implemented only after a thorough discussion with all the parties involved and governments should support business-led rules development where possible. Business is working through its organizations to modify existing rules to ensure an efficient transition from paper-based to electronic commerce.

The World Information Technology Services Alliance's (WITSA) Survey of Electronic Commerce 2000 reveals that the biggest hurdle facing the electronic commerce industry is a lack of trust of the new business channel. Of the 28 national WITSA member associations that took part in the enquiry into the issues facing the electronic commerce business, over a quarter identified ignorance about the medium as one of the most significant barriers to its development, ahead of difficulties with technology, taxes, availability of skilled workers and regulatory issues. The results of this study show that the information technology industry and regulatory bodies have much work still to do before electronic commerce achieves its full potential.[3] Issues that warrant immediate attention are as follows:

Trust

Security of payments is of paramount importance in the corporate acceptance, adoption and widespread deployment of electronic commerce. Developing countries cited low levels of credit card use and restrictions on using credit cards over the telephone as a problem in implementing consumer electronic commerce. Privacy ranked next among their concerns, followed by authentication—being sure of the identity and credentials of the party you are communicating with. Some three-quarters of the countries that took part in the survey believe that improving trust is vital to the development of electronic commerce.

Technology

Although Internet technology is still relatively new in many markets, WITSA members were confident that technical difficulties thrown up by a largely immature medium could be overcome. Respondents identified a wide range of technological barriers that need to be addressed. Top of the list was a need to make security systems more widely available and to ensure they are more widely used. Efforts to integrate electronic commerce systems with existing enterprise systems and the lack of internationally recognized standards covering such activities as transaction processing, security and authentication were also identified. Networking bandwidth was a prominent concern among developing countries, many of whom are still developing basic telecommunications infrastructures

Public Policy

As industry associations, WITSA members are closely involved in influencing public policy in their countries. Leading public policy issues highlighted by respondents included the development of standards for authentication that would ensure trading partners are legitimate, the impact on electronic commerce of the taxation of online sales, and the confusion caused by conflicting international contractual and legal frameworks. Respondents also pointed to limits on the use of encryption by governments concerned about national security and crime fighting. The ability of governments to influence the growth of electronic commerce is underlined by the fact that over 70% of WITSA members say public policy is critical to the growth of electronic commerce.[4]

Consumer Attitudes

The experiences of WITSA member companies in convincing customers to adopt electronic commerce again underlines the need to reassure users that they can trust the Internet. Fear of committing personal information such as credit card numbers, addresses and telephone numbers to cyberspace was mentioned most often by WITSA members as a significant objection from customers. Fear of losing money by purchasing goods from unknown companies and the absence of regulation governing procedures in the event of disputes were also important reasons for being wary of electronic commerce.

On another note, in dealing with information security, one needs to understand the psyche of the aggressor, who always attacks at the point of maximum leverage. For modern society, this means critical infrastructure—transportation, telecommunications, oil and gas distribution, emergency services, water, electric power, finance and government operations. Increasingly, a critical information infrastructure supports these vital delivery systems and becomes itself a target of opportunity for terrorists, adversary nations, criminal organizations, and non-state actors. This potential vulnerability raises numerous difficult questions for industry and international, national, and local governments about how to best provide critical information protection. Both government and industry have a major stake in protecting critical infrastructure and its underlying information resources from intentional attack or natural disaster. The approach taken in addressing issues of critical information infrastructure reliability and security must highlight policies necessary for the development of electronic commerce that are industry led, market driven, voluntary and self-regulatory.

A February 2000 WITSA survey of WITSA-member IT industry association executives identified cyber security as the next "top priority" issue facing the IT industry around the globe. While association executives expressed a high degree of personal awareness of the information security issue, four out of ten said customers in their countries are either "not very" or are "unaware" of computer protection matters. Sixty-five percent of respondents said their national or regional governments have strong awareness in this area. While 94 percent of the trade association executives personally view information security as a top priority issue, this number dropped to 82 percent in reference to their member companies, 65 percent to their governments and 41 percent to end users. Seventy-six percent of respondents say they are meeting with their respective governments to raise awareness of information security issues; almost 60 percent said their governments are seeking meetings with industry on the same issue.[5]

Possible Solutions

Should government regulation be necessary, the regulations ought to be internationally coordinated, as incompatible national laws create a fragmented global market with significant uncertainty as to what rules apply. In addition, extraterritorial application of a country's laws—and claims for far reaching application of a country's regulatory schemes—poses a significant problem to business, users, and consumers and is a threat to electronic commerce. Therefore, non-discriminatory treatment of regulatory schemes affecting electronic commerce (e.g., financial industry including capital and securities markets, financial services, insurance and banking, transport, advertising, consumer protection schemes, taxes) is crucial. Jurisdiction, choice of law agreements, and enforcement issues must be dealt with in a responsible manner and with full involvement of commercial actors. A potential information security framework could encompass the following:

Scope

-The protection of the national information infrastructure must be based upon a minimum amount of government (national, provincial, and local) regulation.

-The cost of protecting the national information infrastructure must be kept to the lowest level possible commensurate with the threat and the consequences of attack. Parties must be able to differentiate between potential vulnerabilities and specific threats.

Roles and Responsibilities

-The respective industry and governments share an interest in the proliferation of a free and open Internet, electronic commerce, other value-added networks, and an efficient, effective information infrastructure generally.

-In protecting these resources, the specific and immediate priorities of governments and industry may diverge. Specific and immediate priorities will need to be balanced against longer-term priorities.

-Industry will be guided by business considerations to protect itself against physical and cyber attack as the threat to the information infrastructure evolves.

Globalization

-The Internet and electronic commerce are inherently global in nature; therefore, critical information protection will require collaboration among international bodies. Governments are Urged to establish and maintain channels of communication with private and public entities having infrastructure assurance interest in the sector; and to

-Establish and operate an effective information-sharing program, including opportunities for anonymous information sharing.

Communication and Coordination

-Positive interaction between governments and industry is essential. Among issues which will require ongoing communication and assessment is the need to balance the right to privacy with national security concerns.

-Industry must monitor the private sector portion of the national information infrastructure and cooperate both internally and with governments in reporting and exchanging information concerning threats, attacks, and protective measures. Coordination among principals must facilitate creation of early warning systems.

Legal Frameworks

-In creating the information infrastructure, as well as attendant tools and technologies, industry must be provided safe harbor protections and its works viewed as incidental to losses caused by criminal or malicious misbehavior or natural disasters. National law should provide such protection regardless of an attack's origin.

-Distinctions must be made among cyber-mischief, cyber-crime and cyber-war to clarify jurisdictional issues and determine appropriate responses. The adequacy of current laws to prevent these threats from materializing must be reviewed.

-Existing laws must be adapted as necessary to allow appropriate levels of information sharing among companies.

Education

-National law enforcement agencies must gain sufficient cyber-crime expertise to combat specific threats and to investigate specific criminal acts.

-Emergency response organizations must gain sufficient disaster recovery expertise to minimize the effect of catastrophic events on the information infrastructure.

In the end, governments will be the deciding factor; how politics will weigh out against the essence of today's enterprising society. Kelly Levy, member of the U.S. Dept. of Commerce's National Telecommunications and Information Administration, was aptly stated this, saying, "Governments need to exercise self-control and resist the urge to regulate".[6]

Endnotes

1 http://www.itaa.org/infosec/plenary.htm#p1
2 Gates, B. "Business @ the Speed of Thought".
3 http://www.witsa.org/papers/EComSurv.pdf
4 http://www.witsa.org/papers/EComSurv.pdf
5 http://www.witsa.org/papers/ClipSurv.pdf
6 http://www.ansi.org/rooms/room_9/public/1998mar/cybercom_3.html

Topic Three

The Possibilities for Genomics

Introduction

The Commission for Science and Technology will gather to discuss the possibilities and precautions for the study of genomics in the world. This new and rapidly changing field of technology has major concerns for the social and economic welfare of the world at large. The fallout from all probable uses should be discussed now in order to prevent the establishment of unethical precedents. As the members from the United Nations address the complications and procedures for dealing with genomics, they must be aware of its consequences and applications.

Statement of the Issue

At a recent conference of the American Society of Human Genetics, ASHP President, Huntington F. Willard described the emerging technological field of genomics as "the hottest ticket in town."[1] In the last twenty years, genomics has become one of the most studied and examined fields. After a map of the human genome was completed, genomics was recognized to have far reaching implications into people's everyday lives as well as implications into a large number of areas of business, ranging from pharmaceuticals, to medical work, to food production. Not only can we revolutionize the way in which drugs and foods are produced, but it is even possible for doctors to manipulate the human genome in vitro to change the genetic makeup of an unborn child. Mothers and fathers can pick the gender and relative characteristics of the child, including improved disease prevention and a general strengthening of the future child's immune system.

Genomics is defined as the study of genomes, which includes genome mapping, sequencing, and gene function.[2] The word genome is derived from the words gene and chromosome, hence Genomics is the study of chromosomes and genes—basically the hereditary make up of organisms. It is with this study into genomics that applications into the manipulation of human babies are possible.

Each person has about 35,000 genes. These genes determine physical appearance, intelligence, disease predisposition, and innate personality traits. The genes are contained in a double helix structure known as DNA; deoxyribonucleic acid. The DNA molecule is contained in the cell's nucleus. The sides of this double helix are made up of double strands of sugar phosphate, and the rungs are a person's genetic code. There are four possible letters that make of a gene, these letters are A for adenine, T for thymine, C for cytosine, and G for guanine. A gene is made up of three of these four letters. However, not all of the combinations are actual genes, some are mere gibberish. This makes the work of scientists even harder, because determining which combinations are actual genes and which are not is very difficult.

In order to better understand the human body, and particularly genetic diseases, researchers needed to understand the genetic and chromosomal make up of people so that they could have an entire image of the genomic material, rather then guessing which genes are the "bad" ones. Single genes don't just determine many traits and illnesses, interactions among genes and between genes and an individuals' environment also have a profound effect on the eventual complete life form of the human.[3] With gene manipulation, however, the potential and outcome of that child can be greatly altered practically improving upon what nature has provided for us.

It is also important to understand that in truth, there is no one map of the human genome; each individual has his or her own genomic map. However, what researchers have published is a composite genomic map based on the genetic material from a large number of subjects from nearly every ethnic and racial group. This map can give basics that can be used as a generic model for how the interactions between our genes create the finished product of a human being.

History

Within the past fifty years, the greatest advances in Genomics have taken place, starting in 1953 when James Watson and Francis Crick determined that DNA has a double helix structure. Within two years, Joe Hin Tjio would determine that every cell contains 46 chromosomes, all of which are in pairs. The next year, researchers for the first time were able to determine that the cause of a genetic disease was from a specific alteration in cells and that some chromosomes contain abnormalities. In 1966, the genetic code was cracked using the four-letter alphabet of A, T, C, and G. In 1972, the first recombinant DNA molecule was created.

Starting in 1975, the first substantial steps were made toward obtaining the human genome sequence. In that year, the first DNA molecule was sequenced using radioactive substances. This practice was later replaced with the safer use of non-radioactive dyes. In 1980, three researchers first proposed and then used a method to sequence the human genome based on RFLPs, or restricted fragment length polymorphisms. Two years later, the GenBank was formed. (GenBank today remains an invaluable resource to researchers providing them with information from around the world that other researchers have compiled on the genome sequence.) With GenBank, it is possible for remarkable research to be used and improved upon because the shared information can jumpstart operations around the world that want to enter into the cutting edge of the technology.

In 1983, researchers were able to map the first genetic disease. The next year, two researchers developed pulse field electrophoresis. In 1987, the first, very rudimentary genetic map was created. Two years later the STS system, sequence tagged sites, was developed for making physical maps of human chromosomes.

In 1990, the Department of Energy and the National Institutes of Health joined together to launch the Human Genome Project (HGP). Included in the launch was a five year plan that aimed for a complete genetic map. Additionally, they aimed for a genetic sequence of the human body's DNA by 2005. A genetic map indicates where the genes lie on the chromosome. A genomic sequence, on the other hand, shows the entire DNA molecule, as it links all the chromosomes and genes together. The following year, 1991, a NIH researcher, J. Craig Venter announced a strategy to find expressed genes and to help determine the sequences using ESTs or expressed sequence tags. When the National Institutes of Health would not give Venter the funds to test his new idea, he left and set up a non-profit organization: The Institute for Genomic Research (TIGR.) He later helped establish Celera, one of the first for-profit genomic firms.

In 1994, the Department of Energy began the Microbial Genome Program to sequence the genomes of various bacteria. That same year, the Human Genome Project finished a human gene map. In 1995, the first political actions concerning genomic research were taken when Congress enacts a ban on genetic discrimination. That same year, the first genomic breakthroughs occurred. The Haemophilus influenzae and the Macoplasma genitalium genomes were mapped. Although these are two simplistic bacteria, their mapping marked an actual beginning to the mapping of genomes.

The performance of sequencing techniques is vastly better then it was five or ten years ago, however, it is a long way from being a technology open to everyone. The current cost of mass marketing genomics is far more expensive than where it will be when it starts to affect the ethics and problems of modern medicine. It currently costs millions to sequence one genome. Furthermore, the accuracy of current genomic maps is still debatable. The percentage is anywhere from 95% to 99% accurate. The time it takes to do one sequence is still far too long for this to be done on a wide group of people. The human genome map is also not entirely complete to date. Researchers estimate that 55% of the genome is complete while 42% is in draft form.[4]

In the decade that genomics have been heavily researched, the costs of the technology have gone down substantially. In 1985, sequencing cost about $10 per base pair. By 1995 scientists had reduced the cost to $0.39 per base pair.[5] Once costs reach an adequate enough level for mass marketing, it will become clear that only those that can afford it will be able to use it. This will present one of the most interesting problems involving gene manipulation. A new natural selection will become apparent as those that can afford it will be able to produce near-perfect children, and those that cannot continue to rely on the fateful interaction of the genes of both parents.

Relevant International Action

Since the study of genomics has arrived on the international scene, the United Nations has taken a part in addressing its relevant issues. A Universal Declaration on the Human Genome and Human Rights was adopted on November 11, 1997[6] by the United Nations Educational, Scientific, and Cultural Organizations. Article 1 simply stated that the human genome is the key that underlies the "fundamental unity of all members of the human family, as well as the recognition of their inherent dignity and diversity".[6] The United Nations recognized the scientific importance of such research and therefore, the possibilities for its applications in the realms of human society. Article 10 said that "no research or research applications concerning the human genome, in particular in the fields of biology, genetics and medicine, should prevail over respect for the human rights, fundamental freedoms and human dignity of individuals or, where applicable, of groups of people".[6]

In 1999, the Commission on Human Rights drew a resolution to ensure the proper research and application focus of human genome technology with regard to bioethics and human rights. The resolution made it clear to the respective governments of the United Nations that there was extreme value in human genome research and its applications for the improvement of the health of individuals and mankind as a whole. They also recognized a need to safeguard the rights of the individual and his dignity in the presence of such important data. Above all, they stated the necessity of protecting the confidentiality of said genetic data for a particular person.

While committees within the United Nations have addressed the extent to which human rights should be handled with genome sequencing, they also stress the importance of the issue as a science. They fully encourage "technology leapfrogging"[5] between nations that conduct research. This is to ensure that developing countries don't rely on the larger ones for "technological know-how", but rather, can develop the technology themselves and make specific developments that are desirable for their interests. This concept can be made more possible through the use of GenBank. GenBank is an internet research database that is already in existence for the sharing of genomics research and knowledge. While currently available within the scientific community of the big researching companies, this can be extended to developing countries with the desire and aptitude to improve. As long as countries around the world help each other out with the transfer and share of knowledge, more progress can be made. This is the basic idea behind support for the sharing of knowledge in the body of the United Nations.

Analysis

The thrust of this issue relies upon the socioeconomic differences in cultures, countries, and income classes. Firstly, this technology only has the chance to be developed in rich countries, leaving other, poorer nations, without the ability to pay for the research that will help them improve lifestyles and genetic research. A knowledge sharing effort by the international community could aid the lesser income economies in gaining valuable research to improve upon their scientific position. This technology will also make possible the ability to enhance the genetic make-up of unborn children. With the ultimate purpose to increase the lifestyle of children and improve upon such important factors as immunity and disease possibilities, the ability to perform this type of service will probably not come at a cheap price. Even regulation of some sort could do very little to improve upon what will ultimately be a high price for perfect children that only the very wealthy could afford. A third issue that needs to be addressed would be the dangers of technology sharing that would allow terrorists to create perfect biological weapons, once they understood the human genome perfectly. If the scientific community shared this data with scientists in rogue nations, it would become possible for diseases to be engineered to mimic processes of human cells such that they are left undetected by the immune system and later wreak havoc on the body (somewhat similar to how the process of Diabetes works).

The first issue is that of information sharing. What will catapult developed countries above the rest will be the sheer funding and capacity for scientific research. Countries like the United States and France with an already accelerated biological research structure will have great advantages in refining technology to allow for disease cures and preventative in vitro immunity enhancements. These countries already have the resources to advance the study of genomics far faster than those around them. They will have access to the benefits of the technology at a far greater rate. Smaller countries without the wealth or resources will continue to suffer from disease unless aid is provided by the larger ones. The U.N. has proposed an international scientific sharing community to redistribute some knowledge about the genomics process in order to let trailing countries catch up in their scientific efforts. This concept can be made easier through the use of GenBank which is already in existence. It would involve a mere extension to other countries. Smaller countries would be able to begin their research at a level where they probably would not have gotten for many decades otherwise and continue on independent paths to refine the technology as best suited for their own individual needs.

However, there are many problems with this issue. To begin with, what forum could possibly be set up in order for this sharing of information to be efficient and worthwhile but also be safe from hacking, tampering, and leaking? Scientists in smaller countries do not necessarily have the technological capacity to communicate in highly safe and secure mediums to ensure that a transfer of knowledge would not be abused. Which scientists would gain access is another issue that would have to be resolved. The sharing community would have to be regulated by some sort of central medium that would remain unbiased in the access capabilities for different countries to ensure that the right people can see what research is being performed while irresponsible people are not.

The more important issue related to scientific incentive has to be addressed in this larger sharing capacity. Once scientists realize that all of their hard work can be shared for no gain, it will become hard to encourage research. Scientists work just as hard on research as they do getting government grants and money in order to perform the research. Facilities and equipment do not come cheap. Most genomic scientists reap benefits from patenting technologies and selling them to pharmaceutical companies. When they have to be forced to share the knowledge, they won't be able to profit off of their work, rendering all incentives moot. The impetus for many of our current biological and technological strides has been monetary profit. Sure, doctors and scientists love to discover cures for their sake, but there is always a monetary reward that allows them to continue research and embark upon new endeavors. When you take away that incentive by allowing the information to be shared freely without promise of patents or drug company deals, you may find many scientists and doctors resorting to other avenues of research.

Worse yet, many scientists or doctors could join in secretive efforts to further their science privately, rendering any U.N. position on information sharing totally irrelevant. What type of structure could possibly be set up to ensure that this technology sharing is performed? If drug companies want the lead in this line of work and knowledge, they may do it anyway without telling other countries or authorities. Where does the U.N. draw the line between drug research done with genomics technology and that done with conventional biomedical efforts? If drug companies want to claim that their genomics research that helped them make drug X was actually made without genomics research and, therefore, does not have to be shared, what powers does the U.N. have to make sure this is so? What will give drug companies the incentives to improve upon genomics research if they realize that all of their strides that were paid with hard-earned corporate dollars have to eventually be shared with other "lazy" drug companies or countries? Companies with the capabilities will not understand why they have to spend money to give away free research without any reward.

Still, smaller countries must be given the chance to improve upon their lifestyles if they so desire. This brings up the issues that the second question asks. The fairness of access to such technology is of deep moral concern. Richer citizens of richer countries can pay to make their children more perfect, healthier, and more disease-free. A new genetic caste system could eventually develop whereby children of richer families are born with fewer flaws, unnaturally improving upon evolution, where middle class and lower-income families around the world will only continue upon the conventional evolutionary track. Right now, a certain natural fairness exists where genetics still play a role in the child's physiological make-up at birth where we can still say "all men are created equal". When doctors go into the wombs of wealthy mothers to make their babies prettier, smarter, taller, immune to many diseases, and more resistant to life's harms, we can no longer safely believe that edict. In a sense, the scientific world will take on the role of a deity, unnaturally controlling the evolutionary forces upon earth to create two classes of people—one with access to genetic improvement, and one without.

In order to ensure that unnatural separation between classes does not occur, a sharing of information must occur. But a more important question could be whether or not to allow this type of technological advancement because of the intense societal differences that it could create. Should it be allowed in the first place for technology to be created that could carry immense impact on the fate of the human race? Should scientists be allowed to bridge that gap between created and Creator? These are certainly important moral questions, but ones that also hold roots in many of the world's religions—and not necessarily the religions of those scientists investigating the possibilities. How should the U.N. deal with differences in religious beliefs that would prohibit such research from existing in the first place? Should parents be allowed to change the sex of the child, the cosmetics, phenomology, and disease susceptibility? While it may not be entirely preventable through international standards, this question will no doubt plague national legislatures as well.

The last issue of concern that must be addressed in an international resolution is the possibility for access by terrorist networks and rogue nations. If the U.N. is to propose a communication network for knowledge sharing, the chances that important information gets into the hands of ones that will use it for harm increase. While currently only large corporations with access to millions of dollars worth of equipment to research genomics have the capability for genetic manipulation, this barrier is easily erased over time as costs decline. Terrorists won't have to spend money first on updating their technology and building years of research to get to where biology is right now. They will be able to tap into current standards and use the information to build and manipulate genetic mappings to create incurable diseases. If they know how the body works to rid itself of disease and pathogens, they can easily genetically engineer a disease given genomic structure that will be immune to normal bodily prevention mechanisms. There are many terrorist networks and rogue nations that currently engineer biological weapons. With the knowledge gained from genomic research, their efforts can be redirected to this new and potentially far more dangerous area.

What kind of security should be set up to ensure that this information does not get into the wrong hands? What kind of attributes would grant one access to such information in the first place? Are there guidelines for what research should be made public to other countries/scientists and what can be kept quiet? This must be taken into consideration when drafting legislation in order to ensure maximum safety precautions.

Possible Solutions

If the research is to continue, U.N. resolutions must be enacted to ensure that the knowledge isn't available for abuse or mistreatment. An obvious solution would be to prohibit genomics research altogether. A second solution would be to include mandatory amounts of knowledge sharing through GenBank if research is to occur. Those countries who make concessions and enter into agreements with the U.N. can receive, in return, access to scientific breakthroughs. A third solution would be to allow the research, but not mandate knowledge sharing.

The first, easiest solution would be to ban the study of genomics altogether. To best alleviate all ethical and moral issues, it would be best not to address them at all. Any possible danger for its abuse or mistreatment would no longer be put into question. However, this head in the sand approach greatly denies the possibilities for beneficial scientific advancement. Whatever benefits we can achieve from research into the human genome will not be realized and many people will continue to suffer from diseases that could very well be preventable through the research that is currently pursued by many scientists and research centers. This solution, while the most clear cut, lacks responsibility and foresight and may only be adopted by those countries that have strong religious aversion to scientific research. Those countries with dictatorial government structures and strict national religions may be in favor of such courses of action. Since many of these same countries lack the ability to perform the scientific research, it will be an easy choice for them to make.

The second solution would be to fully allow for the research to occur as long as some mandatory amounts are disclosed in a GenBank of sorts. The amounts and kinds of research whose disclosure should be mandatory are certainly up to the discretion of the members of the U.N. who draft the resolutions. This type of resolution would allow for the research to continue, but would also allow for smaller countries to get a piece of the action by using the progress of other countries as a jumping off point for further research. Those countries that currently lack momentum in genetics research can be aided by the larger countries' previous investments to start down new avenues of investigation. Besides aiding smaller countries, this GenBank that exists can also bridge international gaps between advanced countries. For example, if Canada and

Japan are researching along the same path of knowledge, they won't have to waste time repeating experiments and inquiries if the other country has already solved these problems. Research will not have to be duplicated, allowing the entire world to piggyback off of one another to get it done that much faster. The world will be united in its attempts at genomic research. If larger drug corporations want to continue to profit from their research efforts, it may be wise to put minimal amounts of required information in the bank.

In order to be allowed to access such information, each scientific entity must pass minimal requirements. These requirements should be set up by the U.N. to ensure that people who don't deserve to have the information won't be able to access it. This is to prevent any terrorist networks or independent drug research centers from taking the information and profiting off of the advances. Once the information becomes public on GenBank, it must be decided how the intellectual property would be treated. One option would be to treat it as if it is published, giving rights but not patents to the source. If they so choose, the owner could then publish this data as in status quo, but the GenBank would not require such action to take place. Another option would be to require only minimal amounts in efforts to help countries piggyback, but not steal the processes of the research in order for the companies to continue to patent and sell the research as part of drugs or gene therapy. This option will most likely be preferred by the smaller countries that are interested in jump-starting their genomic scientific research and by those drug companies looking to advance the research quickly while sharing knowledge in order to expedite the process.

Another possibility along this option would be to allow certain recognized scientists from smaller countries to aid in research in the national centers of the larger countries. By contributing their knowledge as scientists to cutting edge research, they will be giving back to the countries what they will later be taking back to their country. This way, the research is not a one-way track. Science communities around the world that want to benefit from the genomic research will have the opportunities as long as they provide human capital in the form of scientists. If not scientists, small amounts of funding, or whatever resources they can provide in return for help in starting a scientific research program.

The last option would be to allow the research to continue and not require any information sharing between countries. Smaller countries will clearly be at a disadvantage if they lack the federal funding to further the scientific efforts. The larger, richer countries will not be required to share their knowledge along the way and therefore will be decades ahead of any efforts the smaller countries may attempt. Of course, this does not mean that information sharing will not occur. When drug companies find it beneficial, as they do now with the use of GenBank, there will probably be dialogue so that repetition of scientific efforts is avoided. However, without requiring knowledge sharing, the smaller countries will most definitely be left out of the greatest scientific strides and will forever lag behind the larger countries in health accessibility and gene therapy improvements.

Bloc Positions

As mentioned earlier, there are certain ideals that countries hold based primarily on their government structure that will influence their decision on genomic research. The more fundamentalist nations that tie deep-rooted religious values into their structure of government will likely be opposed to any and all genomic research that would affect the genes of unborn children. These countries, quintessentially in the Middle Eastern Arab bloc and similar strongly religious nations, typically have little genetic research set up in their country anyway. They will be opposed to any strides in science that will risk the genetic mutation of unborn children and will therefore only be interested in the limitations of such research.

Smaller, lower-income countries, typically those in Central/South America and Africa that are looking to improve the health needs of their populations but can't afford to will promote the knowledge sharing between established countries and themselves. The more religiously aligned countries in these areas will, of course, act the same as the above-mentioned Arab bloc. The rest that are interested in societal improvement will most likely welcome scientific dialogue in order to benefit from new research findings.

The larger, more technically advanced countries, like those in North America, Europe, and parts of Asia, that aren't religiously aligned will probably support genomic research. It is uncertain if they will also support scientific knowledge sharing. However, if a clear incentive is introduced to nurture the dialogue, they will likely comply.

Conclusion

It will be hard to ignore the benefits that the efforts of genomic research will provide the generations of tomorrow. No longer will children have to worry about growing up with diseases that can be prevented in vitro. Congenital birth defects and many illnesses will be prevented and removed from the mainstream society. Health factors will be reduced and immunities will be strengthened. The real questions are when, how, and who. When will this become available? How will we get there? Who will have access to such scientific achievements? All of this could naturally be solved by the market factors of the global economy. However, it may be in the best interest of the United Nations to determine the direction of such research in order to ensure no abuses of the technology are present. With so many different possibilities for where this technology could lead, some larger power may need to oversee and provide a general guideline for its direction and destination.

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