

The Underutilization Of The Sciences In The U.S. War On Terrorism

by Philipp Steger

"In the war against terrorism, America's vast science and technology base provides us with a key advantage." (George W. Bush as quoted in an official document of the Office of Science & Technology Policy/OSTP entitled "Combating Terrorism. Research and Development Funding in the President's 2004 Budget" [http://www.ostp.gov/html/budget/2004/OSTP%20CT%201-pager%20\(OMB\).pdf](http://www.ostp.gov/html/budget/2004/OSTP%20CT%201-pager%20(OMB).pdf))

"We'll continue to support science and technology because innovation makes America stronger. Innovation helps Americans to live longer, healthier and happier lives. Innovation helps our economy grow, and helps people find work. Innovation strengthens our national defense and our homeland security, and we need a strong national defense and homeland security as we fight people who hate America because we're free." (George W. Bush during a speech at the Presentation of the National Medals of Science and the National Medals of Technology, June 12, 2003
<http://www.whitehouse.gov/news/releases/2002/06/20020612-7.html>)

One could arguably claim that U.S. Science & Technology (S&T) Policy has become dominated by the exigencies of the "War on Terrorism", a term coined soon after the September 11 attacks and encompassing the myriad efforts undertaken by the U.S. government to respond to the vulnerability of the U.S. to terrorism.

This is clearly evidenced by the President's Research & Development (R&D) Budget for FY2004 with its focus on R&D areas that are pertinent to "national security" and the "war on terrorism". The White House budget proposal would allocate 55 % of federal R&D funds to defense research, which is an increase of 7.2 % over FY 2003. That means that a substantial part of the overall increase in the R&D budget (as compared to FY2003) of 4.4 % actually goes toward defense related R&D. The beneficiary of the majority of the remaining overall increase for non-defense R&D are the National Institutes of Health (NIH) which play a crucial role in bioterrorism-preparedness efforts.

The S&T policy community has picked up the signals and, for the most part, seems to follow the money. There is hardly any gathering of the S&T policy crowd in Washington DC these days that does not feature the various aspects of the "war on terrorism" and its repercussions on the fate of the sciences in this country. The annual AAAS colloquium on S&T policy held in Washington DC this past April served as another reminder of the preponderance of this particular aspect of S&T policy. Its program <http://www.aaas.org/spp/rd/colloqu.htm> emphasized "homeland security" and related issues.

The Role Of The Sciences Is Limited In Scope

At meetings like the AAAS colloquium and others of that sort, one gets the impression that there is a general consensus that S&T assumes a strong role within the efforts broadly summed up in the "war on terrorism", and that there are no doubts as to the nature of that role. A closer look at the role of S&T in the anti-terrorism efforts will show, however, that not only is the clarity about the nature of this role restricted to a fraction of the whole spectrum of S&T, but also that this often quoted essential role of S&T in fighting terrorism is less pervasive than its ubiquitous proclamation would let one believe.

Much of the buzz concerning the sciences' pivotal role in protecting the nation against terrorist attacks centers around so-called "bioterrorism preparedness". The U.S. Department of Justice defines bioterrorism as "the deliberate use of microorganisms or toxins derived from living organisms to induce death or disease in humans, animals or plants". In this understanding Bioterrorism preparedness describes the extent to which the U.S. would be able to deal with a bioterrorist attack and its aftermath. The Anthrax scare that had threatened to paralyze the U.S. postal system after several people had died in the late fall of 2001 provided a glimpse of the potential havoc that bioterrorism could wreak on the country. Ever since, a substantial part of the scientific anti-terrorism efforts has been focused on improving bioterrorism preparedness.

In trying to assess the actual state of bioterrorism preparedness in the U.S. and the role of the sciences in this particular arena of the science-led war against terrorism, one comes across one, seemingly insurmountable, problem: all the preparations and all the science that is being carried out is based on fictitious scenarios whose likelihood, or lack thereof, is not substantiated by any impressive array of scientific studies.

SARS – Nature As The “Bioterrorist”

The single most important role of science in the immediate aftermath of a bioterrorist attack is to come up with the appropriate remedies and antidotes as quickly as possible. But presumably there are challenges going well beyond those imposed by the immediacy and urgency of a medical response. These challenges are, in essence, the same regardless of whether the perpetrators of a biological attack are terrorists or nature itself.

For that reason, a look at some of the challenges posed by SARS, in particular the efforts to keep it from turning into a large-scale, global pandemic, provides the opportunity to shift from a "what-if" scenario to a specific case. By looking at how the "minimal" challenges have been dealt with by the U.S. one should be able to make some general conclusions as to the breadth and depth of the role of S&T in fighting the "War on Terrorism".

SARS, actually a disease in the minor league when it comes to the death toll, has already shown a horrific ability to attack the crucial vulnerabilities of an open, interdependent and highly globalized society. As Prof. Palese points out in his guest commentary (LINK), a relatively small amount of a deadly pathogen is enough to cause major disruption. Therefore, the way the U.S. addresses the challenges arising from this threat of an endemic is indicative of how S&T is applied in general in the context of U.S. bioterrorism-preparedness.

- ❑ One of the most comprehensive studies on the nature of the challenges of bioterrorism and contagious diseases was done by the Institute of Medicine: Microbial Threats to Health: Emergence, Detection, and Response (2003)
<http://www.nap.edu/books/030908864X/html/>

SARS – The Story So Far

WHO's declaration on June 5 that the SARS epidemic had passed its peak was preceded both by an extraordinary degree of international scientific collaboration over several months, but also by a staggering display of the effects of panic and hysteria caused by the uncertainty surrounding the mysterious new disease. The disease has not only caused the death of 813 people worldwide, but has also been a sobering lesson on the multifarious challenges associated with a highly contagious disease. And it is more likely than not that SARS will reappear next winter.

Until the beginning of March, even after the first reports on the mysterious lung infection by the name of "Severe Acute Respiratory Syndrome" (SARS) had surfaced in newspapers around the world, SARS remained relegated to the status of a curiosity in the news. The initial disinterest turned into a fixation soon after WHO had declared the disease a "worldwide health threat" and the U.S. and Canada had their first SARS cases.

SARS, an airborne disease, supposedly first appeared in November 2002 in China's Guangdong Province. Since then there has been strong evidence that SARS constitutes the emergence of a natural disease, given the proclivity of the corona virus' RNA for a very flexible recombination after absorbing bits of stray genetic material. While there had initially been speculation that SARS might be caused, at least in part, by a virus belonging to the paramyxoviridae family, there is now scientific consensus that it is caused by a novel form of a corona virus that might possibly have developed after the virus jumped species from animals to humans. By April 14, the corona virus had been sequenced by both the U.S. Centers for Disease Control and Prevention (CDC) and Canada's National Microbiology Laboratory. The comparatively low lethality of the disease – according to a WHO report it is just below 10% – is another indicator supporting the hypothesis of a newly emerging disease with natural origin.

Within the U.S. the brunt of the work of addressing the SARS epidemic has been carried by three agencies: the Centers for Disease Control and Prevention (CDC), the National Institute of Allergy and Infectious Diseases (NIAID), which is a part of the National Institutes of Health (NIH), and the Food and Drug Administration (FDA). The CDC has played a central role in terms of coordination measures including keeping the public informed and overseeing the implementation of response actions. To carry out these activities the CDC received a supplemental appropriation of \$ 16 million from Congress.

- Information regarding the SARS death rate - WHO Cumulative Number of Reported Probable Cases of SARS
http://www.who.int/csr/sars/country/2003_07_11/en/

7 Challenges Posed By SARS (And Bioterrorism)

Bioterrorism, just like contagious diseases, usually arrives without prior announcement, thus leaving little to no time to prepare if countermeasures have not already been planned. Nonetheless, -neither bioterrorism nor pandemics are unavoidable phenomena – there is always the chance of preventing bioterrorist attacks and keeping the emergence of a new contagious disease from turning into a pandemic. By taking a broad look at the challenges inherent in dealing with an emerging contagious disease, it becomes evident that successfully addressing the most apparent challenge, the medical challenge, largely depends on whether other interrelated challenges have been adequately dealt with. If, for instance, the adequacy of public health system were to be neglected, the best medical science would be of little use in combating bioterrorism.

A brief analysis of how the U.S. addresses each of the seven main challenges will show a disproportionate focus on supplying good medical science, while most of the other challenges remain sorely under-addressed.

Challenge Number 1 – Rapid Availability Of Good Medical Science

“The Department of Homeland Security will be charged with four primary tasks. This new agency will control our borders and prevent terrorists and explosives from entering our country. It will work with state and local authorities to respond quickly and effectively to emergencies. It will bring together our best scientists to develop technologies that detect biological, chemical, and nuclear weapons, and to discover the drugs and treatments to best protect our citizens.” (George W. Bush, Address to the Nation, June 6th 2002)

The foremost challenge, and the one posing the keenest sense of urgency, is the need to quickly identify the agents (pathogens, viruses, bacteria) causing the pathological symptoms, to provide the public health system with epidemiological studies, to develop tools for reliable diagnosis and to come up with some sort of antidote. All of these needs can be summed up as the need for the rapid availability of good medical science.

It is fair to say that there is generally a high level of awareness and preparedness in the U.S. to deal with the immediate research exigencies. Considerable amounts of money have already gone into the research that focuses on contagious diseases. The recently completed

doubling of the NIH budget has provided the biomedical sciences with hitherto unheard of capacities. The National Institute of Allergy and Infectious Diseases (NIAID) is at the forefront of that research. As Anthony S. Fauci, a prominent scientist and director of NIAID, declared during a Senate hearing in April, this means in particular, *“rapidly addressing the issues of vaccine development, drug screening, and clinical research.”*

There have been complaints, however, that it has not been possible to sufficiently involve the private sector in the general research effort to find ways to combat SARS. One of the main reasons cited by the government is the uncertainty in regards to the potential long-term market for any drugs that might be developed as a result of such research. This concern has also surfaced in government-coordinated research aimed at being prepared for the eventuality of a bioterrorist attack. In this instance, however, fears that private companies might not be lured into joining the effort appear to have been allayed. In the context of bioterrorism preparedness activities, the government has to some extent “created” the necessary market with its “Strategic National Stockpile” (SNS) program that, in essence, stockpiles vaccines and other antidotes to biological pathogens and chemical agents for rapid distribution in case of attack. A specific program linked to the SNS is “Project BioShield” which also provides additional funds for the development of vaccines. According to an article in “Nature,” “Project BioShield” seems to exude an irresistible charm to quite a few companies in the beleaguered biotech sector.

Within the scope of supplying good science there are some deficits, for instance in providing adequate epidemiological studies. A recent article in the magazine “Science” highlighted the complexity of the challenges facing those who set out to develop models to reliably predict the potential of a disease. (See Dorothea Strozkyk’s explanation of the basic challenges involved in epidemiological studies at the end of this article).

- ❑ <http://www.nap.edu/catalog/2008.html> Emerging Infections: Microbial Threats to Health in the United States (1992)
- ❑ "Infection risk puts the brakes on Canada's biomedical research", Nature, 04/17/03.
- ❑ "SARS Outbreak. Modelers Struggle to Grasp Epidemic's Potential Scope", 04/25/03
- ❑ Testimony of Anthony S. Fauci, Director of NIAID, at a Senate hearing on April 7, 2003
http://www.senate.gov/~labor/testimony/030_tes.html Fauci's testimony gives a good overview of what NIAID does in particular in regards to SARS, but also overall in maintaining a high level of preparedness to address newly emerging contagious diseases.
- ❑ White House Press Release on Project Bioshield:
<http://www.whitehouse.gov/news/releases/2003/02/20030203.html>
- ❑ Information on the Strategic National Stockpile on the DHS Website:
<http://www.dhs.gov/dhspublic/display?theme=15&content=327>
- ❑ The CDC National Pharmaceutical Stockpile:
<http://www.bt.cdc.gov/stockpile/index.asp>
- ❑ "Biotech firms pin hopes on defense", Article in "Nature" (04/24/03)

Challenge Number 2 – Smooth International Cooperation

“SARS highlights (...) that fulfilling (...) CDC's domestic mission – to protect the health of the U.S. population – requires global awareness and collaboration with domestic and international partners to prevent the emergence and spread of infectious diseases. (...SARS) also serves as an excellent illustration of the intense spirit of collaboration among the global scientific community to combat a global epidemic. It is not possible to adequately protect the health of our nation without addressing infectious disease problems that are occurring elsewhere in the world.” (Dr. Julie Gerberding, CDC Director, in a Congressional testimony on April 29, 2003)

International cooperation, a hallmark of successful research and an essential component of fast and reliable scientific advances and insights, is particularly important in dealing with an emerging contagious disease, especially when little is known about the agents causing the disease and its pattern of spreading. Early findings of one lab need to quickly be ascertained by other research institutions, and common hypotheses formulated and tested. The response to the SARS outbreak, in large part managed and coordinated by WHO, has been blessed by unusually smooth and nearly frictionless international cooperation. Apart from the occasional victim of international politics – Taiwan, lacking recognition by the UN, was for months dependent on second-hand information received from mainland China – the collaboration between the 13 laboratories in 11 different countries that make up a network of WHO-coordinated labs was, at least to the public's eye, flawless and produced considerable and reliable results.

WHO, a United Nations agency, has very few formal means of wielding power, since it lacks regulatory or policy implementation competence. But the management of the emergency response to SARS has shown that the international body can still be very influential. The one exception was WHO's decision to withdraw its travel advisory regarding Toronto, only a week after it had imposed the restrictive, three-week travel advisory. The original decision that put Toronto on the list of affected areas to which non-essential travel was strongly discouraged constituted a move that was certain to increase Toronto's by then already enormous economic fallout. By giving in to the ensuing political pressure exerted on WHO and its director general, Gro Harlem Brundtland, the agency undermined the perception that its expertise is undisputed and its public health decisions politics-free, and thus cut short its emergence as a powerful player. WHO's quick reversal of its decision certainly allayed any fears the current U.S. administration, somewhat weary of powerful international organizations, might have had over early signs of WHO successfully transforming itself into a powerful international player through its SARS crisis management.

In addition, past and more recent experiences show that WHO's potential strength as an international public health advisor and crisis manager above the fray of national and international politics is severely hampered by an onslaught of interventions aimed to either influence or prevent public health recommendations that run counter to the interests of powerful political interest groups. Take, for instance, the U.S. Sugar Association as an example (<http://www.sugar.org>). The lobbying group that represents the sugar industry spared no effort in a recent, not-so-subtle attempt at undermining WHO's role as a neutral scientific advisor. After WHO had published its new guidelines on nutrition and exercise recommending a lower sugar intake, the association heavily lobbied both Congress and the Administration to threaten WHO to cut its US funding, if WHO continued to refuse to substantially revise the guidelines.

- ❑ Testimony of Dr. Julie L. Gerberding, Director, Centers for Disease Control and Prevention (CDC) during Senate Hearing from April 29, 2003
http://www.senate.gov/~labor/testimony/033_tes.html
- ❑ "Taiwan left isolated in fight against SARS", Article in Nature, 04/17/03
- ❑ WHO Report "Diet, Nutrition and the Prevention of Chronic Diseases", 2003
http://www.who.int/hpr/NPH/docs/who_fao_expert_report.pdf
- ❑ "Health News 24/04/2003 U.S. and the U.N. at war over sugar guidelines" – Report by the Australian Broadcasting Cooperation (ABC) on the UN-U.S. controversy regarding the above mentioned report
http://www.abc.net.au/science/news/health/HealthRepublish_839642.htm
- ❑ Sugar industry threatens to scupper WHO, 04/21/03, The Guardian <http://www.guardian.co.uk/usa/story/0,12271,940479,00.html>
- ❑ Various News releases of the Sugar Association regarding the "misguided" WHO report on health & nutrition guidelines.
<http://www.sugar.org/newsroom/releases.html>

Challenge Number 3 – Adequacy Of The Public Health System

“A strong and flexible public health infrastructure is the best defense against any disease outbreak.” (Dr. Julie Gerberding, CDC Director, in a Congressional testimony on April 29, 2003)

“People are now back in dumb-and-happy mode” (Tara O'Toole, director of the Center for Civilian Biodefense Strategies at Johns Hopkins University lamenting the virtual stand-still of the National Smallpox Vaccination Campaign. Quote taken from “Focus on Smallpox Threat Revived” in the Washington Post, July 17, 2003)

Hardly any of the challenges highlight the far-reaching repercussions of bioterrorism-preparedness as much as does the challenge of preparing the public health system for the eventuality of widespread infection of people with a pathogen, regardless of whether the source is terrorism or nature.

SARS and, more recently, an outbreak of monkey pox in the Midwest, have served as a wake-up call to all those involved in the public health enterprise. Some argue that the response to the sudden outbreak of monkey pox had been too slow. According to the CDC, by June 14th, 81 people in several Midwestern states were suspected of having contracted monkey pox, a rare viral disease imported from Africa and first detected in humans in 1970. Although there are several reasons to believe that the infected persons contracted the disease via animals, the CDC has not excluded human-to-human transmission. The biggest deficit in responding to this particular threat was that it took considerable time for public health officials to realize that there was a problem and to identify the source of the problem. Clearly, a majority of doctors and other health care workers are simply not prepared or trained to look for and detect the signs of any unusual disease.

There is, however, a strong argument that hospitals are in general already aware and prepared to address these issues due to the alertness created by the threat of bioterrorism. The increased awareness will likely not suffice to address those shortcomings that are a reflection of systemic weaknesses brought about, at least in part, by the increased shifting of the burden of providing adequate health care to privately managed Health Care Organizations (HMOs). This shift and the cost-cutting following in its wake has, for instance, caused many hospitals to decrease the number of beds significantly in order to reduce the costs associated with empty beds. It is hardly surprising then, that many hospitals would be completely overwhelmed in the case of a specific crisis requiring the hospitalization of large numbers of patients. SARS is a perfect example for this, since suspected victims require both intense treatment and isolation.

The lack of general health insurance makes the specter of highly expensive and – for the individuals involved – potentially ruinous prolonged hospital stays a particularly daunting problem. To give an idea of the dimensions of the problem: in 2001, 40 million Americans were without any sort of health insurance, and many millions more were underinsured. These data are particularly worrisome in view of studies that show a strong correlation between a disease's death rate and the general public's access to health care.

A timely GAO report concludes that significant improvements to the U.S. Public Health System need to be made in order to meet the needs of bioterrorism or an emerging infectious disease. Among the shortcomings, the report cites gaps in the various disease surveillance systems and laboratory facilities, an absence of regional planning and coordination between individual states, strongly varying levels of public health preparedness and the inability of most hospitals to handle a large influx of patients due to lack of adequate equipment, isolation facilities and staff. One remedy recommended by the General Accounting Office is that the federal government foot the bill of eliminating the shortcomings on the state level.

These observations allow a simple conclusion: even a pathogen with a low lethality rate, but very high infection rates, could eventually result in a disproportionate number of casualties

due to the inability of the Public Health System to respond to an overwhelming wave of victims.

The recent campaign to vaccinate health care workers and first-responders to smallpox is a perfect example for both the intricacies of the challenge and the mundane details that can cause even plans based on the best of intentions to go awry. The experiences of the U.S. smallpox vaccination campaign are a sobering lesson in the intricacies and pitfalls of administering preventive immunizations on a large scale.

As part of the overall campaign to increase U.S. preparedness for a potential bioterrorist attack, the Bush administration decided it would have the so-called “first responders”, mostly health care workers such as doctors and nurses, inoculated against smallpox, a pathogenic agent considered the likely choice by terrorists. The president took the symbolic lead in this campaign by receiving the controversial immunization himself.

The outcome of the campaign has so far not been promising: of the envisioned 439,000 people receiving smallpox vaccination only about 25,000 had actually been inoculated by the end of March, the time by which the whole campaign was scheduled to be completed.

The emergency responders’ reluctance to get the vaccination stems mostly from the potentially harmful side effects of the vaccination. The death of 2 people who had received the vaccination didn’t help the matter either, although in both cases the negative side effects had been exacerbated by previous illnesses. The worries about potential side-effects were made worse by a long period of uncertainty of whether affected persons could expect any compensation for damages incurred by the negative side effects. Legislation to address that crucial aspect of the whole campaign made very slow progress in Congress, where Democrats and Republicans disagreed strongly over the amounts of the compensation, with Democrats favoring more generous compensation for emergency responders that take ill after receiving the vaccination. The outcome, a compromise reached in April, was met with heavy criticism from those that would be entitled for compensation under the new legislation.

The approach underlying the current vaccination campaign has its critics – amongst them the Institute of Medicine. The Institute, part of the National Academies of Science, published a report highly critical of the approach, which neglects looking at the actual level of preparedness among health care providing institutions. A more outspoken critic is Senator Kennedy (D-Mass.) who called the vaccination campaign an “absolute disaster”. The General Accounting Office (GAO) came down particularly hard on the CDC and the civilian part of the “National Smallpox Vaccination Program” in a very recent report criticizing the agency for having missed the target of inoculating close to 500,000 health care workers within 30 days by a huge margin.

The factors quoted by GAO as being responsible for the “disastrous” results are particularly troublesome to anyone involved in bioterrorism preparedness: the program schedule itself and the targeted participant’s hesitation to fully engage in the program. The CDC’s reaction to this disappointing outcome has raised some eyebrows: without any scientific explanation, the vaccination of 50,000 health workers in the U.S. is now deemed to provide sufficient response capacity by the CDC. This stands in obvious contrast to the early plans calling for much higher numbers.

- ❑ CDC information regarding monkey pox
<http://www.cdc.gov/ncidod/monkeypox/qa.htm>
- ❑ Report on the repercussions of Monkey pox appearance in the Midwest on “All things considered”, National Public Radio, 1 7 . 6 . 2 0 0 3 -
<http://www.npr.org/dmg/dmg.php?prgCode=ATC&showDate=17-Jun-2003&segNum=6&NPRMediaPref=RM>
- ❑ WHO fact sheet on monkey pox
<http://www.who.int/inf-fs/en/fact161.html>
- ❑ Collection of data on healthcare expenditure by the Agency for healthcare research and quality <http://www.ahrq.gov/data/>

- ❑ Report by the Center on Budget and Policy Priorities on the number of Americans without Health Insurance <http://www.cbpp.org/9-30-02health.pdf>
- ❑ “Sars Outbreak: Improvements to Public Health Capacity are Needed for Responding to Bioterrorism and Emerging Infectious Diseases” <http://www.gao.gov/cgi-bin/getrpt?GAO-03-769T>
- ❑ The highlights of the above mentioned report <http://www.gao.gov/highlights/d03769thigh.pdf>
- ❑ <http://www.bt.cdc.gov/agent/smallpox/index.asp> extensive information on smallpox provided by the CDC (<http://www.cdc.gov/>)
- ❑ CDC information regarding patterns of reaction to the smallpox vaccination <http://www.bt.cdc.gov/training/smallpoxvaccine/reactions/default.htm>
- ❑ CDC Smallpox Fact sheet <http://www.bt.cdc.gov/agent/smallpox/overview/disease-facts.asp>
- ❑ Review of the CDC’s smallpox vaccination program by the Institute of Medicine <http://www.nap.edu/books/NI000498/html/>
- ❑ Smallpox Vaccination: Implementation of National Program Faces Challenges. GAO-03-578, GAO Report from April 30, 2003 <http://www.gao.gov/cgi-bin/getrpt?GAO-03-578>
- ❑ National Public Radio, Radio discussion about the Smallpox Vaccination campaign, 4.4.2003 <http://www.npr.org/dmg/dmg.php?prgCode=TOTN&showDate=04-Apr-2003&segNum=6&mediaPref=RM>

Challenge Number 4 – Germs Vs. Globalization

“Still, some scientists fear that the nation may soon become less able to prevent outbreaks such as that of West Nile virus – whether accidental or intentional. They said the U.S. system for screening incoming animal, plant and microbial life – a patchwork of more than 20 agencies – has long been undervalued and under funded.” (Rick Weiss in: “West Nile’s widening Toll”, Washington Post, Dec. 28th, 2002.)

The rapid spread of SARS, facilitated by the ease and ubiquitousness of international air travel, the outbreak of Monkey pox in the American Midwest, and the increasing threat of the West Nile Virus, supposedly originating in the Middle East, all show that the dangers of an epidemic rapidly spreading throughout the world once it has successfully overcome the primary barriers in one place are exacerbated by the high degree of global interdependence and permeability.

While SARS in particular has raised this issue – the grounding of airplanes and cancellation of flights to SARS “infested” destinations bears witness to this – little has been done so far to address the question on how to deal with the “demons” of globalization without unduly curtailing its benefits.

In scientific terms, one very important area of research in this regard focuses on invasive species. The U.S. has long been the victim of its own success in global trade. It is hard to underestimate the damage caused by invasive species. One of the more visible examples, which left a lasting legacy in the structure of forests along the East Coast is the nearly complete eradication of the American chestnut caused by a pathogen originating in China. Yet, in spite of the very limited knowledge about invasive species, a comparatively small amount of R&D funds are directed towards research aimed at better understanding the arrival and the spread of invasive species. For instance, although invasive aquatic species have turned out to be a major problem exacerbated by the growing number of consumer goods arriving in the US on cargo ships, the funding level for the specific programs dealing with this challenge have remained surprisingly stagnant (see the figures in a table prepared by the Northeast-Midwest Institute, quoted below).

Going beyond the specific unwanted side-effects, one has to address some very basic ques-

tions about how a trading nation like the U.S. would deal with the negative repercussions of a large scale outbreak of a contagious disease. Guangdong province, where SARS is thought to have originated, is not only a global hub for the manufacturing of information technology but also a hotbed for all sorts of new diseases, apparently due to an uncontrolled migration to this economically prosperous area and an unprecedented explosion in population growth as a consequence thereof. Addressing some of these social, regulatory and human rights issues will be unavoidable in the future and might, as an attractive byproduct of dealing with the undesirable side effects of globalization, lead to equally high regulatory and health standards across the globe.

The fact that globalization also has its clear advantages in this issues highlights once more how intricately linked all the challenges are. While there has been a reluctance of countries to report outbreaks due to fear of the negative impact this news would have on travel, trade and tourism, the global access to news from all over the world, provided by the media and in particular the Internet, has created enormous pressure for quick and complete disclosure. Countries are increasingly aware of the advantages of prompt outbreak reporting and official country notifications accompanied by prompt international help when needed.

- ❑ CDC Information regarding the West Nile Virus
<http://www.cdc.gov/ncidod/dvbid/westnile/>
- ❑ Information on the chestnut blight
http://www.forestpathology.org/dis_chestnut.html
- ❑ “West Nile’s widening toll”, Article on the ecological impact of the West Nile Virus in the Washington Post of December 28th, 2002
<http://www.washingtonpost.com/wp-dyn/articles/A45800-2002Dec27.html>
- ❑ A table prepared by the Northeast-Midwest Institute
<http://www.nemw.org>, an independent research organization, shows at the example of funding for the Aquatic Nuisance Species Programs that the funding level for most of these programs have hardly increased in the time frame 1992–2001.
<http://www.nemw.org/ANSfundhistory.pdf>

Challenge Number 5 – Harnessing All Of Science For The Sake Of Prevention

It’s obvious that the actual act of bioterrorism is the last step on a tortured path cluttered with myriad possibilities for intervention and prevention of the attack or of the potentially serious consequences of the attack. Recognizing these possibilities and seeing where the potential points of positive leverage lie requires substantial observation and analytical thought, an area in which the behavioral and social sciences have substantial contributions to make. Yet, most of the anti-bioterrorism efforts aimed at harnessing science neglect the insights potentially offered by the “other sciences”, thus leaving the playing field to a small group of scientific disciplines at the near exclusion of most other disciplines and renouncing the strength of interdisciplinary approaches.

This was made evident during the aforementioned AAAS colloquium on S&T Policy. During the discussion following a thorough description of the role of S&T at the newly created Department of Homeland Security (DHS) by the agency’s new undersecretary for S&T Charles McQeary, a participant inquired about the role the social & behavioral sciences would get to play in DHS efforts. The question, a justified one since both the social & behavioral sciences have been conspicuously absent in all the glorious talk about a Manhattan-Project-like surge in funding for the sciences, turned out to be more informative than the answer.

This is not to say that there aren’t scholars addressing these questions, but their insights seldom make it into the arena of public considerations regarding the role of S&T in dealing with the threat of bioterrorism. If one were to, for instance, go to the superbly informative website of the National Academies and type “bioterrorism” into their search engine, one would marvel at the amount and the quality of the material gathered there. Most of it, however, focuses on a very narrow aspect of bioterrorism, the immediate health effects of an attack, while little is to

be found regarding the causes, the ways of addressing these causes and the likelihood of how the various worst-case scenarios would play out in real life.

By pursuing an interdisciplinary approach one might also counteract the current trend of S&T merely reacting to external threats and new developments.

- Text of DHS Under Secretary for S&T Charles McQueary's Talk on Homeland Security <http://www.aaas.org/spp/rd/mcqueary.pdf>

Challenge Number 6 – The Economic Fallout

"[...] macroeconomic recovery may fall victim to microbe economics. Serious people know that germs pose a far greater threat to mankind than terrorism, and readers of books like William McNeill's "Plagues and Peoples" and Jared Diamond's "Guns, Germs and Steel" know microbes have been the downfall of many a civilization." (Paul Krugman in: "Guns, Germs and Stall?", New York Times, April 4th 2003)

Cruel as it may sound, in terms of mortality rate SARS has been anything but spectacular. Rather the indirect economic damage caused by fear and widespread hysteria is what really got heads shaking. If one compares the 42,000 traffic accident related deaths in the U.S. in 2002 and the economic disruption this high number of casualties has caused with the number of SARS related deaths and the resultant economic fallout a city like Toronto had to suffer, the disproportion becomes readily apparent.

At the point when WHO issued a travel advisory for Toronto, economic losses were estimated at \$ 30 million a day. After all, the cancellation of a big medical conference in Toronto during the early phase of the SARS scare was estimated to cause \$ 6 million in lost revenues. During the height of the crisis, the Bank of Canada pronounced a downward revision of its prognosis for economic growth, citing SARS as one of the main culprits. The considerable and eventually successful pressure that the Canadians exerted on WHO was to a large extent due to the unbearable prospect of even worse economic losses. Toronto's losses pale in comparison to the impact SARS had on Hong Kong, the most important trade hub between Asia and the West with the busiest airport in Asia and one of the most important seaports in the world.

Even in places relatively unscathed by the disease, i.e. the U.S., which reported no deaths, panic and hysteria abounded. The internet was alive with those predicting immediate doom and those who used people's credulity to sell a most impressive array of alleged antidotes. People in New York and San Francisco avoided the normally popular "Chinatowns" and left restaurants and shops in these areas deserted.

The sheer enormity of economic losses induced by the pandemic that never really came to the fore highlights a very serious problem: how to balance the need for early warning with the imperative of avoiding panic? This is a question that ought to be addressed by science and the social sciences in particular. As of now, there are hardly any signs that U.S. S&T Policy makes a concerted effort to support that sort of research as part of its bioterrorism preparedness activities.

- Paul Krugman: Gun, Germs and Stall?, in: The New York Times, April 4th 2003
- Press release from the Bank of Canada regarding its Monetary Policy Report: <http://www.bankofcanada.ca/en/press/2003/pr03-8.htm>
- Monetary Policy Report - Bank of Canada (04/23/2003) <http://www.bankofcanada.ca/en/mpr/pdf/mprapril03.pdf>

Challenge Number 7 – Containment Vs. Civil Liberties

"The United States remains lucky to have had no superspreaders and only 41 probable cases, with no deaths. Yet vigilance remains important. New York

City's health officials were appropriately cautious when they forced a foreign tourist to stay in hospital isolation for 10 days because he was a suspected SARS case. Their aggressive response ruined the tourist's vacation, but that kind of attitude can save the city from potential infections” (From an editorial in the New York Times from April 29, entitled “Finally, good news about SARS”)

While no one was particularly surprised or up in arms at the draconian quarantine measures undertaken by Singapore, known for its one-party authoritarian political system, there was considerable surprise among international observers at the willingness and perceived eagerness of Hong Kong's denizens to have the government impose severe quarantine measures against all possibly infected fellow citizens.

Hong Kong's experience highlights what in the U.S. has become one of the most controversial issues in the discussion about the war on terrorism: the encroachment of government controls on civil liberties. The containment of pandemics, with the undeniable necessity of imposing quarantine measures in order to prevent the spread of a contagious disease, always runs the risk of interfering with civil rights. Toronto and the province of Ontario, Canada, have been able to count on a very civic-minded public, but the few cases in which potentially infected people were court-ordered to stay in isolation have become notorious, because there is something deeply troublesome about the notion of de facto imprisonment of people because they are infected with a disease.

The U.S. has been lucky so far; not a single death from SARS has been reported. But recent experiences, such as the Anthrax scare in 2001 or the sniper shootings in the Washington area last fall, offer a glimpse of the population's susceptibility to panic and behavioral changes that are out of proportion to the actual risk posed by these incidents to individuals. The average American watches an average of 4 hours of TV per day, and a majority of Americans gets their news from the TV, not just from news shows, but from all sorts of shows. Statistics and reasonable risk assessment intended to show the extent of danger for the individual and thus avoid panic don't make a difference to a nation hooked on TV.

A recent article in the New York Times mentioned a study carried out in China that showed the psychological toll that widespread discrimination against suspected or recovered SARS victims has taken on a large number of people. That study highlighted another problem stemming from discrimination against infected persons: the stigma associated with the disease will make it less likely that people will seek out a health professional at the earliest appearance of symptoms and will thus make containment even harder.

Civil libertarians and other like-minded groups in the United States will have a tough time arguing against severe quarantine and isolation measures in case of a potentially stronger outbreak, given the lack of scientifically valid alternatives.

While the greater good at stake may seem to justify locking someone up for 10 days and thereby spoiling their vacation – as happened in the case of a tourist in New York who was suspected of having SARS –, there are some troubling aspects to the general approach: in spite of all the science at our hands and the scholarly insights of decades of psychological and sociological research, we are still essentially using the same approach that was applied during the plagues of medieval times.

The experience of SARS shows that – independent of whether a bioterrorist attack is likely or not – these issues need to be addressed and better, more humane solutions found.

Conclusion

Looking at the seven challenges of bioterrorism as evidenced by SARS, one cannot fail to notice a lack of balance in how these challenges are being addressed in terms of political rhetoric, the appropriation and distribution of R&D funds and in terms of public perception. There is a disproportionate focus on the immediate medical preparedness and response to an eventual bioterrorist attack, while the other challenges, although essential in minimizing the damage of such an attack, are being more haphazardly addressed by the current administra-

tion. The highly complex interdependency of the challenges posed is largely ignored. The disproportionate effort going into the biomedical solutions to the problem reflects a poorly developed understanding in the general public about what it is that science can actually accomplish, especially in regards to the multifarious aspects of bioterrorism.

While there is certainly no shortage of clever and insightful research addressing the other six challenges, one gets the feeling that although there are many different and interesting approaches out there, hardly anyone bothers to listen or even promote such research. In addition, truly harnessing all of science would require the promotion of an intellectual atmosphere that encourages the sort of scientific and scholarly discussion that dares to question even some of our most basic assumptions and thus contributes to the development – and hopefully application – of innovative solutions.

Bioterrorism, like newly emerging contagious diseases, is a large problem and as such requires a similarly “large” solution. The current approach does not appear to attempt such a “large” solution and has thus far failed to entice and arouse the sort of all-out, nationwide research effort that characterized the Manhattan Project, a historical effort of legendary dimensions which these days is often implored as the great role model for this endeavor.

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