# 1AC Lowell VB

## CONTENTION 1 IS SOLVENCY

#### Plan: The United States federal government should offer to sign a science and technology agreement with Cuba.

#### Status quo is insufficient – removing barriers to science cooperation is key

Johnson 12 – CSIS, a senior fellow and director of the Americas Program at the Center for Strategic and International Studies, a Washington, D.C.-based think tank. He has more than 20 years of experience in Western Hemisphere affairs spanning policymaking, policy advocacy, and public affairs in the Department of Defense, the Washington policy community, and the State Department. From 2007 to 2009, Johnson served as deputy assistant secretary of defense for Western Hemisphere affairs, overseeing the development and execution of policies, strategies, and programs governing hemispheric defense and security ties. From 1999 to 2006, Johnson served as a senior foreign policy analyst at the Washington-based Heritage Foundation, testifying before Congress and authoring studies on U.S. policy as well as Latin American politics, trade, development, and security. His commentaries have appeared in the Wall Street Journal, Miami Herald, Business Week, and Diario Las Américas. His broadcast appearances have included CNN en Español, Univisión, Telemundo, C-SPAN, and MSNBC. He is the author of Iran’s Influence in the Americas. (Stephen, “U.S.-Cuba Academic and Science-Based Exchanges”, August 2012, <http://csis.org/files/publication/120821_Johnson_U.S.-CubaExchanges_Web.pdf>, HW)

Since the early days of official U.S. public diplomacy at the outset of the Cold War, promoting dialogue with citizens of foreign nations has been a way to build bridges of understanding and defuse tensions. The Fulbright Exchange Program, which dates from 1946, and more recent U.S. International Visitor Programs have exposed individuals, some who later became national leaders, to American life and its democratic values. Exchanges with friendly countries are easy and help strengthen existing ties. Exchanges with hostile nations are sometimes nearly impossible but develop inroads that can lead to better relations. To the extent that the U.S. government can finance much of these activities, Americans consider it good public policy, even though such long-term investments can take decades to pay off. Pursuing exchange opportunities with Cubans follows this logic, but with a twist. Current U.S. rules allow purposeful travel on the part of academics, students, medical professionals, and journalists. Over the past decade, as many as 2,500 American students a year have studied in Cuba. However, travel for Cubans to the United States is extremely limited. Since the revolution that replaced a petty dictator with a repressive, totalitarian government in 1959, the population has served as a captive labor force in which all able adults were expected to work for the state. In the past two years, that situation has begun to change as a result of the shift in leadership from Fidel Castro to his brother Raúl. The twist is that Cuban authorities remain deeply suspicious of any U.S. government involvement in exchanges and still worry about letting citizens travel to countries where they may be tempted to stay. While lifting the U.S. ban on tourism to Cuba might put feet on the ground and increase chances for superficial encounters, exchanges afford some measure of control and open the door to relationships that may result in deeper understanding. While artistic and sports exchanges are probably the most familiar, they usually provide only modest exposure, whereas academic exchanges can involve intense discussions and personal interactions. Literature, social science, and economics are safe subjects that generate interesting debates. If they are designed to prevent leakage of sensitive technology, medical, scientific, and technological exchanges can be mutually beneficial and enable further cooperation in such areas as environmental protection, disaster response, and public health. Conferences and study opportunities that take place in the United States afford the best possibility for enabling Cubans to experience American life and be exposed to democratic values. One caveat must be clearly understood: for the most part, Cuban exchange participants do not represent a broad cross-section of society. Rather, they are government employees, selected on the basis of loyalty to the state. Still, this segment of Cuban society should not be ignored. As it turns out, the United States and Cuba have a long history of exchanges, ranging from short-term collaboration to long-standing partnerships. From the early twentieth century, the two countries have shared information in fields ranging from meteorology to dentistry. However, decades of tension followed the rise of Cuba’s Soviet-style dictatorship and the break in bilateral relations. Still, a substantial number of education and science-based initiatives have been attempted since 1961, meeting with success and failure, depending on the political and social climate at the time. It is worth noting that U.S. advocates of science exchanges have pursued initiatives with other closed societies, including Iran, North Korea (Democratic People’s Republic of Korea, or DPRK), Syria, and Myanmar. Most have faced significant challenges in arranging visits to partner countries. Nonetheless, these advocates have helped establish relationships between U.S. and partner country participants that could be expanded when political relations improve. Such relationships include information sharing on topics such as health and medicine, agriculture, forestry, and technology and have contributed lessons on how to facilitate and plan scholarly exchanges in similar situations. Also noteworthy are barriers that both the United States and Cuba impose on meetings. U.S. restrictions are grounded in legislation that tasks the Department of the Treasury’s Office of Foreign Assets Control (OFAC) to regulate financial transactions and travel. A party desiring an exchange with Cubans must find a Cuban partner organization and work with the government. Visas for licensed American travelers to visit Cuba legally and exit permits for Cubans to travel to external locations are difficult but not impossible to obtain. Practical impediments include expenses that most Cubans are not able to pay. U.S. migration policies that welcome Cuban asylum seekers coupled with economic opportunities unmatched on the island have also led Cuban authorities to insist on picking participants they believe are likely to remain loyal to the regime and return to the island. Until those situations change, best practices for conducting successful exchanges include observing equality in participant numbers and professional status. Agendas for conferences should be developed jointly to avoid sensitive subjects—a precaution that is especially important for events taking place in Cuba, where freedom of expression is restricted. A recent Latin American studies conference in San Francisco broke this guideline and featured Raúl Castro’s daughter, who said she would vote to reelect President Obama, highlighting the fact that political observations by a U.S. exchange participant would not be tolerated in Cuba.1 Finally, for study opportunities in the United States. For the time being, prospects remain modest for meaningful exchanges as well as study opportunities for Cubans in the United States. However, properly structured, they might yield beneficial results in building friendly contacts and mutual understanding with Cuba’s younger generations and perhaps future leaders. This is one area where the United States could take measures such as lowering U.S. visa fees, should the regime’s foreign travel restrictions change. Changes in migration policies that grant automatic residency may not be practical until Cuba implements basic human rights guarantees. Although U.S. regulations are strict and Cuban travel barriers are difficult to overcome, academic exchanges that result in visits to the United States do occur on an infrequent basis and have the potential to expand if U.S. educational institutions and associations work within restrictions and guidelines, seek Cuban partners, and pay expenses.

#### The Plan is key to effective US-Cuba engagement – Cuba would say yes and science cooperation solves a laundry list of impacts

Lempinen 12 – AAAS reporter, AAAS is The AAAS Center for Science Diplomacy is guided by the over-arching goal of using science to build bridges between countries and to promote scientific cooperation as an essential element of foreign policy. Since its establishment in 2008, the Center has been particularly interested in identifying opportunities for science diplomacy to serve as a catalyst between societies where official relationships might be limited and to strengthen civil society interactions through partnerships in science and technology. In 2012, the Center launched a new open-access, quarterly publication, Science & Diplomacy, as a forum for policy discourse at the nexus of scientific cooperation and foreign policy. (Edward, “Oceans, Weather, Health—U.S. Researchers Explore Potential Collaboration with Cuban Colleagues”, May 1, 2012, <http://www.aaas.org/news/releases/2012/0501cuba.shtml> HW)

They are next-door neighbors, sharing all the amenities and challenges of the neighborhood—oceans teeming with life, the risk of tropical diseases, a changing climate that may be giving rise to bigger and more frequent hurricanes. And yet, because the neighbors are barely on speaking terms, they cannot share the opportunities and the responsibilities that come with solving the challenges. Today, however, scientists in both Cuba and the United States are exploring whether a thaw in relations between the two nations could allow for a range of new or expanded joint research projects that could bring benefits to both nations and others in the Caribbean Basin. Recent visits and consultations facilitated by AAAS and the Academia de Ciencias de Cuba (Academy of Sciences of Cuba) underscored that both sides see potential for substantive science collaboration. “The recent visits showed that the Cuban mindset is really ready to reach out,” said Peter Agre, a Nobel laureate in chemistry and a former president of AAAS, who returned in March from his third visit to the nation. “The scientists would have no trouble working together... The Cubans are understandably proud of their science, and they see us very positively. I would anticipate if we could normalize relations and do science as a starting point, then really good things could happen.” “The possibility of open scientific exchange between researchers in Cuba and the U.S. can only bring increased benefits for both scientific communities, and of course, for the people in their respective countries,” said Sergio Jorge Pastrana, foreign secretary of the Academia de Ciencias de Cuba. “The kind of scientific development that took place in Cuba for the last half-century has produced original results that have been internationally recognized as being in the frontiers of knowledge in several fields. Science, along with technology and innovation, has produced outcomes that are important for societies not only in Cuba and the United States, but in neighboring countries of the Caribbean, and for sustainable development everywhere.” Vaughan C. Turekian, director of the AAAS Center for Science Diplomacy, said that researchers from both nations have focused on science, not on the politics that have divided the two nations for a half-century. “Especially on the environmental side, there is not an issue that we discussed that doesn’t have direct implications and impact both on Cuba and the United States,” said Turekian, who also serves as AAAS’s chief international officer. “Given the proximity, when you’re talking about atmospheric or marine science, if it travels to Cuba, it travels to the Southeast coast of United States, too. If it spawns off the coast of Cuba, it is caught or affected by currents that go into the United States.” The AAAS Center for Science Diplomacy organized an initial three-day visit to Cuba in November 2009, with Agre, then the AAAS president, and seven other U.S. science leaders. AAAS helped to facilitate a second visit last December, with 18 independent scientists traveling to the island for informal talks centered on marine science, atmospheric science, environmental change, conserving biodiversity at large scales, sustainable fisheries, and capacity-building. Agre, who heads the Johns Hopkins Malaria Research Institute, returned to Cuba in March to speak at [Biotechnology Havana 2012](http://biomed.cigb.edu.cu/), an international congress that focused on medical applications of biotech. Since the early 1960s, just after the Cuban revolution, the two neighbors have been locked in a Caribbean cold war; though they are just 90 miles apart, the relationship has been characterized by economic and cultural barriers, sometimes sharp political conflict, and broad dimensions of mistrust. Advocates see science diplomacy as a way to do important research with value for all sides, and to build constructive engagement in a non-political environment. History dating back well over 100 years suggests that Cuba and the United States are “natural scientific partners,” Pastrana said in an April email interview. “As both science communities were establishing their own scientific institutions during the 19th century, many scientists and scholars from both countries started links of exchange, discussion and cooperation,” he said. “The relations of Cuban scientific research centers, as well as of many scientists and scholars, with the Smithsonian Institution, universities like Harvard, Columbia or Yale, go way back and, in many ways, have been important for both sides for a very long time. “Some of those links have never disappeared, and have continued over particularly difficult moments, overcoming political hurdles, to produce important publications, collections, and scientific results that are of benefit to the peoples in both countries.” The recent engagements have allowed AAAS and other scientists to further develop their ties with Pastrana and Fidel Ángel Castro Díaz-Balart—Fidel Castro’s oldest son—a nuclear physicist and leader in his nation’s science policy community. The December trip also included a special side event: Agre and Alan Robock, a Rutgers atmospheric scientist, were invited to a three-hour meeting with former Cuban leader Fidel Castro, Castro’s wife, and his sons Fidel and Antonio, an orthopedic surgeon. “The meeting with Fidel was really interesting,” Agre said. “It was about the past. He spoke about his family, growing up... He described the Revolution, the Bay of Pigs, the missile crisis. It was a much different perspective than I expected. “I mostly listened. If I meet him again—and I don’t know if I will—he asked me to bring him my research papers. But the fact that he and I sat in the same room—he didn’t see me as an enemy. I’m a scientist, born the same year as his son.” But the central focus of the Cuban meetings was science, and informal scientist-to-scientist consultations and discussions. They focused on common interests and on the prospects—and challenges—of working together. “There’s a definite pride in the work they do there, and the research they do,” said Joanne Carney, director of the AAAS Office of Government Relations. “When we talk about collaboration, they really want honest collaboration and partnership, as opposed to funding or resources. They definitely are interested in pursuing areas of mutual interest.” Malaria and the Caribbean Both Turekian and Agre cited malaria as one area where the U.S. scientists might learn much from Cuba. And that might tie in to an interest shared by both countries in working to support health and human development in the impoverished Caribbean nation of Haiti. “Malaria is endemic in Haiti,” Agre said. “It was endemic in Cuba, but one of the objectives of the revolution was to eliminate malaria—and they achieved that. How did they do it? That’s something I would like to pursue.... In Cuba, vaccinations and prevention are a high priority.” Unchecked malaria or other diseases in Haiti can be a destabilizing factor even for neighboring nations, Turekian said. “It leads to a lot of people moving back and forth, and it reduces Haiti’s internal strength and stability,” he explained. “So Cuba and the United States could have mutual interests in working on this.” So too with post-traumatic stress disorder (PTSD), added Agre. Because of hurricanes, earthquakes, crime and other human disasters, PTSD is widespread in Haiti. “The Cubans have an interest in that, and we have an interest in that,” he said. “We could work on it together.” Atmospheric Science Atmospheric research is another area where Cuba and the United States share tangible common interests. Hurricanes and other storms go over Cuba en route to the United States. Clues gained from atmospheric conditions over the Caribbean can give insights—and perhaps early warning—about tornados in Oklahoma and Arkansas, or storms in Chicago and New York. It is an area of particular interest for Turekian, an atmospheric geochemist. “There is no doubt that real atmospheric science involving Cuba—measurements, understanding of atmospheric conditions—is important not only for better understanding of transport of African dust, but also for getting a handle on how atmospheric conditions and dynamics affect the Gulf of Mexico and the southeastern United States,” he said. “Given that tornadoes are driven by really complicated dynamics that involve large amounts of warm air coming up through the Gulf and interacting with cold fronts, any data we can gain can mean lives saved.... But you can’t hope to understand things like storms as they affect the Southeast Coast of the United States without having better joint cooperation between scientists in the U.S. and Cuba, and without research, instruments, and calibration to measure dynamics that affect us both.” Still, both Turekian and Robock suggested that official mistrust and the trade embargo combine to make such collaboration on climate research difficult, if not impossible. Robock, in an interview, outlined efforts by the [National Center for Atmospheric Research](http://ncar.ucar.edu/) in Boulder to install global positioning system devices in the central Cuban city of Camaguey. The GPS devices receive signals from satellites; microwave signals are affected by transmission through the atmosphere, and depending on the density of the atmosphere, that allows for insights on weather and climate change. There are nearly 100 such devices in the Caribbean, Robock explained, but Cuba, though one of the largest land masses in the Caribbean, hosts none of them. “Basic weather data are already shared by all the countries of the world,” he said. “But taking specific measurements there with the GPS would be useful to Cubans and to the larger community. It gives you better information about the state of the atmosphere—temperature, humidity, soil moisture. That’s what you need to start a weather forecast model.” But the Cuban military is wary of the GPS devices, and the nation has not approved the installation. At the same time, the U.S. embargo of Cuba makes it impossible for Cuban scientists to come to the United States for even a week-long course in how to use a computer climate model. “Scientists from both countries want to work together,” Robock said. “We’ll do the best we can... but there are significant limitations.” “From the scientific standpoint,” Turekian added, “this is about the ability to go to a place to make measurements so that we can better understand hurricanes and other conditions that affect the Caribbean and the southeastern United States. To do that, we need relationships and protocols so that Americans and the Cubans together can benefit from measurements in Cuba.” Marine Science Coral reefs in much of the Caribbean have sustained significant damage from human activity—over-fishing, climate change, oil spills, and other pollution. But off of Cuba’s coasts, says marine scientist Nancy Knowlton, the reefs have been less exposed to development, and they’re in better health. Knowlton is the Sant Chair for Marine Science at Smithsonian Institution and senior scientist emeritus at Smithsonian Tropical Research Institute. She’s worked in fields of marine biodiversity and ecology; coral reefs are her specialty. Save for a cruise that stopped in Guantanamo, she’d never been to Cuba, but on her visit in December, she was deeply impressed with opportunities for research in the Cuban reefs and by the marine science already underway there. “There are amazing habitats, much less impacted by people than most places in Caribbean, in terms of over-fishing and that sort of thing,” she said. “And there’s a large community of marine biologists there, many with shared interest in biodiversity and conservation.” For Knowlton, the Cuban reefs are like “a window in time,” allowing researchers a view of what healthy reefs looked like in an era past. “They give you a baseline as to what a healthy fish community should look like,” she explained. And that gives greater insight into other Caribbean reefs where damage is more pronounced. “So there are a lot of things to learn from Cuban marine scientists,” she said. “And there are a lot of reasons for Cubans to come here, or for Cubans to come and work at the Smithsonian. There’s a huge potential for interchange because there are so many shared interests.” Small Steps, Significant Potential Those shared interests appear to extend across many fields. Carney, whose parents were born in Cuba, met in December with Cuban counterparts who study and help shape government science and technology policy. “From my own perspective in talking to their scientists, I was struck by some of the similarities between our communities,” Carney said. The Cubans “face challenges in policy decisions regarding research priorities, and how to balance between basic research and applied research. They provide universal health care, and so life science research is a bit more targeted, a bit more applied. But looking forward, you want to balance the applied portion with the basic research. “It’s interesting that we’re both faced with similar issues, even though our systems are different.” Scientists from both countries are aware, of course, of the considerable obstacles that stand in the way of full collaboration. Visas and the U.S. embargo are obvious problems. But where scientists in a wealthy nation like the United States take digital and Internet resources for granted, bandwidth in Cuba can be so limited that it’s difficult or impossible to exchange data. Given those constraints, the immediate prospects for full, constructive engagement between science communities are slender at best. And yet Robock, Carney, and others said the visits have made clear that working with Cuban scientists is easier than it might appear. “Any academic can go to Cuba and spend money without restriction,” Robock explained. “You need a license from the U.S. Treasury Department to spend money, but as a researcher, you are subject to the existing general license. So many more Americans could go to Cuba and start doing science with them—but they don’t know that they can.” One of the ideas to emerge from the discussions, Carney said, was a Web resource page that would provide such practical information to both scientific communities. These may be small steps, but they have a significant value in helping to build the foundation for collaboration among researchers in Cuba and the United States. Though the formal relationship between the two nations has long been strained, the scientists are betting on better times ahead, even if they don’t know exactly when. “While it’s been the same for 50 years, it will change—political relationships always do,” said Turekian. “Whenever that relationship changes, you want to be in place where you have the groundwork laid and relationships built so you can take advantage of areas where science cooperation can actually contribute to both countries.” In the meantime, efforts will continue, building on the collegiality that visitors to the island have shared with their hosts. “Everyone who was there was a pretty good science diplomat,” said Knowlton. “There was no uneasiness—there was a lot of curiosity on both sides to meet people and find out what people are doing.... Everyone was going out of their way to be gracious. That’s important—you have to be willing to listen as well as to talk. It was lovely. I’d really like to go back.” Added Agre: “Non-governmental science and AAAS have a tremendously important role to play. More than ever, science is a way for us to break barriers between adversaries. It’s a constructive way for the world to move ahead.” Pastrana, too, sounded an ambitious note for the future. “Any hurdle that comes in the way of international exchange in science is limiting its capacity to be of help for increasing the resilience of this world’s environments,” he said. “Only the knowledge, technologies, and products that come from scientific developments could provide the tools for societies to be able to continue human development in harmony with the only planet that sustains them so far, which has been abused for the last half-century far beyond its capacity to cope with such abuse. “Let us be in favor of scientists and their open communication everywhere. In this way, they would be able to contribute to the sustainability of human societies on planet Earth.”

#### Its topical and solves – science and technology agreements create a bilateral framework for economic engagement

State Department (“Science and Technology Cooperation”, http://www.state.gov/e/oes/stc/)

Thirty U.S. S&T Agreements worldwide establish bilateral frameworks to facilitate the exchange of scientific results, provide for protection and allocation of intellectual property rights and benefit sharing, facilitate access for researchers, address taxation issues, and respond to the complex set of issues associated with economic development, domestic security and regional stability. S&T cooperation supports the establishment of science-based industries, encourages investment in national science infrastructure, education and the application of scientific standards, promotes international trade and dialogue on issues of direct import to global security, such as protection of the environment and management of natural resources. S&T collaboration assists USG agencies to establish partnerships with counterpart institutions abroad. These relationships enable them to fulfill their individual responsibilities by providing all parties with access to new resources, materials, information, and research. High priority areas include such areas as agricultural and industrial biotechnology research (including research on microorganisms, plant and animal genetic materials, both aquatic and terrestrial), health sciences, marine research, natural products chemistry, environment and energy research.

#### Science cooperation solves Latin American relations and biotechnology

Pastrana & Clegg, 08. Foreign Secretary of the Academia de Ciencias de Cuba, Foreign Secretary of the U.S. National Academy of Sciences and Donald Bren Professor of Biological Sciences, Ecology and Evolutionary Biology at the School of Biological Sciences, University of California (Sergio, Michael, “U.S.-Cuban Scientific Relations”. 7/3/13. <http://www.sciencemag.org/content/322/5900/345.full?ijkey=3aK7XuLHCJLJ.&keytype=ref&siteid=sci>. KJ)

In a few years, the two oldest national academies of science in the world outside of Europe—those of the United States and Cuba—will celebrate their 150th anniversaries. Yet despite the proximity of both nations and many common scientific interests, the U.S. embargo on exchanges with Cuba, which began in 1961 and is now based on the 1996 U.S. Helms-Burton Act and subsequent regulations, has largely blocked scientific exchange. It's time to establish a new scientific relationship, not only to address shared challenges in health, climate, agriculture, and energy, but also to start building a framework for expanded cooperation. ¶ Restrictions on U.S.-Cuba scientific cooperation deprive both research communities of opportunities that could benefit our societies, as well as others in the hemisphere, particularly in the Caribbean. Cuba is scientifically proficient in disaster management and mitigation, vaccine production, and epidemiology. Cuban scientists could benefit from access to research facilities that are beyond the capabilities of any developing country, and the U.S. scientific community could benefit from high-quality science being done in Cuba. For example, Cuba typically sits in the path of hurricanes bound for the U.S. mainland that create great destruction, as was the case with Hurricane Katrina and again last month with Hurricane Ike. Cuban scientists and engineers have learned how to protect threatened populations and minimize damage. Despite the category 3 rating of Hurricane Ike when it struck Cuba, there was less loss of life after a 3-day pounding than that which occurred when it later struck Texas as a category 2 hurricane. Sharing knowledge in this area would benefit everybody.¶ Another major example where scientific cooperation could save lives is Cuba's extensive research on tropical diseases, such as dengue fever. This viral disease is epidemic throughout the tropics, notably in the Americas, and one of the first recorded outbreaks occurred in Philadelphia in the 18th century. Today, one of the world's most outstanding research centers dedicated to dengue fever is in Cuba, and although it actively cooperates with Latin America and Africa, there is almost no interaction with U.S. scientists. Dengue fever presents a threat to the U.S. mainland, and sharing knowledge resources to counter outbreaks of the disease would be an investment in the health security of both peoples. ¶ Cuba has also made important strides in biotechnology, including the production of several important vaccines and monoclonal antibodies, and its research interests continue to expand in diverse fields, ranging from drug addiction treatment to the preservation of biodiversity. Cuban scientists are engaged in research cooperation with many countries, including the United Kingdom, Brazil, Mexico, China, and India. Yet there is no program of cooperation with any U.S. research institution. ¶ The value system of science—openness, shared communication, integrity, and a respect for evidence—provides a framework for open engagement and could encourage evidence-based approaches that cross from science into the social, economic, and political arenas. Beyond allowing for the mutual leveraging of knowledge and resources, scientific contacts could build important cultural and social links among peoples. A recent Council on Foreign Relations report argues that the United States needs to revamp its engagement with Latin America because it is no longer the only significant force in this hemisphere. U.S. policies that are seen as unfairly penalizing Cuba, including the imposition of trade limitations that extend into scientific relations, continue to undermine U.S. standing in the entire region, especially because neither Cuba nor any other Latin American country imposes such restrictions. ¶ As a start, we urge that the present license that permits restricted travel to Cuba by scientists, as dictated by the U.S. Treasury Department's Office of Foreign Assets Control, be expanded so as to allow direct cooperation in research. At the same time, Cuba should favor increased scientific exchanges. Allowing scientists to fully engage will not only support progress in science, it may well favor positive interactions elsewhere to promote human well-being. The U.S. embargo on Cuba has hindered exchanges for the past 50 years. Let us celebrate our mutual anniversaries by starting a new era of scientific cooperation.

#### US-Cuba science cooperation solves biotech development

Chen 2003

[Chen May Yee. Editorial Consultant at Straits Times in Singapore. Writing for Christian Science Monitor. “Cutting-edge biotech in old-world Cuba.” April 17, 2003. <http://www.csmonitor.com/2003/0417/p14s03-stct.html>] WD

This crumbling, isolated throwback to a cold-war past is probably one of the last places you'd expect to find the sciences of the future. In Old Havana, wood-paneled pharmacies with crystal chandeliers and empty shelves attract more gawking tourists these days than customers. Food is so scarce that the government urges citizens to grow fruit and vegetables in small urban plots to supplement their diet. Yet this struggling island nation is chipping away at a longtime US embargo with an unlikely tool: biotechnology. More than three years ago, Smith-Kline Beecham PLC - a charter member of the capitalist world's pharmaceutical sector - signed an agreement with Cuba's Finlay Institute to market the institute's vaccine against meningitis B - the world's first. Now called GlaxoSmithKline PLC, the second-biggest pharmaceutical company in the world is running trials for the Cuban vaccine in Europe and Latin America. If those trials are successful, the company says it plans clinical trials in the US. For Cuba, the deal was a tiny crack in the door that might open up lucrative new markets for its biotechnology products. Besides earning the impoverished communist country much-needed dollars, it could help build new economic bridges with a world that has become a much lonelier place since the collapse of Cuba's old ally, the Soviet Union. "We have neither money nor time," says Concepcion Campa, the scientist who developed the vaccine and the president of Finlay, Cuba's main research and manufacturing center for human vaccines. With GlaxoSmithKline, which holds a 7 percent share of the world pharmaceutical market, Cuba gains access to marketing heft and a vast commercial network. The market for such a vaccine is "hundreds of millions of dollars," according to Moncef Slaoui, a senior vice president at GSK Biologicals, the Belgian-based vaccine division of GlaxoSmithKline. Cuba currently earns just $100 million a year from its total pharmaceutical and biotechnology exports. The official line on science's value When meeting foreign visitors, Cuban officials like to quote something Fidel Castro said in 1960 just after he marched into power: "The future of our homeland must be that of men of science." Ironically, the 42-year-old US trade embargo might actually have spurred the island's pursuit to science. Imposed in 1960 by President Kennedy after Mr. Castro infuriated the US by nationalizing $1 billion worth of US-owned property in Cuba, the embargo remains in place decades later. Unable to import some of the medicines it wanted, Cuba began making its own generic drugs through reverse engineering - piracy by another name. From there sprang a state pharmaceutical industry and later, a biotechnology offshoot. Cuban officials say the country now produces 80 percent of the types of drugs and medicines used by its 11 million people, though the empty shelves in pharmacies suggest the actual shortfall in quantity may be greater. The healthcare strategy is straightforward: The government develops the drugs and vaccines according to the demands of Cubans. It then tests them and dispenses them across the population through a network of neighborhood family doctors, polyclinics, and hospitals. "Cuban science does not produce as much in peer-reviewed English-language scientific journals as its size [would merit], but [there is] more input into social practice," the application of science in a real-world setting, says Sergio Jorge Pastrana, who handles international relations for the 142-year-old Cuban Academy of Sciences. In the early 1990s, when the economy's implosion got so bad that the average Cuban adult lost 20 pounds, the government continued to set aside 1.5 percent of gross national product each year for scientific research. A total of $1 billion between 1992 and 1996 went toward creating a no-frills, centralized version of Silicon Valley, the Western Havana Scientific Pole. In the mid-1990s, crippled by the economic crisis, Cuba sent its scientists to labs in Sweden, Spain, and Germany so they could continue working. Today, Cuba's economy is recovering, thanks to emergency liberalization measures that promote tourism and allow Cubans to start limited private businesses and hold and use the US dollar. At the Western Havana Scientific Pole, scientists at 52 institutes are researching vaccines and therapies for AIDS and Alzheimer's, among others. There are some cooperation agreements - for product sales, joint ventures, contract manufacture and research - with entities in Latin America, China, Europe, the former Soviet Union, and Australia. Cuba has filed applications for 500 patents around the world. Embargo blocks biggest market But the biggest market has so far eluded it: Although the US has granted Cuba 24 patents, the embargo has so far prevented it from selling any of the products in America. There is also some biotechnology research in agriculture, but it has not been commercialized, Cuban officials say, partly for fear that genetically modified food crops might hurt that famed Cuban export - cigars. Stories of frustration abound. Scientists have limited access to Western journals and can't always afford the latest equipment. They are often denied US visas for scientific exchange. One Finlay Institute scientist who works with a mass spectrometer, a machine for analyzing biochemicals, says he can't get a US visa to attend conferences to discuss the cutting-edge technology. Another researcher shares his subscription to the journal Nature with 20 colleagues. They are also abysmally paid, especially when compared with workers in the growing tourist industry, where cash registers ring with dollars, not the Cuban peso.

## CONTENTION 2 IS SCIENCE

**Science diplomacy creates cultural exchanges that spill over**

**Federoff**, KAUST professor of life sciences and Biotechnology, **’08.**

(Nina, 4/2/13, <http://www.gpo.gov/fdsys/pkg/CHRG-110hhrg41470/html/CHRG-110hhrg41470.htm>, Accessed 6/25/13, ARH)

**Scientists have played an important role on the front-lines of U.S. diplomacy since the end of World War II.** **They have been the enablers of larger international diplomacy efforts, from the robust scientific exchange with China to renewed and strengthened relations with Egypt, India, and Pakistan-all started with the peaceful beachhead of scientific diplomacy.** For instance, polls indicate that **people in the Middle East generally view American S&T more favorably than other aspects of our society. This approving attitude provides for** favorable **forums to explain other** aspects of American **policies** and actions. Our nation's citizens also benefit directly from **S&T cooperation**, asit **provides our scientists and engineers with greater access to cutting-edge research and allows us to work across geographical boundaries to solve global problems.** In addition, **globalization has amplified the worldwide competition for ideas, science and engineering (S&E) talent, and leadership in turning new knowledge into real-world applications**. Many nations are accelerating their investments in research and development, education, and infrastructure in order to drive sustained economic growth. To continue being a global leader in S&T, we must ensure that we have access to discoveries being made in every corner of the world. **The National Science Foundation understands the global nature of scientific discovery, and the international character of knowledge creation and research activities are stressed** in NSF's FY 2006-2011 Strategic Plan, Investing in America's Future. For more than 55 years, **NSF has connected S&E researchers and educators in academic organizations, industry and informal science institutions, both nationally and internationally, to leverage intellectual capabilities. NSF has strengthened the Nation's collaborative advantage by leading or participating in key interagency initiatives as well as by developing innovative collaborations across all S&E disciplines.**

### The impact is Warming

#### We solve, three internal links:

#### Biotechnology is key to stop global warming—establishes a transition into sustainable energy and resource consumption

OECD 11([Organisation for Economic Co-operation and Development](http://www.oecd.org/)¶ “Industrial Biotechnology and Climate Change” 11-7-2011 http://www.oecd.org/sti/biotech/49024032.pdf)\\BJ

Besides biofuels, industrial biotechnology can contribute to climate change mitigation through diverse products in the plastics and chemicals sectors. These products are less controversial, some are closer to market than second generation biofuels, and yet do not enjoy the wealth of supportive supply and demand policies as seen with biofuels.¶ Several sources predict that biobased chemicals could in the near future occupy a much larger market share than at present. As befits the remarkable biodiversity of microorganisms, the diversity of potential biobased chemicals is wide. In many cases, organic chemistry has no feasible replacement; in other cases, biobased chemicals can replace their fossil-based counterparts with significant GHG emissions reductions.¶ Plastics from fossil fuels have grown faster than any other group of bulk materials for several decades. By 2100, a predicted 1 billion tonnes annual plastics demand would require 25% of current oil production. Biobased plastics are potentially attractive in terms of specific emissions and energy savings. In recent years biobased plastics have been developed for increasing types of applications, way beyond simple packaging applications as once envisaged. Estimates of total technical substitution potential for petro- with bio- plastics is 33-90% and yet global bioplastics consumption is a mere 0.4% of total plastics. As biobased plastics become proven in GHG emissions reductions, they should become an obvious target for supportive policy.¶ This paper explores the potential role of industrial biotechnology in the biobased economy. Along the way it examines emerging trends, the impact of innovation, the convergence of technologies, and goes on to identify the challenges involved. It concludes with a need for an integrated and strategic approach to allow industrial biotechnology to fulfil its potential as a force for good, not a panacea, in the struggle with climate change. Industrial biotechnology has suffered a lack of investment at all levels, and there is a serious mismatch between future expectations of this industry and this low level of investment. Policy intervention is seen to be required across three broad criteria – social/ environmental, industrial performance and economical. To make this all happen requires not only national but international policy in a rapidly globalising world.¶ 6 INDUSTRIAL BIOTECHNOLOGY AND CLIMATE CHANGE: OPPORTUNITIES AND CHALLENGES – © OECD 2011¶ Introduction¶ Climate change is challenging almost all human endeavours, including the future ways in which energy will be generated and consumed. It could adversely affect water supplies and agricultural productivity, and the need to cut CO2 emissions to avoid harmful environmental degradation has made the transition from conventional fossil fuels to alternative and renewable resources a global priority. The United Nations Environment Programme (UNEP) (2010)1¶ has noted that “doubling of wealth leads to 80% higher CO2 emissions”. Therefore there is a need to break the link between growth and increasing emissions at the expense of sustainability.¶ Meeting market demands whilst at the same time reducing the impact on the climate is of critical importance to industry. Although past discussions have centred around the causes of climate change, society, industry, governments and other stakeholders are now searching for solutions to mitigate the impacts on health and the environment. In most countries, industrial greenhouse gas (GHG) emissions have substantially decreased over recent years. Both regulators and industry have responded to the need to work towards a sustainable future and have focused on developing and innovating technological improvements for the benefit of the environment. However, in spite of these endeavours, current practices and technologies will most likely be insufficient or inadequate to achieve the ambitious objectives set by countries to tackle climate change. Industries should take bold steps towards establishing more sustainable growth and should be given the opportunity to implement new technologies including the use of biotechnology to reduce the carbon footprint.¶ With the Kyoto Protocol due to expire in 2012, parties to the United Nations Framework Convention for Climate Change (UNFCCC) are currently in the process of negotiating a new treaty. It is critical that current and emerging uses of biotechnology are recognised by stakeholders as being part of the toolkit necessary to achieve sustainable solutions to climate change. Furthermore, it is also of vital importance that a new worldwide climate change agreement both supports and enables the implementation of eco-friendly innovations.¶ The over-arching goal of this paper is to explore how industrial biotechnology can be used as part of the toolkit in the struggle to control climate change. For this to happen, the products of industrial biotechnology (biofuels, biobased chemicals and bioplastics) have to be demonstrated to produce less GHG emissions than their non-biological counterparts, whilst maintaining product performance.¶ INDUSTRIAL BIOTECHNOLOGY AND CLIMATE CHANGE: OPPORTUNITIES AND CHALLENGES – © OECD 2011 7¶ Industrial biotechnology as part of the solution to climate change¶ Since the industrial revolution, economic growth has been inextricably linked with accelerating negative environmental impact. Industrial biotechnology challenges this pattern and has the potential to break the cycle of resource consumption by allowing for a rethinking of traditional industrial processes. Industrial biotechnology, by providing a range of options for competitive industrial performance in selected sectors, could enhance economic growth, while at the same time save water, energy, raw materials and reduce waste production.¶ Industrial biotechnology, based on renewable resources, can save energy in production processes and significantly reduce CO2 emissions.2 The impacts of biotechnology on industry are confirmed by scientific studies and reports, such as the OECD’s report on the application of biotechnology to industrial sustainability3 and, more recently, by a EuropaBio report (2009) on the potential of industrial biotechnology to help mitigate climate change.4¶ It has been claimed that the full climate change mitigation potential of biotechnology processes and biobased products ranges from between 1 billion and 2.5 billion tons CO2 equivalent per year by 2030. To put this in context, it represents more than Germany’s total reported emissions in 1990. Even though the industrial biotechnology sector is still embryonic, it globally avoids the creation of 33 million tonnes of CO2 each year through various applications, without taking ethanol use into consideration, whilst globally emitting 2 million tonnes of CO2.¶ 8 INDUSTRIAL BIOTECHNOLOGY AND CLIMATE CHANGE: OPPORTUNITIES AND CHALLENGES – © OECD 2011¶ The role of industrial biotechnology in the biobased economy¶ Industrial biotechnology, also known as white biotechnology, uses enzymes and micro-organisms to make biobased products in sectors as diverse as chemicals, food and feed, healthcare, detergents, paper and pulp, textiles and energy. Agricultural products, biomass and organic waste, including food processing waste and effluents (also referred to as renewable raw materials) are transformed into other substances, in the same way as crude oil is used as a feedstock in the production of chemicals.¶ Existing energy infrastructure and production processes are largely based on fossil fuels, which result in high levels of GHG emissions. In a biobased economy society is no longer wholly dependent on fossil fuels and industrial raw materials.¶ By contrast, industrial biotechnology holds promise by avoiding the use of limited fossil resources as starting materials, but in some instances it competes with edible feedstocks. This important issue, specially raised in the case of biofuels, can be solved by the introduction of second generation biofuels using non-edible biomass as a sole feedstock. Besides biofuels, the wide variety of intermediate products that may enter at different stages in different value chains introduces complexity when analysing biotechnological products. The OECD predicts the following industrial biotechnology applications have a high probability of reaching the market by 2030:5¶ • Improved enzymes for a growing range of applications in the chemical sector.¶ • Improved micro-organisms that can produce an increasing number of chemical products in one step, some of which build on genes identified through bioprospecting.¶ • Biosensors for real-time monitoring of nvironmental pollutants and biometrics for identifying people.

#### LA relations key to solving warming—the region is establishing itself as a leader in climate change.

West 12 (Charlotte, a former Fulbright fellow, is a frequent contributor to NAFSA’s award-winning International ¶ Educator magazine, “New Approaches to Cooperation with Latin America”, NAFSA 2012, <http://www.nafsa.org/uploadedFiles/Chez_NAFSA/Find_Resources/Publications/Periodicals/Epublications/epub_latin_america.pdf>, MB)

Margaret Heisel concluded her presentation at the¶ NAFSA forum with reference to common challenges¶ for Latin America and the United States: “What are¶ the global problems facing the world that this generation¶ of students is going to have to deal with, and¶ what do we have to offer them educationally that is¶ going to address these problems?”¶ Academic collaboration can be increased by defining¶ distinctive niches of excellence that Latin American¶ institutions can occupy, one participant pointed out.¶ One strategy is raising awareness among U.S. faculty¶ about which Latin American institutions would be¶ the best match for their particular area of research,¶ using some of the addressed marketing and communications¶ activities. Another approach is designing¶ programs and joint research projects that focus on¶ common challenges facing Latin America and the¶ United States.¶ One place where Latin America has a distinct¶ research advantage is in the area of climate change.¶ For example, a recent survey from MIT showed¶ that 95 percent of major cities in Latin America are¶ planning for climate change, compared to only 59¶ percent of such cities in the United States. Quito,¶ Ecuador is considered a global leader in areas such¶ as studying the effects of global warming on nearby¶ melting glaciers and developing ways of dealing with¶ potential water shortage.25¶ José Lever, Mexico coordinator at the University of¶ Arizona, said that his institution has focused efforts¶ on developing bilateral research in areas where they¶ have a lot in common with Mexican institutions, such¶ as biotechnology, environmental sciences, climate¶ change, and pharmacology. Other areas where they¶ are active include business, technology transfer,¶ and innovation. Through partnerships with Mexican¶ centers of excellence, they are trying to foster a¶ better understanding of how innovation works, better understanding of how innovation works,identify business opportunities from emerging technologies,¶ and help market them in order to foster¶ better economic prospects in the region. They are¶ also building a network of U.S. university representatives,¶ including institutions such as the University¶ of Southern California, the State University of New¶ York, and Texas A&M.“[We want to] work together¶ with not only with Mexican higher education, but¶ also with the Mexican National Council on Science¶ and Technology (CONACYT— Consejo Nacional de¶ Ciencia y Tecnología),26 to address regional challenges¶ and identify ways to bring faculties together¶ to discover some of the best places to do research¶ on these topics,” Lever said.

#### Science diplomacy key to solving warming

David Dickson, 2010 (Director, SciDev.Net). June 28, 2010. “Science in diplomacy: “On tap but not on top”” Accessed Sept 11, 2010 at <http://scidevnet.wordpress.com/category/science-diplomacy-conference-2010/>

Chris Whitty, for example, chief scientist at the UK’s Department for International Development, described how knowledge about the threat raised by the spread of the highly damaging plant disease stem rust had been an important input by researchers into discussions by politicians and diplomats over strategies for persuading Afghan farmers to shift from the production of opium to wheat. Others pointed out that the scientific community had played a major role in drawing attention to issues such as the links between chlorofluorocarbons in the atmosphere and the growth of the ozone hole, or between carbon dioxide emissions and climate change. Each has made essential contributions to policy decisions. Acknowledging this role for science has some important implications. No-one dissented when Rohinton Medhora, from Canada’s International Development Research Centre, complained of the lack of adequate scientific expertise in the embassies of many countries of the developed and developing world alike. Nor – perhaps predictably – was there any major disagreement that diplomatic initiatives can both help and occasionally hinder the process of science. On the positive side, such diplomacy can play a significant role in facilitating science exchange and the launch of international science projects, both essential for the development of modern science.

#### Warming’s still reversible, but a tipping point exists

Lemonick, taught science and environmental journalism at Princeton, Columbia, and Johns Hopkins, 2012

(Michael D., 8-4-12, Climate Central, “Study Shows Planet Keeping Pace With CO2 Emissions,” <http://www.climatecentral.org/news/new-study-shows-planet-keeping-pace-with-co2-emissions>, accessed 7-15-13, EB)

Climate change is a serious enough problem, but it could be a lot worse. About half of the carbon dioxide we’ve pumped into the atmosphere by burning fossil fuels has been absorbed by plants and oceans, rather than staying in circulation to drive up temperatures. Scientists are convinced this can’t go on forever — but a new study in Nature shows that we haven’t come to the danger point yet. Over the past 50 years, says the report, humans have quadrupled our emissions, but the planet has kept up by doubling the amount of CO2 it absorbed. That comes as something as a surprise: several earlier, small-scale studies have suggested we might be on the verge of a tipping point where the planet can’t absorb any more carbon dioxide. “So we decided to take a step back and ask, ‘do we see this at a global scale?’” said Ashley Ballantyne of the University of Colorado and lead author of the new report, in an interview, “and the answer is no.” To get that answer, Ballantyne and his co-authors used what Ingeborg Levin of Heidelberg University, writing in a Nature commentary, called “a strikingly simple approach.” They took estimates of how much CO2 humans have been pumping out over the past half-century and subtracted the amount that has stayed in the atmosphere. Whatever’s left over must have been absorbed by the land (or more accurately, by plants growing on land) or by the ocean; there’s nowhere else it could have gone. The calculation is so obvious, it probably could have been done long ago, but, said, Ballantyne, “we [scientists] can become too focused on details, and lose sight of the big picture.” It wasn’t quite as easy as it might sound, however. “Our ability to measure CO2 in the atmosphere has gotten a lot better over the years,” Ballantyne said, “but our ability to measure emissions has actually gotten worse.” The reason, he said, is that nobody measures carbon dioxide emissions directly. Instead, they use economic activity as a proxy — reasonable enough, since economies run on energy, and that energy comes largely from fossil fuels. In developing countries like China and India, he said, “growth is happening really fast, and emissions accounting isn’t necessarily keeping pace, so there’s more error.” Indeed, said Ballantyne, “10 percent of our work went to making the calculations, and 90 percent was scratching our heads over the uncertainties.” In the end, the scientists combined emissions estimates from three different sources to ensure they had the best possible information. What the new study doesn’t answer is where, exactly, the CO2 is being absorbed. One possibility is the lush vegetation in the tropics, where plants take in CO2 for growth, and where, said Ballantyne, very little data is available. Another is the deep oceans — again, a place where scientists and their instruments haven’t gone. Knowing where the carbon is going is important because it could give scientists a better handle on how much capacity is left. Sooner or later, however, that capacity will disappear. Plants take in more CO2 if there’s more in the atmosphere, but only up to a point. The oceans will ultimately stop absorbing carbon dioxide as well, in part because plankton and other sea-based plants will reach their own limits, and also because sea water gets less and less able to take in CO2 as it warms (in some ways, this will be a good thing). When the Earth finally does reach its absorption limit, all of the CO2 humans emit will stay in the atmosphere, and that will turbo-charge the pace of global warming. “We don’t know exactly when we’ll reach the limit,” Ballantyne said, “but our models suggest things will turn around on land, at least, sometime in the coming century, maybe even by 2030-2050. I would really hope,” he said, “that we can cut back on fossil fuel emissions before that.”

#### Warming is real and anthropogenic **C2ES 11**(Center for Climate and Energy Solutions - successor to the Pew Center on Global Climate Change, and recently named the world’s top environmental think tank, "Science FAQs," <http://www.c2es.org/global-warming-basics/faq_s/glance_faq_science.cfm>)

A more detailed, state-of-the-art attribution of various climate trends is possible using optimal fingerprinting approaches that match individual forcings (for example, greenhouse gases, solar intensity or airborne particles) to observed climate change patterns using global climate models. This technique has detected human-induced trends in a wide variety of climate variables including land surface warming, vertical warming of the oceans, loss of Arctic sea ice cover, and changes in precipitation patterns at different latitudes on the Earth. Observations of global land and ocean surface warming and warming of all continents except Antarctica show that no combination of forcings that excludes manmade greenhouse gases can explain the warming trend of the past half-century (see figure). Top How do we know greenhouse gases are increasing because of human activity? Some greenhouse gases (GHG), such as industrial halocarbons, are only made by humans, and thus their presence in the atmosphere can only be explained by human activity. For naturally occurring GHG, several independent lines of evidence make it crystal clear that they are increasing because of human activities: First, CO2, methane, and nitrous oxide concentrations were stable for thousands of years. Suddenly, they began to rise like a rocket around 200 years ago, about the time that humans began to engage in very large-scale agriculture and industry (see figure). Second, scientists and economists have developed estimates of all the natural and human GHG sources. When they add them up, only the human contributions are increasing. In fact, the amount of human-made GHG in the budget are more than enough to explain the rise in concentrations, which means that natural processes are absorbing the excess amount, keeping GHG concentrations from rising even more. For CO2, the most important human-produced GHG, scientists can tell from chemical measurements of the atmosphere that the additional CO2 is from:

combustion (i.e. burning fossil fuels) because the amount of oxygen in the atmosphere is decreasing in direct proportion to the rise in CO2; a prehistoric (fossil) source because the amount of radioactive carbon in the atmosphere has been decreasing over the past century; from plants (i.e. ancient trees that became coal and oil) rather than a geological source (i.e. volcanoes). Together, all of these independent lines of evidence leave no doubt that GHG concentrations are increasing because of human activities.

#### **Warming causes multiple scenarios for extinction:**

#### **Ocean acidification**

**Ward 10** (Peter, PhD, professor of Biology and Earth and Space Sciences at the University of Washington, paleontologist and NASA astrobiologist, Fellow at the California Academy of Sciences, The Flooded Earth: Our Future in a World Without Ice Caps, June 29, 2010)

In the rest of this chapter I will support a contention that within several millennia (or less) the planet will see a changeover of the oceans from their current “mixed” states to something much different and dire. Oceans will become stratified by their oxygen content and temperature, with warm, oxygen-free water lining the ocean basins. Stratified oceans like this in the past (and they were present for most of Earth’s history) **have** always **been preludes to biotic catastrophe**. Because the continents were in such different positions at that time, models we use today to understand ocean current systems are still crude when it comes to analyzing the ancient oceans, such as those of the Devonian or Permian Periods. Both times witnessed major mass extinctions, and these extinctions were somehow tied to events in the sea. Yet catastrophic as it was, the event that turned the Canning Coral Reef of Devonian age into the Canning Microbial Reef featured at the start of this chapter was tame compared to that ending the 300 million- to 251 million-year-old Permian Period, and for this reason alone the Permian ocean and its fate have been far more studied than the Devonian. But there is another reason to concentrate on the Permian mass extinction: it took place on a world with a climate more similar to that of today than anytime in the Devonian. Even more important, it was a world with ice sheets at the poles, something the more tropical Devonian Period may never have witnessed. For much of the Permian Period, the Earth, as it does today, had abundant ice caps at both poles, and there were large-scale continental glaciations up until at least 270 million years ago, and perhaps even later.4 But from then until the end of the Permian, the planet rapidly warmed, the ice caps disappeared, and the deep ocean bottoms filled with great volumes of warm, virtually oxygen-free seawater. The trigger for disaster was a short-term but massive infusion of carbon dioxide and other greenhouse gases into the atmosphere at the end of the Permian from the spectacular lava outpourings over an appreciable portion of what would become northern Asia. The lava, now ancient but still in place, is called the “Siberian Traps,” the latter term coming from the Scandinavian for lava flows. The great volcanic event was but the start of things, and led to changes in oceanography. The ultimate kill mechanism seems to have been a lethal combination of rising temperature, diminishing oxygen, and influx into water and air of the highly poisonous compound hydrogen sulfide. The cruel irony is that this latter poison was itself produced by life, not by the volcanoes. The bottom line is that **life produced the ultimate killer in this and surely other ancient mass extinctions.** This finding was one that spurred me to propose the Medea Hypothesis, and a book of the same name.5 Hydrogen sulfide poisoning might indeed be the worst biological effect of global warming. There is no reason that such an event cannot happen again, given short-term global warming. And because of the way the sun ages, it may be that such events will be ever easier to start than during the deep past. How does the sun get involved in such nasty business as mass extinction? Unlike a campfire that burns down to embers, any star gets ever hotter when it is on the “main sequence,” which is simply a term used to described the normal aging of a star—something like the progression we all go through as we age. But new work by Jeff Kiehl of the University of Colorado shows that because the sun keeps getting brighter, amounts of CO2 that in the past would not have triggered the process result in stagnant oceans filled with H2S-producing microbes. His novel approach was to estimate the global temperature rise to be expected from carbon dioxide levels added to the energy hitting the earth from the sun. Too often we refer to the greenhouse effect as simply a product of the gases. But it is sunlight that actually produces the heat, and that amount of energy hitting the earth keeps increasing. He then compared those to past times of mass extinctions. The surprise is that a CO2 level of 1,000 ppm would—with our current solar radiation—make our world the second hottest in Earth history—when the five hottest were each associated with mass extinction. In the deep history of our planet, there have been at least five short intervals in which the majority of living species suddenly went extinct. Biologists are used to thinking about how environmental pressures slowly choose the organisms most fit for survival through natural selection, shaping life on Earth like an artist sculpting clay. However, mass extinctions are drastic examples of natural selection at its most ruthless, killing vast numbers of species at one time in a way hardly typical of evolution. In the 1980s, Nobel Prize-winning physicist Luis Alvarez, and his son Walter Alvarez, first hypothesized that the impact of comets or asteroids caused the mass extinctions of the past.6 Most scientists slowly come to accept this theory of extinction, further supported by the discovery of a great scar in the earth—an impact crater—off the coast of Mexico that dates to around the time the dinosaurs went extinct. An asteroid probably did kill off the dinosaurs, but the causes of the remaining four mass extinctions are still obscured beneath the accumulated effects of hundreds of millions of years, and no one has found any credible evidence of impact craters. Rather than comets and asteroids, it now appears that **short-term global warming was the culprit for the four other mass extinctions**. I detailed the workings of these extinctions first in a 1996 Discover magazine article,7 then in an October 2006 Scientific American article, and finally in my 2007 book, Under a Green Sky.8 In each I considered whether such events could happen again. In my mind, such extinctions constitute the worst that could happen to life and the earth as a result of short-term global warming. But before we get to that, let us look at the workings of these past events. The evidence at hand links the mass extinctions with a changeover in the ocean from oxygenated to anoxic bottom waters. The source of this was a change in where bottom waters are formed. It appears that in such events, the source of our earth’s deep water shifted from the high latitudes to lower latitudes, and the kind of water making it to the ocean bottoms was different as well: it changed from cold, oxygenated water to warm water containing less oxygen. The result was the extinction of deep-water organisms. Thus a greenhouse extinction is a product of a changeover of the conveyor-belt current systems found on Earth any time there is a marked difference in temperatures between the tropics and the polar regions. Let us summarize the steps that make greenhouse extinction happen. First, the world warms over short intervals due to a sudden increase in carbon dioxide and methane, caused initially by the formation of vast volcanic provinces called flood basalts. The warmer world affects the ocean circulation systems and disrupts the position of the conveyor currents. Bottom waters begin to have warm, low-oxygen water dumped into them. The warming continues, and the decrease of equator-to-pole temperature differences brings ocean winds and surface currents to a near standstill. The mixing of oxygenated surface waters with the deeper and volumetrically increasing low-oxygen bottom waters lessens, causing ever-shallower water to change from oxygenated to anoxic. Finally, the bottom water exists in depths where light can penetrate, and the combination of low oxygen and light allows green sulfur bacteria to expand in numbers, filling the low-oxygen shallows. The bacteria produce toxic amounts of H2S, with the flux of this gas into the atmosphere occurring at as much as 2,000 times today’s rates. The gas rises into the high atmosphere, where it breaks down the ozone layer. The subsequent increase in ultraviolet radiation from the sun kills much of the photosynthetic green plant phytoplankton. On its way up into the sky, the hydrogen sulfide also kills some plant and animal life, and **the combination of high heat and hydrogen sulfide creates a mass extinction on land**.9 Could this happen again? No, says one of the experts who write the RealClimate.org Web site, Gavin Schmidt, who, it turns out, works under Jim Hansen at the NASA Goddard Space Flight Center near Washington, DC. I disagreed and challenged him to an online debate. He refused, saying that the environmental situation is going to be bad enough without resorting to creating a scenario for mass extinction. But special pleading has no place in science. Could it be that global warming could lead to the extinction of humanity? That prospect cannot be discounted. To pursue this question, let us look at what might be the most crucial of all systems maintaining habitability on Planet Earth: the thermohaline current systems, sometimes called the conveyor currents. It is both presumed and observed that current systems that run like a conveyor belt (it runs horizontally until ducking down, reversing direction, and returning up to its original starting point) are among the most important of the many ways that the earth redistributes heat from the sun. Such current systems have been present on Earth whenever there has been ice at the poles, and perhaps when there is no ice at all. In the past, short-term global warming caused perturbations to several of the conveyor current systems. Will the melting of Greenland and Antarctica cause such perturbations in the near, warmed future? Could these changes even be happening now? And if so, what might the consequences be? Today the most important of these currents appears to be the one that moves warm water north and east from the warm Gulf Stream of eastern North America. As that current moves into higher latitudes, its water cools and finally sinks. This cold, highly oxygenated water is a crucial part of maintaining a mix among the ocean’s gaseous elements, rather than allowing them to become stratified, with oxygenated tops and oxygen-free bottoms, like today’s Black Sea, or even totally anoxic from bottom to top. If the Gulf Stream-related current were to change the position where the water sinks, so that less-oxygenated warm water sinks from the surface or so that no water sinks at all, which would be the cessation of the current system, Europe might be immediately cooled, even in a globally warmed world, at least for a while. The result would certainly be a great change in the weather, which would certainly affect agriculture, and probably not for the better. In 2005, for the first time, a research group reported a slowing of the North Atlantic conveyor current, probably due to massive amounts of freshwater already entering the sea in northern areas due to the rapid melting of the northern ice cap.11 As this melt increases in volume, the current will be massively affected. Freshwater is of lower density than seawater, and it will float along the top of the ocean, effectively stopping the conveyor action of the current itself. Just how sensitive is the conveyor current to the sort of change that could lead to a major disturbance in the world’s climate—the kind of dramatic global change that in the past caused mass extinction? In other words, what would it take to cause a short-term but radical change in the conveyor current? Some climatologists regard the Atlantic current as robust; they believe that only massive changes in oceanography would be required to perturb it. But a larger number of scientists, including Richard B. Alley, in his now classic and important 2002 book The Two-Mile Time Machine, regard the Atlantic conveyor current system as very finely balanced and hence very susceptible to change .12 The easiest way to activate this change, according to sophisticated computer models, is to pump freshwater into the northern part of the system, and that is just what is happening today. The truly staggering rate at which Arctic ice is melting—a phenomenon not even noticed before about 2003—is introducing massive volumes of freshwater into the most dangerous point for the integrity of the conveyor current. And that input of freshwater is really just the tip of the melting iceberg. However, another way to change the system is by rapid global temperature rise, of sufficient magnitude to significantly reduce the temperature difference between poles and equator. The consequence of perturbation to this system is that the deep, cold, and oxygenated bottom water from high-latitude sinking will change to deep, warm, anoxic water that came from mid-latitude sinking. With that change a relatively cool world gives way to worldwide tropics. But could this happen again and if so, how soon? These questions stimulated an interesting NASA meeting in 2009. In January 2009 I received an unexpected telephone message from Dr. Carl Pilcher, director of the NASA Astrobiology Institute (NAI), summoning me to a spring meeting of the NASA Ames Research Center in Sunnyvale, California, to join a discussion on life and planetary change. It turned out that the director of Ames, former astronaut Pete Worden, had instigated the meeting to discuss the implications of short-term climate change on global biodiversity, past and present. Greenhouse extinction, in other words. Thus a small group composed of scientists who have each worked on either past mass extinctions or on the consequences of ancient climate change convened in welcome California warmth. We were all glad to meet with NASA, because it had been frustrating to see how little traction this concept had gotten with the public, other scientists, and the national agencies that fund scientific research. The other scientists attending were fellow paleontologist Doug Erwin of the Smithsonian; geochemists Lee Kump of Penn State and Ariel Anbar of Arizona State; biologist Jon Harrison, also of Arizona State; biochemist Roger Summons of MIT; and climate modeler Jeffrey Kiehl of Colorado. In making our presentation to a small cadre of NASA scientists and administrators, Summons, Erwin, and I conveyed data and information supporting the hypothesis that more than one of the past mass extinctions might have been caused by short-term global warming, with the devastating Permian mass extinction especially featured. Next, several scientists reported about the prospect of future greenhouse extinctions. Lee Kump of Penn State spoke first, and that was highly appropriate, for in 2005 he and colleagues first published the evidence suggesting that H2S played a major role in mass extinction. Kump showed the results of modeling of the Atlantic and Pacific oceans that investigated whether the gigantic thermohaline conveyor currents (integral to keeping the deep ocean oxygenated) could soon be affected by polar warming and the infusion of freshwater. He also added a new and important variable: the effect of enhanced nutrients to the deep ocean at the same time as global warming. He included this factor because the mechanism that he proposed for the Permian extinction, while triggered by global warming, had as its real “kill mechanism” the formation of vast quantities of hydrogen sulfide dissolved in the oceans (and at high enough concentrations, leaking into the atmosphere, literally bubbling out of the sea). For H2S to be produced by microbes from a group that used sulfur, not oxygen, for respiration, and to get large enough quantities of H2S to kill things, there would have to be a lot of nutrients down there. To my surprise, his findings indicated that both the Atlantic and Pacific oceans could see the start of oceanic slowdown not millennia hence, but early in the next century. The only factor in his scenario that Kump failed to take into account was rising sea level. It is this mechanism, perhaps more than any other, that would put the necessary nutrients onto the bottom of the sea, for as the many rivers and river mouths drowned, vast quantities of organic-rich silt and mud would be carried out to sea, where it would serve as fertilizer, rich in phosphates and nitrates that could stimulate the growth of the H2S-producing microbes, akin to fertilizing a garden bed filled with plants producing deadly poison. Jeffrey Kiehl, who was the day’s final presenter, also used models to look into the near future. He too saw signs that changing oceans are heading toward low oxygen and that warmed ocean bottoms could begin in the current century if current global warming persists. Yet in all of the models he neglected the topic of this book: the effects that rising sea level will have on global temperatures. Water absorbs heat from the sun and generally reflects back into space less energy than land surfaces do. Thus, all else being equal, the larger the ocean area, the greater the warming through reduced albedo (planetary reflectivity). It is a vicious circle, a positive feedback. Snow and ice melt, reducing albedo and raising sea level. As the sea rises, it absorbs ever more heat, causing more ice to melt at the poles, again raising sea level, and on and on. The result of this Ames meeting was a report that NASA said was headed to the desk of President Barack Obama’s science adviser. Whether it got there we never found out. But what we do know is that NASA has seemingly awakened to the vital connection between ancient climates and impending climate change. Although a number of scientists have tried to communicate this argument to the public, at the end of the first decade of the new millennium, few in the nation’s electronic media and print and newspapers allowed us to make our case. They did not disbelieve us; they just responded that the past scenarios were too horrifying for us to contemplate that they could happen again, and soon. Let us hope that a new generation will quickly decide to open their ears and listen.

#### Global Warming depletes Ozone layer

Shah, founder of global issues and chief of environmental section, 02 (Anup Shah 6/8/02 <http://www.globalissues.org/article/184/the-ozone-layer-and-climate-change> PB)

Scientists believe that Global Warming will lead to a [weaker](http://www.ens-newswire.com/ens/nov1998/1998-11-25-01.asp) Ozone layer, because as the surface temperature rises, the stratosphere (the Ozone layer being found in the upper part) will get colder, making the natural repairing of the Ozone slower.¶ NASA, for example, [reports](http://www.gsfc.nasa.gov/topstory/20020422greengas.html) that by 2030, "climate change may surpass chlorofluorocarbons (CFCs) as the main driver of overall ozone loss."¶ The Ozone layer protects all life on Earth from the harmful effects of the Sun's rays. It has been depleting for many years now. Scientists have said that currently over Antarctica the Ozone hole is [three times the size of the United States](http://news.bbc.co.uk/1/hi/sci/tech/916037.stm) and[growing](http://www.planetark.org/new/news/02109801.html).¶ Also, according to scientists, [more than 60 percent](http://www.ens-newswire.com/ens/apr2000/2000-04-06-06.asp) of the ozone layer blanketing the Arctic Circle was lost in the 1999/2000 winter.¶ Also, September 9 to 10, 2000, the ozone hole [stretched over a populated city for the first time](http://www.aspa.amc.org/aspa3.htm#10/04/00). It was in Punta Arenas, a southern Chile city of about 120,000 people, exposing residents to very high levels of ultra violet radiation.¶ The ozone depletion has also been correlated with higher levels of cancer in humans and animals.\

#### Ozone depletion causes complete extinction – scientific consensus is on our side

Greenpeace, 1995, Full of Holes: Montreal Protocol and the Continuing Destruction of the Ozone Layer, http://archive.greenpeace.org/ozone/holes/holebg.html

When chemists Sherwood Rowland and Mario Molina first postulated a link between chlorofluorocarbons and ozone layer depletion in 1974, the news was greeted with scepticism, but taken seriously nonetheless. The vast majority of credible scientists have since confirmed this hypothesis. The ozone layer around the Earth shields us all from harmful ultraviolet radiation from the sun. Without the ozone layer, life on earth would not exist. Exposure to increased levels of ultraviolet radiation can cause cataracts, skin cancer, and immune system suppression in humans as well as innumerable effects on other living systems. This is why Rowland's and Molina's theory was taken so seriously, so quickly - the stakes are literally the continuation of life on earth.

#### Warming destroys biodiversity—Leads to extinction

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As long as the total movement of isotherms toward the poles is much smaller than the size of the habitat, or the ranges in which the animals live, the effect on species is limited. But now the move­ment is inexorably toward the poles and totals more than one hun­dred miles over the past several decades. If greenhouse gases continue to increase at business-as-usual rates, then the rate of isotherm movement will double in this century to at least seventy miles per decade. Species at the most immediate risk are those in polar climates and the biologically diverse slopes of alpine regions. Polar animals, in effect, will be pushed off the planet. Alpine species will be pushed toward higher altitudes, and toward smaller, rockier areas with thinner air; thus, in effect, they will also be pushed off the planet. A few such species, such as polar bears, no doubt will be "rescued" by human beings, but survival in zoos or managed animal reserves will be small consolation to bears or nature lovers. Earth's history provides an invaluable perspective about what is possible. Fossils in the geologic record reveal that there have been five mass extinctions during the past five hundred million years— geologically brief periods in which about half or more of the species on Earth disappeared forever. In each case, life survived and new species developed over hundreds of thousands and millions of years. All these mass extinctions were associated with large and relatively rapid changes of atmospheric composition and climate. In the mostextreme extinction, the "end-Permian" event, dividing the Permian Triassic periods 251 million years ago, nearly all life on Earth— more than 90 percent of terrestrial and marine species—was exterminated. None of the extinction events is understood in full. Research is active, as increasingly powerful methods of "reading the rocks" are being developed. Yet enough is now known to provide an invalu­able perspective for what is already being called the sixth mass ex­tinction, the human-caused destruction of species. Knowledge of past extinction events can inform us about potential paths for the future and perhaps help guide our actions, as our single powerful species threatens all others, and our own. We do not know how many animal, plant, insect, and microbe species exist today. Nor do we know the rate we are driving species to extinction. About two million species—half of them being insects, including butterflies—have been cataloged, but more are dis­covered every day. The order of magnitude for the total is perhaps ten million. Some biologists estimate that when all the microbes, fungi, and parasites are counted, there may be one hundred million species. Bird species are documented better than most. Everybody has heard of the dodo, the passenger pigeon, the ivory-billed woodpecker—all are gone—and the whooping crane, which, so far, we have just barely "saved." We are still losing one or two bird species per year. In total about 1 percent of bird species have disap­peared over the past several centuries. If the loss of birds is repre­sentative of other species, several thousand species are becoming extinct each year. The current extinction rate is at least one hundred times greater than the average natural rate. So the concern that humans may have initiated the sixth mass extinction is easy to understand. However, the outcome is still very much up in the air, and human-made cli­mate change is likely to be the determining factor. I will argue that if we continue on a business-as-usual path, with a global warming of several degrees Celsius, then we will drive a large fraction of species, conceivably all species, to extinction. On the other hand, just as in the case of ice sheet stability, if we bring atmospheric composition under control in the near future, it is still possible to keep human-caus ed extinctions to a moderate level.

#### Biodiversity loss risks extinction

Walsh 10 [Bryan, covers environment, energy and — when the need arises — particularly alarming diseases for TIME magazine, Wildlife: A Global Convention on Biodiversity Opens in Japan, But Can It Make a Difference? October 18, 2010 http://ecocentric.blogs.time.com/2010/10/18/wildlife-a-global-convention-on-biodiversity-opens-in-japan-but-can-it-make-a-difference/#ixzz131wU6CSp]

The story of non-human life on the planet Earth over the past few decades is a simple one: **loss**. While there are always a few bright spots—including the recovery of threatened animals like the brown pelican, thanks to the quietly revolutionary Endangered Species Act—on a planetary scale biodiversity is steadily marching backwards, with extinctions rising and habitat destroyed. Species as diverse as the tiger—less than 3,500 live in the wild today—to tiny frogs could be gone forever if the trends **keep heading downwards**. In a bitterly ironic twist, back in 2002 the United Nations declared that 2010 would be the international year of biodiversity, and countries agreed to" achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level," as part of the UN Convention on Biological Diversity (CBD). At this paper in Science shows (download a PDF here), however, the world has utterly failed to reduce the rate of biodiversity loss, and by just about every measurement, things are getting worse all the time. (Read the Global Biodiversity Outlook if you really want to be depressed.) With that cheery backdrop, representatives from nearly 200 nations are meeting in the Japanese city of Nagoya—home to Toyota and not a whole lot else—for the 10th summit of the CBD, where they will set new goals for reducing species loss and slowing habitat destruction. At the very least, they should know how critical the biodiversity challenge is—as Japanese Environment Minister Ryo Matsumoto said in an opening speech: All life on Earth exists thanks to the benefits from biodiversity in the forms of fertile soil, clear water and clean air. We are now close to a 'tipping point' - that is, we are about to reach a threshold beyond which biodiversity loss will become irreversible, and may cross that threshold in the next 10 years if we do not make proactive efforts for conserving biodiversity. Ahmed Djoghlaf, the executive secretary of the CBD, struck an even darker note, reminding diplomats that they were on a clock—and time was running out: Let's have the courage to look in the eyes of our children and admit that we have failed, individually and collectively, to fulfil the Johannesburg promise made by 110 heads of state to substantially reduce the rate of loss of biodiversity by 2010. Let us look in the eyes of our children and admit that we continue to lose biodiversity at an unprecedented rate, thus mortgaging their future. But what will actually come out of the Nagoya summit, which will continue until Oct. 29? Most likely there will be another agreement—a new protocol—outlining various global strategies on sustaining biodiversity and goals on slowing the rate of species loss. (You can download a PDF of the discussion draft document that will be picked over at Nagoya.) It won't be hard for governments to agree on general ambitions for reducing biodiversity loss—who's against saving pandas?—but the negotiations will be much trickier on the question of who will actually pay for a more biodiverse planet? And much as we've seen in international climate change negotiations, the essential divide is between the developed and developing nations—and neither side seems ready to bend. The reality is that much of the world's biodiversity—the most fantastic species and the most complete forests—is found in the poorer, less developed parts of the world. That's in part because the world's poor have been, well, too poor to develop the land around them in the way rich nations have. (There was once a beautiful, undeveloped island off the East Coast of the U.S., with wetlands and abundant forests. It was called Mannahatta. It's a little different now.) As a result, the rural poor—especially in tropical nations—are directly dependent on healthy wildlife and plants in a way that inhabitants of developed nations aren't. So on one hand that makes the poor directly vulnerable when species are lost and forests are chopped down—which often results in migration to thronging urban areas. But on the other, poverty often drives the rural poor to slash-and-burn forests for agriculture, or hunt endangered species to sell for bush meat. Conservation and development have to go hand in hand. That hasn't always been the mantra of the conservation movement—as Rebecca Tuhus-Dubrow writes in Slate, conservation projects in the past sometimes displaced the human inhabitants over a reserve or park, privileging nature over people. But that's changed in recent decades—environmental groups like Conservation International or the Nature Conservancy now spend as much of their time working on development as they do in protecting nature. "Save the people, save the wildlife"—that's the new mantra. The missing ingredient is money—and that's what will be up for debate at Nagoya. As climate change has risen on the international agenda, funding for biodiversity has lagged—the 33 member nations of the Organization for Economic Co-operation and Development (OECD) donated $8.5 billion for climate change mitigation projects in 2008, but just $3 billion annually for biodiversity. One way to change that could be through "payment for ecosystem services." A biodiverse landscape, intact forests, clean water and air—all of these ebbing qualities of a healthy world are vital for our economies as well. (The Economics of Ecosystems and Biodiversity, a UN-funded study, estimates that nature degradation costs the world $2 trillion to $5 trillion a year, with the poorest nations bearing the brunt of the loss.) Rich countries could pay more biodiverse developing nations to keep nature running—allowing poorer countries to capitalize on their natural resources without slashing and burning. Will that work? I'm skeptical—the experience of climate change negotiations have shown that the nations of the world are great at high ideals and fuzzy goals, but not so hot at actually dividing up the pie in a more sustainable fashion. That doesn't mean there aren't smaller solutions—like Costa Rica's just-announced debt-for-nature deal—but a big bang from Japan this month doesn't seem too likely. The problem is as simple as it is unsolvable, at least so far—there's no clear path to national development so far that doesn't take from the natural world. That worked for rich nations, but we're rapidly running out of planet, as a report last week from the World Wildlife Fund showed. And there's something greater at stake as well, as the naturalist E.O. Wilson once put it: The one process now going on that will take **millions of years to correct** is the loss of genetic and species diversity by the destruction of natural habitats-this is the folly our descendants are least likely to forgive us. We're losing nature. And that loss really is forever.

## CONTENTION 3 IS IMPACT FRAMING

#### Nuclear war is obsolete:

#### Globalization creates cooperative problem solving

Ikenbarry, Professor of Politics and International Affairs at Princeton University, and Deudney, professor of political science at Johns Hopkins University, 2009

(Daniel and G. John, Jan/Feb, “The Myth of the Autocratic Revival,” Foreign Affairs, Vol. 88, Issue 1, p. 8, EB)

It is in combination with these factors that the regime divergence between autocracies and democracies will become increasingly dangerous. If all the states in the world were democracies, there would still be competition, but a world riven by a democratic-autocratic divergence promises to be even more conflictual. There are even signs of the emergence of an "autocrats international" in the Shanghai Cooperation Organization, made up of China, Russia, and the poorer and weaker Central Asian dictatorships. Overall, the autocratic revivalists paint the picture of an international system marked by rising levels of conflict and competition, a picture quite unlike the "end of history" vision of growing convergence and cooperation. This bleak outlook is based on an exaggeration of recent developments and ignores powerful countervailing factors and forces. Indeed, contrary to what trhe revivalists describe, the most striking features of the contemporary international landscape are the intensification of economic globalization, thickening institutions, and shared problems of interdependence. The overall structure of the international system today is quite unlike that of the nineteenth century. Compared to older orders, the contemporary liberal-centered international order provides a set of constraints and opportunities — of pushes and pulls — that reduce the likelihood of severe conflict while creating strong imperatives for cooperative problem solving. Those invoking the nineteenth century as a model for the twenty-first also fail to acknowledge the extent to which war as a path to conflict resolution and great-power expansion has become largely obsolete. Most important, nuclear weapons have transformed great-power war from a routine feature of international politics into an exercise in national suicide. With all of the great powers possessing nuclear weapons and ample means to rapidly expand their deterrent forces, warfare among these states has truly become an option of last resort. The prospect of such great losses has instilled in the great powers a level of caution and restraint that effectively precludes major revisionist efforts. Furthermore, the diffusion of small arms and the near universality of nationalism have severely limited the ability of great powers to conquer and occupy territory inhabited by resisting populations (as Algeria, Vietnam, Afghanistan, and now Iraq have demonstrated). Unlike during the days of empire building in the nineteenth century, states today cannot translate great asymmetries of power into effective territorial control; at most, they can hope for loose hegemonic relationships that require them to give something in return. Also unlike in the nineteenth century, today the density of trade, investment, and production networks across international borders raises even more the costs of war. A Chinese invasion of Taiwan, to take one of the most plausible cases of a future interstate war, would pose for the Chinese communist regime daunting economic costs, both domestic and international. Taken together, these changes in the economy of violence mean that the international system is far more primed for peace than the autocratic revivalists acknowledge. The autocratic revival thesis neglects other key features of the international system as well. In the nineteenth century, rising states faced an international environment in which they could reasonably expect to translate their growing clout into geopolitical changes that would benefit themselves. But in the twenty-first century, the status quo is much more difficult to overturn. Simple comparisons between China and the United States with regard to aggregate economic size and capability do not reflect the fact that the United States does not stand alone but rather is the head of a coalition of liberal capitalist states in Europe and East Asia whose aggregate assets far exceed those of China or even of a coalition of autocratic states. Moreover, potentially revisionist autocratic states, most notably China and Russia, are already substantial players and stakeholders in an ensemble of global institutions that make up the status quo, not least the UN Security Council (in which they have permanent seats and veto power). Many other global institutions, such as the International Monetary Fund and the World Bank, are configured in such a way that rising states can increase their voice only by buying into the institutions. The pathway to modernity for rising states is not outside and against the status quo but rather inside and through the flexible and accommodating institutions of the liberal international order. The fact that these autocracies are capitalist has profound implications for the nature of their international interests that point toward integration and accommodation in the future. The domestic viability of these regimes hinges on their ability to sustain high economic growth rates, which in turn is crucially dependent on international trade and investment; today's autocracies may be illiberal, but they remain fundamentally dependent on a liberal international capitalist system. It is not surprising that China made major domestic changes in order to join the WTO or that Russia is seeking to do so now. The dependence of autocratic capitalist states on foreign trade and investment means that they have a fundamental interest in maintaining an open, rulebased economic system. (Although these autocratic states do pursue bilateral trade and investment deals, particularly in energy and raw materials, this does not obviate their more basic dependence on and commitment to the WTO order.) In the case of China, because of its extensive dependence on industrial exports, the WTO may act as a vital bulwark against protectionist tendencies in importing states. Given their position in this system, which so serves their interests, the autocratic states are unlikely to become champions of an alternative global or regional economic order, let alone spoilers intent on seriously damaging the existing one. The prospects for revisionist behavior on the part of the capitalist autocracies are further reduced by the large and growing social networks across international borders. Not only have these states joined the world economy, but their people — particularly upwardly mobile and educated elites — have increasingly joined the world community. In large and growing numbers, citizens of autocratic capitalist states are participating in a sprawling array of transnational educational, business, and avocational networks. As individuals are socialized into the values and orientations of these networks, stark: "us versus them" cleavages become more difficult to generate and sustain. As the Harvard political scientist Alastair Iain Johnston has argued, China's ruling elite has also been socialized, as its foreign policy establishment has internalized the norms and practices of the international diplomatic community. China, far from cultivating causes for territorial dispute with its neighbors, has instead sought to resolve numerous historically inherited border conflicts, acting like a satisfied status quo state. These social and diplomatic processes and developments suggest that there are strong tendencies toward normalization operating here. Finally, there is an emerging set of global problems stemming from industrialism and economic globalization that will create common interests across states regardless of regime type. Autocratic China is as dependent on imported oil as are democratic Europe, India, Japan, and the United States, suggesting an alignment of interests against petroleum-exporting autocracies, such as Iran and Russia. These states share a common interest in price stability and supply security that could form the basis for a revitalization of the International Energy Agency, the consumer association created during the oil turmoil of the 1970s. The emergence of global warming and climate change as significant problems also suggests possibilities for alignments and cooperative ventures cutting across the autocratic-democratic divide. Like the United States, China is not only a major contributor to greenhouse gas accumulation but also likely to be a major victim of climate-induced desertification and coastal flooding. Its rapid industrialization and consequent pollution means that China, like other developed countries, will increasingly need to import technologies and innovative solutions for environmental management. Resource scarcity and environmental deterioration pose global threats that no state will be able to solve alone, thus placing a further premium on political integration and cooperative institution building. Analogies between the nineteenth century and the twenty-first are based on a severe mischaracterization of the actual conditions of the new era. The declining utility of war, the thickening of international transactions and institutions, and emerging resource and environmental interdependencies together undercut scenarios of international conflict and instability based on autocratic-democratic rivalry and autocratic revisionism. In fact, the conditions of the twenty-first century point to the renewed value of international integration and cooperation.

#### Nuclear weapons deter all war – empirics prove

Tepperman, LL.M. in International Law from NYU, former Managing Editor of Foreign Affairs, 2009

(Jonathan, 8-28-9, The Daily Beast, “Why Obama Should Learn to Love the Bomb,” <http://www.thedailybeast.com/newsweek/2009/08/28/why-obama-should-learn-to-love-the-bomb.html>, accessed 7-14-13, EB)

A growing and compelling body of research suggests that nuclear weapons may not, in fact, make the world more dangerous, as Obama and most people assume. The bomb may actually make us safer. In this era of rogue states and transnational terrorists, that idea sounds so obviously wrongheaded that few politicians or policymakers are willing to entertain it. But that's a mistake. Knowing the truth about nukes would have a profound impact on government policy. Obama's idealistic campaign, so out of character for a pragmatic administration, may be unlikely to get far (past presidents have tried and failed). But it's not even clear he should make the effort. There are more important measures the U.S. government can and should take to make the real world safer, and these mustn't be ignored in the name of a dreamy ideal (a nuke-free planet) that's both unrealistic and possibly undesirable. The argument that nuclear weapons can be agents of peace as well as destruction rests on two deceptively simple observations. First, nuclear weapons have not been used since 1945. Second, there's never been a nuclear, or even a nonnuclear, war between two states that possess them. Just stop for a second and think about that: it's hard to overstate how remarkable it is, especially given the singular viciousness of the 20th century. As Kenneth Waltz, the leading "nuclear optimist" and a professor emeritus of political science at UC Berkeley puts it, "We now have 64 years of experience since Hiroshima. It's striking and against all historical precedent that for that substantial period, there has not been any war among nuclear states." To understand why—and why the next 64 years are likely to play out the same way—you need to start by recognizing that all states are rational on some basic level. Their leaders may be stupid, petty, venal, even evil, but they tend to do things only when they're pretty sure they can get away with them. Take war: a country will start a fight only when it's almost certain it can get what it wants at an acceptable price. Not even Hitler or Saddam waged wars they didn't think they could win. The problem historically has been that leaders often make the wrong gamble and underestimate the other side—and millions of innocents pay the price. Nuclear weapons change all that by making the costs of war obvious, inevitable, and unacceptable. Suddenly, when both sides have the ability to turn the other to ashes with the push of a button—and everybody knows it—the basic math shifts. Even the craziest tin-pot dictator is forced to accept that war with a nuclear state is unwinnable and thus not worth the effort. As Waltz puts it, "Why fight if you can't win and might lose everything?" Why indeed? The iron logic of deterrence and mutually assured destruction is so compelling, it's led to what's known as the nuclear peace: the virtually unprecedented stretch since the end of World War II in which all the world's major powers have avoided coming to blows. They did fight proxy wars, ranging from Korea to Vietnam to Angola to Latin America. But these never matched the furious destruction of full-on, great-power war (World War II alone was responsible for some 50 million to 70 million deaths). And since the end of the Cold War, such bloodshed has declined precipitously. Meanwhile, the nuclear powers have scrupulously avoided direct combat, and there's very good reason to think they always will. There have been some near misses, but a close look at these cases is fundamentally reassuring—because in each instance, very different leaders all came to the same safe conclusion. Take the mother of all nuclear standoffs: the Cuban missile crisis. For 13 days in October 1962, the United States and the Soviet Union each threatened the other with destruction. But both countries soon stepped back from the brink when they recognized that a war would have meant curtains for everyone. As important as the fact that they did is the reason why: Soviet leader Nikita Khrushchev's aide Fyodor Burlatsky said later on, "It is impossible to win a nuclear war, and both sides realized that, maybe for the first time." The record since then shows the same pattern repeating: nuclear-armed enemies slide toward war, then pull back, always for the same reasons. The best recent example is India and Pakistan, which fought three bloody wars after independence before acquiring their own nukes in 1998. Getting their hands on weapons of mass destruction didn't do anything to lessen their animosity. But it did dramatically mellow their behavior. Since acquiring atomic weapons, the two sides have never fought another war, despite severe provocations (like Pakistani-based terrorist attacks on India in 2001 and 2008). They have skirmished once. But during that flare-up, in Kashmir in 1999, both countries were careful to keep the fighting limited and to avoid threatening the other's vital interests. Sumit Ganguly, an Indiana University professor and coauthor of the forthcoming India, Pakistan, and the Bomb, has found that on both sides, officials' thinking was strikingly similar to that of the Russians and Americans in 1962. The prospect of war brought Delhi and Islamabad face to face with a nuclear holocaust, and leaders in each country did what they had to do to avoid it. Nuclear pessimists—and there are many—insist that even if this pattern has held in the past, it's crazy to rely on it in the future, for several reasons. The first is that today's nuclear wannabes are so completely unhinged, you'd be mad to trust them with a bomb. Take the sybaritic Kim Jong Il, who's never missed a chance to demonstrate his battiness, or Mahmoud Ahmadinejad, who has denied the Holocaust and promised the destruction of Israel, and who, according to some respected Middle East scholars, runs a messianic martyrdom cult that would welcome nuclear obliteration. These regimes are the ultimate rogues, the thinking goes—and there's no deterring rogues. But are Kim and Ahmadinejad really scarier and crazier than were Stalin and Mao? It might look that way from Seoul or Tel Aviv, but history says otherwise. Khrushchev, remember, threatened to "bury" the United States, and in 1957, Mao blithely declared that a nuclear war with America wouldn't be so bad because even "if half of mankind died … the whole world would become socialist." Pyongyang and Tehran support terrorism—but so did Moscow and Beijing. And as for seeming suicidal, Michael Desch of the University of Notre Dame points out that Stalin and Mao are the real record holders here: both were responsible for the deaths of some 20 million of their own citizens. Yet when push came to shove, their regimes balked at nuclear suicide, and so would today's international bogeymen. For all of Ahmadinejad's antics, his power is limited, and the clerical regime has always proved rational and pragmatic when its life is on the line. Revolutionary Iran has never started a war, has done deals with both Washington and Jerusalem, and sued for peace in its war with Iraq (which Saddam started) once it realized it couldn't win. North Korea, meanwhile, is a tiny, impoverished, family-run country with a history of being invaded; its overwhelming preoccupation is survival, and every time it becomes more belligerent it reverses itself a few months later (witness last week, when Pyongyang told Seoul and Washington it was ready to return to the bargaining table). These countries may be brutally oppressive, but nothing in their behavior suggests they have a death wish.

#### Miscalculation is unlikely and doesn’t escalate

Mueller, professor of Political Science at Ohio State University, 2010

(John, Atomic Obsession: Nuclear Alarmism from Hiroshima to Al-Qaeda, p. 100, EB)

However, even if a bomb, or a few bombs, were to go off, it does not necessarily follow that war would result. For that to happen, it is usually assumed, the accident would have to take place at a time of high war- readiness, as during a crisis, when both sides are poised for action and when one side could perhaps be triggered—or panicked—into major action by an explosion mistakenly taken to be part of, or the prelude to, a full attack." This means that the unlikely happening—a nuclear accident—would have to coincide precisely with an event, a militarized international crisis, something that is rare to begin with, became more so as the cold war progressed, and has become even less likely since its demise. Furthermore, even if the accident takes place during a crisis, it does not follow that escalation or hasty response is inevitable, or even very likely. As Bernard Brodie points out, escalation scenarios essentially impute to both sides "a well-nigh limitless concern with saving face" and/or "a great deal of ground-in automaticity of response and counterresponse." None of this was in evidence during the Cuban missile crisis when there were accidents galore. An American spy plane was shot down over Cuba, probably without authorization, and another accidentally went off course and flew threateningly over the Soviet Union. As if that weren't enough, a Soviet military officer spying for the West sent a message, apparently on a whim, warning that the Soviets were about to attack." None of these remarkable events triggered anything in the way of precipitous response. They were duly evaluated and then ignored. Robert Jervis points out that "when critics talk of the impact of irrationality, they imply that all such deviations will be in the direction of emotional impulsiveness, of launching an attack, or of taking actions that are terribly risky. But irrationality could also lead a state to passive acquiescence:" In moments of high stress and threat, people can be said to have three psychological alternatives: (1) to remain calm and rational, (2) to refuse to believe that the threat is imminent or significant, or (3) to panic, lashing out frantically and incoherently at the threat. Generally, people react in one of the first two ways. In her classic study of disaster behavior, Martha Wolfenstein concludes, "The usual reaction is one of being unworried."32 In addition, the historical record suggests that wars simply do not begin by accident. In his extensive survey of wars that have occurred since 1400, diplomat-historian Evan Luard concludes, "It is impossible to identify a single case in which it can be said that a war started accidentally; in which it was not, at the time the war broke out, the deliberate intention of at least one party that war should take place." Geoffrey Blainey, after similar study, very much agrees: although many have discussed "accidental" or "unintentional" wars, "it is difficult," he concludes, "to find a war which on investigation fits this description." Or, as Henry Kissinger has put it dryly, "Despite popular myths, large military units do not fight by accident."

#### And nuclear war doesn’t cause extinction:

#### Nuclear Winter Theory Flawed

Ball, Professor at the Strategic and Defence Studies Centre at the Australian National University, 2006

(Desmond, May 2006, Strategic and Defense Studies Center, “The Probabilities of On the Beach: Assessing ‘Armageddon Scenarios’ in the 21st Century,” working paper, p. 4, EB)

The leading populariser of the ‘Nuclear Winter’ hypothesis was Carl Sagan, the brilliant planetary scientist and humanist. He had noticed in 1971, when Mariner 1 was examining Mars, that the planet was subject to global dust storms which markedly affected the atmospheric and surface temperatures. Large amounts of dust in the upper atmosphere absorbed sunlight, heating the atmosphere but cooling the surface, spreading ‘cold and darkness’ over the planet. He recognised that wholesale ground-bursts of nuclear weapons and the incineration of hundreds of cities could produce sufficient dust and smoke to cause a similar effect on the Earth. Sagan even postulated the existence of some threshold level— around 100 million tonnes of smoke—for production of ‘Nuclear Winter’.7 I argued vigorously with Sagan about the ‘Nuclear Winter’ hypothesis, both in lengthy correspondence and, in August-September 1985, when I was a guest in the lovely house he and Ann Druyan had overlooking Ithaca in up-state New York. I argued that, with more realistic data about the operational characteristics of the respective US and Soviet force configurations (such as bomber delivery profiles, impact footprints of MIRVed warheads) and more plausible exchange scenarios, it was impossible to generate anywhere near the postulated levels of smoke. The megatonnage expended on cities (economic/industrial targets) was more likely to be around 140-650 than over 1,000; the amount of smoke generated would have ranged from around 18 million tonnes to perhaps 80 million tonnes. In the case of counter-force scenarios, most missile forces were (and still are) located in either ploughed fields or tundra and, even where they are generally located in forested or grassed areas, very few of the actual missile silos are less than several kilometres from combustible material. A target-by-target analysis of the actual locations of the strategic nuclear forces in the United States and the Soviet Union showed that the actual amount of smoke produced even by a 4,000 megaton counter-force scenario would range from only 300 tonnes (if the exchange occurred in January) to 2,000 tonnes (for an exchange in July)—the worst case being a factor of 40 smaller than that postulated by the ‘Nuclear Winter’ theorists. I thought that it was just as wrong to overestimate the possible consequences of nuclear war, and to raise the spectre of extermination of human life as a serious likelihood, as to underestimate them (e.g., by omitting fallout casualties). The current US-Russian nuclear forces The sizes of the US and Russian nuclear stockpiles have declined substantially since the end of the Cold War. They now have only about 20 percent of the peak number of around 70,000 in 1986, when the Soviet Union had about 45,000 and the United States about 24,000 (down from a peak of 32,500 in 1967), of which 33,800 and 10,550 respectively were classed as tactical or ‘theatre’ weapons and 11,200 and 13,450 as strategic. Most of the tactical and theatre weapons have been dismantled and the numbers of strategic weapons halved.

#### No Impact to Fallout

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(Brian, May 1984, Scientists Against Nuclear Arms Newsletter, “Extinction politics,” number 16, p. 5-6, EB)

The promotion of beliefs in massive death and destruction from war has been an important facet of the efforts of many peace movements. In the 1930s, British military planners estimated the effects of aerial bombardment by extrapolating linearly from the very limited experience of bombardments and casualties in World War I. On the basis of such assumptions, people such as Philip Noel Baker in the 1930s predicted the obliteration of civilization from war. But the experience of World War II showed that the 1930s military expectations of casualties per tonne of bombs were sizeable overestimates.[1] By the 1950s, a large number of people had come to believe that the killing of much or all of the world's population would result from global nuclear war. This idea was promoted by the peace movement, among which the idea of 'overkill' - in the sense that nuclear arsenals could kill everyone on earth several times over - became an article of faith. Yet in spite of the widespread belief in nuclear extinction, there was almost no scientific support for such a possibility. The scenario of the book and movie On the Beach,[2] with fallout clouds gradually enveloping the earth and wiping out all life, was and is fiction. The scientific evidence is that fallout would only kill people who are immediately downwind of surface nuclear explosions and who are heavily exposed during the first few days. Global fallout has no potential for causing massive immediate death (though it could cause up to millions of cancers worldwide over many decades).[3] In spite of the lack of evidence, large sections of the peace movement have left unaddressed the question of whether nuclear war inevitably means global extinction. The next effect to which beliefs in nuclear extinction were attached was ozone depletion. Beginning in the mid-1970s, scares about stratospheric ozone developed, culminating in 1982 in the release of Jonathan Schell's book The Fate of the Earth.[4] Schell painted a picture of human annihilation from nuclear war based almost entirely on effects from increased ultraviolet light at the earth's surface due to ozone reductions caused by nuclear explosions. Schell's book was greeted with adulation rarely observed in any field. Yet by the time the book was published, the scientific basis for ozone-based nuclear extinction had almost entirely evaporated. The ongoing switch by the military forces of the United States and the Soviet Union from multi-megatonne nuclear weapons to larger numbers of smaller weapons means that the effect on ozone from even the largest nuclear war is unlikely to lead to any major effect on human population levels, and extinction from ozone reductions is virtually out of the question.[3] The latest stimulus for doomsday beliefs is 'nuclear winter': the blocking of sunlight from dust raised by nuclear explosions and smoke from fires ignited by nuclear attacks. This would result in a few months of darkness and lowered temperatures, mainly in the northern mid-latitudes.[5] The effects could be quite significant, perhaps causing the deaths of up to several hundred million more people than would die from the immediate effects of blast, heat and radiation. But the evidence, so far, seems to provide little basis for beliefs in nuclear extinction. The impact of nuclear winter on populations nearer the equator, such as in India, does not seem likely to be significant. The most serious possibilities would result from major ecological destruction, but this remains speculative at present. As in the previous doomsday scenarios, antiwar scientists and peace movements have taken up the crusading torch of extinction politics. Few doubts have been voiced about the evidence about nuclear winter or the politics of promoting beliefs in nuclear extinction. Opponents of war, including scientists, have often exaggerated the effects of nuclear war and emphasized worst cases. Schell continually bends evidence to give the worst impression. For example, he implies that a nuclear attack is inevitably followed by a firestorm or conflagration. He invariably gives the maximum time for people having to remain in shelters from fallout. And he takes a pessimistic view of the potential for ecological resilience to radiation exposure and for human resourcefulness in a crisis. Similarly, in several of the scientific studies of nuclear winter, I have noticed a strong tendency to focus on worst cases and to avoid examination of ways to overcome the effects. For example, no one seems to have looked at possibilities for migration to coastal areas away from the freezing continental temperatures or looked at people changing their diets away from grain-fed beef to direct consumption of the grain, thereby greatly extending reserves of food.