

Winter CSSP meeting focuses on hot button issues

Climate change: political meets physical By Gaylen Bradley, CSSP Board

The weather was crisp but not inclement. The CSSP winter meeting participants were fully awake after their walks from the hotel to the American Chemical Society headquarters, but appeared to have no desire to leave the sessions to tour museums. Indeed the importance of this meeting and the quality of the presentations were sufficient by themselves to hold everyone's attention. With substantial changes in legislative and executive government offices underway, much of the conference was devoted to opportunities and challenges facing scientific societies and their leadership. Among them were the worldwide economic crisis and the failure of the United States to remain economically competitive in the world market.

CSSP 2008 Chair Peter Jumars opened the meeting by addressing strategies and challenges for improving the future, using consequences of climate change as a platform. He asked the attendees to think about the definition of "conservation" in a world where substantial new combinations of habitats (in terms of rainfall, runoff and seasonality patterns) have been created. He noted that the European settlers introduced many of the species that have been established for centuries in North America; for example, honey bees. He asked what species are to be maintained and what depleted species are to be restored in a given habitat. He challenged attendees to define sustainability in a world whose human population continues to climb. Does it refer to the population that can be maintained at a survival level, or maintaining the quality of life of a population?

Jumars turned to CSSP issues, encouraging members to contact their Congressional delegations about science-based policies, to send succinct science articles to Congressional staff, and to write to their Representative when a grant is funded to thank him/her and tell him/her how the funds will be used and how they will benefit the district.

CSSP President Martin Apple followed Jumar's presentation with his call for formulating grand challenges to lead us out of the current economic crisis. The six areas of concern were the economy, the environment, education and how these interfaced with the national agenda, politics and leadership. He reviewed the current economic crisis with a projected deficit of \$1 trillion, and a trade deficit of \$665 billion. Growth in world population between 1950 until now drops the amount of grainland from .55 acres per person to .25 acres per person. France, Japan and Germany produce 250-350 metric tons of carbon dioxide per \$1 million of gross domestic product whereas the USA, Canada and Mexico produce 600-800 metric tons per \$1 million of gross domestic product. Climate change, brought about in large part by human activities, now threatens biological diversity, food production, drought, flooding, and deterioration of quality of life. Workers will have 10 jobs during their career(s), competition will be global, and organizations will be networked. The grand challenges were identified as restoration of land and water, population control, sustainable energy, sustainable fresh water, proficient math and science education, food security, economic growth not based on environmental exploitation, use of new knowledge for the common good, control of infectious and chronic disease and finding new solutions to learning and problem solving. Although public goodwill for science is high, this is not accompanied by financial investment in science. In order to thrive in the changing environment, individuals, scientific societies, universities and businesses must act with a sense of urgency, pull together, develop new strategies, seek understanding and commitment, remove barriers to action, act to achieve some short-term goals, persevere in implementing change and replace traditions with new behaviors. Our challenge is to promote the broader vision for science to make our lives healthier, the economy stronger, our environment cleaner and our society more secure.

Eugene Rosa spoke on risk perceptions and climate change behaviors. During the past decade essentially all constituencies have agreed that human activities are contributing to climate change. Climate change reciprocally impacts food, housing, transportation, consumer goods and services. A number of barriers were identified: growth in consumer demand, too many "free riders," social and psychological barriers to change, and ideological and political values.

Don Treffinger spoke on enhancing teaching and learning of creativity skills. He asked if we can teach people to think creatively, or if it is an innate skill. He also pondered what works best for whom and in what environment. A necessary element of critical thinking is to think about your thinking -- is it working?

James Evans gave examples of how e-publishing narrows science and scholarship. Online journals serve more information to more dispersed audiences, and are more efficient to search. Scientists tend to search electronically and follow links rather than browse or read. Evans has found that as more journal issues come online, the articles cited tend to be more recent, but fewer journals and articles are cited. A consequence of online journals is that scientists know more about less.

Duff Gillespie discussed the environmental factors that will limit population growth. During the past 200 years, the world population has increased six-fold; carbon dioxide emissions increased 20-fold; energy use 35-fold and gross domestic product 70-fold. During the past five decades, the number of births per woman globally has decreased from 5.3 to 2.7, but the annual population growth rate continues to increase, from 48 million in 1950 to 79 million now.

Clayton Christensen closed the Saturday program with a provocative analysis of the innovator's dilemma. He illustrated how established businesses got into serious economic problems. A well-known computer company produced its circuit boards and memory chips, designed the circuitry, assembled the components, packaged and shipped the finished computer, and marketed the brand-name computer. The company found it could save money by outsourcing the production of circuit board and memory chips to a company in a developing country. The profit margin for making the circuit boards was small, so by outsourcing, the company's return on investment increased. Managers of the offshore company offered to take on more and more work when it came to updating and assembling the computer. The executives were rewarded for their skill in negotiating agreements that required no manufacturing, only marketing of the brand name computer. The offshore company however approached a major electronics outlet distributor, and proposed that they had the capability to produce and deliver a quality computer at a low price, and all they needed was the store's name to distribute is to mutual economic benefit. The electronics outlet agreed, and they entered into a very successful venture. The brand name computer now had no source for its merchandise, and was forced into bankruptcy.

Sunday morning, Boris Groysberg analyzed the portability of stardom and explored the difference between men and women. He used two case studies: one based upon professional football and one based upon Wall Street analysts. In professional football, the punter and field goal kicker are largely solo performers. Their stardom is based upon strength for distance and accuracy. They are able to switch employers (teams) and continue to perform at a high level. The success of receivers however is dependent upon the quarterback and the offensive line. Star receivers are likely to underperform when they change teams. The parallel in science is that star scientists usually underperform when they change jobs in academia unless a team relocates together. Groysberg then presented stage one of a case study, which was that a star Wall Street analyst was offered a new job. Groysberg asked if the group thought she ought to take the new position and the group split evenly between yes and no. He then revealed that the analyst did take the position, and asked the group to predict the outcome. The group discussed the analyst's work strengths and personality, and the environment of the new employer. Because the analyst was a solo high performer, the analyst made a successful transition for five years, but the abrasive personality was disruptive in the new company, which prized team work, and the analyst left the second employer.

As is customary, the members of CSSP spent Sunday morning in committees. The committee on energy, population and the environment proposed a resolution opposing corn-ethanol based on severe water quality effects and questionable benefit for greenhouse gases. The committee also proposed, "Any climate-response strategies should be evaluated in terms of their net benefit on environmental integrity, and this evaluation should be firmly based on best-available, peer-reviewed science." The committee on information technology and scholarly publications concluded, "In a time of change (e.g., political and technological), it is important that scholarly societies re-examine and newly articulate their core missions and prune traditional but non-viable practices, and adopt new, more vital ones. Assessment and dissemination of new ideas will likely remain core, however, the methods of doing so are changing." The committee on diversity and science careers asks each member society of CSSP to send an email message to Martin Apple (cssp@acs.org) or Bill Dahl (wdahl@botany.org) itemizing 1) what they are doing to increase membership diversity (age, international, ethnic, etc.); 2) what works; and 3) what do they see as challenges and opportunities. The societies are requested to respond within 6 months so this can be addressed at the May 2009 meeting. The committee on science and mathematics education suggests that CSSP focus on science education be shifted from high school to the middle school. It is proposed that the Federal government should make environmental education a high priority in the reauthorization of the Elementary and Secondary Education Act and provide an opportunity for all students to gain the essential skills that will enable them to contribute to a more environmentally sustainable future. The international science committee expressed concern about continuing problems with visa for visitors and trainees, the new policy that requires international scientists to register on-line one month prior to attending a meeting in the USA, and the need to enhance support for international exchange programs. The ethics committee discussed conflict of interest and authorship/attribution. No new recommendations were proposed. The committee on government and public policy examined "Barack Obama and Joe Biden's Plan for Science and Innovation." The committee concluded that there is a need to ensure that scientific/technological goals represented in the Plan are aligned with the budget requests to Congress. The committee on public understanding and appreciation of science proposed that there be a focus on the quality of science and mathematics education with an emphasis on social networking around the doing of science. It was deemed critical to link out-of-school experiences to the home and school. There was a call for increased 'citizen science.'

After the committee meetings on Sunday, the group returned to formal presentations on various aspects of sustainable environment and education. Russ Jones described very high efficiency photovoltaics. Boeing Spectrol Lab claims a conversion efficiency of greater than 40%. The efficiency in 1960 was 12%, in 1970 15%, in 1980 and 1990 18%, and in 2000 25%. The high efficiency photovoltaic cells use concentrators of the solar energy so smaller cells can be used. A 10-meter parabolic concentrator could produce 36 kilowatts, enough to run 36 refrigerators. The concentrators must be able to track the sun, and the heat potentially will 'burn out' the cell. Theoretically concentrators totally 100 km X 100 km could meet the USA need.

Mario Biondini examined plant roots, 3-D models and water conservation. About 37.5 million acres of land have been restored to native grass. In restoration projects, it is necessary to know what grasses will survive, thrive, and retain soil

moisture. He reported that root mass correlates with root volume, that nutrient uptake is inversely related to root radius and that mycorrhiza contributes to adsorption of nutrients. He asked in his research what diameter of root maximizes water uptake, and how many branches increase water uptake. The most stable grassland is a mixture of native grasses with some broad leaf plants mixed in.

Bridget Chisholm focused on the environmental impact of meetings, including scientific conferences. Trade shows are second only to construction in creating waste. A five-day meeting uses 62,500 plates, 87,500 napkins, and 75,000 cups and cans. To reduce wastes, Chisholm recommended eliminating bottled water and making it available in pitchers or jugs, and substituting tea and lemonade for canned beverages. She indicated that these measures saved money as well; for example, at a 1000 person 4-day meeting, \$4,000 by using online registration, \$13,000 on water, and \$10,000 by eliminating carpeting from the exhibit hall. She suggested that hotels be encouraged to not change sheets and towels for the duration of the meeting except on request.

Margaret Anderson continued the theme, by encouraging use of virtual meetings. She described her experience in leading international teams. She indicated that telephone and email remained cost effective, but cautioned that email was easily misunderstood. She found videoconference too expensive for routine use, and complicated by the need to go to a videoconferencing site. Anderson offered guidelines for holding a virtual meeting: set clear goals, have timelines, have updates, have them on a regular schedule, but she observed that the leader also needs to be available outside regular hours. In international meetings, mutually acceptable times must be found, and the speakers must avoid use of colloquialisms. Virtual meeting should be no longer than 60 minutes and have about a dozen participants.

Anita Jones spoke on resource allocation for federal agency research. She pointed out that Thomas Edison had recommended funding of the Office of Naval Research, so federal investment in research is not new. Federal funding of research is based upon national need and security (health and prosperity). NSF was established to create and maintain science capacity, which includes trained people, instrumentation and facilities. Every federal agency is mandated to maintain capacity relevant to its mission, without limitation to discipline. Jones rated the Departments of Defense and Energy, and NSF as having a good record. She indicated that NIH does not follow its guidelines and fails to support relevant capacity across disciplines. She did indicate that NIH did a good job in funding people.

Sunday evening, CSSP recognized Linda Darling Hammond, Stanford University, for her research on education, and Craig Barrett, Chairman of INTEL, for support of science.

Arthur Levine spoke about the future mathematics and science teachers. He pointed out there was a great need for math and science teachers, and a great competition for them. There is however a debate as to what do you need to do to be a math teacher. He described the program of the Woodrow Wilson Foundation to enhance capacity. The Woodrow Wilson Foundation initially provided fellowships, but now has as its goal to increase the number and quality of mathematics teachers. The new programs have focused on Indiana and Ohio.

Angelos Pangratis, Deputy Head of the European Commission spoke about China, India USA and the EUs strategies. He questioned the impression that the EU and the USA are losing manufacturing to China. In deed, the EU had a trade surplus in 2007. The imports into the EU are industrial materials that allow the EU to add quality and value to goods. He concluded that China has its own problems, including a state monopoly that has overinvested in some sectors. He also questioned the quality of products, the lack of high technology capacity, uncontrolled urbanization, deteriorating water and air quality and the need for venture capital. He noted that the EU is a major investor in India. There have been difficulties in negotiating agreements with India, in part because of India's lack of action on climate control. Another concern is India's nuclear arsenal and the tensions with Pakistan. The EU will continue to seek more engagement with India on global issues.

Debra Stewart spoke about global education and the Banff principles. In 1985 there were 20,000 entering US doctoral students in science and engineering and 5,000 international students, and in 2006 30,000 US and 25,000 international. The European Union had 10,000 in 1985 and 20,000 since 2000. Asia (India and China) had 7,500 science doctoral students in 1985 and 20,000 in 2006. Although transnational research is thriving, global graduate education is fragile. In research English has become the universal language but in education the national languages are used in teaching. The Banff principles are as follows: respect and learn from different programs; promote the quality of graduate programs; develop global career competencies and awareness; encourage innovation in programs; clarify and strengthen the role of the masters program; promote high quality inter-university collaboration; review and understand global flow of graduate students and post-doctoral fellows; engage stakeholders (employers, policy makers and university); and establish an inclusive global platform for discussion of best practices.

The final series of formal presentations focused on key emerging issues. Charles Vest from the National Academy of Engineering made suggestions on meeting our new globalization challenge. Raymond Orbach, the Undersecretary for Science in the Department of Energy discussed rapid advances in renewable energy systems, rapid progress on increasing efficiency of generating electricity from sunlight, advances in producing biofuels, and novel science and technology for generating hydrogen from water.

David Rejeski from the Woodrow Wilson International Center for Scholars asked what should be our future nanotech policy? Rejeski reviewed the evolution of products into a new generation of materials, a likely trillion dollar market worldwide, policy issues of having 1000 products on the market mostly textiles, cosmetics and materials in contact with our skin, and the poorly documented (too little R&D money on this topic) nanotoxicology,

Gary Marchionini, President-Elect of the American Society for Information Science & Technology discussed the new ways people are using social network sites and the potential impacts on our CSSP societies and how to harness them.

Those attendees able to stay Tuesday participated in a breakfast in the Rayburn House Office Building. This was a historic time as the debate over the 'bail-out' of the US auto industry had become quite tense.