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Monday, May 12, 2008

To: Tony Frank, Senior Vice President and Provost

From: Task Force for a School of the Environment
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Our Task Force met each week this semester in response to your charge for us to consider the potential opportunities for a Colorado State University School of the Environment. We focused on the big picture of what the university needs to strengthen its contributions to global environmental problem solving, and a consensus emerged in terms of the School's vision, mission, and goals. We produced a report that summarizes our vision, and invited faculty from across the institution to provide feedback during a 2-hour workshop. We incorporated major suggestions into our report, and we attach the detailed comments.

In our report, we present a vision and mission for the School, and discuss the opportunities for our campus in the areas of scholarship, interdisciplinary education, engaging sustainable communities. We present a set of metrics for success of such a new unit, and provide some details on structural characteristics that we feel will need attention as the unit develops. We conclude with some next steps that can be addressed at once.

Below, we would like to emphasize a few key points.

First, our group is genuinely excited about the opportunities for advancing CSU's environmental capabilities in progressive ways that stretch beyond our current boundaries. We spent many hours together, and despite our disparate perspectives, we reached a solid consensus that a horizontal institutional "School of the Environment" could launch a new dimension of success at CSU.

Second, the diverse group of about 40 faculty members who attended our workshop was very enthusiastic about our ideas and the School's potential. Based on these initial reactions, we are reasonably confident that the School as described in the report would be supported by the campus community.

Finally, while we did not design the administrative characteristics of the School, we did develop a set of structural characteristics that would be necessary to meet the stated goals. Importantly, the School would not duplicate College and Department functions, but rather provide new opportunities, enabling faculty, students, and staff to more effectively work across unit boundaries. To fuel broad participation and support from those units, the School's accomplishments must reflect on the contributing colleges and departments. To ensure mutual benefits, very careful consideration will need to be given to the structure of the relationships between the School and the university's existing Colleges/Departments (see attached article).

Thank you very much for the opportunity to participate in this effort. We are excited about this new direction, and we learned a lot from one another. Even this effort has allowed us to forge new relationships that stretch across disciplines, and we look forward to building on those interactions in the future.

A School for Environmental Studies at Colorado State University
Task Force Report
May 12, 2008

Background

Humans have an unprecedented impact on the global environment, and our future depends on our environmental interactions. These changes are new, emerging, interactive, occurring at a much more rapid rate than humans have previously confronted, and they are not easily studied by traditional university settings. This will require universities to forge new structures to accelerate innovative research, education and communication. As the primary force behind environmental change, humans will dictate the quality of the environment and its ability to sustain life. A comprehensive understanding of the environment, upon which sustainable human actions can be based, must be capable of providing solutions for problems associated with

(1) human impacts on the environment today,
(2) coupled human-natural drivers of environmental change, and
(3) impacts of environmental change on humans and animals.

Our highest priority should be placed on stimulating research aimed at developing such knowledge and ultimately guiding human-environment interactions in sustainable ways.

Universities have traditionally been structured "vertically" via colleges and departmental units. This organizational approach can result in barriers, both real and perceived, to the interdisciplinary approaches necessary for solving the complex environmental problems facing us today. Although CSU has been at the forefront of developing creative ways to cross vertical boundaries (e.g., GDPE, Superclusters), much more can be done to create an optimal organizational structure for studying environmental problems. Our university has been recognized for numerous accomplishments in sustainable energy and environmental issues. Those accomplishments have largely been individual or intradepartmental. Operationally, a team approach to rigorously generating and effectively disseminating knowledge, facilitated by strong leadership and innovative approaches, will allow our university to significantly increase our environmental research output and recognition. Indeed, the breadth and complexity inherent in dealing effectively with issues of the environment dwarfs anything CSU (and likely any other university) has attempted in the past. Every college, and at least some faculty from every department at CSU, should have a stake in the creation and health of a more "horizontally" organized structure: a School of the Environment. Such an entity would harness CSU's strong capabilities in environmental studies and focus our energies on addressing global environmental problems. Further, the school will better prepare CSU students for environmental leadership roles by providing them with an extensive environmental education.

We see additional structure as raising our ability to work effectively in a variety of ways. Currently, research efforts are PI or largely small-team based initiatives, driven by individual faculty or groups identifying opportunities to direct their expertise. We envision that a School could enable us to be much more pro-active, bringing a problem-based focus to our campus. Faculty could be more encouraged and better rewarded for

engaging in such interdisciplinary endeavors. Prominent individuals could be attracted to our campus for short- or long-term visits, because of the excitement and effectiveness of our structure for supporting interdisciplinary approaches to problems. Leadership would be charged with facilitating broader themes of activity, requiring larger teams not likely to emerge on their own, and optimally harnessing our faculty's energies to solve the bigger and more challenging problems that are now confronting us. We see this as especially important as our complex global problems increasingly require broader interdisciplinary faculty groups to assemble and be productive.

Similarly, curricular efforts are hampered by a lack of common purpose and oversight. Identifying gaps in our educational offerings in an area as broad as environmental studies require a School's faculty to determine what is needed, which Colleges or Departments should be encouraged to offer it, and when. When a need is identified, there may be several units open to generating courses, and a School could provide coordination and advice on overlaps and requirements so that our students are not presented with a confusing array of unorganized opportunities (even though all may be good individual experiences). A School could provide the campus leadership in marketing our curricular offerings, making it easy and seamless that all students and advisors know what we offer, where, when, and how.

Finally, a key element of the vision for such a School would be to dramatically enhance our campus' ability to solve practical problems with innovative ideas and energy from faculty, staff, and students. We see our campus as generating ideas with real purpose, effecting translational research with clear links to community applications and both global and local impact. Traditional commercialization modes may be appropriate for some of this, but it is likely that effective partnering with NGOs, governments (at all levels), and foundations will be necessary and welcome.

Vision

Colorado State University will have a School of the Environment, focused on scholarship, that will:

- conduct the innovative research that leads to the knowledge and understanding necessary to solve our most pressing human-environmental problems;
- provide a challenging, integrative, and provocative environmental education for students around the world, at all levels, to learn the principles and the practices of sustaining our environment;
- assist partner groups, communities, institutions, local, national, and international governments, NGOs and industry in translating our discoveries into practical solutions to environmental problems

as befitting a great Colorado land-grant institution with a global perspective.

Mission of the School

The School will:

- be a magnet for excellence at CSU, and will provide both an external and an internal focus for activities in environmental studies;

- provide an organizational structure that can link the proven talent in residence at CSU in focused and dedicated ways to tackle the most pressing issues related to the environment;
- provide our best faculty with the resources and time necessary to be successful in solving these problems; and
- support our faculty in creating and sustaining outstanding educational and outreach programs addressing environmental topics, in partnership with our Colleges, government, communities, and industry, with a view to translating research into positive and practical change.

Goals

1. The School will support a scholarly environment that leads to ground-breaking knowledge generation through multi-investigator teams focused on human-environmental systems;
2. The School will enable our top scholars to disseminate that knowledge through interdisciplinary state-of-the-art learning opportunities for all CSU students on campus that includes an environmental literacy program that benefits both students and citizens at large;
3. The School will nurture a vibrant campus and local community that focuses on sustainable human-environment interactions - adopting a model that knowledge gained from local actions will have global impacts.

Achieving these goals will result in CSU being recognized as the leader in environmental problem solving and will help build sustainable human-environmental systems through the generation and dissemination of new knowledge, ultimately producing a new generation of informed citizens.

The Scholarly Environment:

Highly successful scholarly environments rely upon faculty members who are extraordinarily creative and are encouraged to express their creativity to tackle the complex issues of their discipline. These scholars must have sufficient infrastructural resources, access to their colleagues, and time to move their field forward. By virtue of already being a strong research and teaching university, particularly in the disciplines related to human/animal/environment interactions, CSU is well-placed to generate such an integrated scholarly community. Certainly some level of new resource investment will be necessary, but much of the infrastructure necessary for this program (labs, field sites, analytical equipment, educational and outreach venues and technology) already exists.

For this School to be a success, what faculty truly need is more time to focus on the study of the environment, allowing them to express their creativity in collaboration with their colleagues in ways that enhance both knowledge generation and dissemination. The key requirements for such a scholarly environment will include:

- a research atmosphere that enhances collaboration and interaction beyond the abilities of a single individual, while nourishing and promoting creative thinking and ideas;
- strong leadership with a vision of what is necessary to make progress in dealing with issues of the environment, and capable of directing efforts to acquire necessary resources and developing internal and external relationships;
- individual faculty who have an institutional status that allows them to confidently commit to dedicating years of effort to problems that are complex in nature; and
- an institutional structure that provides the above.

Evidence that the School is meeting its primary knowledge generation mission would be the self-assembly of cross-College research teams focused on tackling complex human-environment issues, successful extramural funding of the research proposed by these teams, and the global dissemination of new knowledge to other scholars, policy-makers, students, and the public.

Interdisciplinary Education in the Environment:

Despite Colorado State University's very broad expertise in environmental disciplines, we do not have an integrated, well-recognized undergraduate program in environmental science or studies. The University Catalog states "The broad spectrum of environmental studies at Colorado State is uniquely dispersed in 100 majors and concentrations housed in departments throughout the University", but there is currently no integration or roadmap for navigating among the opportunities. Clearly, we are among the strongest universities in the world with respect to our environmental scholarship and technological advances, which gives us the opportunity to truly distinguish ourselves from other programs, by producing an interdisciplinary education program that gives students the leading edge in contributing to an environmentally sustainable society.

An integrated approach to interdisciplinary environmental education could serve every student at CSU. Such a program will:

- provide the opportunity for students in any major, at any level, to connect their expertise to understanding and applying knowledge about environmental sustainability;
- integrate across existing areas of expertise to generate new interdisciplinary environmental curricular specialties; these might include majors (e.g. Environmental Science or Environmental Studies), minors, and interdisciplinary certificate programs;
- provide interested students the opportunity for experiential environmental learning opportunities working with faculty, graduate students, or community mentors; and
- bring sufficient visibility to CSU that we become the "go-to" center of the country for interdisciplinary environmental education.

Sustainable Community

The global challenge of sustainable human-environment interactions brings with it new opportunities for collaboration across disciplines, among governments, scientists and business leaders, and with those committed to innovative responses to complex ecological, social and economic issues. A vital role of the School will be to provide the leadership skills and interdisciplinary knowledge to lead to sustainable solutions from the campus community, to Fort Collins, the state, nationally, and internationally.

We envision a School that, as part of its broader mission, is committed to problem-solving approaches that include innovative partnerships with communities, businesses and the public sector. With a focus on achieving sustainable communities and organizations, the School will undertake research designed to advance capacity building, organizational effectiveness, environmental protection and resource stewardship. Students and faculty will collaborate on, and work with, on- and off-campus projects that will bring continued visibility, funding, and environmental expertise to the university. As a result, Colorado State University and the School will be seen as a nexus for research and information related to sustainability issues.

The School will:

- Catalyze the campus community of students, faculty, and staff to develop, learn about, and implement sustainable strategies for campus operations;
- Be the lead for the university in community partnerships with the city, county, local and regional businesses, and the state, in the development and implementation of place-based sustainability knowledge
- Be a nexus for information flow, both in and out of the University, providing a significantly higher level of visibility for our campus efforts, and more effective public dissemination of what we know and how well we work.

Metrics For Success

1. Faculty: The School's faculty will, as individuals, represent the highest levels of achievement in the country. They will form teams to offer exciting interdisciplinary instruction to our students, and to solve national and international problems facing our society and our planet. Collectively, they will be recognized as the most effective environmentally-focused major unit on any US campus.
    - Goal: Every department on campus has a School faculty member.
    - Goal: The number of faculty on our campus able and willing to be affiliated with the School increases by 50%.
    - Goal: Every School faculty member has a collaborator in the School, not in their home department.
    - Goal: The number of our faculty who are presidents of their professional societies, editors of major journals, NAS members, etc. increase dramatically.
2. Students: Colorado State University will be graduating the most environmentally literate population of students, and the most well-prepared students in environmentally related majors, in the country.

- Goal: Every student will have a transcriptable experience (course, seminar, field experience, internship) related to environmental studies before graduating from CSU.
- Goal: Every department offers a course that relates to environmental studies.
- Goal: The number of courses, concentrations, certificate programs, minors, and majors related to environmental studies at CSU dramatically increases.
- Goal: Every undergraduate program of study has the ability to incorporate a concentration, certificate program or minor in environmental studies, without exceeding COF credit limits.
- Goal: Every qualified and interested student at CSU has access to experiential learning opportunities (field work, internships, undergraduate research, service learning, etc.) during their undergraduate career.

3. Research: The research productivity of our School members (faculty, staff, and students) is demonstrably in the top ten of such units in the country.
    - Goal: The number of publications, citations, and presentations by our faculty increases dramatically.
    - Goal: External grant funding increases dramatically.
    - Goal: Workshops and nationally prominent seminar series on our campus increase dramatically.
    - Goal: High-Impact projects resulting from translational research efforts increase in number and effectiveness.
4. Reputation: Colorado State University will be seen across the globe as one of the few institutions to look to for study and research partnerships in environmental studies.
    - Goal: The number and quality of undergraduate students explicitly interested in environmental majors increases.
    - Goal: We successfully compete with the top institutions in the country for attracting graduate students in environmental studies to CSU.
    - Goal: We are consistently ranked in the top ten for environment and ecology studies.
    - Goal: Colorado State University is the preferred partner for government and industry in all matters related to the sustainable environment.
5. Community
    - Goal: All residents of Fort Collins have an opportunity to increase their environmental literacy through seminars and workshops offered throughout the community to all levels of audiences.
    - Goal: The city of Fort Collins and surrounding communities benefit directly from advances developed through collaborations with the School of the Environment
    - Goal: Every program within the school will have an outreach and engagement component for Fort Collins, Colorado, the US, and the world.
    - Goal: The School of the Environment will provide useable solutions on environmental issues for communities, and all students at CSU have the opportunity to work directly with communities on pressing environmental issues regardless of their disciplines.

- Goal: The School of the Environment will dramatically increase the reach of CSU into minority and lower economic communities internal and external to the US by providing useable products or management strategies
- Goal: The School of the Environment will exemplify strong environmental practices in every aspect of operation and demonstrate the value of such actions to community organizations and institutions.

6. Fundraising: The activities of the School will enable the President to successfully raise significant funds to support the School.
    - Goal: The School enjoys annual base funding sufficient to support its activities on a steady state.
    - Goal: The School has an $100M endowment in ten years.

Characteristics of the School

Our task force recommends that the following key attributes be pursued in order to achieve the goals set forth above for this School at CSU.

1. Faculty: The School will stretch across all existing Colleges and Departments, where it could attract a core of our best faculty. Core Faculty would have tenured appointments in departments and colleges, but would maintain multiple-year positions in the School, where their primary responsibility would be contributing to interdisciplinary research, education, and outreach related to the School. We imagine that these positions will ultimately be endowed positions for fixed terms (2-5 years), and could be project-related. Affiliate faculty from across the university and from partnering organizations will also contribute to scholarship and education, supported through memoranda of understanding established with departments and colleges. Explicit faculty and department/College incentives will need to be built in to the structure of the School.
2. Research: The School will foster creative and innovative interdisciplinary and transdisciplinary research. There is growing recognition in funding agencies of the the need to discover new ways of thinking, and to bring new tools and methodologies to the study of linked human-environmental problems. The School will provide a locus to address these research problems. The School will provide the organizational structure that is a magnet for identifying problems and providing collaboration among researchers across the University to tackle the most pressing issues. The School will also be a place where exciting workshops, nationally renowned scientists and working groups can come together to address these problems. The School will ensure that CSU is recognized by national and international environmental research community as being at the forefront of developing new complex research ideas, tools and knowledge for practical solutions to complex challenges via a vigorous translational research effort.
3. Education program: The School will sponsor classes and programs of study for CSU's undergraduates and graduate students - taught collaboratively by Core and Affiliate Faculty - and also offer "Inreach" to the rest of the CSU campus faculty (similar to the recent highly successful Changing Climates" effort) to assist faculty in incorporating “Issues of the Environment” into curricula across all of campus. For classes, we envision that the School would support introductory, core courses for

students desiring interdisciplinary environmental literacy in human-environment interactions; interdisciplinary foundational courses that provide deeper study of more focused material; targeted upper-division and capstone courses designed for majors related to environmental sciences; and experiential learning opportunities at all levels that tie well with multiple aspects of the curriculum. For programs of study, we see the School fostering and promoting appropriate core courses for all majors, interdisciplinary programs (with certificates) for students of any major, minors that are flexible and pair well with a variety of majors, and new interdisciplinary undergraduate majors and graduate programs that will attract students from all over the globe. A Curriculum Committee will serve to instigate, promote, and approve curricular developments.

4. Building: We recommend that a new or remodeled, state of the art, "green" building be dedicated to the scholarship, collaboration, and educational efforts associated with the School. This building would embody all of our best knowledge about sustainable building and resource use, would provide state of the art resources for research, collaboration, and active learning, and represent the hub of activity for activities related to the environment on campus.
5. Community: The School will support seminars, working groups, online resources, and workshops designed to accomplish its mission by inviting the very best scholars to address pressing scientific issues. The School will coordinate the dissemination of information about other ongoing activities on campus that are relevant to the school's goals.
6. Staff: The School will have a dedicated support staff. Administrative staff will support faculty in facilitating writing proposals (accounting, sponsored programs representative, publications assistance). There will be dedicated University Advancement experts to assist the leadership in fundraising. School advisors who are knowledgeable and dedicated to environmental disciplines will assist students in choosing academic paths that will best lead them toward their interests and future careers in environmental disciplines.
7. Institutional fit: The School will be designed to minimize potential negative impacts of shifting faculty efforts away from departments and college by instituting a number of innovative steps. There will be fixed resources to support the needs in 1-5 above, from the University to the School. Memoranda of understanding developed between the School and colleges/departments will ensure that they are rewarded for core and affiliate faculty participation, fueling enthusiastic collaborative scholarship and team teaching.

Summary and Next Steps

The School will improve Colorado State University's ability to address the great environmental challenges that will impact the future of human society. It will help identify problems and develop translational solutions that benefit the environment and society on a global scale. By integrating the strengths of people and programs across the University, the School will help in the creation of new knowledge, develop novel technologies, influence policy and government regulations, educate a new group of

environmental leaders, create an environmentally literate public, and nurture even more purposeful outreach and engagement.

We recommend that the University:

1. Allocate budget for FY'09 that will allow the creation of a School of the Environment;
2. Conduct a search for Director of the School of the Environment;
3. Charge the Director with:
    a. developing a strategic plan, budget and timeline to implement the report;
    b. establishing high visibility for CSU environmental research, education, and outreach programs; and
    c. develop a "Code" for the School of the Environment that identifies how faculty will become part of the school, how appointments will be structured and MOU’s with departments developed, and other structural issues;
4. Install the School of the Environment as a priority in the upcoming capital campaign.

SPECIAL REPORT

An indifference to boundaries

As some of the world's largest universities undergo dramatic departmental restructuring to foster interdisciplinary research, **John Whitfield** asks whether they're making the right move.

Immunologists at Imperial College London have been tripping over a sticky problem: the structures of the molecules they are working on. The obvious go-to team is the institute's strong corps of structural biologists. But the immunologists are in the division for cellular and molecular biology, whereas the structural biologists are in the division of molecular bioscience. Splitting the funding — and the credit — causes turf wars. The solution? A department of life sciences that merges three biological divisions. "We decided we needed to break the incentive to be selfish," says ecologist Ian Owens, who heads the new interdisciplinary department.

Established three months ago, the department is part of a trend at traditionally structured universities towards initiatives that foster interdisciplinary research. Harvard University — which has a reputation as a place of powerful departmental fiefdoms — and University College London are also rejigging their institutions to remove internal barriers and encourage researchers to come together in new combinations. Part of the trend springs from subject areas that have emerged over the past decade — such as global health, climate change, neuroscience and systems biology — that straddle the boundaries of older disciplines.

It is an idea pioneered by boutique institutes such as Santa Fe Institute in New Mexico, where complexity theory was developed; Bell Laboratories in New Jersey, where lasers and information theory were developed; and the UK Medical Research Council's Laboratory of Molecular Biology in Cambridge, where a group of physicists-turned-biologists pioneered molecular biology.

Social engineering

"Without any exceptions, over the past century the lead scientist on any major discovery has internalized a great deal of scientific diversity," says science historian Rogers Hollingsworth of the University of Wisconsin-Madison. He studies the types of research that lead to major breakthroughs in biomedical science — the kinds that win Nobel, Lasker or Crafoord prizes — and what gives the places that do that research their edge. Such internalization, Hollingsworth says, is most likely to happen in small institutes that have few internal barriers and flat hierarchies, where the bosses stay close to the labs. He points to Rockefeller University in New York and the California Institute of Technology in Pasadena as the exemplars of such an ethos.

UCL

Getting the right people together is important (see 'So, you want to be interdisciplinary …'), as is the physical environment. While planning for the Janelia Farm research campus in Loudoun County, Virginia, director Gerald Rubin discovered that many of the most successful research institutes valued their canteen above all other facilities, owing to the contacts it helped people to create. So Janelia Farm serves three meals a day, seven days a week — but the cafeteria is open for just 90 minutes at lunchtime, encouraging people to bump into one another. Tables seat eight people, but research groups have a maximum size of six, so they must mingle, and you pay more for take-out than eating in. There's also an on-campus pub, serving free coffee all day to deter people from brewing up in their labs, and beer and meals in the evening. "We have done a huge amount of social engineering," says Rubin.

But while distinct departments still control rewards and credentials, not everyone believes that traditional universities will achieve the interdisciplinary success of specialist institutes such as Santa Fe — or even that it is a worthwhile exercise to attempt.

"Interdisciplinary is becoming the buzzword in science, but I'm extraordinarily sceptical about what's going to result in the next 10–15 years from this," says Hollingsworth. "Large research organizations have an enormous

Escape the intellectual blinkers

Researchers working in traditional departments have several places to go to escape the grind of teaching, applying for grants and running a lab. And the demand for such places is rising, says ecologist Marten Scheffer of Wageningen University in the Netherlands, who is helping to set up two interdisciplinary institutes.

Scheffer is a founding father of the Institute Para Limes (IPL), currently being installed in a fourteenth-century monastery in Doesburg in the Netherlands. The IPL started running scientific meetings last year and plans to be fully operational by 2012, with an annual budget of €5.5 million. It will be staffed by cast of 'visitors' coming in for anything from a few days to a few months, and what they do is up for grabs, says Scheffer. "The most important thing is to bring the right mix of people together, and let it evolve."

He is also involved in setting up a similar but more focused institute in Uruguay, the South American Institute for Resilience and Sustainability Studies, which will look at issues such as fisheries, biodiversity and climate change from the broadest possible viewpoint. Like the IPL, everyone will be just visiting. Meetings should start in 2009. "We're planning to get policymakers involved at an early phase," Scheffer says. He hopes that humanities researchers, politicians and artists will also visit the institute. **J.W.**

GIANT FROG FOUND IN MADAGASCAR
'Frog from hell' fossil hints at later split of continents.
www.nature.com/news

PNAS

A. CAMPBELL; P. FETTERS/HHMI

Traditional universities such as University College London (left) are restructuring to encourage interdisciplinary research, inspired by the purpose-built Janelia Farm Research Center (top). Collaborations are fostered at canteens (Santa Fe, middle) and in the bar (Janelia Farm, bottom).

amount of inertia, and individuals have a great vested interest in the way they were trained, and what they were doing yesterday."

"It's the Walmart model of the university," complains pharmacologist David Colquhoun of University College London, who is unhappy that his department has become part of a new faculty of life sciences. "There's never been any barrier to interdisciplinary work — you can just pick up the phone or e-mail."

Publishing problems

But neuroscientist Paul Grobstein, who ran an interdisciplinary centre at Bryn Mawr College in Pennsylvania, says that traditional structures make it hard for researchers to be interdisciplinary. "Younger faculty tend to be concerned that if they get involved [in interdisciplinary work], their colleagues in the departments in charge of promotion and tenure will feel they haven't lived up to the standards of the discipline." Other problems, he says, include finding places to publish — "it's much easier for people to get published in traditional disciplinary settings" — and finding an audience. A physicist could, say, publish a paper on stock-market patterns in *Physical Review E*, but how many economists will read it is another matter.

Such problems will be difficult to address through restructuring of traditional universities. Even advocates of interdisciplinary research think that the traditional departmental model will, and should continue to be, used in the majority of cases. It is needed, for example, to support undergraduate teaching and create excellence in specialist subjects. "The drive to form disciplines is a very reasonable one," says Sean Eddy, a computational biologist working at Janelia Farm. "It's phenomenal to be part of a group of labs all thinking the same thing." But you need the alternative, he says: "There's a normal mode of science that works very well, that I wouldn't want to change. But when you're trying to crack something really new, you need people with different experiences to work together."

Rather, Hollingsworth says, the solution may be to spend a small proportion of the national research budget on many small institutions in which scientists can work with as much autonomy as possible (see 'Escape the intellectual blinkers'), Hollingsworth says. "It's easier to establish a new research organization than it is to change an older one." ■

So, you want to be interdisciplinary ...

Interdisciplinary research is not for everyone, and personality is hugely important. At the Santa Fe Institute in New Mexico, president Geoffrey West is always looking for people who have the right mindset. "You need a person with a passion for a bigger picture of science, who can see beyond boundaries and wants to see where the threads of their ideas might lead in other contexts." But, he adds, philosophy does not guarantee quality. "There are extraordinarily smart and creative people that don't care about anything outside their discipline. And there are flaky people who are interested in everything at a very superficial level."

Here are some tips:

Pay your dues Traditional disciplines give you a strong base from which to launch yourself. "If you're not well educated in a basic discipline you can't do interdisciplinary research," says Kathleen Buckley, director of academic affairs for interdisciplinary science at Harvard University in Cambridge, Massachusetts.

Listen — and explain "Traditional disciplines have very different cultures, languages, criteria for judging what's good, and even senses of what science is," says West. "It's very easy to look over at another discipline and say 'that's a bunch of rubbish' — and it's important to make sure that doesn't happen."

Be humble Meetings of minds don't work if one party does all the talking, says Marten Scheffer from Wageningen University in the Netherlands. "Having alpha-male scientists at interdisciplinary institutes is a risk," he says. "If you have one or two very dominant people it can destroy openness."

Be patient Sean Eddy of Janelia Farm in Virginia started his research career as a developmental neurobiologist. He's now a computational biologist, but it's taken him until his early 40s to learn the requisite computer science, maths and statistics. "It was slow and painful," he says. "It's only just now that I feel I'm trained enough across three or four fields that I can get something done."

Be brave Exploring new ground is risky, says Janelia Farm director Gerald Rubin. "This isn't a place for every scientist. You need a large amount of self-confidence and the willingness to take risks. We say: 'We're going to bet $10 million, and you're going to bet your career'." **J.W.**

School of the Environment

General Session Summary

(from table notes and report-out summaries)

Question 1.

Common threads: A place for fostering growth, nurturing "cross pollination", a "playground" to explore new ideas. The structure would allow new ideas while breaking down silos and creating award mechanisms for faculty involvement

Question 2.

Common threads: The three thrusts represent the mission of a land grant institution and while these core threads are intertwined and inseparable, the main focus should be on scholarship and research.

Question 3.

Common threads: Some of the big questions may be developed as multi-disciplinary teams work together but some common themes are environmental justice, climate change, water issues, sustainability, energy, resilience, and protected areas. The school should build on the existing strengthen of CSU to choose the major problems that it will address.

Question 4.

Common threads: School would be a door opener to opportunities for interdisciplinary research while expanding the tool kit for new research ideas. The new structure would provide incentives, and attract prominent people.

Question 5.

Common threads:

General Session detailed notes (duplicate entries removed and noted with star)

Question 1. Is there a value in a structure for our campus that is ore horizontal than vertical: A school of the Environment? Elaborate

- Create community—how do you break down academic silos? Top down approach?*
- Need top down approach
- Create metrics
- Opportunity for horizontal growth
- How big will umbrella be? Framework for horizontal structure*
- Transaction costs
- Magnet for opportunities/Think tank/playground of ideas*
- Combination of vertical and horizontal structure
- Physically housed together on campus/Meet at the same table to work through issues*
- Need time and reward to do this (buy-outs, sabbatical, etc)*
- Speed of response to grant proposals (quality of proposals and rapid responses)
- Already manifesting value in our efforts to organize horizontally in education and research (but on a smaller scale—the school should institutionalize the effort)
- Think-tank mentality—going on sabbatical together, access easier cross disciplinary lines
- Bring in long-term visitors/ bring in prominent people*
- Resource center (on campus) spaces for interaction, labs, demo, teaching
- Shared language, shared goal
- Creates value where it adds dimensonality but not detract from existing disciplines
- Educationally especially valuable for some particular disciplines like state, business that already have natural overlay with other (perhaps more technical) fields
- Raise profile of the university—marketing tool (good and bad)*

- Even within a department faculty don't work well across their expertise
- What is the value-added? Partially horizontal has to be partially vertical core activities persistent do to time
- Magnet for opportunities: time issue of faculty, tried not to address practical issues
- Opportunities have to outweigh costs
- Communicate within the university and collaborations between colleges—translational problems*
- Outreach to stakeholders
- Let go to create something bigger—theory of abundance
- Metrics of success
- Structure: opportunity for instruction developing curriculum structure—good for promoting education
- Academic training deep but not bound
- Different vocabularies how to create horizontal (need help to create horizontal)
- Does go on forming teams work groups, task forces takes effort to build these bridges
- Vertical versus horizontal money flow?
- Needs recognition of multidisciplinary work that is good involves increase percentage in time outside the department

Question 2. Research, education, and community engagement are the three major thrusts of the School of the Environment: What could be added? Should one be emphasized over another?

- Community = global community
- Scholarship about environmental issues should be main thrust
- Should measure whether current structure shows a larger barrier in any one area.
- Research is heart of school and scholarship a major thrust*
- Community focus is problem oriented
- Three areas mirror core areas of the university and is part of land grant mission*
- Community leaders, NGOs, Red Cross and others should be included in the conversation so statement is more broadly for all partners
- Emphasize teaching, research, outreach are not separate—some research with some interdisciplinary teaching
- Prioritization should be prerogative of individual faculty
- Should interlock and complement each other, interaction is key*
- Add money integration ability to get creativity, bring in speakers*
- Rethink tenure/promotion standards: your work may not be so valued within your department
- Administrative buy-in traditional rules don't apply
- Duplication could be issue, toes could be stepped on*
- Carve out niches
- Don't see it as an undergraduate program
- How to make it stand alone achievable but challenging*
- 46 programs do part of it
- Will require reorganization and needs to be productive bring faculty in to do something*
- Integrated reports—results of involving other departments or colleges

Question 3. What are examples of major global environmental problems that we could better address with a School of the Environment?

- There are so many potential issues allow synergies to emerge
- Need a sharp knife to concisely address
- Where relative strengths currently exist—build on those strengths*
- Environmental governance promotes the synergies, leave open-ended!
- Combine specific problem solving and synergies with new problem solving, units of existing specialties
- Environmental justice*
- Climate change*
- Parks/protected areas/habitat/animal/resource conservation
- Cognitive disabilities and the built environment
- Water scarcity/equity/contamination*
- Energy*
- food production/ transportation
- Strategic planning for innovation—human performance and sustainability
- Governance, internationally and inter-regionally
- Political and cultural practices, population pressures
- Environmentally linked diseases
- Invasive species
- Sustainability and economic development*
- Biodiversity
- Medicine
- Resilience

Question 4. How could the School of the Environment better enable you to address environmental issues

- Synergy*
- Connections
- Expand the tool kit
- Need to provide sustained support and resources to address complex questions*
- Focus around specific complicated problems
- Multi-disciplinary
- Multi-scale
- Needs to be more than a door opener become a thought generator
- Incentives to take risks—provide substitute rewards
- Cross pollination!
- Deal with problems in a focused way
- Incentives to take risks
- Reorient incentives and constraints on faculty operations

Question 5. What is the most important thing the School of Environment could do

- Solve specific problems
- Lift barriers
- Coordinate offerings to help students
- Synergy
- Clearing house for what courses exist
- Sabbatical focused on environment for visiting professors

Question 6. If we had a $100,000,000 endowment to invest in the School of the Environment, what should we do with it?

- Buying time-release time (course buy-out)*
- Create opportunities—workshops
- Speakers, conferences*
- Resources—grant writing
- Administrative support
- Place, arena, buildings*
- Seed grants to promote
- Fellowships for graduate students
- Field trips to the community (nationally and internationally)
- Website
- Town meetings
- Pilot programs
- Cost share
- Senior visiting fellowships
- Engage in act ivies/give public lectures
- Department agreements
- Supplement faculty/ scholars in residence program*
- Travel opportunities for faculty to visit Colorado communities and interact
- Spend or invest endowment
- Physical space acquisition/construction
- Endowed faculty positions and distinguished faculty chairs*
- Spend quickly on real engagement

Question 7. What do you think would get a donor excited about the School of the Environment?

- Watch out for death of environmentalism!
- Look for how futures with respect to the environment
- Senior visiting fellowships
- Choosing critical problems
- Green jobs
- PR involved in a new process
- Clear answer—take and run
- Contributing to a product like students
- Timeliness
- Wind energy and commercial applications
- Building*
- Build excellence quickly
- Emphasize solutions and opportunities (such as green jobs)
- Emphasize current strengths of environmental programs and successes
- Participate in new university structure
- Make the message right to project it*