

Stuwe *et al.* additionally addressed the interactions that anchor the Nsp1 subcomplex to the inner ring complex of the NPC. Binding of the Nsp1 heterotrimer to Nic96 was essential to target the heterotrimer to the NPC, and disruption of this binding decreased nuclear export and had severe effects on growth in the yeast *Saccharomyces cerevisiae*. Interaction between Nic96 and Nup192 of the inner ring complex was also defined and structurally characterized. Unexpectedly, disruption of the binding interface through mutation of either Nup192 or Nic96 did not displace the heterotrimer from the yeast NPC, although it led to severe growth and export phenotypes. These results suggest that additional connections will be identified between Nic96 and other nucleoporins of the inner ring, and, overall, that gaps remain in our knowledge of how these proteins make vital contributions at the NPC core.

The new structural information from Chug *et al.* and Stuwe *et al.* is a launching pad for elucidating many aspects of pore function. In particular, there is now a context for considering posttranslational modifications and processing, which occur under various circumstances ranging from progression of the cell division cycle to viral infection. These structures may also illuminate a familial mutation of Nup62 that is associated with a neurological disorder (13). The highly conserved heterotrimeric structure provides a point of reference against which new information can be compared, such as the structural basis for Nup62/Nsp1's participation in a second, independent subcomplex of the NPC (14, 15). Overall, structural information for this central subunit of the nuclear pore and new insights into its connections to other pore components represent an important stride forward in deciphering the NPC, both its architecture and its fundamental functions. ■

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## CLIMATE CHANGE

## The IPCC at a crossroads: Opportunities for reform

Increase focus on policy-relevant research

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**T**he Intergovernmental Panel on Climate Change (IPCC) has proven its value as an institution for large-scale scientific collaboration to synthesize and assess large volumes of climate research for use by policy-makers, as well as for establishing credibility of findings among diverse national governments. But the IPCC has received considerable criticism of both its substance and process. The new IPCC leadership to be elected in October could help guide the IPCC to a clear, shared understanding of future objectives and could shape procedural reforms. We identify key opportunities for reform by addressing two related questions: Is the IPCC doing the right things? Is the IPCC doing things right?

**DOING THE RIGHT THINGS?** To remain policy-relevant, the IPCC needs to shift focus and increasingly address response options to climate change. The informa-

tion base for making decisions on climate stabilization and related public policies is fragmented. Providing clear and integrated information regarding climate impacts and policy options for mitigation and adaptation at various scales (subnational, national, and international) along alternative climate stabilization pathways—and about their respective costs, benefits, and risks—would better inform decision-makers and societies about consequences associated with alternative policy choices. This does not mean that the IPCC should choose among policy options but rather provide the information to facilitate choices by policy-makers.

A major reason for this fragmentation of key information is that IPCC Assessment Reports (ARs) are organized by Working Groups (WGs) focused on the physical science of climate change (WGI), adaptation and impacts (WGII), and mitigation options (WGIII). A different organization might achieve more integrated analysis of policies. For example, one WG could focus on natural-science aspects of climate change, and a second could provide a more integrated perspective on mitigation, adaptation, and the

socioeconomic implications of impacts.

IPCC reports could also develop better understanding and assessment of climate impacts, drivers of greenhouse gas emissions, and policy options at subglobal levels. However, the approval session of the WGIII summary for policy-makers (SPM) in Berlin in 2014 revealed that such geographically specific assessments can be difficult for governments to accept (1–3).

The architecture of the climate agreement to be concluded at the United Nations Framework Convention on Climate Change (UNFCCC) conference in Paris in December will consist of voluntary pledges by governments that might be compared with one another to provide incentives for increasing levels of ambition over time. In this context, increasing the IPCC's focus on policy assessment, capitalizing on emerging literature in this area [e.g., (4–6)], would offer two advantages. First, it would facilitate learning and diffusion of lessons from climate policy experiments worldwide. Second, credible ex post empirical analysis of policies and comparison with ex ante forecasts are critical to building trust between countries continuously involved in policy negotiations (7). Also, more consideration could be given to alternative options for defining and measuring equity and efficiency in a voluntary, “bottom-up” climate regime—again building trust and possibly prompting increased mitigation ambition over time.

Increased focus on alternative public policies may bring potential for controversy between governments and researchers (1–3, 8). Governments hesitate to have their policy programs publicly scrutinized by an intergovernmental panel, and researchers may not be aware of or sensitive to value-laden and politicized questions. Governments and researchers need to carefully execute their roles at the science-policy interface in recognizing and carefully managing diverse viewpoints, without compromising scientific rigor and objectivity (3, 9).

If the IPCC shifts focus along these lines, it will need to actively encourage targeted research on selected topics for which evidence is still lacking. The next leadership of the IPCC should enhance engagement with policy researchers and modelers to help build the necessary knowledge base.

**DOING THINGS RIGHT?** In addition to building a clear, common understanding of its future focus, the IPCC must address practical and procedural problems. The Fifth AR pushed author teams and technical support units (TSUs) to their management limits. Operating single TSUs from multiple geographical locations should be avoided so as not to further complicate management tasks. Also, the high costs of time and travel commitments put at risk the participation of the best researchers. At the least, the IPCC should consider reducing the number and length of lead author meetings and making greater use of remote collaboration.

Focusing the initial scoping process on identifying policy-maker questions that the

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### *“Governments and researchers need to carefully execute their roles at the science-policy interface...”*

AR will respond to (rather than unspecified broad topics) could increase its relevance and usefulness. IPCC rules enable direct interaction between policy-makers, scientists, and other stakeholders only at the start and end of the multiyear assessment process. This limits opportunities to maximize the AR's policy relevance and address potential conflicts between researchers and government representatives. This could be improved by adding a round of interactions during the writing process. Lessons might be learned from the Structured Expert Dialogues organized during the UNFCCC's 2013–2015 review of the 2°C goal, in which government representatives held interactive question-and-answer sessions with experts from the IPCC and other organizations.

The IPCC could strengthen its process of selecting lead authors. Developing-country perspectives must be adequately represented, although scientific skills, capability, and international reputation should remain paramount. These dual goals of quality and diversity can be better achieved by more actively recruiting from the many distinguished scholars from developing countries who are working in the developed world but, nevertheless, can represent developing-country perspectives. This has sometimes been a challenge in the past. New partnerships, including with national and international academies of sciences, could support the author-nomination process.

The SPMs are the most widely referenced element of each WG report, largely because their text is negotiated and formally

approved by IPCC-member governments. The politically negotiated nature of the government-approval process at the end of each AR can lead to a dilution of key messages. Yet it would be difficult and possibly undesirable to change the SPM production process; IPCC reports are treated as authoritative partly because governments have formally accepted the SPM text. Instead of trying to change the SPM process and format, increasing the prominence of technical summaries (written solely by lead authors) would be useful. Renaming them “executive summaries” and engaging expert communicators could make them more accessible to policy-makers and the public. More clearly distinguishing between these two types of summaries could facilitate explicit acknowledgment and acceptance of divergent views that sometimes prevail between scientists and governments.

As the IPCC considered in its recent round of self-evaluation, the panel could also emphasize shorter, more-targeted reports that focus on recent research and that respond quickly and flexibly to the expressed needs of policy-makers.

**OVERCOMING INERTIA.** The new IPCC leadership will require support from governments to ensure success. The lack of government interest in major IPCC reform in the past can suggest satisfaction with its performance, but also reflects resistance to change in an organization prone to bureaucratic inertia. With its current substantive focus and procedural rules, the IPCC will have a difficult time meeting future challenges. After the UNFCCC Paris talks conclude in December, governments may have more appetite—and reason—to reconsider the IPCC's role in light of a new global climate-policy regime based on national implementation of highly heterogeneous, domestically determined policies. ■

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