major societal consequence (PHYSICS TODAY, July 2010, page 10). Ridley argues that the Royal Society and the American Physical Society should have remained silent on the issue of climate change. My view is that not taking a position would be the height of social irresponsibility and a disservice to science.

The political discourse on climate change needs to be informed by science's best tradition of evidence-based consensus and openness to alternate interpretations. Unfortunately, a cacophony of vested interests has dominated the media and the blogosphere, often giving a false impression of balance by understating the breadth of support for the consensus opinion and overemphasizing dissenting views. The consequences have been serious for such international policymaking efforts as the unproductive 2009 United Nations Climate Change Conference in Copenhagen.

If we had time to let nature run its course, we could trust the scientific process to sort things out. Unfortunately, in the case of climate change, many broadly accepted climate models predict dire economic and social consequences if governments and individuals do not take action.

Scientific societies would be derelict by not speaking out once their internal deliberations determine that such consequences lie ahead. Individual scientists who disagree with the societies' conclusions are free—in fact are obligated by scientific integrity—to put forward alternate interpretations. In that way, the societies and the individual dissenters would work together, to quote Ridley, "to serve and promote science."

I offer an example from medicine. According to Ridley's logic, the American Medical Association and other medical societies should have remained silent as evidence grew about the harm caused by cigarette smoking. Had they done so, they would have violated their principles as healers, and millions of people would have lived shorter, less healthy lives.

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Forging more effective science conferences

The benefits of scientific conferences are well known. Scientists present results of their work, discuss their ideas, and establish personal relationships. Participation, though, is often limited due to costs; for example, to attend a conference in Europe, a US attendee could pay $3000, once fees, transportation, and lodging are included. And financial barriers are even more prohibitive for scientists from developing countries such as India and Poland.

Conferences are not always as effective as they could be. Listening to a dozen or more reports each day for five consecutive days is very demanding, especially at conferences that cover wide ranges of topics. Furthermore, the benefits of listening to reports depend in part on a listener's being at least somewhat familiar with the topic.

The contribution a conference makes to scientific progress depends on many factors, such as the number and diversity of participants, breadth of coverage, logical sequence of topics, percentage of time devoted to discussion, rigidity of the schedule, and so on. I offer here a suggestion on how conference value might be increased.

I propose dividing a conference into two parts: The first would be an opportunity to read papers online and would take place over several weeks. The second part would be a shortened, two- or three-day face-to-face meeting, rather than the five-day span that is now common.

For the first part, conference organizers could establish a time period for online reading and discussion of a group of papers related by topic. Authors would be asked to make their accepted papers available for download from the conference website, for example, one month before the scheduled meeting. Participants would have time to examine papers carefully and to post questions and comments. Currently, the usual meeting schedule leaves limited time for discussion after the oral presentations. Holding preliminary discussions over the internet could resolve most scientific issues before the face-to-face meetings.

This split approach has several noteworthy advantages. One involves the reduction or even elimination of oral presentations. A conference of two or three days' duration, consisting mainly of discussions among scientists who have already read the papers, can accomplish more than a typical five-day conference that involves dozens of oral presentations and necessarily limited discussion time. The shorter in-person conferences would be less expensive and less disruptive for the scientists who must travel to attend. Furthermore, the internet-based discussion of papers would allow attendees to better narrow the scope of their attention for the face-to-face portion and therefore make the best use of their time.

Broader participation is another advantage of the internet portion of a restructured conference. Those who cannot afford to attend the in-person meeting can still participate and add their ideas to the online discussions. Today, those who cannot attend the meetings have no way to contribute to them. Personal encounters among scientists are extremely important, but better use of the internet for conferences can reduce expenses all around and broaden the pool of contributors.

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Bologna reforms in Germany

Toni Feder gave a vivid account of Europe's struggle with streamlining its higher education system under the Bologna Process (PHYSICS TODAY, May 2010, page 24). The overall goal is the establishment of the European Higher Education Area, in which program transparency and course and degree comparability and compatibility greatly facilitate mobility across Europe and attract students from abroad. The idea has seen wide acceptance. In the implementation of the Bologna reforms, however, problems have arisen, often as a result of the strong push for standardization that disregards the diversity of countries and disciplines.

Before Bologna, German universities had five-year physics programs, and the excellent reputation of the *diplom* degree resulted in very few unemployed physicists even in economically difficult times. Consequently, the German physics community initially rejected the bachelor's/master's structure of the Bologna Process. Lawmakers, however, viewed the two-tiered degree system as a welcome cost-cutting measure at public universities and made plans to accept only 30% of the bachelors into master's programs. Reducing the education of 70% of physics students to a three-year bachelor's curriculum would allow publicly funded universities to reduce faculty and cut costs, but it would also create an ill-prepared physics workforce.

After the Bologna reforms were

signed into German law, the Conference of German Physics Departments (KFP), which I represent as a spokesman, and the German Physical Society (DPG), on whose executive board I serve, played a constructive role in implementing them. The resulting recommendations for the design of three-year bachelor's and two-year master's programs were adopted by essentially all German physics departments. Therefore, Barbara Kehm's opinion in Feder's story that German scholars are resisting the dual-degree system does not apply to the physics community. Both the KFP and the DPG have made it clear that physics bachelors should continue toward a master's degree to achieve a qualification comparable with the *diplom* in physics. That recommendation was motivated by discussions with leading industry representatives, who expect physicists to have skills equivalent to those of previous *diplom* holders. Interestingly, efforts at German universities are under way to retain the name of the highly popular *diplom* degree for students who have completed their master's-level education.

German physics departments have weathered the Bologna reforms and have preserved the high quality of their programs in the transition. Much work remains to be done to fine-tune the curricula. Unfortunately, the Bologna reformers have recently opened yet another can of worms by defining the doctoral degree as the third cycle of higher education. Traditionally, the focus of the German doctoral effort in the sciences has been on research rather than classroom study. A structured PhD program would put a stronger emphasis on classroom study. Research across German universities would suffer dramatically, since doctoral candidates are the universities' primary research talent. Enhancing educational components at the expense of research activities in physics doctoral programs is viewed critically by the German physics community.

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Historical perspective on spin-polarized tunneling

I read with interest the article "Frontiers in Spin-Polarized Tunneling" by Jagadeesh Moodera, Guo-Xing Miao, and Tiffany Santos (PHYSICS TODAY, April 2010, page 46). It was also a pleasure to see that devices made from europium chalcogenides, concentrated magnetic semiconductors first studied in the 1960s, are of current interest and subjects of ongoing research.

It is, therefore, useful to give some historical perspective in any review of the subject. Thus I list here earlier work at the IBM Thomas J. Watson Research Center that preceded the tunneling studies described in the article.

The intellectual and scientific environment in the mid-1960s merits a brief description. The first ferromagnetic insulator, EuO, had been discovered[1] in 1961, and a number of laboratories were busily measuring its physical properties. Among them were ETH Zürich, the Lincoln and National Magnet laboratories, and the Watson Research Center. Those labs had succeeded in growing single crystals of the chalcogenides, and most of their studies were on bulk samples, although optical investigations often required thin films.

The IBM researchers thought that EuO and related chalcogenides might provide an alternative to other magnetic materials, such as ferrites and thin-film permalloy, in the development of disk-drive technologies. Fred Holtzberg, a remarkably inventive materials chemist, and colleagues had also shown that the chalcogenides could be doped and that the magnetic characteristics were a strong function of the carrier concentration.[2] In fact, complementary measurements indicated that the transport properties were a strong function of the magnetic state of the material and could be manipulated through either temperature or magnetic field. At the same time, Leo Esaki and colleagues—most significantly the outstanding physicist Phill Stiles—were exploring thin-film semiconductor technologies for potential applications in computers. It was, therefore, a natural development to wed semiconductor and magnetic-materials physics to provide additional functionality to semiconducting devices.

The Esaki collaboration's tunneling spintronic device,[3] arguably the first, consisted of a junction of normal-metal electrodes separated by a chalcogenide magnetic insulator, Eu combined with either sulfur or selenium. The current–voltage characteristics depended on the insulator's magnetic state, and a value of the conduction-band splitting in the ferromagnetic state was extracted from the data.

Another significant early article on tunneling behavior appeared four years later. By that time, after IBM had learned how to make relatively clean Schottky barriers with the Eu chalcogenides, several experiments showed that the capacitance and transport characteristics of such junctions were also affected by magnetism.[4] The nonlinear current–voltage characteristics of the tunneling current through the barrier were dominated, once again, by the magnetic state of the EuS. In fact, reference 4 describes the band splitting also discussed in the PHYSICS TODAY article. Furthermore, with a detailed analysis of the zero-bias conductance, one could extract the magnetization of the material.

I hope that interested readers of the article by Moodera and coauthors will find this historical note valuable.

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When Holmdel lab opened for business

I find it curious that in his article on laboratory architecture (PHYSICS TODAY, April 2010, page 40), Stuart Leslie gives 1966 as the opening date of the Bell Labs facility in Holmdel, New Jersey.

As a young engineer in the electronic switching development department, I and many others worked in one of the mirrored cell blocks in 1963. I began work at the original Whippany facility in June 1960 and moved to the Holmdel location in, I believe, late 1962.

Buildings were still being constructed after I left for graduate school in 1963, but the facility was already operating with both lab and office space at that time.

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