10. Conclusion

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The relationship between law and science in America can now be summarized. Basic research flourishes under the control of basic researchers. This is not because science is "free of legal control," but because the legal system we have gives power to the scientific community. Without the protections in the Constitution and statutes, our peer review system scattered over scores of agencies and hundreds of universities would not exist. Under our laws, effective control of who receives research funding lies with scientists, not with elected officials or judges.

Moreover, our legal system shields science from religion, a traditional rival. Religious doctrine cannot prevent the teaching of science in the public schools. Our law's tolerance for religious diversity prevents the emergence of a dominant religious perspective even in the private sphere. Indeed, the favorable legal position of science has contributed to a situation in which science plays an unusually large role in public debate on values.

With technology, the tables are turned. Now the legal system stresses adversary-style settings in which diverse voices are heard. The lawyers' process norms dominate, and the progressive values of science are just one point of view, and a relatively weak one at that. The result is the regulatory gap. Ideas that were outstanding from a scientific point of view are not automatically ideal from a social perspective. The consequences range from a slight slowdown in areas like computer software to a dramatic halt in fields like nuclear fission. And the future promises more of the same. So long as our products are incubated in a setting in which scientific norms dominate and born into a world in which legal

norms reign, smooth transitions will be the exception rather than the rule.

The main force working to narrow the regulatory gap is the science counselor. In recent years scientists have increasingly become aware that social consequences must be looked at more closely in the research world. As those consequences begin to shape their work, they become science counselors. Budgets are no longer the only important social reality for the scientist. For the science counselor, health, safety, environmental, and intellectual property concerns work their way ever earlier into the research process itself. It is a matter of self-defense: too many unhappy experiences with technology can lead to reduced public support for science or to something even worse—control by politicians and lawyers over the course of research. Science counselors need not be famous or even known to the public; as time goes by, more and more ordinary scientists become science counselors as they temper their belief in the progressive norms of science with the goal of producing socially acceptable technology. They infuse their scientific work with social concerns.

What can and should be changed in this picture? First of all, it is vital to note that our goal is primarily descriptive. For better or for worse, this is the way things are. Moreover, many of the realities we are describing are not easily changed. The legal status of science and technology is deeply embedded in our laws and customs. And no one would lightly change a system that does to a considerable extent provide freedom for research and an important measure of social control over technology. The process is often messy and inefficient but it has much to recommend it.

The two main areas where change appears possible and worthy of consideration concern the role of science in public debate over values and the role of the science counselor.

The powerful voice of science in matters of morality is something of an oddity. It can perhaps be best thought of as an unintended consequence of the framers' attitudes toward religion, science, and the state. Preventing the establishment of religion has never meant, either historically or in court, that religious perspectives cannot be expressed in public debates over morality. But those perspectives are heard less often than one would expect today, in part because of the astonishing diversity of religious beliefs in America, and in part because of an

overgeneralization from judicial decisions limiting religious teachings in public schools.

At the same time, the philosophical implications of scientific discoveries receive a remarkable degree of attention. Science is virtually the last bastion of the optimistic, progressive part of the American ethos. And it is easy for everyone to slip carelessly from the descriptive power of science to prescriptions. Genetic engineering makes transformations in the human species theoretically possible but that does not mean those transformations ought to be made. Because a new energy source makes abundance theoretically possible does not mean that abundance should be an end in itself. Traditional religious and moral leaders have much to say about essential features of the human endeavor. There is no reason in law or logic that their voices should not be heard at least as loudly as the voices announcing the latest scientific breakthrough. Of course, anyone is free to argue, and some do, that science is all there is; that morality, if it exists, can only be discussed in evolutionary or biological terms. But if the free marketplace of ideas means anything, it means our national debate can include other perspectives as well.

But whereas science plays a surprisingly large role in discussions about our moral natures, the regulatory gap assures that the technology it spawns often does not live up to advance billing. Thus an increasing number of science counselors and an increasing role for those counselors in shaping research is a likely outcome of our current situation.

Are there alternatives for narrowing the regulatory gap? There are calls by government and industrial leaders for research that is more relevant, more goal directed. But there have always been such calls. At times, particularly in carefully targeted areas, they can be effective without endangering the research enterprise. But there is a limit to the effectiveness of this approach. The point of the regulatory gap is that on the science side, the scientific establishment has the bulk of the power. Outsiders, whether they are lawyers, politicians, business leaders, or former scientists working for others, cannot presently exercise effective control over the research process. And very few people, whether scientists or not, want to scrap the peer review, consensus-oriented approach run by the scientific community that now dominates the research landscape. It has simply been too successful in doing science, and there is simply too much of a chance that nonscientists would do worse from every perspective.

This is why the science counselors are so important. Because they are part of the research establishment, they might plausibly have an actual impact on scientific work. So we must look more closely at the impact they could have and whether that impact is desirable.

The first question is whether science counselors, with their interest in social considerations, could really change the nature of the scientific endeavor. In other words, can social considerations actually affect the ethos of science, or will they never be anything more than a set of outside constraints imposed on scientists and resisted accordingly?

Traditional scientists may well doubt that social issues can ever deflect serious scientists from the joy of their work. It is true that scientists have always grumbled about bureaucratic paper shuffling, administrative responsibilities, and budget meetings keeping them from the lab. But an increasing concern with broader social issues may be different. Not only is it important to the progress of science, it is an attractive activity. The challenge of balancing research progress with a heavier-than-usual dose of social implications can be seductive. Lawyers know their work in shaping social decisions is often fascinating. Science counselors discover the same thing.

It is hard to predict the impact of growing social consciousness on the doing of science. This is in part because we are not talking about an all-or-nothing situation. There has always been a continuum on which researchers have varied in the extent that their work reflects a concern for the outside world. But whereas the path from pure scientist to science counselor has been gradual, a great distance has been traversed. Vannevar Bush's classic 1945 report, *Science, The Endless Frontier,* which helped shape the modern research establishment, said the government should fund "the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown."[1] That approach would now appear foolhardy to many researchers.

Let us highlight the potential impact of current trends by speculating about a future research environment utterly dominated by thoroughgoing science counselors. In such a world, the ethic of socially acceptable progress would permeate all research. In other words, basic research would no longer represent one of two cultures—law and science—vying for dominance in our society. No longer would science embody a belief in the progressive growth of knowledge that stands in sharp contrast

with the law's process-oriented belief in the peaceful resolution of social disputes. The science counselor would represent one culture in which progress and process have merged into an ethic of social progress.

There are gains in this scenario—the regulatory gap would be narrowed in the short run, meaning that appropriate technology would be available more efficiently. But there are costs as well, because a complete triumph of the science counselor would not be consistent with productive science in the long run.

Traditional science marches forward, spurred by the goal of priority—the desire to be the first to add a particular bit of knowledge to the cumulative store. Even mission-oriented scientists have absorbed this ethic from the pure scientists. The science counselor, however, will be a mission-oriented scientist who absorbs the ethic of social progress, where priorities are unclear, knowledge is not always cumulative, and progress itself is an ill-defined term. Indeed science counselors, by engaging in socially directed research, may overlook some of the entirely unexpected developments that spur so much of science.

Science counselors grew in influence precisely because the scientific notion of progress does not perfectly match society's desires. On the other hand, society does not want to shut off the flow of science completely; it wants to pick and choose among scientific developments and use or shape those it likes. It is difficult to have it both ways. Because society's efforts to shape science are likely to be clumsy, scientists are forced to temper their own work. In so doing they gradually change the culture of science. As one leading commentator has put it, scientists, in order to forestall government intervention, must sometimes "do what most would consider a form of blasphemy: give up the research."[2] A scientific world utterly dominated by science counselors would take that step far too often.

Science counselors differ in degree, not in kind, from the budget or profit conscious scientists who work in government or private laboratories, but that is hardly reassuring. If scientists cared only about budgets and profits there would be little left of science. The same is true if scientists cared only about environmental, health, and safety issues.

In other words, it is not regulation that most directly threatens modern science. There is no army of litigators or environmentalists or pacifists at the laboratory door. Legal restraints today come primarily after

research leaves the laboratory. Law does not threaten science through the legal control of basic research; it threatens science through the adoption of legal norms by basic researchers. Bridging the regulatory gap requires that science be shaped to social ends, and scientists are better able to do that than anyone. The science counselor seeks to avoid wasteful regulation by bringing science in line with reasonable social goals. In doing so, however, those who would save science, threaten it. The danger is that science will be loved to death, smothered in the embrace of social considerations.

But we have been speculating about a research world utterly dominated by science counselors. The lesson is that such a world is not desirable. The emergence of science counselors need not presage the extinction of traditional science. It is in the interests of the scientific community and the public at large that we always retain a prominent place for those pure scientists who care first and foremost about science's progress, not its implications. It may seem ironic that so soon after scientists were urged to embrace social concerns they are being warned not to go too far, but the warning is apt.

The influence of science counselors in the scientific community is likely to be far more pervasive than most scientists realize. Fortunately, there is no logical reason science counselors cannot coexist with traditional pure scientists, so long as there are enough of the latter in the scientific community. Given all of the pressures forcing science into a socially acceptable mold, it is worthwhile to assure that enough traditional pure science survives. It is, after all, in society's interest to spend at least some money and some tolerance on the unalloyed search for testable hypotheses. The path of scientific progress is sufficiently uncertain that society should take the chance on a surprisingly useful development. And knowledge for its own sake, although it should not be our only value, can nonetheless be treasured. Science counselors at their best will balance social and scientific values. If representatives of the latter fade away, science counselors may not be able to keep a meaningful scientific perspective of any kind. Accordingly, every once in a while, amidst the discussions of how scientific developments can serve the world, a word should be said about how scientific developments can serve science.

So in the end, our imperfect reality can only be improved in imperfect

ways. A heavier dose of social concern is coming into the scientific world, and, if that dose remains a limited part of the research endeavor, it can perform a valuable service in narrowing the regulatory gap. There are no exact standards available here, but a clear understanding of law and science in American life makes steps in the right direction more likely.