

group were not only at the bottom of the denominational schools, but were also well below average for all schools studied. In only one field, arts and professions, were they above the median of all schools. In total productivity, they lost some ground over time, their gains in the physical and biological sciences being overbalanced by losses in the other fields. The Catholic University of America is very deviantly productive among these schools. This is due primarily to its exceptional record in the arts and professions (theology mostly; also philosophy and languages), and in the early period in the social sciences and education. Otherwise its record is undistinguished. The only other Catholic school with high productivity is Gonzaga University, which is high in the arts and professions and, to a lesser extent, in the social sciences.

*Congregational and Jewish.* Because these two denominations are represented by only one school each, enrolling a small fraction of their population, it is hazardous to draw any conclusions from the two schools involved. It might be noted, however, that the moderately high productivity of the one Congregational school (Drury College), especially in the 1920 to 1939 period, corresponds with the position of the Congregational faith in Lehman and Witty's early study (1). In the case of the Jewish faith, the great productivity of Yeshiva in the later period is mirrored in certain New York (and possibly other North Atlantic seaboard) schools.

### An Integrative Ranking

Table 6 represents an attempt to integrate the relevant research findings into a rough ordering of denominational productivity. The placement of most groups is rather definite, though the changes over time noted above suggest that the Evangelical, Reformed, and the Mormon groups are less productive than formerly, with the Presbyterians more productive. In the analysis of values below, these changes in productivity are interpreted as being partially reflective of shifts in values.

Unitarians and secularized Jews are difficult to identify in analyses of this type and their placement in the highly productive group in Table 6 is based on somewhat indirect evidence. In their study of 1189 scientists, Lehman and Witty (1) found 81 times as many

Table 6. Religious groups rated by output of scholarly doctorates in United States (summary of all studies).

Religious group	Religious type
<i>Highly productive</i>	
Unitarian	Liberal, secularized
Quaker (Friends)	Protestants and
Secularized Jewish	Jews
<i>Productive</i>	
Church of the Brethren, Evangelical,	Moderately liberal,
E. U. Brethren,	dissident, anti-
Mormon, Reformed	traditional Prot-
Christian, Reformed	estants
Congregational	
<i>Fair productivity</i>	
Presbyterian*	Traditional Protes-
Methodist*	tants
Baptist*	
<i>Low productivity</i>	
Southern Prot-	Fundamentalist,
estant†	conservative Prot-
Disciples of Christ	testant
Lutheran	
<i>Very low productivity</i>	
Roman Catholic	Catholic

\* Especially Northern congregations. † Data for white congregations only, especially Methodist and Baptist congregations.

Unitarian scientists as expected from the proportion of Unitarians in the U.S. population, far more than any other group. While many of these scientists might have become Unitarians as adults, and thus cannot be said to have been produced by the Unitarian ethic, it is highly improbable that virtually all of them were converted as adults. Other studies (23, 24), in which the high degree of education of Unitarians generally and the historical importance of this religious group in such New England universities as Harvard have been considered, indicate that their placement in Table 6 is well justified.

The secularized Jews are placed in the highly productive category on the basis of indirect data (16, 25-28) because such Jews are not identifiable in most of the baccalaureate data. The following observations are supportive of a high placement for this group:

1) A 1969 survey (26) showed that Jews now constitute a disproportionate percentage of university faculty in the United States. This is more pronounced among the younger faculty than it is among the old, and is more pronounced among the prestigious schools. Further, of the 67 Americans who were scientific Nobel laureates up to 1965, 18 (27 percent) were Jewish (27).

2) Yeshiva, the only Jewish school in my study (see Table 5), was devoted primarily to rabbinical training in the

earlier time period, which explains its low productivity, but broadened its training and showed very great productivity in the later period.

3) The great upsurge of the Middle Atlantic region, especially New York, and the more moderate gains of the New England states in the time period 1950 to 1961 are most easily interpreted as being due to the children and grandchildren of impoverished Jewish immigrants, largely from the eastern European cultural area, who inundated these regions in the period from 1880 to 1924. The great bulk of American Jews are descendants of these immigrants (13).

### Analysis of Values

If one integrates all of the data, one can infer that certain broad cultural influences are sharpened in particular religious sects, social classes, and individual families (5), and that these influences account, at least in part, for the geographical and baccalaureate institutional variations noted above. From the reservoir of talent found in any sizable population, cultural influences operate to stimulate or dampen, and to channel in one direction or another the capabilities of its members. I suggest that there is a set of cultural values that promote scientific and scholarly activity and that these are found most clearly in those groups highest in the production of scientists and scholars; these values appear to be less pronounced in groups of moderate productivity, and the antithesis of these values is found most clearly among those groups who are least productive of scientific and scholarly workers (30).

In Table 7 I show a set of contrasting values which seem to characterize highly productive groups on the one hand and unproductive groups on the other. Groups of intermediate productivity present a more mixed blend of these values, possessing a more moderate view on some values, or a more mixed set of values. These values probably undergird the cognitive and motivational orientations of the individuals involved as they work out their life styles and career plans. A discussion of each of these values may help to clarify their role in the process.

*Naturalism.* The naturalistic assumption that the world is governed by law is basic to men's interest in the processes which are involved in the opera-

Table 7. Cultural values associated with high or low production of scholars and scientists.

High productivity	Low productivity
<i>Naturalism.</i> Belief in a world of order, law, pattern, meaning	<i>World is unknowable, incomprehensible.</i> Events are capricious, mysterious, whimsical
<i>Intrinsic valuation of learning, knowledge.</i> To be learned, wise, is highly valued. Broad conception of valued learning	<i>Suspicion of learning, education.</i> Constricted view of valued learning. Anti-intellectual
<i>Dignity of man.</i> Optimism concerning man's ability to discover truth, accomplish things, change the world	<i>Disparagement of man.</i> Man is powerless, at the mercy of fate, destiny, luck, chance. He is evil, incompetent
<i>Personal dedication.</i> Seriousness of purpose, sense of mission, positive mysticism. Long-range striving. Responsibility beyond family	<i>Sense of indirection.</i> Must take, enjoy what is available now. Loyalty to family, kin
<i>Equalitarianism.</i> Active promotion of causes to improve status of disadvantaged. High status for women, children. Pacifism	<i>Authoritarianism.</i> Reliance on authority. Power relations important. Patriarchal order: male dominance. Aggressiveness, militarism
<i>Antitraditional.</i> Not satisfied with established ways of doing things. Restless, inquiring spirit	<i>Traditional.</i> Past is respected, romanticized. Filial piety valued
<i>Centered on near future.</i> Concerned with this world. Orientation toward the foreseeable future	<i>Centered on present and distant future.</i> Hope for a better break in the distant future, the next life

of natural phenomena. It underlies the deterministic or causal mode of thinking which characterizes science. The contrasting value interprets events as being beyond man's understanding, a result of capricious or supernatural forces, thus discouraging inquiry.

*Valuation of learning.* The development of individual knowledge, understanding, and wisdom is highly prized. This applies not only to religious matters narrowly conceived, but also to learning about the physical world, life processes, and the great diversity of human activities. Among the Jews, for example, the process of secularization produced a broadening of valued learning from the traditional knowledge of the Torah and Talmud characteristic of rabbinical training to the broader fields of science, medicine, and the arts (16, 25-29). The valuation of individual learning is captured in the following quotation from William Ellery Channing, noted Unitarian minister [quoted in (23), p. 70]: "The great end of religious instruction is not to stamp our minds irresistibly on the young, but to stir up their own; not to make them see with our eyes, but to work inquiringly and steadily with their own; not to give them a definite amount of knowledge, but to inspire a fervent love of truth; not to form an outward regularity, but to touch inward springs; not to burden the memory, but to quicken and strengthen the power of thought . . . not to tell them God is good, but to help them to see and feel His love in all that He does within and around them. . . . Never forget that the

child is a rational, moral, free being." In contrast to this value is a constricted view of valued learning, which stresses the folly of man's understanding. In the United States it has been associated with catechistic education, biblical literalism, and the anti-intellectualism of fundamentalistic Christianity.

*Dignity of man.* This cultural value stresses the worth of the human being as a creature with great potential for discovering truth and for accomplishing good. It is illustrated by the Mormon concept that man is of the race of the gods, capable of eternal progression toward godhood himself. The contrasting value emphasizes man's depravity, his worthlessness, and his incompetence in the face of cosmic forces.

*Personal dedication.* This is probably a central value in the development of long-term purposive striving which characterizes scientific education and discovery. Life is a serious business, and the individual has an important work to perform. He may be actuated by a belief in a partnership with deity. Several examples may clarify this behavior. Among the Quakers a sense of positive mysticism which energizes dedicated striving derives from being guided by the "Inner Light" of God. The Mormon scientists, who come from devout, pious homes (31), report a sense of mission in their work. A quotation from Joseph Priestley, the noted Unitarian chemist, is also illustrative [quoted in (23), p. 40]: "All those who labor in the discovery and communication of truth, if they are

actuated by a love of it and a sense of its importance to the happiness of mankind may consider themselves as workers together with God." The sense of personal responsibility extends to the human family far beyond one's own kin. Notions of universal brotherhood are supportive here.

In contrast to individual striving is the view that life is out of one's control, that what happens to a person is determined by fate or luck. This leads to a passivity toward the future and an active interest in using and enjoying what is immediately available. Responsibility tends to be centered upon relatives rather than upon community or humanitarian service.

*Equalitarianism.* There is a strong undercurrent of democratic and equalitarian ideals shared by the productive groups, and a powerful empathy for the downtrodden and oppressed. Highly productive groups have been in the forefront of humanitarian causes such as the abolition of slavery, women's rights, and the enlightened treatment of the mentally ill, for example (23, 24). Within the family, women and children are granted almost the same treatment and same amount of respect as men. An interesting additional feature is a strong pacifism, as best exemplified by the Quakers. In contrast, obedience to authority is stressed in the low-producing groups. "Children should be seen, not heard." The father is the dominant figure, his influence not muted by a strong mother. Issues are resolved by power and aggressive force; militarism is one expression of this.

*Antitraditional.* The scientific view that no theory is immune from questioning is congenial with the pragmatic, antitraditional attitude of high producing groups, who have a history of fighting the dominant or established churches and doctrines of the time. In contrast, the traditional emphasis stresses respect for ancestors and established doctrines, for example, "Give me that old time religion, it's good enough for me."

*Near-future orientation.* The struggle to overcome obstacles, to actively surmount the challenges of the world despite past hardships, is a common response among the high-producing peoples, which fits the scientific role. The practical, down-to-earth orientation potentiates the empirical data-collecting component of scientific work. Such a disposition differs from one which relies on the faith and efforts of

Inw 5300B  
FT 169-1

others, or which passively hopes for Heaven in some distant future.

Interestingly, the same groups found highly productive in this study, or groups with a similar cluster of characteristics have been identified as highly contributive to the economic development of society (29). The achievement-striving entrepreneur prospers in the same cultural soil as the budding scientist-scholar. This seems to be true not only in Western European civilization but worldwide. The dominant cultures of Islam and the Orient, possessing a core of values typical of the low producing groups, have resisted both science and economic development. This is also true of the Latin American countries with their traditional Catholic values. Pockets of economic growth have occurred, according to McClelland (29), among the Jains, Parsees, and Vaishnava Hindus in India; among reform Catholics in Italy and Mexico; and among the Zen Buddhists of the Samurai class in Japan, to whom he attributes in large part the rise of modern industrial Japan. All of these groups share values which depart from the "low" cluster in the direction of the "high" cluster.

Finally, to show that certain social groups and value clusters are more productive of scientists and scholars does not imply that these are "better" in any ultimate sense. It does suggest that to the extent that scientific-scholarly pursuits are valuable to a society, then that society should provide the conditions which promote such pursuits.

## Summary

Data from a wide variety of sources reflect geographical, baccalaureate, and social class variations in the production of scientific and scholarly doctorates in the United States. To a significant extent, these variations are associated with the kind of religious-ethnic group from which such persons come. Roman Catholics are extremely low producers of scientists and scholars, but fundamentalistic and traditional Protestant faiths (southern white Protestants, Lutherans) are also low producers. Liberal Protestant sects, such as Unitarians and Quakers, and secularized Jewish groups are highly productive, and less liberal faiths are moderately productive.

Variations in productivity are reflective of differences in beliefs and values. Highly productive groups share

a certain set of values, unproductive groups hold the antithesis of these, and those groups intermediate in productivity possess a mixed blend. Tentatively, the common beliefs and value systems of high producers seem to include naturalism; intrinsic valuation of learning and the individual quest for truth; emphasis on human dignity, goodness, and competence; a life pathway of serious dedication, of service to humanity, of continual striving; humanistic equalitarianism; a pragmatic search for better ways of doing things unfettered by traditional restraints; and a focus on the relatively immediate, foreseeable future which can be affected by personal effort.

Historically, the scientists (or their immediate ancestors) have broken away from the traditional orthodoxy, broadened certain values, and retained others. For example, the children of Jewish immigrants to the United States departed from the traditional ritualism of the eastern European Jewish community, broadened the old value of scriptural erudition to include secular learning of all kinds, but maintained emphasis upon personal striving and social responsibility. Also, it appears that eminent scientists often emerge from devout Protestant homes emphasizing learning and responsibility but that such scientists frequently depart from the parental religious faith (31).

Psychodynamically, this set of cultural values produces a person with an inquiring cognitive disposition, whose duty it is to strive diligently to improve the human condition. Given a certain level of intellectual talent, and cultural support in educational, scientific, and scholarly institutions, youth will frequently choose careers in scientific and scholarly professions. This same cultural milieu apparently also produces disproportionate numbers of inventors and entrepreneurs; historically, it produced those who activated the industrial revolution and those who generally were responsible for rapid economic growth.

The data discussed herein extend only to about 1960, prior to the great social unrest of the 1960's and early 1970's. Speculatively, one might predict that productivity will diminish to the extent that current social movements stressing existential futility, goal attainment "now," or power relationships are successful in penetrating groups which have been highly productive, since these emphases undermine long-term scholarly striving.

habilitation, peace education, community and interfaith activity), reflecting an emphasis upon the "social gospel" [R. E. Sappington, *Brethren Social Policy 1908-1958* (Brethren Press, Elgin, Ill., 1961)].

22. K. K. Bailey, *Southern White Protestantism in the Twentieth Century* (Harper & Row, New York, 1964).
23. H. H. Cheetham, *Unitarianism and Universalism* (Beacon, Boston, 1962).
24. G. W. Cooke, *Unitarianism in America* (American Unitarian Association, Boston, 1902).
25. M. Zborowski, *Social Forces* 29, 351 (1951); *Harv. Educ. Rev.* 19, 87 (1949).
26. Survey data are from S. M. Lipset and E. C. Ladd, Jr., in *American Jewish Yearbook* 72, 89 (American Jewish Committee, New York, 1971). Unfortunately, the survey grouped all Protestant faculty together. As my study shows, the variation between Protestant denominations is so great that very significant differences are masked and meaningful analysis is prevented.
27. Nobel laureate data are from E. Van den

Haag, *The Jewish Mystique* (Stein & Day, New York, 1969), p. 22.

28. On the importance of secularization, see Lipset and Ladd (26), and McClelland (29).
29. D. C. McClelland, *The Achieving Society* (Van Nostrand, Princeton, N.J., 1961), p. 336.
30. For discussion of related sets of values, see (7, 8), also B. Barber, *Science and the Social Order* (Collier Books, New York, 1962), p. 95.
31. R. T. Wootton, thesis, University of Utah (1956). In contrast to the frequently reported departure from the parental faith among Protestant and Jewish scientists (1, 5, 16, 26, 29), 72 percent of the Mormon scientists in Wootton's study were actively affiliated as adults.
32. Partial support for this work was given through a Brigham Young University Faculty Research Fellowship. I thank Richard Weaver for patience and competence in performing the computer analysis, and staff personnel of the U.S. Office of Education and many college registrars in supplying missing baccalaureate data.

## ting Violations: ll in the Family

dents, approximately a dozen of the 92 nuclear tests the Soviet Union is known to have conducted since August 1963 have vented "appreciable" amounts of radioactivity into the atmosphere and across Soviet borders in northern Europe and the Far East.

The way the State Department and the Soviet embassy in Washington have treated these venting incidents provides an instructive glimpse at the difficulties involved in enforcing arms control agreements in general, and test ban treaties in particular. Critics of the partial ban on underground testing signed at Moscow in July believe the new

agreement may raise similar problems.

In addition to banning nuclear explosions everywhere but underground, the Limited Test Ban Treaty also prohibits tests under any circumstances that would cause "radioactive debris to be present outside the territorial limits" of the nation conducting the test. On this ground, sources say, the State Department has considered the Soviet ventings to be breaches of the test ban treaty. However, the U.S. attitude during both the Johnson and Nixon administrations has been that periodic puffs of radioactivity floating out of the Soviet Union were the product of careless testing, not of attempts to evade the treaty.

"There has been some disregard for the letter of the law" on the part of the Soviet Union, an intelligence official who has served both administrations said. But, like other sources, he added that none of the infractions had seemed serious enough to jeopardize the treaty or to warrant public criticism.

Detailed information is sketchy, partly because the ventings extend over a long time and memories have faded, and partly because the State Department and the Atomic Energy Commission, as a matter of policy, do not discuss them. It is known, though, that they occurred as long ago as 1965 and as recently as 1971. Ventings have occurred at both Soviet nuclear testing sites—one at the southern end of the arctic island of Novaya Zemlya and the other in the central Asian desert just south of the city of Semipalatinsk. The vented clouds have consisted mostly of radioactive krypton and other gases that tend to remain high in the atmosphere, although some clouds have distributed particulate fallout. In every case, the sources say, the overall



crater and may have violated the Limited Test Ban Treaty.