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Conflicts of Interest and Conflicts of Commitment[1]

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I. Introduction

One popular view of the scientific method postulates that scientists should study nature in a value-free manner without any biases.[2] Despite the impossibility of its complete realization, this still functions as an ideal for scientific research. Scientists, like all other people, have a variety of interests and commitments of an intellectual, personal or financial nature that could conflict with a purely unbiased approach to their work and compromise good scientific judgment. Recognizing and finding ethical ways to deal with these conflicts is the subject of this chapter.

Take the following example:

> Dr. S.T., an M.D. from National Taiwan University with a Ph.D. from the University of California at San Francisco, became interested in the use of a vitamin A ointment as a remedy for keratoconjunctivitis sicca, an eye disease that prevents tearing, when he was studying with Dr. A.E.M. at Johns Hopkins University. S.T. first tested vitamin A on rabbits under a series of federal research grants that A.E.M. and he received from the National Institutes of Health. Having apparently achieved some temporary success with rabbits, he began testing on human subjects, first at Johns Hopkins and later at Massachusetts Eye and Ear Infirmary, a prestigious clinic that is linked to the Harvard Medical School, where S.T. received a two-year fellowship.
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> At Massachusetts Eye and Ear the initial studies of the drug were carried out with the permission of the hospital's Human

Studies Committee which, under federal guidelines, evaluates all experiments that involve human subjects. This committee approved initial studies of 25 to 50 patients. As a result of these studies S.T. published a paper stating that "all patients demonstrated clinical improvements in symptoms" (Gosselin, 1988a, p. 17).[3] At the same time A.E.M. and S.T. set up a company, Spectra Pharmaceutical Services, to manufacture the vitamin A ointment. Shares in Spectra were publicly sold, and A.E.M. and S.T. became the majority shareholders (Gosselin, 1988b).

According to press reports on this story, S.T. actually tested many hundreds of patients without permission of the Human Studies Committee. He subsequently produced two favorable reports on the ointment and began to use the ointment at that time manufactured by Spectra, on patients at Massachusetts Eye and Ear. According to reports, however, his test results had not proven whether or not the ointment produced positive long-term results. A later study performed by researchers who were not shareholders of Spectra in fact resulted in an unfavorable report about the effects of the ointment. Moreover, according to testimony of a number of Infirmary nurses, S.T. often tested other drugs that had not been approved on patients' eyes, often without their knowledge or approval. No patient's eyes were injured, but the vitamin A ointment has proved to be ineffective as a long-term solution to "dry eye" (Booth, 1988; Gosselin, 1988b; Kurt, 1990).

S.T. has since left Harvard and is a physician at the University of Miami. A *Boston Globe* investigation concluded that he and his family made at least $1 million on the sales of his Spectra stock (Gosselin, 1988c, p. 29). Because of the publicity surrounding the S.T. affair, both the president of Massachusetts Eye and Ear and one of its leading researchers, Dr. K.K., have left the Infirmary. Harvard investigators later concluded that S.T.'s involvement with Spectra violated university rules on conflict of interest. Eventually charges brought by the State of Massachusetts Medical Board were dropped against K.K. and S.T.. The Board decided that K.K. had not been party to S.T.'s activities. Charges against S.T. were dismissed, despite the fact

> that he was found to have violated the Infirmary's research policies, because of his other contributions to medicine and because there was no long-term harm to any of the patients (Booth, 1988; Gosselin, 1988b; Flint, 1989; Kurt, 1990).

This case shows what can happen when conflicts are not recognized, made public, and remedied. S.T. had financial interests and professional aspirations that may have conflicted with the norms of good scientific research practice and human subject experimentation procedures. S.T. wanted to find a remedy for "dry eye." Like all scientists he sought professional recognition, and like most of us, he desired financial rewards for his discoveries. But he failed to test his drug thoroughly, he appeared not to have reported test results that were negative, and he tested the drug without permission of the Human Studies Committee. These are all violations of acceptable scientific procedure. Moreover, he apparently tested drugs other than the vitamin A ointment, for which he had no approval and without patient knowledge—a violation of the norm of informed consent. S.T. had a conflict among his financial interests, his personal desire to be well-known in his field, and the unbiased judgment expected of him as a scientist. Such conflicts are to be expected; however, S.T. appears to have *acted without paying attention* to his conflict of interest. That is, he continued his work without informing others of his conflict. Had he done so, he might have been able to seek independent confirmation of his results. As a consequence of his disregard for his conflicts, he was less than thorough in following acceptable scientific research procedures. There may have been no improper motives, but failing to recognize his conflict of interest, or acting in disregard of it, created a situation that compromised his scientific judgment.

Scientists cannot simply observe the world unencumbered by theory or bias. No one can never "observe nature without prejudice." Physicist Werner Heisenberg noticed that the act of observing subatomic particles affects the activities of those particles. He concluded that one cannot completely separate the observer from the observed. This basic characteristic of some kinds of physical observations is also true of the scientific process in general. Whether scientist or not, each of us perceives and experiences the world from a set of perspectives and

theories that focus, schematize, and organize what and how we perceive. This "theory-laden" nature of science and scientific investigation means that pure objectivity is impossible. Nevertheless, the theoretical ideal of value-free science or purely objective research provides the basis for identifying possible biases, particularly those associated with various roles.

Scientists, like all people, have multiple interests and goals—to be good friends, spouses, or parents, to be collegial, to be successful in their work, to make a decent living, as well as to achieve success as teachers, researchers, administrators, and/or writers. Thus, each scientist occupies a number of roles. A role is a position "defined by a set of rules or practices that indicate what that person should do [in a certain set of contexts]" (Bowie and Duska, 1990, p.4). Roles refer to "repeatable patterns of social relations . . . which are structured partly by the rules of acceptable behavior" (Downie, 1971, p. 128). Role responsibilities are spelled out by institutional, social, and/or cultural expectations of how a person should behave in that role. Roles are impersonal; that is, they define a position not a person. An individual scientist may also occupy the roles of spouse, parent, research associate, professor, member of a professional association, university administrator, citizen, and so on. Each of these roles has defined expectations, and in each role the person is held accountable in terms of these expectations.

Because of their complexity and diversity, some roles compete or conflict with one another. For example, having a financial interest in the company producing a drug you are studying creates a clear conflict, particularly when the studies do not have clearly positive results. Competing with colleagues for funding or wanting to be "first" to make a discovery creates conflicts for an individual who is reviewing grant proposals or manuscripts. Being both a parent and a researcher can involve conflicting role commitments because of competing demands on one's time. Passionate commitment to a particular theory can conflict with careful interpretation of new experimental data. This is sometimes the biggest conflict for a scientist, since there is an ego investment in how he or she wants the results of a study to come out. The existence of conflicting interests and commitments, then, is not uncommon for a socialized, passionate, interested human being functioning in a complex world. For the scientist the challenge is to recognize the existence of

various interests and commitments and keep inappropriate ones from threatening or becoming the controlling aspect of professional behavior. The challenge for the scientific community is to create public policies and guidelines that will help individual researchers avoid conflicts.

S.T. apparently acted without regard to the conflict between his personal ambition, financial interests and professional duties. All scientists and engineers have a number of different kinds of conflicts. One way to sort out conflicts is to distinguish conflicts of interest from conflicts of commitment, a common distinction outlined in a number of policies for conducting research (AAMC, 1990). Conflicts of interest are those that exist between professional interests and personal or financial interests (e.g., AAMC, 1990; Harvard UFAS, 1992). What distinguishes conflict of *interest* situations is that the conflict is between what one is trusted or expected to do in one's role (with its duties) as a scientist or engineer, and financial or personal influences or interests that will or could compromise one's professional judgment and behavior in that role. Conflict situations involving an individual's financial stake in the outcome of a research project tend to be emphasized, but the investigator's professional stake (recognition) in a research result can be at least as critical. Conflicts of *commitment* are conflicts that entail a conflict between two or more sets of professional commitments that will affect one's focus of time, attention, and responsibility. For example, a well-known professor may have obligations to her profession to lead and give symposia, but also have an obligation to her university to teach and mentor graduate students. Because of their magnitude, she finds it difficult to honor both commitments.

II. Conflicts of Interest

Having conflicting interests and commitments is part of the human condition. Only sometimes does a situation arise that may provide an individual with the temptation to compromise professional judgment for financial or personal gain. This is a conflict of interest situation. Where possible, researchers should avoid conflict of interest situations since they provide the temptations to act unethically.

The word 'conflict' implies that the interests at issue do not coincide. Conflict of interest situations are ordinarily those in which all interests

may not, or in some cases, cannot, be realized simultaneously, and where choosing a financial or personal interest over a professional one may violate a code or norm, a promise or contract, or some other specific professional responsibility. "Conflict of interest" describes a situation that has the possibility for irresponsible actions or poor judgment which can potentially produce negative outcomes for others or for oneself. But "[the existence of] a conflict of interest by itself does not indicate wrongdoing—it merely refers to a setting in which factors exist that might influence one's conduct" (Rothman, 1993a, p. 2782). One can consider such circumstances as a continuum, where competing interests can lead to conflict of interest situations that, in turn, can develop into unethical behavior. In some cases the distinctions can be somewhat arbitrary, but clear delineation will facilitate the discussion.[4]

The existence of conflicts of interest will be distinguished from actually acting without regard to that conflict. In the latter cases, when one *acts* in disregard to a conflict of interest one may succumb to placing financial or personal interests ahead of those of the profession. In these cases one's professional role as a scientist is compromised. Moreover, in these cases compromised judgment can negatively affect scientific results so that harm to some persons, to some institution or institutions, or to the advancement of science itself is usually a result (Rothman, 1993a). One definition of scientific conflicts of interest from a moral point of view is that 'conflict of interest' refers to "any conflict between research or other professional scientific judgements and financial or personal interests where acting with disregard to that conflict by placing one's personal or financial interests ahead of professional interests compromises or detrimentally influence professional judgement in conducting or reporting research" (Association of American Medical Colleges, 1990). Conflicts of interest raise ethical issues insofar as:

(a) the integrity of the scientist or engineer as a professional researcher may come into question,
(b) trust in what one expects of the scientist as a professional researcher may be betrayed,
(c) scientific research may be unduly biased in favor of personal or financial interests, and/or
(d) there can be harmful outcomes.

According to the press reports, in S.T.'s case

(a) he did not follow traditionally specified scientific procedures involving human subjects, thus bringing into question his role as a scientist;
(b) he apparently experimented on patients without their permission or knowledge despite their trust and the trust of the Infirmary in him as a physician, thus damaging the reputation of the Infirmary;
(c) it is not clear that he published all the pertinent data of his testing, in particular his negative results, and
(d) his testing of unapproved drugs could have harmed patients.

S.T. could have mitigated or avoided such conflicts of interest by one or more methods such as (1) by disclosure (of his financial interests), (2) by not acting on his financial or personal interests, and/or (3) by removing himself altogether from the conflict situation, e.g. by divesting himself of one of the conflicting interests.

III. Ethical Problems with Conflicts of Interest

From a moral point of view, there are at least three kinds of criteria for evaluating what is wrong with acting in disregard to a conflict of interest. (1) One can judge ignoring a conflict of interest in terms of whether professional standards, codes, or laws were violated. (2) One can evaluate the conflict in terms of its foreseeable positive or negative outcomes, determining whether ignoring the conflict of interest in question created or contributed some harm, e.g., by affecting scientific judgment, by biasing research or results, or by harming institutions or individuals who are affected by that conflict. (3) One can evaluate acting without regard to a conflict of interest from the point of view of the act itself, judging the activity according to whether it violated a moral rule. Let us consider these three criteria in more detail (Wells *et al.*, p. 5).

Acting in disregard of a conflict of interest usually entails a violation of a social norm, a professional standard, or a code. Sometimes acting without regard to conflicts of interest even violates the law. Because of their membership in a profession, scientists, physicians, and engineers are expected to meet the standards of their profession as spelled out in

professional codes of ethics and institutional guidelines for research. When in the course of scientific research those standards are compromised for other, nonprofessional, interests the persons in question violate the norms of their profession. S.T. was accused of violating some of the norms of his profession as a scientist and as a physician. He may not have faithfully followed well-defined procedures for scientific research by possibly not reporting all results. He violated the guidelines of the hospital's Human Studies Committee as well as federal regulations for protection of human subjects which required him to get approval for all drugs to be tested. Moreover, evidence suggests that he did not always take the well-being of his patients as his primary aim as a physician; indeed, he violated norms of informed consent and could have compromised their health.

A second way we judge the morality of an action is on the basis of its foreseeable outcomes, that is, on the basis of what harmful or beneficial results could be expected to accrue. From this point of view, whatever one's motives or intentions are, we judge the morality of human actions in terms of their foreseeable outcomes, the positive or negative utility of an action itself. The best sorts of actions are ones that maximize human interests, optimally satisfy desires or pleasures, or minimize harms, including benefits or harms to life, health, well-being, human dignity, autonomy, or pleasure. One measures harms and benefits in terms of their qualitative and quantitative merit, long-term and short-term results, and immediate or latent satisfaction. The best outcome is that which maximizes interests, leading to a net of benefits over harms for the most people, or for all people equally, or minimally, reduces harms, all things considered. Reasoning in terms of foreseeable outcomes is an important criterion for evaluating conflicts of interest, since disregarding conflicts of interest often reduces the reliability of scientific results, and can result in other harms as well. This harm may be to the advancement of science, to the reputation of the scientist or institution in question, or a more specific harm to some individual or individuals.

From the perspective of evaluating actions in terms of foreseeable outcomes, S.T.'s activities did not improve his patients' illnesses, a promising research agenda was truncated and indeed sidetracked by S.T.'s research techniques, and the reputation of Harvard Medical School, the Infirmary, and its staff and administrators suffered.

Fortunately, there was no long-term harm to any of S.T.'s patients, but under the test conditions S.T. established there was a real possibility of that harm. His research techniques may have affected the testing of the ointment such that its real worth was not measured, and his reports may have failed accurately to present the results of his laboratory studies. Moreover, all of these harms could have been avoided had S.T. recognized and disclosed his conflict of interest, and acted in a more professional manner.

A third criterion for moral assessment appeals to more general standards that are not simply an evaluation of foreseeable outcomes nor merely reflect law, codes, or societal mores. S.T.'s experimentation did no permanent damage to his patients, and the Infirmary is recovering its reputation. So from one perspective one might argue that although the S.T. incident is embarrassing, in the long run, not a great deal of harm resulted from the S.T. affair.

Nevertheless, S.T.'s actions set a bad precedent, a precedent one would not want other researchers to emulate for fear of graver consequences. The fact that S.T. appeared not to fully inform his patients and the Infirmary raises questions about his trustworthiness with his colleagues and patients, and makes his action objectionable from a moral point of view, whether or not there were harmful results in this particular instance. Some actions are wrong not merely because of their positive or negative outcomes, but because they violate moral rules. We should make every effort to avoid deception, keep promises, respect basic equal rights (e.g., the rights to life, freedom, and privacy), and treat people fairly, as well as avoid causing harm. Such rules are not without exception, because there are situations in which one cannot respect all moral rules or respect them equally. For instance, when one's life is threatened one might kill in self-defense. But one can override a rule or standard (e.g., that everyone has a right to life) only when one has good reasons, reasons that other reasonable people would accept as good ones (e.g., in self-defense). These are "good reasons" just because they appeal to another standard (e.g., equal rights that include my right to life and freedom) (Smith, 1978, i.,ii., 12-14). While moral rules are general rules, how they are interpreted depends in part, on the context of a particular situation.

If reports are accurate, S.T. broke a number of moral rules. As a well-educated scientist and a physician with a good reputation he elicited the trust of the Infirmary to carry out his research in a professionally acceptable manner. He also elicited the trust of his patients, who would not expect their physician to treat them as uninformed subjects for experimental drugs. Also, he violated a basic rule of the scientific profession. Scientists do not expect their fellow scientists to break rules of acceptable procedure, to override standard research techniques for financial interests, or to use their names to develop and profit by a drug at the expense of research and patient interests. S.T. broke a number of explicit and implicit promises to his employer, to his colleagues, to his patients, and to the professions of science and medicine in which he held membership. S.T. also did not fully disclose his testing procedures nor reveal important failures in his test results. Insofar as he published only those test results that confirmed the effectiveness of his ointment he withheld important information that he had a duty to disclose; this is deception.

The S.T. case is a clear case of someone apparently acting in disregard of a conflict of interest. However, not all cases involve clear wrongdoing. Let us look at an example.

> P.M. is a biochemist at Johns Hopkins University. Dr. M's area of expertise is in the Field of antisense technology. Currently there is a debate within this field over the value of two different types of synthetic DNA analogs used in blocking gene expression. In 1991 Dr. M. wrote a review of one particular class of these compounds for *Bio/Technology* in which he concluded that the compounds in question "are promising candidates for therapeutic agents." Readers had no way of knowing that P.M. not only holds several patents on the compounds but is a cofounder of the biotech firm to which they are exclusively licensed. Dr.M. expressed surprise at any hint of conflict of interest and stated that the idea of disclosing his affiliation with Genta, the biotech firm which licenses the compounds, never occurred to him (Barinaga, 1992, p. 616).

P.M.'s case illustrates the existence of a conflict of interest. There is no evidence that P.M., an outstanding researcher, lied about the value of the

compounds, nor is there any way to check whether P.M. was biased in his defense of these compounds. Nevertheless, at least on the surface of things, he acted without paying attention to this conflict of interest. It is probably true that some of these compounds are promising. But his financial interest in Genta and his failure to disclose that interest lead us to question his objectivity in evaluating these compounds. Would he have written the review in exactly the same way if he had no financial interests in Genta?

Appealing to our three criteria for questioning the moral status of acting without regard to a conflict of interest—professional norms, foreseeable outcomes, and moral rules—for each criterion, questions arise. P.M.'s failure to disclose his interests in Genta gives us pause to wonder whether he is following good scientific procedures in testing the compounds, or whether his interest in Genta might bias his procedures and evaluations of his findings. Second, because we might begin to question the objectivity of his research, this questioning creates negative implications for P.M. of not revealing the Genta connection. And obviously *if* the Genta relationship becomes an overriding factor, P.M.'s research will suffer as well as science. Third, from the point of view of moral rules, the fact that he did not disclose this relationship or think it was an issue leads us to wonder about his trustworthiness as a reporter of scientific research. These questions give us pause to wonder whether P.M. acted on the basis of financial considerations, and they give us reason to question P.M.'s evaluation of the compound, questions that probably would be troublesome if P.M. had simply acknowledged that his financial interests constituted a conflict of interest.

Let us look at a more complex case in engineering that illustrates acting without regard to the existence of a conflict of interest.

> When water-levels get too low in a heating boiler, the boiler can be damaged or even blow up. The American Society of Mechanical Engineers (ASME) advisory boiler code Section IV, Paragraph HG-605a recommends that a boiler be fitted with an automatic cutoff device that takes effect when water-levels fall to the lowest visible part of a water gauge glass. The codes are model standards maintained by ASME. While only advisory, the

standards have great influence, and are often incorporated by reference in Federal, state and city regulations.

In the mid-1960s, Hydrolevel Inc. of Farmington, New York, entered the market with a new device that featured a 60-second time-delay, designed to avoid unnecessary cutoffs due to safe variations in water-levels. In 1971, Hydrolevel won a contract with Brooklyn Union Gas, formerly a client of MacDonald and Miller (M & M) of Chicago, the largest maker of cutoff mechanisms and a subsidiary of ITT.

Eugene Mitchell, Vice President for M & M Sales, was worried at the loss of a large client, and began to question the safety of Hydrolevel's device. Over two dinners in March, 1971, he held meetings with John James, Vice President of M & M Research and the Vice Chairman of ASME's Heating Boiler Subcommittee (HBS) of the Boiler and Pressure Vessel Committee (B-PVC) and T.R. Hardin, Vice President of the Hartford Steam Boiler Inspection and Insurance Co. and the Chairman of the HBS. Hartford was the largest underwriter of heating boilers and was owned by ITT (Beardsley, 1984, p. 67). James Solon, President of M & M, attended the second of these meetings, during which Hardin said that he interpreted paragraph HG-605a to mean that actual cutoff must happen when the water reaches the bottom of the water gauge glass, and no later (Wells *et al.*, 1985, p. 3).

James subsequently drafted a letter to ASME in April, 1971, asking for an interpretation of HG-605a, and sent it to Hardin for suggestions. Neither of them signed the resultant letter. However, Mitchell did. Comparatively few of the inquiries received by ASME every year need referral to Subcommittees, but M & M's letter was one of them (Rueth, 1975). W. B. Hoyt, Staff Secretary of the HBS, passed it on to Hardin, as procedure demanded (Rueth, 1975, p. 34; Beardsley, 1984, pp. 67-8). Hardin's reply repeated the opinion he had expressed at the dinner meetings, and he submitted it to the B-PVC's Chairman, who approved it. M & M included copies of the reply, signed by Hoyt, in a promotional package which their salesmen used to damage

Hydrolevel's sales. During the following year, ITT acquired M & M (Beardsley, 1984, p. 67).

In 1972, when Hydrolevel heard about James' letter to the ASME, it requested a copy from ASME. What returned from ASME named neither James nor Hardin (Wells et al., 1985; Beardsley, 1984). Russell Rymer, Hydrolevel's President, demanded a review of the matter, which the HBS undertook on May 4, 1972. Hardin had retired, and the HBS Chairman was now James, who disqualified himself from discussion of Hydrolevel. The HBS replied that time-delay devices, if properly installed, could reach ASME standards. Reporting to the B-PVC, James suggested rewording the last paragraph of the HBS's reply to confirm that time-delay mechanisms should operate before the water reached a critical level, to which the B-PVC agreed (Beardsley, 1984, p. 67; Rueth, 1975, p. 34). In July of 1974, an article in *The Wall Street Journal* (Meyer, 1974) accused M & M of unfairly misrepresenting Hydrolevel's product and misusing ASME's letter to do so and also accused ASME of making possible this misrepresentation. An ASME Professional Practice Committee investigation cleared James, while knowing of neither the events of March-April, 1971, nor his rewriting of the second ASME letter. However, the matter went to the Senate Antitrust and Monopoly Subcommittee, where Mitchell revealed James' and Hardin's involvement in M & M's original inquiry, although James testified that no one had known that Hardin would answer the query (Rueth, 1975, p. 35; Beardsley, 1984, p. 68). He also admitted that he had destroyed correspondence with Hardin when he learned, from Hoyt, that the *Journal* had been asking questions (Beardsley, 1984, p. 68). Hydrolevel sued M & M, Hartford, and ASME, a case which reached the Supreme Court and which eventually cost ASME, a non-profit group, $4.75 million.

Names to remember:

T. R. Hardin—chair of Heater Boiler Subcommittee (HBS) of ASME Boiler and Pressure Vessel Committee (B-PVC) and vice president

of Hartford Boiler Inspection and Insurance Company (an ITT subsidiary).

W. B. Hoyt—secretary of ASME Boiler and Pressure Vessel Committee, in charge of correspondence for that committee and its subcommittees.

Hydrolevel—Hydrolevel Corporation of Farmington, New York, the plaintiff in *Hydrolevel*, the legal case.

John James—M & M vice president for research, vice chair of ASME Heating Boiler Subcommittee when Hardin was chair, and chair of that subcommittee after Hardin retired.

M & M—MacDonald and Miller, Inc. of Chicago, makers of the low water cutoff dominating the market before the entry of Hydrolevel's time-delay cutoff (acquired as a subsidiary by ITT).

Eugene Mitchell—M & M vice president for sales.

The Hydrolevel case displays some of the problems that can arise when conflicts are not recognized and dealt with as soon as a situation arises. The conflict of interest first arose at the dinner meetings. In their capacity as officers of the ASME, neither Hardin nor James should have expressed an opinion about the safety of the Hydrolevel system. James, as an M & M employee, had a clear conflict of interest between that role and his role as a member of ASME's Heating Boiler Subcommittee. When engaging in dialogue concerning the status of Hydrolevel's cutoff mechanisms and later when participating in writing the HBS report on the safety of a competitor's product, James was acting in disregard of the existence of that conflict. His participation in drafting the original letter to ASME again put him in conflict with his role as a member of the ASME committee. Hardin also had a conflict, which he disregarded, when he helped draft an inquiry on which he was subsequently to rule. Both men violated generally accepted professional practices and both should have excused themselves from the ASME inquiry. As officers of a professional organization which sets industry standards for public safety, they compromised their official judgments.

Their case demonstrates the limitations of codes of conduct. ASME has a code of ethics, but it did not cover violations such as this, since, as in any code, all particular cases cannot be spelled out with detailed specificity.

The actions of James and Hardin injured ASME's reputation. Once reported in *The Wall Street Journal*, the case undermined public confidence in ASME's judgment and the value of its codes. These codes were originally put in place to protect public safety, and if, because of this episode, the public now views the codes as unreliable and biased, and possibly ignores them, the consequences could be very serious for the public as well as for the companies involved in the manufacture of these mechanisms.

IV. Conflicts of Commitment

Conflicts of commitment are conflicts between at least two sets of professional obligations. Conflicts of commitment differ from conflicts of interest because conflicts of commitment involve the distribution of focus and effort between two sets of professional obligations, rather than a conflict between professional and financial/recognition interests. Conflicts of commitment are those conflicting commitments where competing obligations prevent honoring both commitments or honoring them both adequately. Conflicts of commitment are much harder to avoid than conflicts of interest, and acting in conflict of commitment situations may require a reassessment of one's obligations.

These situations can indirectly lead to compromised scientific or engineering judgment. For example, a professor who is frequently away from the lab giving talks at conferences is not available to adequately provide mentoring to the students. Thus, there is a conflict between two professional obligations. Conflict of commitment situations do not directly create bias in scientific judgment, but can nevertheless affect the quality of judgment. If the professor is pressed for time, data may not be evaluated adequately before it is published. This violates a professional obligation (see the discussion of this obligation in Berger and Gert, this issue, p. 43).

One can distinguish three kinds of conflicts of commitment: role conflicts of commitment, structural conflicts of commitment, and intellectual conflicts of commitment. As we shall see, in specific instances these often overlap. Like conflicts of interest, conflicts of commitment raise ethical issues when acting without regard for such conflicts skews one's judgment as a scientist or engineer such that the sort of judgment

one makes negatively affects other scientists, compromises research outcomes, reflects negatively on one's institution or profession, and/or harms people who depend on one's professional judgment.

Role conflicts of commitment involve clashes either between two different roles, e.g., one's role as a parent and as a graduate student, or between two commitments within the same role. In the latter case the conflict may be between two commitments within one institution, e.g., one's commitment to be a good teacher and a prolific researcher. Alternatively, the clash can be between a commitment to one's primary employer or institution and other professional obligations independent of one's primary employer, for example, when one has commitments both to one's academic institution and outside professional activities. Many of these role conflicts entail problems of time where one simply cannot perform all of one's role obligations. Nevertheless, even in such inevitable cases, the shortage of time can negatively affect one's research. If one acts without regard for the conflict of commitment, there is sometimes the temptation to take shortcuts, to overwork when one is tired, or to borrow from another's research.

Role conflicts occur in a variety of settings. For example, engineers and scientists who work for employers other than a university often face role conflicts of commitment between demands of their employer and demands of their profession or professional code (e.g., NSPE, 1987). One such example is the famous Challenger case.

> Morton Thiokol was the manufacturer of the solid fuel rocket boosters for the space shuttle program including the boosters for the ill-fated Challenger. The Challenger disaster has been traced to a failure of the O-rings, the seals in the connecting joint between two segments of the rocket booster, to seal one of the boosters, thereby creating the environment for the fuel explosion that resulted.
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> According to testimony to the Presidential Commission investigating the cause of the disaster, from the very beginning of the development of the rocket boosters, Morton Thiokol engineers working on the rocket boosters had worried about the strength and flexibility of the O-ring sealing mechanism. As early as the sixth shuttle flight heat damage to the O-rings was

evident, and it became clear in subsequent launches that the secondary O-rings which backed up the primary ones were crucially important to the shuttle, because they too, suffered erosion. Yet the secondary O-rings were reduced in diameter in subsequent design changes, and they were even thought by some to be redundant. After the 17th successful flight, O-ring erosion was described by a NASA official, Larry Mulloy, as "accepted and indeed expected—and no longer considered an anomaly" (Bell & Esch, 1987, p. 43).

Early in January, 1986, Thiokol's engineers had become particularly concerned because it was evident that the behavior of the rubber O-ring material could not be accurately predicted when atmospheric temperatures were below 30 degrees Fahrenheit. In fact, the ideal launch temperature for the O-rings was 50 degrees. On January 27th, the day before the scheduled launch, a launch that had been delayed several times, this concern became heightened, because the weather at Cape Canaveral was particularly cold, and even colder weather was predicted for January 28th.

Accordingly, Alan McDonald, project supervisor at Thiokol, and at least 14 engineers in the solid fuel rocket unit, including Roger Boisjoly, formally protested the launch to the vice president of the Wasatch division, Joe Kilminster, who was vice president for space booster programs at Morton Thiokol, and to NASA directly. McDonald, as manager of the engineering-design team, went so far as to refuse to sign the launch go-ahead release for Thiokol, a signature necessary in order for the launch to proceed. There were three concerns voiced about the launch. First, the engineers were worried about the potential leaks of the joints sealed by the O-rings if the latter did not function properly under the predicted low temperatures of the launch. Second, some engineers were concerned about heavy weather sea recovery of the $40 million dollar boosters after launch. And third, it was speculated that the predicted presence of ice in the booster support troughs might affect the shuttle orbiter. The engineers were then asked by Thiokol managers and NASA to provide scientific data that would prove that the O-rings would definitely

not seal the joints. However, the engineers were unable to substantiate their intuitions on such short notice since the flexibility of O-rings had never been tested below 47 degrees F.

The engineering team at Thiokol reported to Robert Lund, the vice president of engineering. Although under pressure from NASA to override McDonald's refusal, Lund himself originally would not sign off on the launch, agreeing with his engineers that low temperatures might affect O-ring performance. NASA, however, was anxious to launch the Challenger and confident of its success. Realizing that, Jerry Mason, to whom Lund reported, made his now infamous remark to Lund, "take off [your] engineering hat and put on [your] management hat," whereupon Lund capitulated, agreed to the launch, and Kilminster signed off for Thiokol.

This case illustrates a conflict between managerial and engineering roles within a single organization. According to most engineering codes of ethics, public safety should be the primary concern of an engineer. This professional standard is to take precedence over other demands even when one is working for someone else. For example, the National Society of Professional Engineers' Code of Ethics states:

> Engineers in the fulfillment of their professional duties, shall:
> Hold paramount the safety, health and welfare of the public in the performance of their professional duties (Callahan, 1988, p. 460-61).

On the other hand, for managers, efficiency, progress, and accomplishment are primary goals. Moreover, most managers do not belong to an independent professional association with a specific code of conduct to guide their performance. In the Challenger incident, on the night before the launch the Thiokol engineers were caught between a commitment to their company, Thiokol, and their professional code. The Code's rule of "safety first" could not be upheld without flouting the authority of the managers for whom the engineers worked. The engineers saw their protests against the launch stymied by the managerial mentality of their superiors, and they did not see their way clearly to blow the whistle before the launch was carried out. They did not view their code as

dictating an overriding obligation. Should the engineers have blown the whistle to top management at Morton-Thiokol or to the press before the launch? Their code implied they should; generally accepted moral rules and the possible negative consequences of a failed launch indicated that action. At the same time, engineers in this type of situation might argue that their moral commitment to their code of safety ended when they no longer had the responsibility to sign off for the launch. One could also argue that managers, too, had obligations to place engineering safety concerns over management concerns. Faced with commitments both to a professional code of safety and to management, in this case the latter took precedent.

Conflicts of commitment can also originate from the social structure of science. For example, the reward system at a university may claim to value teaching equally with research but in fact reward research proportionally more. This system affects how a faculty member allocates time and effort despite obligations to teaching. Structural conflicts of commitment often arise in interrelationships among scientists, laboratories, and scientific discovery. An important aspect in the progress of basic science is that discoveries are shared with the community of scientists. That practice includes the custom of recognizing and giving credit to the original discoverer while at the same time allowing other scientists to repeat the experiment, expand the research, etc. At the same time the structure of the reward/grant system is such that it is an important professional benefit to be the first to discover something or the first to publish data about a new discovery. Conflicts develop between one's interest in being "the first" and the professional obligation to properly recognize another colleague's or student's efforts. This is illustrated by the following example.

> A researcher visited a colleague's laboratory only to find that photocopies of a paper he had submitted to a (well-respected scientific journal) were in the hands of several people in the (colleague's) laboratory, who quizzed him carefully about the details. Apparently, the author answered the questions without rancor, but afterwards he complained. Rightly it will be thought. It is more than a little worrying that the photocopying (colleague/) referee, one of three referees, had not submitted his

> report for five weeks after receiving the manuscript . . . (Maddox, 1992).

While the researcher had no concrete proof that his colleague had acted in disregard to his conflict of commitment, it is evident that the researcher's work was important to his colleague's research, an importance that conflicted with that colleague's role as referee for the journal. The use of another person's unpublished research without permission is a violation of the norms of scientific professional practice and is clearly wrong. Moreover, the trust between reviewer and researcher-writer comes into question in this instance.

Sometimes the existence of a structural conflict of commitment is less clear.

> An author submitted a manuscript to a highly respected, peer-reviewed journal. It was rejected on the basis of reports from three referees, including one working very much in the same field, whose report, while positive, was at best lukewarm. The author then submitted the manuscript to another journal, where he learned that a similar paper had already been received and accepted for publication. At that stage, inevitably, the author guessed the identity of the lukewarm referee of his paper. The author then raised the question whether the referee might have been helped by an earlier reading of the manuscript. Technically that might just have been possible. Mercifully, there was published evidence of the referee's earlier interest in the same problem . . . . Eventually the author was satisfied that nothing sinister had occurred (Maddox, 1992).

Here, in the absence of further information, the author certainly had reason to believe that the referee in question had a conflict of commitment. The referee *could* have used the author's findings or ideas without permission, violating professional norms and committing intellectual theft—actions that undermine the whole peer review process. Some might argue that when a referee receives a manuscript or proposal on a topic closely related to her own work she should simply declare the existence of a conflict of commitment and not review it. However, if such a practice were routinely followed, it would prevent those most

qualified from reviewing a given paper or proposal. With this in mind, some granting agencies are now asking reviewers to declare whether a conflict of commitment exists *and* review the proposal anyway.

Third, conflicts of commitment may be intellectual conflicts where one's passion for discovery or convictions about research findings may conflict with careful methodology or judgment. For example, the excitement of a new discovery may lead a scientist to publicize that discovery before independent verification has been made. A scientist acts with disregard for an intellectual conflict of commitment when her interest in a hypothesis and conviction of its provability conflict with her methods for proving that hypothesis, and thus bias the results. Such biased self-deception is a pitfall against which every scientist must constantly guard.

Unlike conflicts of interest, one cannot ordinarily divest oneself of a conflict of commitment, nor is that always desirable. For example, the dual commitments to employer and the professional code are a very real part of the way science and engineering are done successfully in the private sector. The reward system of science, while imperfect, may be the most acceptable means to encourage scientific research. Peer review of manuscripts is a viable way to evaluate scientific progress despite its problems. Without enthusiasm for a project, scientists would not engage in research at all. In all cases it is important to recognize conflicts and determine whether someone acted without regard to that conflict, thus compromising the quality of their scientific judgement.

V. Conflicting Interests, Conflicts of Interest, and Conflicts of Commitment

Conflicts of interest can be avoided or dispensed with in most cases; conflicting interests and conflicts of commitment usually cannot. Sometimes, however, in specific instances, it is not easy to sort out conflicting interests from conflicts of interest and conflicts of commitment. Moreover, the mere existence of these various conflicts may have an undesirable effect.

Consider a recent complex case where both conflicts of commitment and conflicts of interest exist could be quite important.

Between 1989 and 1992, Lt. Col. R.R. of the Walter Reed Army Institute of Research (WRAIR) tested the therapeutic value of gp160, a vaccine made by the Connecticut biotech firm MicroGeneSys. The drug is intended to limit levels of HIV in the blood ("viral load"), and thus, it is hoped, retard the onset of full-blown AIDS. Measurement of viral load involves a process called the quantitative polymerase chain reaction (PCR). WRAIR's M.V. conducted a new, experimental version of PCR for R.R., who, speaking at a prestigious conference in Amsterdam on July 21, 1992, compared PCR results from a group of untreated HIV-positive patients with those from 15 recipients of gp160, and called the differences in viral load "statistically significant."

However, R.R. was not telling the whole story; 26 people, in all, took gp160. It was also revealed that he had used questionable criteria for his statistical analysis. When W.M., head of biostatistics at the Jackson Foundation, a private foundation that contracts to help the Army with AIDS research, reworked the data, it showed that gp160's effect was, if anything, minimal (Cohen, 1993b, p. 883.) An informal WRAIR inquiry on August 28, called by R.R.'s superior, Col. D.B., decided that the first analysis had been rushed, due to pressure of time, and should have been done like W.M.'s. R.R. accepted this conclusion, which both he and M.V. repeated in presentations at a gathering in Chantilly, Virginia, only days later (Cohen, 1993a, p. 825).

The explanation did not prevent two USAF AIDS researchers from lodging an official complaint that R.R. "overstated" his results. During the Army's investigation, undertaken by Col. H.D., R.R. said that full PCR data had not reached him till July 24, 1992, and that he had consequently used what there already was on "the first 15 patients who had entered the study and who had been studied for a minimum of 18 months" (Cohen, 1993a, p. 824). M.V. for her part, contended that she had supplied full data by May 19. She allowed that selection of results need not be suspect, but R.R. stated that he had selected nothing, and was backed up on this by Lt. Col. J.B., who had worked with him on

the first analysis. H.D. accepted R.R.'s account, without giving clear reasons for rejecting M.V.'s.

Suspicions of data-selection persist. W.M. resigned his post in disgust at what he sees as a whitewash, and unnamed WRAIR personnel have cast doubt on PCR's reliability, on the Army's impartiality, on how rushed R.R.'s first analysis really was, and on the likelihood that reputable researchers would ever use rushed analyses. Some think the Amsterdam report was part of a scheme to secure a large sum of funding. R.R. is on the advisory board of a group called Americans for a Sound AIDS/HIV Policy (ASAP). M.V. claims that W.S., ASAP's president and a gp160 therapy enthusiast, called her on August 24, 1992, betraying familiarity with unreleased test data. Furthermore, W.S. once conducted an investment seminar for MicroGeneSys, thus linking R.R. to the interests of a company whose product he tests.

Most controversially, MicroGeneSys conducted intense lobbying of several US Senators to ensure that $20 million, earmarked for Army research into gp160, was added to the 1992 Defense appropriations bill, weeks after R.R.'s Amsterdam report. R.R. at that time lobbied the NIH, FDA and the Centers for Disease Control to further the testing of AIDS vaccine in pregnant women (Cohen, 1992a, p. 539). Outraged, some say envious, researchers have accused R.R. of trying to make gp160 look better than it is, using political influence to circumvent peer review. A blue-ribbon panel, convened by the director of the NIH, was sufficiently critical of the appropriation to have it reversed in January, 1994, the money redirected to more general research (Cohen, 1994).

R.R. has a commitment, a professional obligation to secure funding for his work. Is that commitment compromising his scientific judgment on the significance of the test results? R.R.'s ASAP membership indicates he also has a commitment to an important social cause. Is that in some way affecting his interpretation of data? Further, does R.R. have any connections to the interests of MicroGeneSys that could compromise his judgment regarding their product, which he is testing? The

fact that he spoke to the Amsterdam Conference about results that were, at best, tenuous, casts doubt on his findings. The conflict of interest situation is certainly exacerbated by the appropriation of government funds to test gp160 in response to MicroGeneSys lobbying after the Amsterdam presentation.

These are all conflicts of interest or conflicts of commitment. But we have scant evidence that R.R. acted with disregard to any of these conflicts. However, the existence of these conflicts raises questions about the competency of R.R. as a researcher, since he used experimentally questionable criteria and a small statistical base for his original report. The existence of a conflict of interest between R.R.'s financial and professional interests, and the existence of a conflict of commitment between R.R. as a researcher and R.R. as a fund-raiser for moneys for his research bring into question the trust people have in a professional's scientific judgment. Thus, in this case the existence of these conflicts do harm to the overall scientific enterprise.

Commitments and interests may be conflicting when one's discovery is sponsored by a university or company that would like to patent that discovery. This patenting would preclude sharing information with other members of the scientific community, a tradition of the scientific profession, until the patent is formally applied for. The question does not merely concern the ownership of the discovery, but also whether the interests of science are advanced when certain discoveries are patented, whether who finances the research affects its outcome, and whether the possible financial stakes engendered by the patenting become an overriding interest. The patenting and financing of genes and gene sequencing raises such issues.

> Geneticists have recently begun to patent some human genes, when they have "mapped" them (i.e., established their positions along the chromosomes) and discovered their functions. On June 20, 1991, the NIH filed an application with the US Patent Office, for the rights to 337 human genes, studied by Craig Venter and his research team at the National Institutes of Health. This was remarkable, for the genes were unmapped, their functions unknown. Furthermore, these were not even complete gene sequences. The team had selected "random clones from a

collection of cDNA which correspond to active genes" and sequenced a part of each, using machines and robots (Roberts, 1992a). A fragmentary sequence would identify a gene when sequencing of the whole gene took place. In February, 1992, Venter requested rights to 2,375 other fragments, by which time the machines were sequencing 168 genes daily.

Presently, most researchers place unmapped gene sequences in the public domain through publication, and submit the sequences to a database. No company or researcher can patent those genes unless they have near-clinical uses (Anderson, 1991). Venter argues that a patent ensures the gene's availability to all researchers and for any company willing to license it. However, some see his application as part of a trend towards "insubstantial" patents based on the means of making the discovery rather than the discovery itself" (Roberts, 1992a). Controversy does not end there. The Human Genome Project was designed to map and sequence the entire human DNA molecule over a 15-year period, at a cost of about $3 billion; Venter claims that he could sequence—though not map—almost all the genes far sooner, for about $10 million. Scientists fear that Congress may withhold funds for the necessary subsequent mapping. The patent may adversely affect individual research also, by draining money in patent rights, and by introducing a spirit of competition, not collaboration, among researchers and countries. There is the concern that licensing battles over sequences with no known function will slow research.

On July 10, 1992, Venter left NIH, to head up The Institute for Genome Research (TIGR), a privately-funded enterprise. Its goal, he says, is to "do the genome project," (Anderson, 1992a) including gene mapping and biology, beside cDNA sequencing. Once fully operational, the Institute will be able to sequence 60 million base pairs a year. The initial funding is a 10-year grant from the Healthcare Investment Corporation (HIC), a venture capital group that has funded other biotech companies, and which has also created a new company, Human Genome Sciences Inc., to turn Venter's discoveries into products. Interestingly, HIC's head has ruled that neither the Institute nor Human Genome

Sciences will seek patents on gene fragments. HIC's other companies currently accept the standard policy on gene patents, but are observing the Venter application's outcome.

An invention or discovery must satisfy three criteria to be considered worthy of a patent: it must be novel, non-obvious and have some utility. Venter's application failed on all three counts in September 1992 (Roberts, 1992b). NIH originally intended to negotiate a revised claim with the Patent Office, but in February, 1994 dropped its patent bid altogether as "not in the best interests of the public or science" (Anderson, 1994a). However, in January, 1993, Incyte Pharmaceuticals, of Palo Alto, California, filed for patent rights on 40,000 cDNA sequences. The company has increased its sequencing ability and hopes to file patent applications for about 100,000 gene fragment sequences per year, then use computers to search through the random gene fragments to determine their utility. As of this writing, this application is still pending.

This case raises the question of who should fund research and what claims does the funder have on the discoveries that result. Venter was originally supported by the publicly-funded National Institutes of Health. He left NIH for a privately-funded institution, and sought patents on gene fragments using technology developed at NIH. In such a situation sharing scientific information and materials may conflict with the potential for financial benefit when patents are granted to private for-profit institutions. NIH guidelines for the use of research developed at NIH are still unclear. If the ultimate goal of such research is to provide better diagnosis and treatment of human genetic diseases, then the question, from the perspective of positive or negative foreseeable outcomes, must be whether patenting will actually enhance or retard the rapid development of such new technologies.

Linked to the question of funding is that of intellectual property. Is the work of Craig Venter and his researchers at NIH theirs to transfer to The Institute for Genome Research and then to patent? Many ideas for gene sequencing are theirs. Yet without NIH support they could not have gotten the project started, and without HIC funding they cannot continue. Concerning the patenting, one might argue that only after clearly useful

products and technologies have been developed might the issuing of patents for those products and technologies not conflict with scientific progress. The basic rules for granting of patents should help ensure that patents are not issued too early in the experimental development of a field, possibly retarding its progress. The case also raises an issue of the existence of a conflict of interest. The potential of financial rewards from patents could compromise one's research focus. While making money can be a part of research, one needs to be careful that the existence of financial interests do not compromise one's judgment regarding the most appropriate research approach to use in answering important questions.

VI. Dealing with Conflicts of Interest and Conflicts of Commitment

As all these examples illustrate, conflict of interest and conflict of commitment situations do not pose simple problems. They involve questions where it is not always clear that there is a well-defined "right thing to do." Ideally, depending on the particular circumstance, conflicts of interest should be either avoided, disclosed, or ended as soon as possible. While not all conflicts of interest can be avoided, ordinarily they can be resolved. In conflict of commitment cases it is usually very difficult to serve all interests equally and maximally. Yet conflict of commitment situations, too, can usually be mitigated. How, then, should we approach these issues and their resolution?

The disclosure of conflicts to the person or group relying upon the judgment in question has often been considered the most appropriate approach to these issues. This of course depends on the assumption that the scientist in question recognizes and acknowledges that a conflict situation exists in a particular instance. Guidelines being developed are intended to help investigators recognize conflict of interest situations, and they are often designed to prevent one from getting into such situations. Despite their status as guardians of public trust, universities in many cases have no clear guidelines as to what should be considered a conflict of interest. Policies sometimes require disclosure from faculty who are employees or stockholders of organizations doing business with the university, but these university policies do not specifically pertain to conflicts arising in the conduct of scientific research by faculty. They do

not always address issues of research supported by outside agencies such as NIH or NSF.

Harvard Medical School has recently adopted a detailed disclosure policy governing all research and other faculty activities (Harvard, 1990). Faculty must internally disclose all conflict situations which are then reviewed by department heads and then a standing committee. A number of specific activities are indicated that are only allowable with oversight after review and approval by the standing committee. These include such things as receiving research support from a company in which the faculty member has a financial interest, participating in research on a technology owned by a company in which the faculty member has a financial interest, or publishing results without disclosing a financial interest in such results. Conflicts of commitment involving outside commitments, which, if disregarded, could interfere with a faculty member's primary commitment of time to the university, are also reviewed by the same process.

For example, Johns Hopkins and other universities have prohibitions on researchers holding equity in companies with whom they do consulting work or from whom they receive research support. Hopkins recently reversed this policy, indicating that researchers can hold stock but ordinarily may not sell it until 2 years after the product on which they worked goes on the market (cited in Anderson, 1993e).

The Association of American Medical Colleges (AAMC) has produced its own guidelines for conflicts of interest and commitment (AAMC, 1990). They indicate that each institution should have its own procedure for disclosure and review, and they recommend several levels of review beginning with the department chairperson. The guidelines suggest that each institution develop its own list of possible conflict situations but also gives its own list of specific situations that should be viewed as particularly problematic. These include faculty members doing research on products from companies in which they or immediate family members have financial interests, using students to perform work for a company in which the faculty member has financial interests, or unauthorized use of privileged information acquired from professional activities. The AAMC guidelines also recommend that each institution develop clear standards for faculty obligations to that institution to prevent conflicts of commitment.

Journals have also begun to ask for disclosure, and a very broad approach has recently been taken by the journal *Science*. Every manuscript submitted there must now contain "any information about the authors' professional and financial affiliation that may be perceived to have biased the presentation (Information for contributors, 1993)." Not only authors, but reviewers, editors and news writers are asked to inform the journal of

> . . . any potential conflict of interest that might consciously or unconsciously bias their opinion in refereeing or writing a paper. That information could include such items as financial interest, work in the reviewer's own laboratory that conflicts with or competes with the paper being reviewed, or strongly held intellectual, religious or social convictions when relevant (Koshland, 1993).

The information received is kept confidential, and if the editor thinks it is important, a comment is included in the author credits and the author is consulted before publication. The journal also uses the information to avoid choosing direct intellectual competitors in the selection of reviewers.

However, *Science's* policies have not escaped criticism. According to one researcher:

> *Science* and other journals imply that authors' affiliations, funding sources, financial interests, intellectual passions, and perhaps even sexual orientation or religion should be somehow taken into account when one reads a paper . . . . [T]hese policies are counterproductive; by shifting the attention of readers away from content, journals are encouraging ad hominem evaluations and thereby reducing the overall objectivity of scientific discourse. These policies are also ethically questionable, because they impugn authors with the implied accusation of wrongdoing without evidence and without recourse (Rothman, 1993b).

Disclosure forces individuals to examine carefully their own activities and the activities of others with whom they work for ways in which their scientific judgement could be compromised. Sometimes the mere hesitancy a scientist feels in disclosing activities may indicate that this is a situation where a conflict exists. Disclosure, by openly acknowledging

relevant facts of a situation, can prevent suspicions that an individual had a conflict of interest. Had the biochemist at Johns Hopkins University disclosed his financial interests in the firm making the antisense reagents about which he was writing the review, there may not have been a suspicion that he "had something to hide" and his credibility in a very important research area might not have been weakened.

It should be understood that disclosure does not resolve or end a conflict of interest situation nor exonerate those who may have acted in disregard to the conflict. "What it ends is the passive deception of allowing one's judgment (or other service) to appear more reliable than it in fact is" (Wells *et al.*, 1985, p. 23). In some cases it also is important to change the situation so as to avoid the conflict or end it. The guidelines universities are developing to recognize, monitor, and resolve conflicts are essential for accomplishing that.

Granting agencies have also begun to develop guidelines for identifying conflicts of interest. The Howard Hughes Medical Institute does not allow its grant holders to have any "significant" equity in companies related to the scientist's research efforts. The meaning of "significant" is not clear and Hughes makes its decisions on a case-by-case basis (Anderson, 1993e). NIH and NSF do not yet have regulations in place for determining financial conflicts of interest on the part of their supported investigators. Initial indications are that both agencies will allow the investigator's own institution to determine whether a conflict of interest exists based on the information the investigator discloses. The intent of any regulations will be to discourage researchers from having financial interests in companies whose products they are evaluating.

Granting agencies have established conflict of interest guidelines for proposal reviewers. NSF requires applicants to list collaborators during the previous four years and graduate and post-graduate advisors and advisees. This information is then used to "identify potential conflicts or bias in the selection of reviewers" (NSF, 1994). The International Science Foundation instructs grant reviewers: "If you have any relationships with the institution or the persons submitting the proposal, please consider whether they could be construed as creating a conflict of interests for you" (ISF, 1994). If a reviewer answers yes, they are to check a box and describe their conflict of interest. Ordinarily the agency will request the review even if a conflict is thought to exist. The United States Department of Agriculture (USDA) asks applicants to list

collaborators and co-authors over the past five years to help in reviewer selection, but does not regard any other scientists in the applicant's research area as being in conflict of interest. USDA reviewers are asked to disqualify themselves if they have been collaborators, co-authors, thesis or postdoctoral advisors, graduate students or postdoctoral associates of the applicant during the past five years. Reviewers are also to disqualify themselves if they have "an institutional or consulting affiliation with the submitting institution, applicants and collaborators or will gain some benefit from the project, financial or otherwise" (USDA, 1994.).

Professional organizations are also producing conflict guidelines. Since the Hydrolevel affair, ASME has developed conflict of interest guidelines that must be signed by all staff, officers, and committee members. It has changed its procedures for handling interpretations of its code. These must now be reviewed by at least five people and made available to the public through their publications. Responses to these interpretations are also published and an appeal procedure for questioning code interpretations is in place (Beardsley, 1984, p. 73).

Despite these guidelines, in both journal submissions and grant reviews, much of what constitutes a conflict of interest is left to the individual scientist. While codes, standards or guidelines are important, they alone cannot solve problems of conflict of interest or conflict of commitment facing the individual scientist or engineer. So further guidance is needed—thus our appeal is to common sense morality. Here the guidelines for evaluation are less clear. But in evaluating these cases we can take three approaches.

First, we can ask a number of questions that guide our evaluation of a specific conflict of interest or conflict of commitment.

1. Is this the kind of conflict of interest or conflict of commitment an impartial scientist or engineer would find acceptable, all things considered? In particular, will the conflict create a significant temptation for the researcher to render a biased scientific judgment? Would such actions be acceptable to colleagues or to the public? In many of the cases described above the answer to all these questions was "no."
2. What kind of precedent would acting in disregard to this conflict of interest or conflict of commitment set? Is this a

conflict peculiar to this situation or would accepting financial and personal considerations set a standard for similar cases? The P.M. case is a good illustration, where his failure to disclose his financial connections with Genta set a negative precedent that one would not want other researchers to emulate.

3. What are the interests and expectations of parties involved or affected by this situation? Can I make my interests known to them and receive their approval? The reviewer of the manuscript that was shared with the reviewer's laboratory illustrates a case where interests and expectations were not respected and where the writer of the manuscript did not approve of this practice.
4. The publicity test: Can this conflict of interest be made public and defended in a public forum? The Hydrolevel case illustrates an instance where one could not defend the actions of James and Hardin in a public setting.
5. What kind of institutional structure, accountability procedure, constraint, or absence of constraint might have contributed to the conflict of interest or conflict of commitment? Are there structural or societal factors that must be taken into account? How might one change any of these factors to try to avoid similar dilemmas of this sort in the future? The Challenger case, in particular, illustrates that a change in the corporate structure and accountability system at Thiokol could help to prevent disasters such as this one.

A second set of questions needs to be asked from the point of view of foreseeable outcomes. Who is harmed and who benefits if one acts in disregard of this conflict of interest or conflict of commitment? Are there tradeoffs of costs and benefits that can be either avoided or, alternately, justified by long-term benefits? The S.T. eye research case raised this issue. One is not sure what the long-term benefits of his research will be while the conflict of interest was ultimately harmful to scientific research and discovery.

Third, we can test the conflict of interest in question against moral rules, such as being open and avoiding deception, keeping one's promises, respecting basic rights, avoiding creating harms, and treating

people fairly. Here we ask the question, does the conflict of interest violate any moral rules? In the Hydrolevel case, James and Hardin did not treat Hydrolevel fairly nor properly take into account public safety. Whether Lt. Col. R.R. is telling the truth is not clear, but he was less than forthright about the tenuous results of his first gp160 experiments.

Finally, if the conflict of interest or conflict of commitment in question does not pass these tests, that is, if it does not conform to codes and standards, if it does not meet the precepts of common sense morality, and/or if acting upon it, on balance, increases harms, we are faced with the question: what should one do? What one should do, obviously, is to clear up or remove the conflict. But what specifically one should do depends on the context and facts of the situation. There are several options.

1. Disclose the conflict.
2. Divest oneself of interests that threaten independent scientific judgment. S.T. might have taken this path, and thus avoided difficulties that arose as a result of his experimenting and marketing the "dry eye" ointment.
3. Withdraw from the situation altogether, or, in some cases of evaluating research or manuscripts, do not render a judgment.
4. Appeal to laws, rules or policies that accommodate clashing interests (Weil, 1991).
5. Change institutional procedures or policies. For example, in the Challenger incident, the engineers' failure to stop the launch has to do with the managerial structure of modern corporations, and this case illustrates both individual and institutional conflicts of commitment. The company, Morton-Thiokol, had no mechanisms in place to expedite considerations of safety concerns, nor had it trained its managers to place engineering safety commitment ahead of managerial commitments. So the inability of Thiokol engineers to halt this launch was partly a failure of the structure of the company in which they worked, as well as the "go/no go" process of decision making. This does not excuse Morton-Thiokol. Corporations can make structural changes; mechanisms for prioritizing safety concerns can be institutionalized; engineers and managers can

communicate better with each other; and these conflicts of commitment due to differing roles can be resolved.

6. Change expectations of involved parties. For example, some universities now encourage research liaisons with industry, but these are made public and explicit guidelines are often in place so that there can be no question of hidden conflicts of interest.

VII. Conclusion

Conflicts of interest and conflicts of commitment are inevitable outgrowths of the scientific process; but acting in disregard of these conflicts is not. This conclusion does not imply either that financial, social, and personal interests are all questionable or, on the other hand, that conflicts of interest are to be ignored. Nor does it imply that one can escape conflicts of commitment. But acting in disregard of a conflict of interest is not inevitable, and conflicts of interest can be avoided, escaped, or resolved. Conflicts of commitment can be disclosed and mitigated.

Objectivity is an ideal—an ideal or standard by which we judge scientific investigations and technological advances. Scientific research is a process through which one works toward the ideal of objectivity through various techniques and procedures that attempt to overcome biases and other hazards to discovery (Rothman, 1993a, Popper, 1966). In that process one tries to sort out those influences, perspectives, and pressures that preclude the achievement of that ideal. Financial interests that taint one's research projects, personal interests that interfere with one's progress as a student of science, excessive enthusiasm for one's "pet" theory, as well as issues arising from conflicts of professional commitments all work against that ideal. As a result there are personal, professional, scientific, technological and institutional losses that, while not always measurable in the short run, lead to a net loss in scientific progress that only research under the ideal of objectivity can achieve. The issues raised by conflicts of interest and conflicts of commitment, then, are crucial ones. They must be faced openly, standards must be in place to prevent some of these occurrences, and the process of moral reasoning must be fostered to help individuals and institutions facing these issues deal with them rationally and effectively.

Notes

1. Research for the cases in this paper was done by Jean McDowell and Liam Harte of Loyola University Chicago, to whom we are greatly indebted. This chapter has benefitted from comments by other members of the consortium, in particular, Stephanie Bird, Deni Elliott, Bernard Gert, Judith Swazey, and Vivian Weil, as well as Rachelle Hollander and Michael Davis. Its shortcomings are unfortunately our own.

2. The origin of this idea probably comes from the 16th century philosopher of science, Francis Bacon. See, *The Philosophical Works of Francis Bacon*, ed. John M. Robertson. (London: Oxford, 1905).

3. See, for example, Feyerabend (1961), and Kuhn (1970). If there were nor prior organizing principles, any inquiry would probably of limited value. Without the commitment and ego-emotional energy essential to engage in the meticulous study of data, becoming a scientist is hardly imaginable.

4. For a more detailed theoretical discussion see Davis (1982) and (1993).