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Ethical Virtues in Scientific Research

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Abstract

Most approaches to promoting integrity in research are principle-based in that they portray ethical conduct as consisting of adherence to ethical rules, duties, or responsibilities. Bruce MacFarlane has recently criticized the principle-based approach to promoting integrity in research and offered a virtue-based alternative. MacFarlane argues that principle-based approaches do not provide adequate guidance for ethical decision-making and are not very useful in moral education. In this article, I examine and critique MacFarlane's defense of the virtue-based approach. I argue that virtue-based and principle-based approaches to ethics are complementary and that they both can help promote research integrity.

Keywords

decision-making; education; leadership; mentoring; policy; principles; research ethics; virtue

INTRODUCTION

Most approaches to promoting integrity in research are principle-based in that they portray ethical conduct as consisting of adherence to ethical rules, duties, or responsibilities. Ethics guidelines and codes of conduct adopted by professional associations are usually framed in terms of rules, duties, or responsibilities. For example, the Nuremberg Code (1949), consists of ten directives for human experimentation, the Helsinki Declaration includes thirty-five ethical principles for medical research involving human subjects (World Medical Association, 2008), and *The Belmont Report* articulates three principles for research involving human beings (National Commission, 1979). In 2010, participants in the 2nd World Conference on Research Integrity developed the Singapore Statement on Research Integrity, which includes four principles and fourteen responsibilities pertaining to the ethical conduct of scientific research in various disciplines, not just research with human participants. Some examples of professional codes of research ethics stated in terms of rules, duties, or responsibilities include those adopted by the American Chemical Society (2007), the American Physical Society (2002), and American Society for Microbiology (2005). Principle-based textbooks and monographs in research ethics include works by Shrader-Frechette (1994), Resnik (1998), Macrina (2005), Steneck (2007), Shamoo and Resnik (2009), and the National Academy of Sciences (2009).

In an insightful book, *Researching with Integrity*, University of Hong Kong education professor Bruce MacFarlane (2008) criticizes the principle-based approach to promoting integrity in research and defends a virtue-based approach. MacFarlane argues that principle-based approaches do not provide adequate guidance for ethical decision-making and are not

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very useful in moral education. In this article, I will examine and critique MacFarlane's defense of the virtue-based approach. I will argue that virtue-based and principle-based approaches to ethics are complementary and that they both can help promote research integrity.

THE PRINCIPLE-BASED APPROACH

In order to explicate and evaluate MacFarlane's position, it is necessary to understand the difference between virtue-based and principle-based approach to ethics (or morality). The central insight of the principle-based approach is that ethical conduct consists in following rules for behavior (Beauchamp and Childress, 2009). These include general rules (i.e., principles) as well as specific rules (i.e., duties, obligations, rights, or responsibilities). Specific rules can be derived from general ones. For example, a principle of non-maleficence (do no harm) implies duties not to kill, rape, or assault innocent human beings.

In philosophy, the figure most often associated with the principle-based approach is the Eighteenth Century German philosopher Immanuel Kant. Kant (1964) held that ethical conduct consists in acting according to the motive of duty (duty for duty's sake) rather than self-interest or some other motive. One's duty is determined by a general moral principle, known as the Categorical Imperative (CI). According to one version of the CI, we should follow maxims (or rules for action) that could become universal laws for all rational beings. The CI implies a variety of subsidiary rules, such as duties not to harm or others or one's self, not to lie, to keep one's promises, to benefit others, and so on.

The nineteenth century English philosopher John Stuart Mill (2003) boiled ethics down to one simple rule (known as the greatest happiness principle or principle of utility): one should perform the action that promotes the greatest balance of overall happiness/unhappiness for all people in society. Mill also held that many of the commonly accepted rules of morality are based on this single principle. Other utilitarians, such as Richard Brandt (1998), have developed systems of rules based on the principle of utility.

Long before Kant and Mill wrote about ethics, the seventeenth century English philosopher Thomas Hobbes (2006) argued that morality consists of rules that would be adopted by people who come together to form a civil society. Prior to forming a civil society, people live in what Hobbes called the state of nature. Life in the state of nature is difficult: you may be easily raped or killed, have property stolen, suffer from hunger or disease, and so on. Hobbes argued the people in the state of nature will realize that it is in their self-interest to cooperate for their common good, and that they will enter into a social contract in which they agree to form a government and to live by mutually beneficial rules. Other political and moral philosophers working within the social contract tradition, such as John Rawls (1971), have taken similar positions on the nature of morality.

In the early 20th century, Scottish philosopher W. D. Ross defended a principle-based approach to ethics that has had considerable influence. Ross argued that ethical conduct consists in following widely accepted principles, such as fidelity, non-maleficence, justice, beneficence, and self-improvement. These principles sometimes conflict, however, and when they do, we must carefully consider the facts and our options and use our moral judgment and intuition to decide what to do (Ross, 1930). Ross' view has considerable appeal because it strips morality of some of the controversial concepts and assumptions associated with robust moral theories, such as Kantianism or utilitarianism, and focuses on a streamlined list of rules that have widespread acceptance.

In the 1970s, Tom Beauchamp and James Childress (2008) developed an approach to biomedical ethics similar to Ross' view. They defended a list of four widely accepted ethical

principles—respect for persons, non-maleficence, beneficence, and justice—which they said apply to conduct and decision-making in biomedicine. When conflicts arise, one must use moral judgment and reasoning to decide what to do. The exercise of moral judgment and reasoning consists in carefully assessing the available options in light of the facts and ethical considerations pertaining to the decision. One must also decide how to prioritize principles when conflicts arise. Other writers have developed approaches to moral decision-making similar to Beauchamp and Childress' view. For example, Kass (2001) has proposed a list of ethical principles for public health, Shamoo and Resnik (2009) have articulated a list of ethical principles for scientific research, and Resnik (2012) defends a set of ethical principles for environmental health.

It is also important to note that the world's major religions also include ethical principles. For example, the Hebrew Bible includes the Ten Commandments and other rules for conduct. These rules date to time of Moses (circa 1300 BCE). The New Testament provides an account of the teachings of Jesus of Nazareth. Jesus urged his followers to love your neighbor as you love yourself and to follow the Golden Rule, i.e., do unto other as you would have them do unto you (Bible, 2004). Other religious traditions, including Islam, Hinduism, Buddhism, and African and Native American religions, also include ethical rules (Smith, 1991).

One of the standard critiques of principle-based approaches to ethics is that these theories do not provide adequate guidance for ethical decision-making when principles conflict. Kant and Mill handled this problem by appealing to an overarching principle (such as the CI or the principle of utility) to resolve conflicts between subsidiary rules. Since these theories include some controversial concepts and assumptions, many ethicists prefer streamlined approaches to ethics similar to theories defended by Ross and Beauchamp and Childress. Many have argued, however, that ethical theories that lack an overarching moral principle cannot resolve conflicts of rules satisfactorily (Gert, 2007).

Proponents of streamlined principle-based theories have tried to answer these objections by developing procedures for resolving conflicts of moral principles (Lustig, 1992; Gillon, 1994; Richardson, 2000; Beauchamp and Childress, 2008; Shamoo and Resnik, 2009;, Resnik, 2012). Some of these procedures are obtaining additional information relevant to the conflict, exploring options that have not been previously identified, interpreting principles, and seeking a reasonable prioritization of principles.

Let's consider an example. Suppose a student asks a professor to change a grade so that he can retain his scholarship. He has a 79.3 on his final grade and needs an 80 average to retain his scholarship. This situation presents a conflict between two principles: help others and act fairly. One could help the student retain his scholarship by changing his grade, but this would be treating the others students unfairly who worked hard for their grades and are not receiving this extra benefit. There appears to be no simple solution to this dilemma, because these fundamental rules conflict.

Obtaining additional information might help to resolve this conflict. For example, suppose that the professor finds out that the student missed a week of school while he was dealing with a death in the family but that he did not seek an official excuse or absence and he missed a quiz. If he had taken the quiz, he could have earned enough points to make an 80 average. The professor could offer to let the student retake the quiz if he gets an official excuse. One could argue that this option would not be unfair to the other students, since they had the opportunity to take the quiz, but the student in need of a grade change did not.

Exploring options that have not been previously identified may also lead to a solution. Suppose, for example, that the professor allows the student to perform an extra credit

assignment that would allow him to earn enough points to receive an 80. One might argue that this option would be fair, because the student would be earning a higher grade only because he is doing more work.

Interpreting principles may also help to resolve conflicts. Suppose that the student did not miss a week of school and completed all the assignments and that extra credit is not an option in this case. One might try to resolve the dilemma by interpreting the concept of "helping" a student. Does helping a student mean that one should advance the student's interests, no matter what, or does it mean that one should help the student learn the course material and provide the student with appropriate feedback, grading, and counseling? One might argue that "helping" a student does not include advancing the student's interests no matter what, because this commitment would demand too much of a professor. Professors are not career counselors, psychologists, or personal assistants. Thus, the conflict between principles could be resolved by interpreting "helping" a student properly.

If obtaining additional information, exploring other options, and interpreting principles do not resolve the dilemma, then one may work toward a reasonable prioritization of principles. A prioritization is reasonable if it takes the relevant information and options into account, provides a consistent approach to the issue, is publicly defensible, and attempts as much as possible to recognize the value of each competing principle. In many cases, it may be possible to reach a solution that represents a fair compromise between competing principles (Resnik, 2012). For example, the extra credit option mentioned above would seem to be a fair compromise between fairness and helping the student, as would the option of allowing a student to retake a quiz that he missed when he was out of school. However, sometimes there may not be a compromise solution and one must provide a reason for giving one principle greater priority. In the student/professor case, one could argue that fairness should take precedence over helping students, because the entire grading system is based on fairness. If professors routinely made exceptions and changed students' grades to help them out, the entire grading system would be jeopardized, which would have far-reaching negative impacts on the university.

The principle-based approach developed by Ross, Beauchamp, Childress, and others does not provide one with a quick and easy formula for inferring solutions to ethical dilemmas from a set of facts and options, but it provides decision-makers with valuable guidance. Beauchamp, Childress, and other writers have articulated clear procedures for dealing with ethical dilemmas. These procedures may not eliminate all moral disagreements, but they can help to reduce them substantially. Though reasonable people may reach different decisions based on the same facts and options because they prioritize principles differently, they can still use these procedures to narrow their range of disagreement by eliminating options they recognize as unacceptable.

THE VIRTUE-BASED APPROACH

The virtue-based approach has its origins in ancient Greek philosophy. The virtue-based approach focuses on the development of good character traits, rather than adherence to moral principles or rules. In the fifth century BCE, Aristotle (2003) published an account of virtue in his *Nicomachean Ethics*. In this treatise, Aristotle explored the notion of human happiness. He argued that happiness consists not merely in satisfying one's desires, but in performing functions that are uniquely human. Though human beings and other life forms share many functions, such as growth and reproduction, only human beings are capable of rational thought and action. Thus, the purpose of human life is rational activity. To be a good person, one must perform the human function well. Just as a good flute is a flute that produces musical tones well, a good person is someone who engages in rational activity

well. Thus, a good person is someone who demonstrates excellence in rational activity, or virtue (Aristotle, 2003).

Aristotle distinguished between practical virtues, such as courage and moderation, and intellectual ones, such as knowledge and wisdom. Virtues are character traits (or habits) that we develop over time, through practice and imitation. We learn how to practice virtue by following the example of other people who exhibit virtue in their conduct and by applying this example to our own conduct. In this way, virtue is similar to other practical skills, such as carpentry, driving, or piano playing. All virtues are means between extremes of behavior. Courage is a mean between too little courage (cowardice) and too much (recklessness) (Aristotle, 2003).

During the 18th, 19th, and 20th centuries, the virtue-based approach fell out of favor among academic philosophers, who focused on principle-based approaches. Ordinary people and theologians continued to talk about the importance of virtue in moral life, however. In the late 1970s and 1980s, contemporary philosophers, such as Foot (1978) and MacIntyre (1984), revived the virtue-based approach. Pellegrino and Thomasma (1993) applied the approach to medical ethics, arguing that physicians should be guided by virtues. Pellegrino (1992) published a brief discussion of moral character in scientific research, and Beecher (1966) emphasized the importance of the investigator's virtue, as opposed to rigid adherence to rules, in protecting human research participants.

One of the advantages of virtue-based approaches is that they can explain the relationship between human motivation and ethical conduct. Most of us want to live a good life and become better persons. Virtue-based approaches provide a clear link between natural human desires for happiness and self-improvement and moral conduct. Some principle-based approaches have difficulty showing the relationship between ethical conduct and motivation, since following ethical rules may not be in our self-interest. Kant argued, for example, that ethical conduct consists in doing our duty for duty's sake, but how many people have such pure motives? Most people act morally for a variety of reasons, including fear of punishment, shame, or guilt (Cahn and Markie, 1998).

In thinking about virtue ethics, it is important to distinguish between two different positions: the replacement view and the augmentation view (Cahn and Markie, 1998). According to the replacement view, virtue theories should replace principle-based approaches to morality. What it means to act morally is to practice virtue, not to follow moral principles or rules. According to the augmentation view, virtues theories are compatible with principle-based approaches. Virtue theories should supplement but not replace principle-based theories. Acting morally includes practicing virtue and following rules.

The augmentation view is not controversial, because most theorists agree that moral theories should include an account of moral virtue. For Kant, virtue is a useful byproduct of acting morally. By following moral rules, we develop the disposition (or strength of will) to continue following moral rules (Kant, 1964). For Mill, seeking virtue is a worthwhile pursuit because it contributes to one's own happiness and the happiness of others, and thus promotes utility (Mill, 2003).

The replacement view is controversial, however, because most theorists do not think we can give an adequate account of morality if we dispense with rules (Cahn and Markie, 1998). First, rules play an important role in moral decision-making. Consider the student/professor example again. What would it mean to act virtuously in this case? The professor could practice the virtue of benevolence and change the student's grade so he can pass the course, or he could practice the virtue of fairness and not change the grade. In both cases, he would be acting virtuously. Virtue theories do not give us clear instructions on how to handle

conflicts between virtues, because they offer us little guidance other than "be benevolent," "be fair," and so on. While principle-based theories also have difficulties in dealing with ethical dilemmas, they are much better at handling these situations than virtue-based theories because they include overarching principles or procedures for settling conflicts (Cahn and Markie, 1998; Beauchamp and Childress, 2008).

Second, dispensing with rules may also lead to problems with developing ethics policies. Institutions, professional societies, and other organizations need to develop ethics policies for guiding conduct in research, education, business, and other activities. Principles and rules can provide better guidance for policy development than virtues because principles and rules can give clear and specific directives for behavior. For example, the virtue of respectfulness may not be very helpful in developing a policy for protecting human research participants, because respecting human subjects involves much more than simply being respectful. Respect for human subjects includes obligations to obtain informed consent from participants (or their representatives), protect confidentiality and privacy, and so on (Shamoo and Resnik, 2009). Ethical rules and principles, such as "obtain informed consent," "protect confidentiality," "protect vulnerable subjects from exploitation," and so on, can give much clearer guidance for policy formation than the virtue of respectfulness. This is not to say, of course, that being respectful is unimportant; it is simply not enough.

MACFARLANE'S VIEW

Now that we have explained the difference between principle-based and virtue-based approaches to ethics, we can consider MacFarlane's view. MacFarlane (2008) defends an account of virtue in scientific research based on the work of Aristotle and contemporary writers, such as MacIntyre (1984). MacFarlane does not clearly state whether he thinks that moral virtues should replace or augment moral principles in scientific research, but it is clear that he favors virtues over principles.

MacFarlane discusses six different scientific virtues: courage (standing up at the appropriate time for what one believes in despite some potential personal cost), respectfulness (treating others with the respect they deserve), resoluteness (staying with one's work, forging on despite difficulties, within the bounds of reason), sincerity (being honest and truthful when appropriate, believing what you say), humility (giving due weight to one's strengths and weaknesses), and reflexivity (being critical enough of one's work, making due allowances for one's own biases). MacFarlane (2008) argues that researchers should teach students about these character traits and demonstrate them in their own behavior. Conceivably, MacFarlane's list of virtues could be expanded to include such traits as fairness (treating people fairly), openness (sharing knowledge and resources when appropriate), resourcefulness (making good use of one's resources, finding new resources), conscientiousness (taking due care in one's work, being meticulous in research), flexibility (being able to change one's plans when necessary), and integrity (reasonably acting in accordance with one's values, avoiding hypocrisy).

MacFarlane (2008) puts forth two different arguments against the principle-based approach to research ethics. The first argument is that principle-based approaches do not provide sufficient guidance for ethical decision-making because principles (or rules, duties, and responsibilities) often conflict, and there is no satisfactory way of settling these conflicts. The result, according to MacFarlane, is that people tend to choose whatever way of settling a conflict fits with their moral intuitions: they use principles to rationalize their decisions post hoc, rather than to provide genuine guidance in ethical dilemmas.

This criticism of principle-based approaches to research ethics is not very convincing, however. First, as shown earlier, proponents of principle-based approaches have developed

procedures for resolving conflicts between ethical principles. These procedures may not satisfy all critics, but they can provide useful guidance for students, scientists, and administrators who face ethical dilemmas in research. Second, also as shown earlier, virtue-based approaches are much worse at dealing with ethical dilemmas than principle-based approaches. A virtue theorist who complains that principle-based approaches do not handle moral dilemmas very well risks stabbing himself with his own knife.

MacFarlane's second argument against the principle-based approach has more merit than the first one. MacFarlane (2008) argues that the principle-based approach is not a very useful tool in moral education because rules, duties, and responsibilities are impersonal, with little connection to one's personal and professional life (MacFarlane, 2008). Personal and professional development consists in becoming a better person and a better scientist, not in internalizing a long list of rules, duties, and responsibilities. A virtue like honesty has a close connection to one's personal and professional life, whereas a rule like "conduct research in human beings only if the risks of the research are reasonable in relation to the benefits to the subjects and society" does not. If one of the goals of professional education is to help students become better people, then the virtue-based approach offers distinct advantages over the principle-based approach in achieving this outcome because it taps into students' motivations, and goals (MacFarlane, 2008).

Further support for MacFarlane's second argument comes from studies showing that mentoring plays a critical role in education in research integrity (Wocial, 1995; Institute of Medicine, 2002; Anderson et al., 2007; Wright et al., 2008). Mentoring is different from formal instruction (e.g., courses and seminars) in that mentoring involves demonstrating professional and ethical behavior while working closely with students. A good mentor does much more than teach students the rules of conduct: he (or she) shows students how to be a competent, professional, and ethical researcher (Institute of Medicine, 2002). A virtue-based approach to research integrity can enhance the mentoring process by providing an analysis and explication of the character traits that scientists should model for their students. Scientific mentors can reflect upon the qualities of the virtuous researcher and try to help their students develop these traits. They can also discuss examples of outstanding scientists to illustrate how virtues function in real life (MacFarlane, 2008). A principle-based approach does not seem to fit well with the mentoring process, according to MacFarlane. The learning that takes places during scientific mentoring bears little resemblance to the internalization of a list of rules, duties, and responsibilities.

Although MacFarlane's observations about the importance of teaching virtue in professional education are right on target, it is worth noting that teaching moral principles involves much more than just helping students internalize a list of rules, since good teaching should include instruction in how to interpret, understand, and apply those rules. A good teacher explains to students why it is important to follow the rules and what one should do when the rules conflict (Davis, 1999). Thus, teaching students about moral principles is much richer and pedagogically complex activity than MacFarlane assumes. Teaching moral principles can also enhance a student's understanding of virtue, since virtuous researchers follow moral principles and rules.

PROMOTING INTEGRITY IN RESEARCH: VIRTUES AND PRINCIPLES

At this point in the essay, one is tempted to ask the question: "Which approach should scientists use to promote integrity in research—the virtue-based approach or the principle-based one?" However, this question presents a false dichotomy because both approaches can be and should be pursued. Virtue-based and principle-based approaches to ethics are complementary because they focus on different aspects of ethical conduct. Principle-based

approaches stress the importance of following moral rules, while the virtue-based approaches emphasize moral character development. Following rules does not interfere with the development of moral character, nor does character development preclude the following of rules. Indeed, one might argue that one of the ways that we develop virtue is by understanding and following moral rules. If a person follows a rule like “don’t lie” repeatedly, this will develop into a habit and they will become an honest person. Practicing excellence in one’s conduct and following rules are often two sides of the same coin.

Although virtue-based approaches and principle-based approaches complement each other, they do have distinct strengths and weaknesses that affect their ability to serve as conceptual frameworks for promoting research integrity. They should therefore be used differently in research ethics. To grasp this point, it is necessary to consider the different ways that institutions can promote integrity in research.

There are four different ways of promoting research integrity in an institution: education, policy development, policy enforcement (also known as compliance), and leadership. These different ways of promoting integrity can work together to build an ethical culture within an institution, that is, a climate in which people appreciate, value, and respect ethical standards (Institute of Medicine, 2002; Shamoo and Resnik, 2009).

Education may include formal instruction, such as seminars or courses in research ethics, or informal instruction, such as mentoring. Studies have shown that education can raise awareness of ethical issues and concerns, increase knowledge of ethical concepts, foster positive attitudes towards research ethics, and improve ethical decision-making (Plemmons et al., 2006; Funk et al., 2007; Powell et al., 2007; Vasgird, 2007; Antes et al., 2009; May and Luth, 2012). In the U.S., the National Institutes of Health (2012) and National Science Foundation (2009) both require that funded students and trainees receive instruction in responsible conduct of research (RCR). Many universities have developed RCR courses and educational materials in response to these federal mandates (Vasgird, 2007; Shamoo and Resnik, 2009).

It should be clear from our discussion to this point that the principle-based approach and the virtue-based approach can both play important roles in education. The principle-based approach may be most useful in formal instruction in research ethics. Educators can teach students about basic ethical principles in research, such as honesty (i.e., telling the truth in scientific communications), fairness (i.e. treating colleagues, students, and other fairly), openness (i.e., sharing data, methods, and results with other scientists, within reasonable limits), objectivity (i.e., minimizing biases in your research), respect (i.e., respecting colleagues, students, and others), and social responsibility (i.e., striving to promote the good of society through your research). Educators can also inform students about specific rules pertaining to misconduct, authorship, publication practices, conflict of interest, data management, peer review, and research with animal and human subjects. They can show students how to interpret principles and apply them to ethical decision-making (Shamoo and Resnik, 2009). Educators can also help students understand why it is important to follow the rules (Davis, 1999).

The virtue-based approach may be more useful in informal instruction in research ethics, i.e., mentoring. When mentoring students, scientists should strive to exemplify ethical virtues. They can demonstrate the virtues mentioned above, such as honesty, fairness, respectfulness, resoluteness, humility, resourcefulness, and conscientiousness, through their actions. They can practice virtue while working in the laboratory, communicating with colleagues, advising students, making department presentations, and so on.

Policy development involves drafting and publicizing written guidelines for the conduct of research. Federal agencies require universities to have policies related to conflict of interest, misconduct, human participant research, and animal research as a condition of receiving funding. Universities have developed policies in response to these federal mandates, including some not specifically required by granting agencies, such as policies related to mentoring, authorship, and data management (Vasgird, 2007; Shamoo and Resnik, 2009).

It should also be clear from our earlier discussion that the principle-based approach to research ethics is better at guiding policy development and enforcement than the virtue-based approach, because it provides clearer direction than the virtue-based approach. Policies are basically a collection of rules and procedures. The most natural way to develop a policy is to derive it from other general principles or rules. For example, the human research regulations adopted the U.S. Department of Health and Human Services are based, in part, on the ethical principles found in the *Belmont Report* (Shamoo and Resnik, 2009). As noted earlier, the connection between virtues and policies is neither obvious nor direct.

Policy enforcement includes procedures for reporting, investigating, and adjudicating violations of research policies. Although the best way to promote integrity is by taking steps to prevent unethical behavior, it is also important to have enforcement systems in place to deter people from violating laws and policies (Institute of Medicine, 2002).

The principle-based approach provides better guidance for policy enforcement than the virtue-based approach, since policy enforcement relies on rules related to reporting, investigating, and adjudicating violations of research policies. These rules can be derived from general ethical principles. For example, the principle of fairness implies that institutions should adopt fair procedures for reporting, investigating, and adjudicating misconduct. Fair procedures include rules for ensuring due process and protecting confidentiality. Fairness in adjudicating misconduct also implies that punishments should be proportional to violations (Shamoo and Resnik, 2009).

Leadership is the fourth pillar for promoting integrity in research. Institutional leaders should demonstrate their commitment to ethics through their words and deeds. Leaders should set an example of ethical conduct for others to follow and allocate institutional resources to ethics initiatives. Leaders can also participate in ethics activities, such as conferences and workshops. While ethical leadership can inspire others to act with integrity and honor, unethical leadership can lead to corruption throughout the institute and have a demoralizing effect on researchers (Shamoo and Resnik, 2009; Vasgird, 2007).

One could also argue that the virtue-based approach provides a better account of the role of scientific leadership in promoting research integrity than the principle-based approach. Leadership, like mentoring, can be best understood as a practice in which one demonstrates moral virtues. Leaders inspire others to follow their example because they appear to have admirable traits, such as courage, honesty, resoluteness, fairness, and the like (Shamoo and Resnik, 2009). Rule-following is also relevant to leadership, however. Institutional leaders can stress the importance of ethical principles in their public communications and set an example for others to follow by living up to these standards. They can also explain why it is important for students and faculty to comply with institutional policies and legal requirements. Even so, the virtue-based approach seems to provide a better account of leadership than the principle-based approach. Though MacFarlane does not make the argument that the virtue-based approach provides the best account of moral leadership, it follows from his views.

CONCLUSION

The virtue-based approach to promoting research integrity is a reasonable alternative to the principle-based approach, but it has shortcomings and limitations. The virtue-based approach provides some insight into mentoring and leadership, but it is not a very useful tool for policy development and enforcement or ethical decision-making. Moral principles provide better guidance for policy development and enforcement and ethical decision-making. The two approaches are not mutually exclusive, however, and they can be pursued together. Scientists, educators, institutional leaders, and others involved in research should follow moral principles and champion moral virtues. Education in research ethics should include formal instruction in ethical principles, rules, duties, and responsibilities as well as demonstration of moral virtues during scientific mentoring. MacFarlane (2008) has made a useful contribution to the research ethics literature by calling attention to the importance of moral virtues in promoting research integrity, but he has not shown that the principle-based approach should be abandoned. Further research on ethics education should be conducted to describe the virtues that operate in science, explore how scientists learn moral virtues, and determine the extent to which virtues have an impact on scientific thinking and behavior.

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