Introduction

There is a widespread recognition that there are significant problems in contemporary science. Social scientists, ethicists, and scientists themselves are concerned about problems in the reliability of scientific results, in the development of innovative insights, and in the declining quality of the working conditions of most researchers. It is the contention of this book that Christian ethics, through its dialogue with social science and philosophy, has resources to help individual researchers and thus the research enterprise as a whole to confront these problems in science. To provide these resources, however, Christian ethics must engage in a somewhat different discussion of the relationship between religion and science than is usually encountered in theological discussions of science.

Many valuable theological works have been written about Christianity and science: reactions to the claims of the New Atheists that defend the compatibility of theology and science, attempts to show the implications of scientific results for Christian ethics, and discussions of how to ethically use the knowledge resulting from scientific research.[1] Yet, reflecting on my own experience as a researcher, there seems to be a lacuna in this valuable literature. I spent many years in the laboratory: two years as an undergraduate researcher studying the genetics of early mouse development at Berkeley; three and a half years in doctoral research at Harvard on limb

[1] The literature in these areas is vast. For reactions to the New Atheists, see Peter Harrison, *The Territories of Science and Religion* (Chicago: University of Chicago Press, 2017); Alister E. McGrath, *Dawkins' God: From the Selfish Gene to the God Delusion* (Malden, MA: Wiley, 2015). For recent examples of theologians engaging the insights of science, see Martin A. Nowak and Sarah Coakley, eds., *Evolution, Games, and God: The Principle of Cooperation* (Cambridge, MA: Harvard University Press, 2013); Celia Deane-Drummond, *Christ and Evolution: Wonder and Wisdom* (Minneapolis, MN: Fortress Press, 2009); Stephen J. Pope, *Human Evolution and Christian Ethics* (New York: Cambridge University Press, 2007). For discussions of the ethics of using the results of science, see Gerald McKenny, *Biotechnology, Human Nature, and Christian Ethics* (New York: Cambridge University Press, 2018); Celia Deane-Drummond, *Genetics and Christian Ethics* (New York: Cambridge University Press, 2005).

development in the mouse and chick; and two years in a postdoctoral fellowship at UCSF studying the genetics of heart valve development in zebrafish. I loved my time at the bench, but there were, of course, many ethical problems that arose in laboratory life. While theological writings were helpful in many ways, nowhere did I find answers to the problems that my colleagues and I discussed: concerns over the pressures of research, anger over the publication restrictions of a Material Transfer Agreement, disputes over authorship, fears of being scooped, or confusions about how to negotiate mentoring relations. Even more troubling, nowhere did I find the question that I and other Christians in the laboratory faced: how can my work serve as a Christian vocation? The literature in theology failed to address for the laboratory what Michael Banner has called the ethics of everyday life.[2]

In part, this lack results from the fact that most of the work on science and religion has dealt with the relationship between scientific theories and Christian doctrines, staying largely at the level of ideas. Yet, as Peter Harrison recently argued, it is a mistake to think of either religion or science as *only* a body of propositional claims, a mistake that ignores the many different historical instantiations of religion and science.[3] Such propositional claims are important, but these endeavors of science and religion are much more than just these propositional claims. We must also consider them as practices.

As Talal Asad argued against Clifford Geertz, we cannot think of religions as merely theoretical constructs of symbolic systems or sets of propositional claims.[4] For most of their adherents, the central aspect of religion is that of practice – not only ritual practice but also all of the small, daily practices that create a whole form of life. Christian ethicists have come to the same conclusions as evidenced by the increasing focus on liturgy.[5] To think of religion *only* in terms of propositional content is to privilege one form of modern Christianity over most other human experiences of religion, a claim that need not deny the important role that propositional systems of knowledge play in religion.

[2] Michael Banner, *The Ethics of Everyday Life* (New York: Oxford University Press, 2014).
[3] Harrison, *The Territories of Science and Religion*.
[4] Talal Asad, *Genealogies of Religion: Discipline and Reasons of Power in Christianity and Islam* (Baltimore, MD: Johns Hopkins University Press, 1993), 27–80.
[5] For an overview of this literature, see Jennifer A. Herdt, "The Virtue of the Liturgy," in *The Blackwell Companion to Christian Ethics*, ed. Stanley Hauerwas and Samuel Wells, 533–46 (Oxford: Wiley-Blackwell, 2011).

Similarly, many scholars studying science have suggested that to only consider science as the system of ideas found in textbooks or even in published journal articles is to misunderstand a large part of what science is. Throughout the last century, scholars, many of whom were practicing scientists such as Ludwik Fleck and Michael Polanyi, investigated science through the lens of practice.[6] They examined what scientists do every day in the laboratory and how these activities relate to the more fully articulated theoretical systems in the published literature. These reflections on the daily practice of science reached their apex in today's science studies literature in the work of Bruno Latour.[7] Thus, we need to consider both science and religion under the lens of practice.

It is especially critical for Christian ethicists to engage science in terms of practice because, as many of these social theorists and philosophers have argued, practices are critically linked to ethics. It is through practices that a certain form of character comes into existence. Practices shape a form of life and, through those daily engagements, shape an individual's dispositions, how one sees and thus reacts to the world. Alternative forms of practice will shape alternative forms of life and thus different forms of character. This book seeks to apply these insights to the practice of science. Different forms of practice can also create friction, so Christian ethics needs to investigate possible conflicts not only between the propositional content of science and religion, but also between the forms of life shaped by the practice of science and the practice of Christianity.

Problems in the Practice of Science

These questions of moral formation require the examination of how one comes to see and to understand the world and how this understanding shapes how one engages the world. They involve the question of the relationship between subjectivity and truth. Conflicts may arise because of the differences in the relationship between truth and subjectivity in alternative ways of knowing. The relationship between truth and subjectivity has become more obvious in science because the current pursuit of scientific truth seems to fail to provide an adequate formation in moral character. Many people in society are concerned about how scientific

[6] Ludwik Fleck, *Genesis and Development of a Scientific Fact* (Chicago: University of Chicago Press, 1979); Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (Chicago: University of Chicago Press, 1962).

[7] Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1988).

expertise might serve the interests of power and threaten the natural order, and many religious believers fear that the pursuit of scientific truth may conflict with faithful discipleship. While a secular scientist might be tempted to say so much the worse for theology and religion, this kind of moral formation has serious implications for the practice of science itself.

It is an especially opportune moment to investigate the relationship between the practices of science and religion because of the crisis in contemporary science discussed by many commentators. As Chapter 1 will discuss, this crisis is exemplified by growing problems with fraud, a lack of reproducibility, a slowing of innovation, and the loss of many young investigators. Several writers trace these issues to problems in the institutions and practices of science. While there are many suggested fixes for one or another aspect of this crisis, this book turns from addressing individual aspects of the practice of science one by one to look at what kind of character today's practice of science as a whole is directed toward shaping. Over the last forty years, shifts in policy, law, and cultural norms have encouraged the scientist to become an entrepreneur, to view the knowledge gained through research as a potential resource to patent or commodify in order to start or contribute to a business. This model of thinking of the self as an entrepreneur reflects modes of thinking more widespread in society.

This diagnosis of the problems of contemporary scientific practice points toward a conflict with a Christian form of life. The scientist entrepreneur is able to turn knowledge and organisms into commodities because she already envisions them in a reductionist manner. One of the most important features of modern moral formation that distinguish it from older models is that the relationship between subjectivity and truth is much more strongly mediated by the physical, organizational, and conceptual tools that we use – in other words, our technology. Scientific practice and research tools are embedded in a modern form of a reductionist rationality that dissolves the objects of the world into a mathematical network of forces that can be freely manipulated for human purposes.[8]

[8] Martin Heidegger, "The Question Concerning Technology," in *The Question Concerning Technology and Other Essays* (New York: Harper Torchbooks, 1977), 3–35. See also Max Weber, "Science as a Vocation," in *From Max Weber*, ed. H. H. Gerth and C. Wright Mills (New York: Oxford University Press, 1958), 129–59; Edmund Husserl, *The Crisis of European Sciences and Transcendental Phenomenology* (Evanston, IL: Northwestern University Press, 1970); George Grant, "Knowing and Making," in *The George Grant Reader*, ed. William Christian and Sheila Grant (Toronto: University of Toronto Press, 1998), 407–17; Hans Blumenberg, *The Legitimacy of the Modern Age* (Cambridge, MA: MIT Press, 1985). In *Laudato si',* Pope Francis makes a similar argument in terms of a technocratic paradigm.

The daily reductionist practice of research in science allows one to see animals and bodies as divorced from greater systems of meaning and purpose and thus open to commodification. These perceptions and this practical attitude contrast with Christian conceptions of Creation that respect the inherent teleologies of other creatures. Given the lack of demonstrable conflict over the propositional content of science and religion, the actual problem between these two domains of approaching the world may lie in the different forms of character to which these practices give rise.

Two Models of Practice

Given these problems in the practice of science, both on its own terms and in relation to Christianity, it is important to understand exactly how practice shapes character and how character can be reshaped through practice. There are two major models of the ethics of practices in contemporary philosophy and social theory, which I will term the Aristotelian and Stoic models, that differ in whether they emphasize social practices or individual practices. The most influential exponent of the Aristotelian model is Alasdair MacIntyre, but one also finds it in other scholars of science such as Polanyi, as well as in Christian ethicists such as Stanley Hauerwas. Discussions of moral formation in religious ethics have focused largely on social practices, arising in part from contemporary appropriations of Aristotelian ethics that tie the development of virtue to the habituation of prerational passions from an early age through the practices of communities dedicated to virtue. This early training leads to the conscious choice of virtuous rather than vicious actions, choices that further develop virtuous dispositions. As I will discuss in Chapter 3, the ideal form of this model is apprenticeship in a craft. This form of Aristotelianism seems to require the individual to dwell in communities that are dedicated to coherent systems of truth and that possess a consistent set of good practices, which many scholars have related to the Church. This account accurately describes scientific training – in its focus on embodied practices, tacit knowledge, and science as a semi-independent community of research – as well as the way external structures can influence character,[9] but, as I will discuss, such an account raises problems for the ethics of science.

[9] Polanyi, *Personal Knowledge*; Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition (Chicago: University of Chicago Press, 1996).

The Stoic model of moral formation, exemplified in the late work of Michel Foucault and in Pierre Hadot, sees practices much more like techniques for shaping subjectivity, reflecting the current use of various practices for self-shaping and the shaping of subordinates.[10] While accepting the role of social practices and structural influences on subjectivity, Stoic ethics looks to how one can fashion one's subjectivity in a different way. Stoicism emphasizes that one must consciously shape one's own initially disordered perceptions and thus one's practical stance toward the world. In so doing, it seeks to integrate seemingly contradictory value systems and social role responsibilities.[11] Along with many other Greco-Roman philosophies, Stoics drew on an array of meditative and ascetic techniques to consciously work on themselves, adjusting their representations and habits in a long process of continuing conversion away from problematic unreflective practices.[12] Through this process, the Stoic sought to become a subject of truth, to translate a coherent system of truths into an *ethos*. Such an ethical system is ideal for working to counteract the negative effects of formation in an exclusively reductionist rationality. While Stoic care of the self can be used by secular philosophies, it also fits well with Christian ethics, since many of the ancient techniques of the self were adapted to Christianity in the form of devotional, meditative, and ascetic techniques that are still central to many Christians' moral and spiritual lives. This book argues that if one lives in a world with deformed social practices that have already formed one in a problematic subjectivity, as in contemporary research, it is necessary to emphasize this Stoic model.

It is important to note that these two models should be understood as ideal types to which I assign certain contemporary thinkers by connecting them to strands of ancient thought on which they draw. Yet it is clear that

[10] This constructive use of Foucault differs from other Christian philosophers and theologians who have productively used Foucault's work to analyze problems in technology and bioethics. These authors use his critique of liberalism but reject his response to the issues he identifies. For example, Jeffrey Bishop says, "Foucault is a master diagnostician, but he is less helpful with therapy." Jeffrey Paul Bishop, *The Anticipatory Corpse: Medicine, Power, and the Care of the Dying* (Notre Dame, IN: University of Notre Dame Press, 2011), 23. For Brian Brock, "Foucault's explicit moral philosophy is of little use in developing a positive theological account of technological development" because he "champions the will." Brian Brock, *Christian Ethics in a Technological Age* (Grand Rapids, MI: Eerdmans, 2010), 145.

[11] Gretchen Reydams-Schils, *The Roman Stoics: Self, Responsibility, and Affection* (Chicago: University of Chicago Press, 2005).

[12] Michel Foucault, *The Hermeneutics of the Subject: Lectures at the Collège de France, 1981–82*, trans. Graham Burchell (New York: Palgrave Macmillan, 2005).

there are Stoic strands in a thinker like Thomas Aquinas, who draws on Aristotle, and there are Aristotelian influences in a scholar like Pierre Hadot. These are labels that allow for convenient theological exploration rather than strict demarcations. The argument here is that both modes of moral formation have important insights, but both need to be modified by each other and, in their purely secular form, by the insights of Christian ethics.

Overview of the Argument

The argument begins by describing the contemporary crisis of science. This crisis is distinguished by at least three aspects. First, there is a growing distrust of the scientific literature. This distrust results not only from an increasing number of retractions due to fraud or from the manipulation of studies by interested parties, but also, and perhaps more importantly, because of the lack of reproducibility of even honestly performed studies. Some of the well-publicized failures to reproduce important studies may be an inevitable part of the scientific process, but many also reflect carelessness and other defects that are common to the practice of contemporary research. A second problem is that there seems to be a lack of innovation even in research that is well done. Despite indicators of falling rates of innovation, however, scientific research is surrounded by hyperbole that shapes policy decisions and public reactions. Finally, there is a growing concern over the future of science since a large percentage of trained researchers do not continue in their fields. The confluence of these issues has led to a flurry of publications, statements, and calls for action from leading members of the scientific community.

The second chapter traces all of these problems to a single source: the growth of entrepreneurial science. This chapter details how, over the last forty years, the structures and practices of sciences have shifted in order to encourage researchers to think of themselves as market actors and their work as the potential seeds for business opportunities. Three character traits of the scientist entrepreneur are clearly connected to the problems constituting the crisis of science. Competitiveness encourages speed and stress, while tempting one with fraud. The need to respond to the short-term incentives of the market discourages long-term innovation and encourages overselling one's results. Finally, viewing knowledge and nature as property intensifies competition and encourages secrecy. The way that all of these problems are tied to the entrepreneurial form of character encouraged in the contemporary scientist reveals the weaknesses of many

suggested solutions to contemporary problems. What actually needs to be addressed is the moral formation of the researcher.

Chapters 3 and 4 address the two different conceptions of the way that practices relate to moral formation described above and how they might change character. Chapter 3 discusses character development in science through the work of Michael Polanyi, Thomas Kuhn, and MacIntyre's influential account of moral formation. In this Aristotelian model, one of the fundamental problems in modern moral formation is the loss of a concept of teleology, which leads to moral incoherence. It is this loss that allows one to view the world as material to be manipulated through techniques and to subordinate the goods internal to a practice, like knowledge in science, to an external good, like money. One becomes educated in both teleology and virtue by training in craft practices that combine teleology, education, and authority. This model describes the apprenticeship of scientific training quite well, suggesting that scientific research itself might be a craft that combats the modern fragmentation of character. The chapter then describes a central problem with this model for addressing issues in contemporary science. The commodification of nature required by entrepreneurial science is made possible by a reductionist worldview shaped by the practices of research themselves. The daily practices, paradigms, and tacit knowledge of biological research reinforce the anti-teleological rationality MacIntyre decries, thus shaping one's vision of organisms in ways that allow them to be viewed as discrete, commodifiable entities.

Chapter 4 turns to a different model of practice to remedy the problems in the Aristotelian model. This chapter explores the daily practices that support this form of reductionist subjectivity and the rise of the entrepreneurial ideal. It first describes how embodied practices shape the affects and dispositions of the subject, using examples from my own eight years as a doctoral and postdoctoral genetics researcher. These and other examples suggest that contemporary power works primarily by encouraging individuals to form themselves as certain types of subjects, thus shaping how people use their freedom. Because systems of power encourage certain forms of subjectivity, ethics, defined as attention to one's own character, becomes an important way to counteract problematic models of moral formation.

Chapter 5 turns to the constructive portion of the project by comparing the Aristotelian-inspired and Stoic-inspired responses to the problems of character in science. For MacIntyre, no individual moral reform can occur without reshaping social practice. This solution points toward a

withdrawal from society into communities of virtue. Such a move is impossible for biologists because biology forms the researcher in the rationality of a cosmopolitan community of research, and the discipline's advancement requires the resources of the modern state. Foucault, in contrast, sees that the most effective resistance to dangerous deployments of power lies in scientific experts embedded in the apparatus of power. To act as effective agents of resistance, however, scientists must engage in ethics: the development of a conscious relation to the self that he models on Stoic care of the self. By addressing common theological and philosophical criticisms of Stoicism as rule-based, individualist, and neglectful of truth, I argue that Stoicism can be effectively used in a virtue ethics of science. Finally, I describe both secular and religious models of scientific care of the self in the works of Max Weber, Sinclair Lewis, and Antonin Sertillanges. While the secular models aid devotion to scientific truth, Christian care of the self sets one's scholarly work in the context of a wider set of social and religious concerns.

Chapter 6 applies the theoretical tools developed in Chapter 5 to the problems of contemporary entrepreneurial science through the virtue of boldly speaking the truth, *parrhesia*. Speaking scientific truth today is dangerous because corporate and political actors use temptations and threats to neutralize scientific findings that could harm their interests. Philosophical care of the self in antiquity bolstered the virtue of *parrhesia* by transforming the individual into a subject of truth, so this care can encourage the scientist's commitment to truth in the face of risk today. The chapter examines scriptural and historical evidence of *parrhesia* in Christian ethics, showing that Christian faith and practice can deepen this risky truth-speaking by tying it to trust and faith in God. The Christian has broader obligations to both speak moral truth in science and defend the consonance of religious and scientific truth in the face of resistance from both scientific and religious communities.

Chapter 7 explores truth and conversion in more depth by examining the strengths and limitations of practice-based social theories of moral formation for developing a substantive Christian ethics. Many commentators are concerned that investigations of the role of practices in truth undermine the possibility of objective truth, while the malleability of character in the face of practices seems to undermine the possibility of a stable subject. In contrast, this chapter argues that an emphasis on the subjective preparations necessary for an individual to attain truth and the transformations that truth can work on subjectivity not only are compatible with but are essential for Christian ethics. Yet critics are correct that

a social theory like Foucault's does not give a substantive ethic because it lacks a system of truth for ethics as well as an ideal form of life that the ethical subject can seek to achieve. These elements are given concrete form in one strand of Christian tradition through a *Logos* theology. The chapter concludes by showing how looking at the ties between truth and subjectivity contributes to a religious anthropology that also emphasizes this tie, the Augustinian understanding of the *imago dei.*