Introduction

This chapter concerns four topics: (1) the origins of religion in human culture, viewed as a scientific problem; (2) the relations between religious beliefs and ideologies and modern science; (3) the relations between institutionalized religion and modern scientific practice; and (4) the role of naturalism in modern science. Each of these topics will occupy one of the following sections (in the indicated order), followed by some final remarks.

Though much has recently been written about the first of these topics, we will see that there is little yet that goes beyond speculation. With respect to the etiology of religion, the discussion here will be limited to what has become the Standard Model (SM) for the evolution of religion. Though the conclusions here will be critical, some recent objections to the SM (Powell and Clarke 2012) will also be criticized. The focus will be on adaptationism which I will question. With respect to the second topic, ‘ideology’ is not being used pejoratively: rather it is being taken to designate an over-arching view of the world that has a normative component. The third topic turns to the institutions that control and propagate religion and how these institutional practices impinge upon scientific practice. Much of what has been written on both of the last two topics, especially the latter, has typically been polemical – perhaps sometimes deservedly so because they have intruded on some of the most important political issues of the day. The attitude here will be cautious and sceptical, with more concern for the subtleties and ambiguities involved than for settling the disputed questions.

The methodology of this chapter will consist of the type of conceptual analysis and inference that the sciences typically find acceptable – thus this chapter is an exercise of a certain form of naturalism. The complex relations between naturalism, religion, and science will occupy the penultimate section. The final section summarizes the major conclusions.

Though this chapter is about religion and science, I will make no attempt to define either term fully. That ‘religion’ is difficult to define should not come as news. Avoiding any attempt at definition, the second section will use two cultural traits (by which I mean beliefs or practices) to identify religious behaviour. While these criteria will thus be regarded as jointly (almost) sufficient to characterize religion, neither is being touted as individually necessary. Subsequent sections will take religion to be roughly what is regarded as such in the Judeo-Christian-Islamic (JCI) traditions since these have been the locus of most of the philosophical
discussions of the relations between religion and science. This choice will remain vulnerable to
the objection that it ignores the religious proclivities of a large segment of the human popula-
tion (in particular, the Hindus and Buddhists who are jointly not insignificant in number).
However, these other traditions seem to have been largely relatively neutral about the relations
between religion and science, usually embracing some form of implicit compatibilism, and thus
not providing much motivation for demands for conceptual analysis. They may thus be less phi-
losophically problematic in this context — but this assessment may only reflect my own limited
competence.

Meanwhile, attempts to define ‘science’ fall afoul of well-known problems connected with
the formulation of a criterion of demarcation between science and non-science (Nickles 2006).
Some philosophers have invoked such a criterion in the context of explicating the relations
between religion and science, for instance, in disputes over creationism in the United States.
Others have rejected such a distinction in the same context and argued that it cannot be epis-
temologically credibly deployed in these arguments (Laudan 2003; Sarkar 2007a, 2011b). It will
suffice here to presume a common-sense descriptive (rather than normative) characterization of
science — one that assumes that there is consensus in scientific practice about what constitutes
permissible methodologies for observation, experiment, and inference. Each of the sections
below will elaborate on these methodologies as the discussion progresses with no claim towards
providing a precise characterization of what constitutes science.

**Whence religion?**

A Martian ethologist exploring Earth would almost immediately conclude that human beings,
like ants, are social animals — and everything that is currently known (by us) about human
psychological development would support the Martian’s inference. The Martian would also note
that most human groups indulge in some structurally uniform behavioural patterns that do not
seem to produce any scruitable immediate benefits, namely ritual behaviours (Winkelman 2000;
McClennen 2002). Finally, perhaps with a little less confidence, the Martian would observe that
a large segment, but not all members, of most human groups accept the existence and authority of
minimally counterintuitive agents that breach ordinary experience, for example, a talking burning
bush, a man who walks on water, or one who descends down a ladder from an empty sky.

The last two Martian observations form the core of what I will use here as characterizing
religious behaviour (or, in short, ‘religion’) in need of scientific explanation. During the last
decade much has been written on the topic. This is not to suggest that much has been under-
stood. The task of this section is to take a critical look at the state of the art, though the treatment
will not be comprehensive. But before we begin, I will note three points:

1. I will take for granted, without further argument, the universality of the two Martian
observations that are supposed to constitute the core of religion. Whether or not there is
complete universality does not matter for the sake of the arguments developed in this
chapter. Even if religion is empirically found to exist only in a significant majority of human
groups (as it surely must be), that fact calls out for attempts at scientific explanation.

2. At least since the first publication of Frazer’s *Golden Bough* (1890), we have also been aware
of the diversity of religious superstructures; since James’ (1902) *Varieties of Religious Experience*,
we have similarly been aware of psychological differences subsumed under religion. These will
be ignored here for a very good reason: not even the most ardent advocates of a science of
religion can credibly claim that, at present, we have any hope of success in scientifically
explaining religious diversity.
3. No normative claim is implicit in this characterization of religion, in the sense that no position is being taken on whether religious behaviour is ethically desirable or, equally, ethically undesirable.

The discussion below, by and large, will be couched in terms of religious belief purely for expository convenience. The arguments are supposed to apply equally to religious behaviour.

Moreover, in what follows, it will be assumed that religion must be scientifically explained – if, indeed, it can be so explained – without assuming veridicality for the relevant counterintuitive agent(s). Now, it is possible to argue that highly theoretical entities of science (quantum fields, carrying capacities of environments, etc.) also breach ordinary experience as much as these agents, but are nevertheless presumed to exist for the sake of producing scientific explanations. However, a response that should suffice here will be to view indirect experimental evidence as being in continuity with ordinary experience: such indirect evidence supports the existence of theoretical entities such as quantum fields or carrying capacities of environments. In contrast, no scientific evidence points to the existence of the counterintuitive agents posited by religion. To put the matter just a little differently: postulating the existence of gods is not the appropriate path towards a scientific explanation of why there is religion – or so I will assume.

Rather, religious traits will be treated as cultural traits like all others. In explaining the etiology of traits, Mayr (1961) notoriously distinguished between proximate and ultimate explanations. The former are supposed to encompass the mechanisms through which the trait is produced – that is, its ontogenesis (to deploy a biological term). The latter are supposed to show why the trait is there, that is, why it is present as it is, instead of some alternative which also may be ‘proximately possible’. While this distinction often seems compelling, especially in biological contexts, it is important not to overestimate its significance: in many cases, once the proximate origins of an entity are known, there is either no felt need for an ultimate answer or any further attempt at an ultimate answer seems uninteresting. A proximate explanation of Old Faithful (say, one that explains its regularity and, better, why that regularity seems to be in gradual decline) requires no further ultimate reckoning. Nor does the occurrence of sunspots.

Ultimate explanations are typically found interesting only when proximate explanations seem to leave some interesting feature indeterminate. In the evolutionary context, this indeterminacy typically arises because proximate factors initially invoked often allow for – that is, are consistent with – a large variety of structures and behaviours, only a few of which are realized. What can fill this gap? There are two types of potential mechanisms: (i) external factors, e.g., ecological (or viability-based) natural selection or sampling fluctuations (that is, drift; see Sarkar 2011a); and (ii) internal factors, such as architectural rules (Gould and Lewontin 1979) or developmental biases (Garson et al. 2003), both of which – very unfortunately – tend to get called ‘constraints’ as if they are not mechanisms in their own right (see, e.g., Powell and Clarke 2012). Even more importantly, if we retain and deploy the proximate–ultimate distinction, these internal factors may also be proximate – in other words, the class of proximate explanatory factors initially assumed must be expanded. But there is no need for any further ultimate explanation.

Let us return to religion. Much work during the last decade has seen potential proximate and ultimate explanatory factors explicitly distinguished and extensively studied. The former are treated in some detail in this volume (in Chapter 29) and I will confine myself to a few remarks using a framework that distinguishes four kinds of relevant mechanisms (Norenzayan and Gervais 2013). All of these mechanisms can be studied at both the neurobiological and the cognitive level and there is no prima facie reason to exclude either. The framework discussed in the next few paragraphs was selected because of its pertinence to what is said later about ultimate explanations. Too little is known at present to indicate how robust this framework is, that is,
whether these factors and their classification will survive future scrutiny (and, if so, to what extent) – consequently, the entire discussion here must be regarded as exploratory and, in that sense, speculative.

Though much of the focus of ultimate explanation has been on the mechanisms responsible for religious belief (rather than non-belief), I focus here on what is known about the mechanisms of non-belief since, as we shall see below, these may then be used to assay the plausibility of the posited ultimate factors of belief. (Throughout the discussion, non-belief will be taken to subsume disbelief.) What also interests me is that the evidence at hand suggests that the same constellation of mechanisms is responsible for both belief and non-belief: these mechanisms include cognitive, motivational, and cultural learning processes (Harris et al. 2009). Four types of mechanism have been identified and distinguished as sources of non-belief (Norenzayan and Gervais 2013): 1. Low levels of mentalizing (e.g., attributing mental states to others) is correlated with, and seems to be a mechanism for, non-belief; 2. Security and predictability of living situations generates non-belief; 3. Religious non-belief can arise because individuals are not culturally taught to have religious belief; 4. Most interestingly, non-belief is associated with analytic thinking; moreover, analytic thinking may provide a mechanism for non-belief – this has been strongly suggested by experimental inductions that activate analytic processing, including perceptual disfluency, incidental visual exposure to an image of thinking, implicit priming of analytic thinking concepts, and recalling a past decision to promote analytically-thinking non-belief (Gervais and Norenzayan 2012). While these are all ‘higher-level’ mechanisms in the sense that they are silent about their underlying neural counterparts, all that is known at present suggests that generating appropriate neural foundations will not in any way be problematic (Harris et al. 2009; Kapogiannis et al. 2009).

As noted earlier, there is an important symmetry insofar as each of these mechanisms can also be used to explain belief: for instance, high levels of mentalizing may explain a higher prevalence of religious beliefs in individuals. With that in mind, let us turn to ultimate explanations. As we begin, it will be worthwhile to note that these discussions of the etiology of religion mirror ‘soft’ discussions of evolution elsewhere, ‘soft’ in the sense that putatively scientific analyses remain entirely verbal with no attempt at quantitative model building even though mathematical reasoning has long been prevalent – if not dominant – in evolutionary biology (Sarkar 2004, 2007b). Moreover, whether it be the etiology of belief (Powell and Clarke 2012) or non-belief (Johnson 2012), the discussion has almost always transformed the question of why there is religious (non-)belief to what it is there for. This is an epistemologically questionable move because it presumes a commitment to a certain kind of adaptationism: even if religious belief is not itself an adaptation, there is some relevant adaptation that explains the existence of religious belief. The exact form of this characterization of adaptationism is important because it is broader than the more customary characterization which restricts the category to situations in which direct selection is supposed to explain a trait’s etiology (Gould and Lewontin 1979).

A recent analysis by Johnson (2012) is relatively unique insofar as the explicit focus is on non-belief rather than belief. Johnson asks: What are atheists for? He explicitly restricts attention to adaptive hypotheses without argument. The hypotheses he considers include: the use of mixed strategies in populations with some members displaying belief and others not – this may lead to frequency-dependent selection for non-belief; direct selection of atheism in some environments; reinforcement of belief through the existence of some non-believers, etc. Returning to belief, the Standard Model (SM) holds that religion is a by-product of selection of some cognitive feature. Folk evidence for such a view is relatively easy to come by if we already have adaptationist commitments: it is hard to see how much of religious beliefs or behaviour directly contributes to higher fitness (measured by expected number of offspring). If anything, given
religious traditions of self-denial and other-oriented activity, folk wisdom would suggest the
very opposite. Most proponents of the SM see it as not being adaptationist because it does not
hold that selection acts directly in favour of religious belief. However, it is adaptationist in the
broad sense being used here insofar as it still envisions some role, however indirect, for selection.

Against the SM, Powell and Clarke (2012) have argued for direct selection for religious
belief. They have noted an epistemological asymmetry that, at least on the surface, privileges a
direct selection explanation. They observe that both SM explanations and direct selections
explanation face a standard objection to adaptationism alluded to earlier: these ‘soft’ or verbal
explanations often consist of ‘just so’ stories (Gould and Lewontin 1979) about how selection is
supposed to favour a trait. In practice, these ‘just so’ stories, no matter how plausible, typically
prove intractable from the perspective of empirical confirmation. Moreover, when one ‘just so’
story fails (on conceptual or empirical grounds), we have the option of inventing another – and
part of the problem with adaptationism has been that these stories are remarkably easy to invent.
(I know of no attempt to specify details of an ultimate explanation of religion that circumvents
this problem.) Now, Powell and Clark claim, SM explanations face an additional problem that
direct selection explanations do not: the former must also specify what selection does act on (for
religious belief to be a by-product) whereas the latter do not (in the sense that they already
presume selection acts on belief).

Unfortunately for Powell and Clark’s argument, the appeal of this epistemological asymmetry
turns out to be transient: it disappears when we turn to detail, in this case to the proximate
mechanisms for (non-)belief introduced earlier. This is where our focus on non-belief makes
the argument easier. It is easy enough (in the sense of ‘just so’ stories) to invent explanations
that putatively show how selection on each of those four families of mechanism (directly or
non-directly) favours non-belief: 1. Given that most of the entities we encounter are not even
sentient, selection favours conservatism in mentalism; 2. If security and predictability are corre-
lated with non-belief, there should be selection on cognitive mechanisms that simultaneously
increase security and predictability and, concomitantly, non-belief; 3. If the capacity for cultural
training is selected for, non-belief has the same status as belief ceteris paribus; 4. It is highly
plausible that the capacity for analytic thinking would be selected for since it is likely to be help
survival in hostile environments (which very likely dominated early hominid evolution). Now,
if an increase in this capacity generates non-belief (as the studies mentioned earlier suggested),
we once again have selection that results in non-belief. So much for direct selection for belief.
However, the arguments for the second and fourth sets of mechanism are quite strong (at this
verbal level) and this has relevance for the SM: for that model to be correct, whatever type of
selection favours belief must be strong enough to overcome this type of selection for non-belief.

There already are two morals to be drawn from the discussion so far: 1. Proximate mechanisms
can be used to assay the plausibility of putative ultimate explanation and, when they can be so
used, they should be so used; 2. This is hardly news, but it deserves continued emphasis that soft
adaptationist stories are suspect. Both the SM and its critics who invoke direct selection rely on
adaptationism to argue for religious belief. My purpose in focusing on non-belief in this section
is intended to show the frailty of adaptationist thinking. Most importantly, none of the ‘just so’
stories on either side amount to more than speculation.

Finally, I wish to go one step further in expressing scepticism about adaptationism. The
debates over evolutionary psychology in the last two decades have exposed how little is genu-
iney understood about the biological evolution of mental traits (Buller 2005). The intended
contrast here is with cultural evolution (with no denial of the multifaceted interactions between
biological and cultural factors). It may well be that credible accounts of the etiology of religion
will require much more from theories of cultural change than what is incorporated into any of
the models discussed earlier in this section. It also may be the case that, once the proximate mechanisms of the etiology of religion are understood, there is no ultimate explanation required. Religious behaviour could be the result of neurological mechanisms – perhaps ones triggered by cultural input – with no selectionist story to be told at all. The point is that we do not know. For all the voluminous output about the evolution of religion in recent years, including much that is geared towards a popular audience (e.g., Dawkins 2006a and Dennett 2006), there is little about the evolution of religion that we do know.

**Modern science and religion**

This section and the next will be brief. Perhaps even more has been written about the relations between religion and modern science than about the evolutionary origins of religion. I will avoid simply repeating familiar platitudes and focus on sharpening the issues that are at stake in the disputes that have arisen. The emphasis will be on trying to achieve clarity on the issues that have been divisive. Let us begin with the most familiar of these platitudes, that there is a deep conflict between religion and science. A critical distinction is one between conceptual issues, regarding the relations between the conceptual frameworks of religion and science, on the one hand and issues of practice on the other, how individual scientists and scientific institutions interact with religious individuals and institutions (and, of course, vice versa). The former is, to put it roughly, a question of the relations between theology and science, the other concerns more sociological questions about the relations between organized religion and science. Unfortunately this distinction is often ignored, for instance by Draper (1874) and White (1876), two polemics that are often held to be responsible for the platitude that religion and science have perennially been in conflict (Harrison 2010). As we shall see, maintaining the distinction does much to sort out the issues that have proved divisive. This section will concern the conceptual issues; the next will take up practice.

In either context it will be important to classify different positions we may take about the relation of religion to science. Here I will distinguish incompatibilism, with conflict and replacement being (potentially non-disjoint) subcategories, and compatibilism, with independence and synergy being subcategories. The familiar platitude mentioned earlier, that of the deep conflict between religion and science, is a prime example of incompatibilism. Restricting religious claims to the normative domain of ethics, and viewing science as purely descriptive – as Gould (1999) suggested – provides a simple example of compatibilism (and, incidentally, trivially satisfies the requirement that religions include a normative perspective).

Much will depend on what we mean by ‘religion’ and ‘science’. As mentioned at the beginning of this chapter, ‘religion’ in the rest of this discussion will be taken to refer to beliefs and practices associated with the JCI traditions. For science, we face the demarcation problem. We also face the problem that the term ‘science’ as understood since the early twentieth century may not capture what was meant by that term in earlier centuries. The advent of relativistic physics and quantum mechanics led to metaphysical transformations that were at least as profound as the emergence of modern science itself in the fifteenth and sixteenth centuries. Relativistic physics challenged ‘absolutist’ concepts of time, simultaneity, etc., that had been unquestioned by the physics of earlier eras. Quantum mechanics challenged fundamental notions of causality – or, at least, determinism. Both developments were revolutionary: they challenged physicists’ and philosophers’ complacency about the possibility of having a final scientific description of the world. They naturally led to the emergence of two (related) assumptions that became central to a ‘received view’ of science that are most relevant to the discussion here: (a) scientific truths are always fallible – the revolutions in physics did much to convince philosophers (and scientists)
that, in principle, no scientific claim is immune from future revision in the face of new data; and (b) it is plausible to hold an instrumentalist interpretation of scientific laws (and theoretical entities posited by laws). In fact, realism faces what are often taken to be insurmountable difficulties though this remains a matter of vigorous debate, depending on how ‘realism’ is construed.9

Now, let us make the case for the independence version of compatibilism. One option noted earlier is to restrict religion to the normative (ethical) realm and science to the descriptive one. But this is probably not a construal of religion that will satisfy anyone with even minimal theological aspirations. But we have another option that relies on the instrumentalist interpretation of science. If that is all there is to science, science does not concern absolute truth, or even truth.10 In contrast, religion is about truth. So, what happens in science is irrelevant to religion. The trouble with this argument is that the conclusion implies that religious beliefs make no substantive claims about the world of experience studied by science. But the price to be paid is that we must remain satisfied with a purely instrumentalist interpretation of science.

Modern physics may well support the stronger synergy version of compatibilism. For instance, the Big Bang cosmological model posits a beginning to time. We may, if we so choose, interpret Big Bang as the creation of the universe (Halvorson and Kragh 2011). Then there are a variety of fine tuning arguments based on numerical coincidences between fundamental physical constants that apparently must exist if we are to have life as we know it on Earth (Dickson 2012). Typically, fine tuning arguments are deployed to argue for the existence of a god – and found wanting in that respect (Sarkar 2011a). However, they may also be taken as providing synergy between religion and science, in the sense of establishing mutually supporting coherence and consistency, as Polkinghorne (1998) has argued. There appears to be no compelling argument against this weaker use of fine tuning arguments. There are several other such examples of modern science providing apparent synergy with religion.11 But there remains a fundamental question: why bother at all with such theological interpretations of science? What do they provide that mundane philosophy of science does not? Any answer will probably have to invoke normative commitments of some sort, that is, some form of ideology.

The trouble also is that we can just as easily argue for incompatibilism. In the same way that we disposed of the purely normative interpretation of religion earlier without much comment, I will also dispose of what happens when the Old Testament is read literally – and the Book of Genesis taken to provide scientific models for the origin of the universe. Almost everything we know from geology and biology is incompatible with these models. Though so-called ‘Young Earth creationists’ continue to promote these views (see the discussion of naturalism below), these views should not intrude upon serious discussions of the relation between religion and science. The main problems here come from biology – and they are sufficient for some figures such as Wilson (1975) to suggest that science as an ideology12 (that is, as something with normative implications) will replace religion as society progresses to a state more consistent with advanced scientific knowledge. At the very least, there is considerable scope for the conflict sub-category of incompatibilism. But all such claims depend on highly controversial interpretations about modern biology – about genetics on the one hand, and evolution on the other.

Problems arise because theological views based on JCI traditions seem to make deep claims about human nature – for instance, the original state of humans. Now, human nature has also long been a favourite domain of speculation (often presented as scientific fact) for biologists and philosophers committed to some form of biological reductionism (Sarkar 1998). Some urge miscellaneous degrees of genetic determinism, though that is becoming increasingly unfashionable; but to the extent that biological nature may constrain human behaviour, there is a challenge to any doctrine of free will. The compatibilist can respond by noting that genetic determinism seems to be in (probably terminal) decline. However, genetics is not all that there
is to biology. Genetic indeterminacy may be compatible with biological determinism – if our entire biological constitution (including whatever genes are relevant) determines our behaviour. There is no compelling evidence against this claim even though it is far from proven – so we may once again have to face the problem of free will.\textsuperscript{13} Those who are convinced of the universality of natural selection and competition as driving forces of human evolution (including Wilson 1978) may infer even more negative conclusions about human nature (‘red in tooth and claw’) and challenge normative theological assumptions about grace. But, once again, the interpretation of the science remains controversial – this includes the debates over evolutionary psychology mentioned earlier.

The only conclusion I wish to draw is the following: unless we are willing to be very precise as to what we take to be the relevant scientific claims, and how we epistemologically interpret the nature of scientific knowledge, and perhaps be even more precise about what we take to be the relevant religious claims, there is nothing determinate that we can conclude about the relations between religion and science at the conceptual level.

**Scientific practice and institutionalized religion**

We turn now to more sociological issues. Recall the platitude of religion being in terminal conflict with science that dominated discussions of the topic for much of the twentieth century. In spite of the discussion of the last section, it remains possible that there is warrant for this platitude when one considers the history and present (socio-political) status of the relations between religious institutions and their scientific counterparts. There is always the case of Galileo and the Catholic Church, though that episode continues to be reinterpreted in new ways (Heilbron 2012). Thanks to an array of historical studies in recent decades, it is well recognized that many of the claims of an alleged conflict between religion and science were engendered by polemics, especially after the ‘classic’ contributions of Draper (1874) and White (1876). As the pendulum has swung the other way, it seems to have become equally fashionable to posit compatibilism, or even synergy, also without sustained argument. But there is no simple pattern that can be endorsed at least until much more systematic historical exploration of the relevant issues has been completed (Harrison 2010).

However, it does not seem appropriate (to me) to invoke some sort of neutrality principle about this debate, one which would claim that nothing normatively salient should be concluded because there are examples on both sides: cases in which religion and science have been compatible (or there has even been synergy), and cases in which they have been incompatible or even been in conflict. One question we must confront is whether science should have some privileged institutional status in our epistemology. If we are willing to privilege science over other epistemological practices, then our ‘neutral assumption’ (or null model, to use a statistical metaphor) should be that other social structures should (by and large) be compatible with science and, preferably, synergistic with it. A sustained discussion of the tenability of the antecedent in this claim is beyond the scope of this chapter; the issues are not simple, and I am not going to urge that scientific research be independent of social scrutiny. Nevertheless, I will argue that science, institutionally, should have some privilege. My grounds are not purely technological, i.e., relating to the control over the non-human world that the sciences have enabled and which I will assume is desirable (Sarkar 2005, 2012) or pragmatic/ethical in the sense that this technology (e.g., modern medicine) has done much to enhance human well-being. Rather, crucial to my view are the intellectual contributions of modern science (Sarkar 2005): how much more of the universe we have come to understand since the emergence of modern science.
Given this assumption, I propose an asymmetry principle in viewing how religious institutions should engage science: cases of conflict deserve far more critical scrutiny than cases of compatibilism or synergy. This is why defences of religious institutions based on (credible) observations of routine and mundane compatibilism become suspect even though cases of conflict are typically much more complex than used to be recognized. There is perhaps only one easy case: modern creationism (Sarkar 2011a), which will be taken up in the next section. What deserves most critical scrutiny is any putative role played by religious institutions to foreclose scientific research. In some cases, this may have some post hoc justification, for example, if there are ethical reasons that should preclude certain investigations — we must always remember Nazi biology and medicine and the Tuskegee syphilis experiment. I am not arguing against the social control of science.

Nevertheless, there is some substance to the platitude that institutional restrictions impede science (and other modes of inquiry). Given that, issues raised by the Galileo affair remain salient in spite of all the recent reinterpretation designed to show it was not simply a case of religion impeding the progress of science (Harrison 2010; Stenmark 2010). I will restrict discussion to one contemporary case: the embryonic stem cell (ESC) research controversy which has been ongoing in the United States since 2001 when (then) President George W. Bush prohibited the use of federal funds for ESC research in spite of the alleged medical promise of the results (Broussard and Shanahan 2003).

Four points will be relevant here. First, I will take it for granted that there should be public debate about the ethics of ESC research — as there should be for any scientific research with implications for humans. Second, even though religious beliefs (of Bush and his supporters) clearly had some role in the prohibition, contrary to popular belief (see Callahan 2009), there was no consensus among religious institutions (within the JCI traditions) (Childress 2001). For instance, at that time, though the Catholic Church officially opposed ESC research, some Catholic theologians endorsed it. Moreover, the Church of Jesus Christ of Latter-Day Saints (Mormons), which typically joins the Catholic Church in opposition to abortion, was neutral:

"The proclaimed potential to provide cures or treatments for many serious diseases needs careful and continuing study by conscientious, qualified investigators. As with any emerging new technology, there are concerns that must be addressed. Scientific and religious viewpoints both demand that strict moral and ethical guidelines be followed."

(Childress 2001: 161)

This diversity of viewpoints is indicative of what should be obvious: religious institutions cannot be credibly treated as a monolith. Third, if all that is being claimed in the Latter-Day Saints’ statement is that a religious viewpoint demands is appropriate attention to ethical issues, the position is probably unexceptionable. Fourth, however, it matters whether the ethical criteria to be used are purely doctrinal rather than being established through normative reasoning acceptable to non-adherents to the relevant doctrine. If the choice is purely doctrinal, we finally have a clear conflict between institutionalized religion and scientific practice. In the case of ESC research, with very few exceptions (most notably, and perhaps expectedly, the Catholic Church), doctrinal presumptions alone were not explicitly used in attempts to adjudicate the debate even though, as others have noted, they were often implicitly invoked in the debate, which often got unduly heated (Callahan 2009). In fact, the heat of this debate is what calls for explanation — but this takes us into political territory, namely the role of religion in public life in general and that is beyond the scope of this chapter.
This discussion should have made it clear that even at the level of the relations between institutionalized religion and contemporary scientific practice, both the issues that are involved and the empirical situation are complex. An empirical question for which I have no confident answer is how common cases such as that of ESC research are — but they appear to be rare. Religious intervention into public life (and not restricted to science), especially successful intervention, is probably more common in the United States than in any other country of the global North. Yet, even if we accept the asymmetry principle for critical scrutiny, it may well be the case that such examples of conflict are rare enough that they should not be taken as indicative of ongoing major conflicts between religious institutions and scientific practice (at least today, if not for the entire historical record). The experiences in other countries seem not to have been studied in much detail, perhaps because, until the last few decades, much of scientific research has been confined to the North. Nevertheless there is little grist for the mill of the New Atheists (Beattie 2007) in their ongoing polemics about how institutionalized religion barricades the frontiers of science.

Naturalism

The many potential sources of discord between religion and science noted in the last two sections have led, especially in the United States, to a somewhat unique political confrontation, unique in the sense that part of the rhetoric of this confrontation has been about a philosophical issue, namely naturalism. In the United States, what is most often at stake in this confrontation is the science curriculum of publicly funded schools. A vocal religious minority there objects to the teaching of biological evolution because it is perceived to be at odds with their religious beliefs, typically arising from a literal reading of the Old Testament (what was earlier called ‘Young Earth creationism’). Some of these activists would replace discussions of evolution with creation stories or, if that proves to be pragmatically impossible, at least require that evolution and creationism be accorded equal time in classroom instruction. What makes it difficult to replace creationism for evolution in school curricula is that the U.S. Constitution mandates a separation of church and state, and courts have routinely interpreted the introduction of creation stories to be advocating religion rather than presenting a ‘creation science’ as is claimed by creationism’s proponents. This legal requirement also precludes equal time for evolution and ‘creation science’. That was the legal consensus in the 1980s with the scientific creationists suffering a bitter legal defeat in an Arkansas case that eventually progressed to the U.S. Supreme Court. In recent decades creationists have re-branded creationism as ‘Intelligent Design’ (ID) and have made some changes to their doctrines, including an abandonment of the assumption of a ‘young earth’ (≤ 10,000 years old). In the courts, so far, they have not fared any better than their predecessors (Sarkar 2007a). At present, the immediate future of the ID movement does not look promising.

What is interesting in our context is that ID’s proponents, especially its founding figures such as Johnson (e.g., 1995), view the battle against evolution as part of a broader war — against naturalism. From the ID perspective, science in recent decades (or, perhaps, centuries) has made an unnecessary commitment to naturalism by precluding ‘supernatural’ causes. Presumably, these supernatural causes are factors such as miracles or other forms of divine intervention in the world. For instance, such interventions supposedly include a boost of information into the biological realm that enabled the Cambrian explosion of animal diversity some 500 million years ago. It is unclear what criteria would make such an event — whether or not it occurred — supernatural. ID creationists have been remarkably vague about the specific contents of these causal mechanisms in spite of repeated taunts of their critics (Sarkar 2011b). The best interpretation of ID’s supernaturalism seems to be that certain events are immune to scientific
explanation if such explanation is restricted to the currently accepted methods of scientific observation, experiment, and inference. Adequate explanation will allegedly require the invocation of a designer not subject to scientific law (Johnson 1995). (Note, here, that we are not talking about normative claims of ethics, etc. – we are talking about the ‘mundane’ descriptive facts unearthed by normal science.)

If we accept this construal of supernaturalism, naturalism can be defined by what it precludes. Naturalism, then, consists of a denial of the permissibility of explanatory factors that are beyond scientific investigation – and critics of creationism have typically defended such a view (Ruse 2001; Sarkar 2007a). Now, suppose we restrict the domain of inquiry to the sciences (and not all forms of knowledge). Then this type of naturalism is called methodological (e.g., Ruse 2001). Abandoning it, as urged by Johnson, would require a reconstruction of scientific methodology. It is worth pondering on what that would mean.

Suppose we are presented with theoretical results or experimental data that current theories, and the entities and processes posited by them, cannot explain. An example from physics of such a theoretical result was Dirac’s (1928) relativistic wave equation that predicted a ‘hole’ in the energy spectrum. From the same period (the 1920s), an example of experimental problems is the apparent non-conservation of energy during beta decay. Employing standard scientific methodology, both problems were resolved in the 1930s by positing new particles, the positron in the former case and the neutrino in the latter. Two aspects of this resolution are important for us: (i) the existence of these new particles was experimentally confirmed – and this was universally viewed as a non-negotiable requirement for their acceptance; and (ii) the laws governing these particles were probabilistic.

Now, suppose that, when the problems mentioned earlier were first recognized, our ID theorist announced that the problems were manifestations of a designer (intelligent or otherwise) not subject to physical law. My problem is: what is the sense in which this is a scientific explanation? In fact, what is the sense in which this is an explanation at all? Perhaps the ID theorist will claim that these are not pertinent examples (especially because the relevant problems were rather quickly resolved). What is required is a situation in which there is no law-like explanation to be found at all; from the perspective of current scientific methodology, that is, of naturalism, the phenomena to be explained are ‘truly random’. There are two obvious responses to this move. First, the laws invoked in the examples of the positron and the neutrino are probabilistic – to that extent embracing randomness is standard fare in current scientific theory and methodology. Second, and more important, the locution ‘truly random’ is meaningless: to say that an event is random meaningfully, we must say more, we must say from what probability distribution it is drawn. We must specify a reference class and a rule that allows us to compute the probability of an event (compared to other members of the reference class). And once we have done that, we have invoked a law of sorts – and have opened up a new domain for scientific inquiry.

There is at least one other potential response available to an ID theorist or any other advocate of a strategy of using science to advocate religious claims beyond science: an invocation of religious claims to explain what is proving recalcitrant for existing science and, in that sense, apparently beyond the orbit of methodological naturalism. Indeed, this is the strategy some ID theorists such as Behe (1996) have deployed when they have marshalled putative inadequacies of current evolutionary theory in support of their claims. This is a version of what is called the god-of-the-gaps argument: saving for a god what current science cannot explain. However, as Drummond (1894) pointed out more than a century ago, it is a poor argument, theologically or otherwise. It will always be available – unless we have sciences that explain everything (and that, perhaps, is what would truly be a miracle). But, worse, in the face of recalcitrant
phenomena, it conflates intractability with impossibility – and to make a claim of the latter credible what we have to do is more science as we know it, that is, indulge in more methodological naturalism.\textsuperscript{16}

These arguments are not intended to be polemical. Rather, they are supposed to suggest that methodological naturalism seems unimpeachable in scientific contexts and that some response to these arguments is required from its critics. Now, Johnson (1995) accepts most of these arguments but argues that methodological naturalism slides inexorably into \textit{metaphysical} naturalism which embraces the additional claim that the entities and process identified using (standard) scientific methodology are \textit{all} that there is. Another way of putting the same point is to claim that all of the universe (including, obviously, all aspects of human mind, culture, behaviour, etc.) is subject to scientific explanation. Now individual scientists (and philosophers) vary in their attitude to this issue, from embracing some strong version of the claim (e.g., Weinberg 1992), to denying it almost entirely (Sarkar 1998; Dupré 2003). The first important point is that scientific methodology requires no commitment with respect to that claim: that methodology provides norms for how we should acquire scientific knowledge, leaving open the question whether there are other epistemological norms. For instance, at present, there is no compelling reason to believe that scientific methodology alone suffices to explain ethical or aesthetic norms (even though this is an area of much ongoing research, some of which was mentioned in the second section). But, surely, this is not a sufficient reason to invoke supernatural intervention in the world. The last point takes us to a second important point that Johnson misses: even if there can be knowledge other than scientific knowledge, why must that other knowledge be religious?

These arguments depend quite critically on how naturalism was construed earlier, which was in the spirit of Nagel (1956), even though the construal given here was explicitly introduced as a denial of Johnson’s (and other ID theorists’) supernaturalism. There are three potential problems faced by this construal of naturalism. First, if naturalism is identified with scientific methodology, does it have any teeth? Why is it simply not some minimal form of empiricism which no one denies is appropriate as an interpretation of science? There are two responses: (1) Naturalism certainly does not consist of an empiricism that requires incorrigible sense-data as the foundation of knowledge. However, if empiricism is liberalized (as, for instance, by the later logical empiricists; see Sarkar 2013) to embrace ordinary-sized physical objects and their behaviour, and allow observation reports to be revisable, then naturalism is indistinguishable from this form of empiricism. It follows that, to the extent that this form of empiricism is uncontroversially appropriate for the interpretation of science, so is naturalism; (2) More importantly, naturalism shows its teeth insofar as it embraces the doctrine that the empirical facts of the world can be understood scientifically. Hume would be happy: there is no scope for miracles.

Second, does this construal definitionally preclude non-naturalistic science? This seems like a simple question, but is not. Since a ‘yes’ answer would probably be taken by critics of naturalism as grist for their mill, let us begin by wondering what a non-naturalistic science would be? One that admits miracles? Or perhaps something along the lines of Plantinga’s (1996) ‘Augustinian’ science. In denying methodological naturalism, Plantinga urged Christian scientists to pursue ‘Augustinian’ or ‘theistic’ science. Such scientists are supposed to view the world against the background of a presumed conflict between the ‘City of God’ and the ‘City of Man’, to interpret all intellectual life as episodes of this conflict, opt for those activities that are consistent with citizenship in Civitas Dei, and use categories such as original sin in the construction of the social sciences. McMullin (2001: 167) had the apt response:

\begin{quote}
I do not think … that [Plantinga’s] theistic science should be described as science. It lacks the universality of science, as that term has been understood in the Western
\end{quote}
It also lacks the sort of warrant that has gradually come to characterize natural science, one that points to systematic observation, generalization, and the testing of explanatory hypotheses. It appeals to a specifically Christian belief, one that lays no claim to assent from a Hindu or an agnostic. It requires faith, and faith (we are told) is a gift, a grace, from God. To use the term ‘science’ in this context seems dangerously misleading; it encourages expectations that cannot be fulfilled, in the interests of adopting a label generally regarded as honorific.

Perhaps no more need be said about non-naturalistic science until we are presented with an example of such that we can study in detail.

Third, some authors have construed naturalism in a very different way. For instance, Sober (2011: 200) takes naturalism to require that numbers exist in space and time (whatever that is supposed to mean). He argues that mathematical evolutionary theory entails that numbers exist and, assuming that they do not exist in space and time, concludes that evolutionary theory provides reason not to endorse naturalism. Part of Sober’s purpose is to disentangle the dispute between creationists and scientists from that between supernaturals and naturalists and to argue that the correctness of evolutionary theory is not relevant to the latter. As such, this view is almost diametrically opposed to the one endorsed in this section – but at the expense of construing naturalism in a way that is tangential to the construal relevant to understanding what most creationists and most of their opponents explicitly believe to be at stake. This is not to suggest that Sober’s construal is entirely idiosyncratic – Papineau (1993) and Maddy (1997) provide evidence to the contrary. But it is not a construal that helps explore the variegated relations between religion and science.

Final remarks

Where does this leave us?

First, the discussion of the etiology of religion should leave us wary of any claim about why humans have religion that is not accompanied by adequate disclaimers about what we really know, and with explicit attempts to keep speculation separate from what is reasoned scientific inference. In particular the facile adaptationism that is all too common in discussions of human mental and cultural traits should be resisted. It may even be the case that there is nothing that religious belief (or non-belief) is for – nothing of interest beyond the proximate mechanisms.

Second, a wide range of possibilities are available to characterize the relations between religion and science, ranging from synergy at one extreme, and conflict and replacement at the other. At the conceptual level, which of these possibilities is most appropriate depends critically on what religion is supposed to consist of, which science is in play, and how the nature of science is construed. The ambiguities are more pervasive for interpretations of religion than for science if we accept the ‘received view’ of science inherited from the twentieth century. While these ambiguities are less problematic when we turn to the relations between institutionalized religion and scientific practice, the relevant issues there are also complex. Once we are careful in clarifying what the disputes are about, the loci of conflict seem highly circumscribed at present. Moreover, even if we accept an asymmetry principle that privileges science over other epistemological endeavours, which in turn requires that cases of conflict deserve more attention than mundane cases of compatibilism, actual disputes that truly are between religion and science may be rare. This is an empirical issue that can only be settled through systematic exploration of potential cases. Nevertheless, much of the polemics about how institutionalized religion impedes scientific progress seem to be no more than that – polemics bereft of historical and sociological empirical support.
Third, the question of how religion and science relate to naturalism depends on the construal of naturalism on which there is no consensus. However, at least in the debate over creationism (particularly in the United States), both creationists and their critics agree that naturalism should be construed methodologically to reflect the practice of science, and especially to deny supernatural explanations such as the occurrence of miracles. If this construal is accepted, then several points become relatively clear: science required naturalism, religion typically demands more, and there is no clear chain of reasoning that shows how naturalism can be brought into question in empirical contexts. Whether any stronger conclusion should be drawn remains open to question.

Notes

1 For discussions over the years, thanks are due to Cory Juhl and John Stachel.
2 The terminology is that of Boyer (2005).
3 See the third section below for a characterization of what I mean by ‘compatibilism’ and related categories.
5 Indeed, the number of non-believers (atheists) should not be understated; recent estimates suggest about a billion, exceeded only by Christians, Muslims, and Hindus, among their religious counterparts (Zuckerman 2007).
6 See, for example, Atran (2002), Barrett (2004), Boyer (2005), Kirkpatrick (2006), and Bloom (2009).
7 In this context see, e.g., Bellah (2011). These models of cultural evolution are being ignored here because it remains far from clear that they would be accepted as science by the majority of the scientific community.
9 For a defence of scientific realism, see Psillos (1999).
10 This argument basically goes back to Duhem (1954).
12 Note that Wilson (1978) does not use this term.
13 There also is the problem of the potential inconsistency between microphysical (quantum) indeterminism and macrophysical (and biological?) determinism, but that is well beyond the scope of this chapter.
14 For details of these developments in the United States, see Forrest and Gross (2004), Numbers (2006), and Sarkar (2007a, 2011b). However, creationism is by no means restricted to that country – see, for example, Coleman and Carlin (2004).
15 For a superb historical treatment of the physical examples from this section, see Pais (1986).
16 There are additional theological concerns about the nature of a god that gets relegated to an increasingly lesser role as science progressively encompasses more of the world. This issue is beyond the scope of this chapter – for an entry into this discussion, see Sarkar (2007a).
17 One should add that there seems to be no tradition, Western or otherwise, in which Plantinga’s science would be viewed as science.