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Understanding Christians' underrepresentation in STEM and why it matters

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In many Western societies, religious people (particularly Christians) are underrepresented in STEM fields, relative to their numbers in the general population. We review existing literature that supports two broad types of explanations for religious underrepresentation in STEM, focusing primarily on Christians in the US. First, Christianity and science may actually conflict or be perceived by Christians to conflict with one another, which reduces Christians' engagement in STEM fields. Second, science and scientists may be portrayed, and Christians stereotyped, in ways that lead Christians to believe they would not belong in STEM. We argue that it is critical to further investigate these explanations, as doing so will shed light on how to broaden participation and engagement in science among a sizeable chunk of the population. We conclude our review by discussing promising directions for future research and implications for non-Christian religions, as well as in contexts outside the West.

KEYWORDS

Christianity and science, religion-science conflict, underrepresentation in STEM, social identity threat, identity-based motivation

1. Introduction

For decades, researchers and practitioners have highlighted the importance of increasing participation and engagement in science, technology, engineering, and mathematics (STEM) fields. Although a great deal of scholarship has focused on the reasons underlying women's underrepresentation in STEM (e.g., Murphy et al., 2007; Cheryan et al., 2009; Diekman et al., 2011; Casad et al., 2018; Cheryan and Markus, 2020), women are far from the only social group that faces recruitment and retention issues in STEM. For example, certain racial/ethnic minority groups in the US (e.g., Black, Hispanic/Latino, and Indigenous Americans) are underrepresented in STEM relative to their numbers in the general population (Estrada et al., 2016), as are LGBTQ individuals (Hughes, 2018; Freeman, 2020) and people with disabilities (Moon et al., 2012). Moreover, the discrepancy between the proportions of these group members in STEM vs. the general population increases at higher levels of education (Moon et al., 2012; Estrada et al., 2016; Freeman, 2020).

Religious individuals are another group that is underrepresented in STEM in many Western countries. Despite that over 80% of US Americans believe in God (Jones, 2022), only 24% of biologists and physicists from universities and research centers in the US report believing in God (Ecklund et al., 2019). Further, the Pew Research Center estimated that 70% of US Americans were affiliated with a religion in 2020 (Pew Research Center, 2022), but this proportion drops to 39% among US scientists. There are notable denominational differences, however. Roman Catholics and Protestants are less prevalent among US scientists

(10 and 11%, respectively) than in the US population (22 and 25%, respectively). Within Christianity, evangelical Protestants (2% of scientists vs. 14% of the general population) and traditional Catholics (1% of scientists vs. 7% of the general population) are particularly underrepresented in STEM (Ecklund and Scheitle, 2007). By contrast, many religious minorities in the US (e.g., Muslim, Hindu, Jewish, Buddhist) are *overrepresented* in the sciences relative to their numbers in the general population (Ecklund et al., 2019). Similarly, more than half of residents of the UK (Office for National Statistics, 2021a) and France (Statista, 2021) are religiously affiliated, compared to 37 and 30% of scientists in those countries, respectively (Ecklund et al., 2016). Thus, although religious people are a majority group in the West, their representation is substantially lower in STEM fields than in the population at large. However, the reasons underlying religious underrepresentation in STEM have received limited empirical attention.

Our primary focus is on Christians, both because Christians constitute the majority of religious individuals in many Western countries (e.g., Office for National Statistics, 2021a,b; Statista, 2021; Pew Research Center, 2022; the US, the UK, France) and because much research on the religion-science relationship has highlighted actual or perceived conflicts between *Christianity* and science (e.g., Rios et al., 2015; Scheitle and Ecklund, 2017; Simpson and Rios, 2019; Rios, 2021; Mackey et al., 2023). That said, we recognize the need for additional research on non-Christian populations' representation in science as well as on religious underrepresentation in science beyond the US, and we expand on these needs in the "Future Directions" section.

2. Why study Christians' underrepresentation in STEM?

We argue that it is critical to investigate why Christians are underrepresented in STEM fields for several reasons. First, in the US and UK, women and people of color tend to be more religious than men and White people (ReviseSociology, 2018; Pew Research Center, 2019; Office for National Statistics, 2021b). Women and people of color are widely known to face barriers to participation in the sciences (e.g., Casad et al., 2018), and understanding whether and how their greater religiosity contributes to these barriers could advance efforts to improve recruitment and retention gaps. Thus, even though Christians are still the majority and historically dominant religious group in the US (Ecklund et al., 2019), their relatively low numbers in STEM may be linked to the underrepresentation of marginalized groups in these fields.

Second, scientific literacy levels in the US and many European countries are alarmingly low. Over a quarter of US Americans and over a third of European Union residents incorrectly believe the Sun revolves around the Earth, and less than half of US Americans acknowledge that humans evolved from earlier species of animals (Nisbet and Nisbet, 2019). Notably, Christians—especially those who interpret the Bible literally or who belong to sectarian Protestant denominations—score lower on scientific literacy measures than do non-religious individuals (Sherkat, 2011). Given that most people in the US (Pew Research Center, 2022) and many European countries (Office for National Statistics, 2021a; Statista, 2021) self-identify as Christian, failing to consider ways to increase religious individuals' representation in STEM has potentially detrimental consequences for scientific literacy and engagement in society at large.

Finally, recent data suggest that there may be, at least under some circumstances, a discrepancy between why people *assume* Christians are underrepresented in STEM and why Christians *actually are* underrepresented in STEM. According to recent empirical work (Ecklund and Scheitle, 2017; Leicht et al., 2022), non-religious people are more likely than religious people to see science and religion as conflicting schools of thought. As a result, religious individuals may be assumed to lack ability, interest, or trust in science, even though most Americans report that science does *not* clash with their personal religious beliefs (Pew Research Center, 2015). Indeed, as we describe in more detail below, Christians in the US are stereotyped as incompetent at and skeptical of science (Rios et al., 2015), due in part to non-religious individuals' perceptions of a science-religion conflict (Mackey et al., 2023). These stereotypes persist despite that US Christians themselves see Christians as no less scientifically competent than other religious (or non-religious) groups (Rios et al., 2015; Mackey et al., 2023). Discrepancies between how Christians view themselves and how others view Christians in scientific domains could in turn fuel misunderstanding and polarization—for instance, between Christians and non-religious groups (Mackey et al., 2023), or between scientists and the public (Krause et al., 2021).

3. Unpacking Christians' underrepresentation in STEM

In the following subsections, we review the evidence supporting two broad sets of explanations for religious individuals' underrepresentation in STEM fields: factors related to religious individuals themselves *(internal factors*), and factors related to societal representations of religion and science (*external factors*).

3.1. Internal factors

3.1.1. Actual conflict between Christianity and science

For decades, cognitive scientists have proposed that there are two processes through which humans form judgments and make decisions: System 1, which involves relying on intuition and responding automatically, and System 2, which involves relying on rational, analytical thought and responding deliberatively (Epstein, 1994; Stanovich and West, 2000). System 1 processing is often implicated in religious belief, whereas System 2 processing is often implicated in scientific reasoning (Zuckerman et al., 2013). Thus, it is possible that religious belief and scientific reasoning involve different, inherently conflicting schools of thought, which could explain religious individuals' relative underrepresentation in STEM.

Consistent with this possibility, a meta-analysis of 63 studies demonstrated an overall negative relationship between religiosity and scores on general intelligence measures, many of which assess analytical thinking (Zuckerman et al., 2013). Despite some

contradictory follow-up evidence (Webster and Duffy, 2016), recent meta-analyses have replicated and expanded upon the religiosity-intelligence relationship, showing a small but robust correlation overall (Zuckerman et al., 2020; Dürlinger and Pietschnig, 2022). Research suggests that intelligent people are more likely to think analytically which in turns predicts lower religiosity, or alternatively, that both intelligence and analytical thinking measures tap into cognitive ability (Zuckerman et al., 2020). Indeed, analytical thinking tends to correlate negatively with religious belief (Pennycook et al., 2016; Stagnaro et al., 2019; Ståhl and van Prooijen, 2021; Yilmaz, 2021), though there is some evidence that the magnitude of this correlation varies cross-culturally (Gervais et al., 2018).

The causal direction of the relation between religiosity and analytical thinking is unclear (Villanueva et al., 2022). Early experimental tests of the effects of analytical mindset on religious disbelief (Gervais and Norenzayan, 2012) have failed to replicate (Sanchez et al., 2017; Camerer et al., 2018). Moreover, it remains to be seen whether increasing the salience of religious beliefs or identity decreases analytical thinking. Nevertheless, the correlation between religiosity and analytical thinking—which has been particularly well documented in Western, majority Christian societies (Gervais et al., 2018; Stagnaro et al., 2019)—could suggest an actual conflict that deters Christians from the pursuit of fields requiring a great deal of analytical thought, such as STEM.

3.1.2. Perceived conflict between Christianity and science

In addition to the possibility that there is an objective conflict between science and religion (perhaps especially Christianity), Christians may sometimes *perceive* a conflict between their beliefs and science—and hence choose not to pursue science—even if there is no such conflict. As noted earlier, religious individuals are generally less likely than nonreligious individuals to see their personal religious beliefs as clashing with science (Pew Research Center, 2015; Ecklund and Scheitle, 2017; Leicht et al., 2022). However, members of conservative religious denominations may be more prone to perceive a conflict, and hence to disengage from STEM fields, than members of other religious denominations. For example, conservative Protestants in the US tend to be more opposed to the scientific method and less motivated to seek scientific knowledge (Evans and Evans, 2008), as well as score lower on science literacy measures (Sherkat, 2011), compared to Catholics and mainline Protestants. Further corroborating the notion of a perceived conflict between religion and science as ways of knowing about the world, McPhetres and Zuckerman (2018) found that in the US, parents' religiosity predicted lower knowledge of and trust in science among their children approximately 20 years later, via more negative attitudes toward science. These findings point to a potential causal relationship between Christians' perceptions of a religion-science conflict and their self-selection out of science.

Another type of conflict that Christians might perceive with science, and that might steer them away from STEM fields, involves morality. Evans (2011) has argued that conservative Protestants in the US sometimes oppose science and want to limit the power scientists wield in society. Specifically, conservative Protestants may believe science promotes questionable moral values—for example, teaching evolution in public schools and conducting stem-cell research. In a similar vein, recent work has shown that over 50% of US college students believe accepting evolution is tantamount to rejecting religious views; and among the most religious college students, such beliefs predict lower acceptance of and willingness to learn about evolution (Barnes et al., 2020a). Although research on conservative Protestants' perceptions of a moral conflict between religion and science has focused on the natural sciences, we discuss implications for the social sciences in our Future Directions section.

Regardless of whether Christians perceive conflicts with science on epistemological or moral grounds, one possible consequence of these conflict perceptions is that Christians disengage from science. Supporting this idea, McPhetres et al. (2021) demonstrated across several studies that religiosity is associated with less interest in and more negative attitudes toward science, but particularly in Western countries (see also Rios and Aveyard, 2019). That is, Christians' disengagement with science likely has less to do with an objective religion-science conflict and more to do with societal perceptions of a conflict. Ultimately, Christians' disengagement from and negative attitudes toward science could predict their underrepresentation in STEM.

3.2. External factors

Thus far, we have highlighted the ways in which religious individuals themselves could contribute to their relatively low representation in STEM fields, either because religious beliefs actually conflict with science or because religious individuals perceive such conflict and therefore self-select out of science. However, a growing body of research suggests that religious underrepresentation in science may also be due to contextual factors, including how scientific values and scientists are represented in many societies, and negative stereotypes about religious individuals (particularly Christians) and the religion-science relationship.

3.2.1. Lack of representation of relevant values

According to identity-based motivation theory (Oyserman et al., 2007, 2017; Oyserman, 2009), if certain behaviors or domains are depicted in ways that are not compatible with people's cherished social identities, people will come to see such behaviors or domains as "not for me" and will refrain from engaging in them. For instance, people of color in the US tend to view health-promoting behaviors (e.g., diet, exercise) as primarily enacted by middle-class White people. Perhaps as a result, people of color are less likely than White people to seek health knowledge and participate in health-promoting activities (Oyserman et al., 2007). As another example, girls may outperform boys in school in part because being a "good student" is framed as more congruent with girls' than boys' identities. Notably, though, describing success as compatible with one's gender identity increases school-related motivation among boys (Elmore and Oyserman, 2012).

We argue that at least in Western societies (e.g., North America, Western Europe), STEM fields are often depicted as being at odds with religious individuals' values and identities, and such depictions can help account for religious individuals' underrepresentation in STEM. In the previous section, we suggested that religious individuals themselves may see their values as conflicting with science. Here, however, we focus on sociocultural representations of science rather than on religious people's values. In other words, we draw attention to several studies demonstrating how Christians' positivity toward STEM can increase as a function of describing science, or scientists, differently.

In a survey-experiment, Scheitle and Ecklund (2017) randomly assigned some participants to read a short passage about either Richard Dawkins, an evolutionary biologist and outspoken atheist, or Francis Collins, then director of the National Institutes of Health and an evangelical Christian. They found that controlling for participant religiosity, those who read the passage about Collins (vs. no passage) were subsequently more likely to report that science and religion could coexist. By contrast, reading the passage about Dawkins had no effect on participants' perceptions of the science-religion relationship, perhaps because the conflict narrative endorsed by Dawkins is the "default" in Western societies (Scheitle and Ecklund, 2017). This study provides preliminary evidence that exposure to a religious scientist exemplar can help participants see science as compatible with their religious values.

Another, more recent experiment demonstrated that religious identity cues can increase US Christians' COVID-19 vaccination intentions. Specifically, participants who read a vaccine endorsement highlighting the religious identities of Francis Collins and other medical experts exhibited greater trust in medical experts and increased willingness to get the vaccine, relative to participants who read a vaccine endorsement without references to medical experts' religious identities. These effects were most pronounced among highly religious participants and were explained by perceptions that the religious medical experts shared participants' values (Chu et al., 2021). Although there was no experimental condition in which the medical experts expressed an anti-vaccine stance, we suspect that such a condition would have decreased highly religious participants' willingness to be vaccinated, especially if the medical experts' religious identities were mentioned.

In a similar set of studies, US Christians perceived religious scientist exemplars as more motivated by moral and prosocial values, and therefore as more trustworthy, than an atheist scientist exemplar, and such perceptions indirectly predicted trust in science more broadly. Even scientists from religious outgroups (i.e., Jewish, Muslim) were perceived as more morally and prosocially motivated, as well as more trustworthy, than atheist scientists (Beauchamp and Rios, 2020).

Taken together, these results suggest that US Christians are more trusting of science and scientists following exposure to specific religious scientists, due to beliefs that religious scientists' values comport with their own values (Beauchamp and Rios, 2020; Chu et al., 2021). However, learning about the religious (vs. secular) composition of STEM fields in general can also affect trust in science. For instance, US Christians who are told that most natural and social scientists self-identify as atheist (vs. Christian) subsequently see science as posing a greater threat to religious values and hence demonstrate less trust in science (Simpson and Rios, 2019). Thus, regardless of whether the religious values and identities of individual scientists or those of scientists as a group are made salient, such salience can make a difference for US Christians. Although the primary outcome variable discussed above was trust rather than participation in science, trust and participation in science are highly correlated (e.g., Pietri et al., 2018). That is, US Christians' increased trust in science (via exposure to religious scientists) may have downstream consequences for their representation in STEM fields.

3.2.2. Awareness of negative stereotypes

In addition to the notion that science-relevant values are frequently depicted as conflicting with religious individuals' values and identities, religious individuals may be underrepresented in STEM in part due to their awareness of negative stereotypes about their group's scientific competence and interest. This possibility is based on stereotype and social identity threat theories (Steele et al., 2002). Stereotype threat theory postulates that members of groups that are negatively stereotyped in a particular domain will underperform in that domain not because they personally endorse the stereotype, but rather because they are anxious about confirming others' stereotypes about their group (Steele and Aronson, 1995). Similarly, social identity threat involves the more general perception that one does not fit into a given context, as a function of one's group membership. Both stereotype and social identity theories involved awareness of being negatively stereotyped by others. However, stereotype threat involves specific negative stereotypes of (e.g., Christians are bad at STEM), whereas social identity threat involves a broader devaluation of one's group (e.g., STEM fields are not welcoming to Christians). Furthermore, although stereotype threat research has focused primarily on performance differences between groups (Steele and Aronson, 1995), social identity threat research examines other outcomes such as feelings of belonging or similarity to others (Steele et al., 2002).

Are religious people negatively stereotyped in STEM? Research conducted within the past decade suggests they are. In an initial study (Rios et al., 2015, Study 1), Christians and non-Christians in the US reported knowing that Christians are perceived as lower in scientific ability and trust in science than the average person. However, only non-Christians personally endorsed these stereotypes. In fact, non-Christians perceived Christians as lower in ability and trust in science relative to both the average person and other religious groups (e.g., Jewish and Muslim Americans). Additionally, nonreligious (but not religious) people are more surprised by scientists who identify as religious than by scientists who identify as atheists (Sharp et al., 2022). Follow-up work has demonstrated that non-religious people in the US stereotype Christians as unscientific and unintelligent in part because non-religious people perceive a conflict between Christianity and science (Mackey et al., 2023). Moreover, biological sciences faculty rate evangelical Christian PhD program applicants as less hirable and competent than PhD program applicants who do not report a religious identity (Barnes et al., 2020b).

Negative stereotypes of religious people, particularly Christians, in science can have detrimental consequences for the targets of such stereotypes and may contribute to their underrepresentation in STEM fields. For instance, when Christians are told that there are religious differences in performance on a scientific reasoning task or complete the task in an identity-threatening environment (i.e., a physics building), they underperform on the task relative to non-Christians. Yet when Christians are told that there are no religious differences in task performance or complete the task in an identity-safe environment (i.e., a divinity school), the performance gap between Christians and non-Christians disappears (Rios et al., 2015). The effects of negative stereotype awareness on Christians' scientific performance are strongest among those who are *highly* identified with science, suggesting that Christians in these studies underperform because they care about debunking perceptions of their scientific ability, and not because they are disengaged from science in the first place (Rios, 2021).

Recently, some stereotype threat findings (e.g., effects of negative stereotype awareness on women's math performance) have been called into question due to null results of replication studies (Finnigan and Corker, 2016; Flore et al., 2018). Research on stereotype threat in the domain of religion is still relatively new, and it remains to be seen whether these effects replicate over time. However, even if the relationship between negative stereotypes and Christians' scientific performance is not robust, the impact of these stereotypes is not constrained to measures of performance. For example, Christians who are reminded of such stereotypes may subsequently distance themselves from science (Rios et al., 2015) and report subjective concerns about being negatively evaluated based on their religion (Rios, 2021). Furthermore, in an investigation of how religious identity affects graduate students in science disciplines, Scheitle and Dabbs (2021) found that strength of religiosity predicted greater concealment of one's religious identity within academia. Religious identity concealment in turn was associated with weaker identification with science. Thus, perhaps due to the stigma surrounding religion within academic science (Barnes et al., 2020b), religious graduate students in STEM ultimately disengage from their field to the extent that they feel pressured to downplay (or outright hide) their religious identity.

Collectively, the aforementioned studies point to yet another sociocultural factor that may affect religious individuals' representation in STEM fields: not only are religious individuals (especially Christians) negatively stereotyped in science, but they are also cognizant of the fact that non-religious people see them as less scientifically competent (Rios et al., 2015; Barnes et al., 2020b). According to stereotype and social identity threat theories (Steele et al., 2002), knowing that one is negatively stereotyped in a certain domain by virtue of one's group membership is a heavy burden to carry. Indeed, research from our and other labs has demonstrated that these negative stereotypes can lead to decrements in scientific performance (Rios et al., 2015; Rios, 2021), subjective concerns about being evaluated based on one's religion (Rios, 2021), and disidentification from science (Rios et al., 2015; Scheitle and Dabbs, 2021), even among religious individuals who are deeply invested in STEM such as graduate students (Scheitle and Dabbs, 2021) and high science identifiers (Rios, 2021).

4. Future directions

Throughout this article, we have reviewed a small but emerging area of research on the different factors that may inhibit religious individuals' representation in STEM. We acknowledge that the literature thus far has examined diverse outcome variables, such as trust in science, science identification, science literacy, and performance on scientific reasoning tasks. However, all these variables ultimately have the potential to further understanding of why and under what conditions religious individuals are recruited and retained in STEM fields less often than their nonreligious counterparts. That said, there are still many questions left unanswered in this body of work, and we highlight some especially fruitful future directions here.

To date, research on conservative Christians' perceptions of a moral conflict between their faith and science has focused on the natural and physical sciences (Evans and Evans, 2008; Evans, 2011). However, conservative Christians may increasingly see the social sciences as conflicting with their religious values as well, given recent debates surrounding whether and how to address gender identity, sexual orientation, and critical race theory in public schools. Indeed, Christian nationalism (the belief that the US is and should continue to be dominated by Christianity) predicts prejudice toward sexual, gender, racial, and ethnic minority groups (Rowatt and Al-Kire, 2021). There may also be differences in how members of more vs. less conservative religious denominations conceptualize STEM. Even within Western cultural contexts, there is limited research on what people think science is and is not. One possibility is that people from conservative or fundamentalist religious traditions define science as including controversial topics such as stem-cell research, vaccines, evolution, and gender-affirming treatment for transgender individuals, and consequently trust science less as a whole. Another possibility, however, is that these individuals denounce such topics as "unscientific" or "politics," thus adopting a relatively narrow definition of science.

As we have noted, most research on religious representation and engagement in STEM focuses on Christians in the US and other Western countries (Gervais et al., 2018; Ecklund et al., 2019; Rios and Aveyard, 2019; Stagnaro et al., 2019; for exceptions, see Davoodi et al., 2019; McPhetres et al., 2021; Khalsa et al., 2022). Some prior work suggests that certain religious minorities in the US (e.g., Jewish, Muslim, Buddhist, and Hindu individuals) are *overrepresented* rather than underrepresented in scientific fields. However, the experiences of these groups in the sciences still warrant investigation, as feelings of inclusion are at least as important to minority groups as numerical representation (Chen and Hamilton, 2015). For example, although Jewish people constitute a much higher proportion of scientists than the general population, this may not be the case for conservative or Orthodox Jews (Ecklund and Scheitle, 2007). In addition, Judaism tends to center on cultural rituals and practices more so than Christianity (especially Protestantism), which tends to be belief-based (Cohen and Hill, 2007). This difference may have implications for the ways in which Jewish and Christian scientists construe and reconcile their identities (Vaidyanathan et al., 2016).

One possible reason several religious minority groups are overrepresented in STEM within the US is that science in the US

(relative to other Western countries) has a substantial international influence. Indeed, over 40 percent of US scientists were born overseas, and many of these scientists may identify as Muslim, Hindu, or Buddhist (Ecklund et al., 2019). Scientists who were born overseas could face other barriers to belonging and participation, such as being perceived as "perpetual foreigners" (Zou and Cheryan, 2017) or as having values that are incompatible with those prevalent in Western societies (i.e., being a symbolic threat to the ingroup's culture; Rios et al., 2018). Moreover, it would be interesting to examine whether scientists from religious minority groups are underrepresented in leadership positions (e.g., tenured full professor, director of a research institute), perhaps also if they belong to racial/ethnic groups stereotyped as low in leadership ability (e.g., East Asian) (Lu et al., 2020).

Research conducted outside the West has generally shown that perceptions of a religion-science conflict are less pronounced (Davoodi et al., 2019; Rios and Aveyard, 2019; Khalsa et al., 2022), as are the differences between religious and nonreligious people on analytical thinking (Gervais et al., 2018; Stagnaro et al., 2019) and attitudes toward science (McPhetres et al., 2021). Additionally, Jewish and Muslim Americans do not tend to see science and religion as conflicting (Vaidyanathan et al., 2016). However, it remains to be seen why some of these effects do not emerge in non-Western countries. One possibility is that in many such countries, scientists are predominantly religious. Indeed, although scientists in the US, UK, and France tend to be non-religious, scientists in countries like India and Turkey (which are majority Hindu and Muslim, respectively) are more likely to report a religious affiliation than not (Ecklund et al., 2016). This may be because the religion-science conflict narrative focuses primarily on Christianity, and scientists from other religions prevalent outside the West (e.g., Judaism, Islam) perceive less of a conflict between science and their belief systems (Vaidyanathan et al., 2016).

Alternatively, because non-Western countries are, on average, more interdependent and collectivistic (e.g., self-definitions are based on social groups and relationships to a greater extent than individual characteristics) than Western countries (Markus and Kitayama, 1991), *science* may be described in more interdependent, collective terms in non-Western countries as well. In other words, science may be depicted in the media and popular culture as involving collaborative work with and prosocial behavior toward others, rather than solitary work and self-interest. Given that group-level traditions (Cohen and Hill, 2007) and prosocial values (Norenzayan et al., 2016) are central to many religions, these types of values could align more closely with religious people's self-concepts than individualism and independence. Similarly, research on women in STEM has shown that in Western cultural contexts, STEM fields are depicted in more individualistic, independent terms, and such depictions are less palatable to women than when STEM is depicted as group- and other-oriented (Diekman et al., 2011, 2017; Belanger et al., 2020).

If descriptions of STEM as collectivistic and interdependent (vs. individualistic and independent) do in fact carry greater appeal for religious people, there is still some nuance within such descriptions to unpack. For example, a field could be characterized as collectivistic or interdependent because its members work collaboratively, promote prosocial values (e.g., prioritizing ethics), or seek to better society as a whole. Thus, researchers must first determine whether religious people do in fact prefer science that is more collectivistic than individualistic. However, it would then be worthwhile to pinpoint which collectivistic attributes are responsible for these effects. And certainly, although we suspect that STEM may be depicted more collectively in non-Western cultural contexts, such depictions could have positive effects on religious people's, women's, and racial/ethnic minority groups' representation in STEM within the West as well.

In addition, we have raised the possibility that religious underrepresentation in STEM is less of a problem in non-Western countries because more high-profile scientists in such countries are religious (Ecklund et al., 2016). This, too, is a potential avenue for future research. For example, some work has shown that religious exemplars (e.g., Francis Collins) can increase perceptions of religion-science compatibility (Scheitle and Ecklund, 2017), as well as bolster US Christians' trust in science or scientists (Simpson and Rios, 2019; Beauchamp and Rios, 2020; Chu et al., 2021). But whether religious exemplars attenuate feelings of threat and heighten interest in STEM among religious individuals—and whether these effects vary across sociocultural contexts—still has not been investigated. Doing so is important for determining the specific factors that underlie religious people's relatively low representation in STEM fields.

Another critical issue involves how, exactly, scientists can and should interact with the public in ways that are non-threatening to religious people. Presenting STEM as more collectivistic and interdependent could help reduce religious individuals' perceptions that they are negatively stereotyped in science, that science is incompatible with their values, or both. It may also be helpful, in terms of increasing religious representation in STEM, for scientists to consider how they broach communication with religious populations. Some work suggests that in domains such as increasing different groups' receptiveness to the COVID-19 vaccine, it is imperative for scientists not to "pathologize" the public. That is, portraying groups that are initially resistant to the COVID-19 vaccine as ignorant or misinformed may backfire and perpetuate polarization between scientists and laypeople (Krause et al., 2021). In a similar vein, portraying religious individuals as "simply not interested in science" or as "low in scientific literacy" without considering the role scientists themselves may play in religious underrepresentation in STEM, could be counterproductive.

Up to this point, we have not thoroughly discussed whether religious people are *actually* discriminated against in STEM. As we mentioned earlier, in one set of studies, biology faculty evaluated evangelical Christian PhD applicants as less hirable, competent, and likable than PhD applicants who did not disclose a religious affiliation (Barnes et al., 2020b). Christians also report experiencing more religious discrimination than non-religious individuals in physics as well as biology (Scheitle and Ecklund, 2018), and they experience concern about fitting into graduate school in social and natural sciences (Scheitle and Dabbs, 2021). But additional research is needed on the degree to which non-evangelical Christians, or members of religious minority groups, encounter bias in STEM fields. Furthermore, context can matter: Recent evidence suggests that undergraduate students at a Christian university are less

likely to perceive anti-Christian discrimination in the sciences than students at secular universities (Soneral et al., 2023). We encourage researchers to continue examining the pervasiveness (and consequences) of both real and perceived biases against religious individuals in STEM.

Finally, it will be critical for additional studies to examine the conditions under which religious underrepresentation is attributable to internal factors (i.e., actual religion-science conflict, conflict perceived by religious individuals) vs. external factors (i.e., representations of science, scientists, and religious individuals in society). For example, given some findings that fundamentalist and conservative Christians score lower on science literacy measures (Sherkat, 2011) and perceive more of a conflict between religion and science (Evans and Evans, 2008; Evans, 2011), it could be that the "internal factors" we reviewed apply more to fundamentalist and conservative religious groups. In addition, "external factors" may be more likely to account for religious underrepresentation in STEM in contexts that are relatively secular (as is the case with science in many Western countries; Ecklund et al., 2016), whereas "internal factors" may be more at play in less secular contexts where highly religious people do not commonly encounter negative societal stereotypes (e.g., faith-based universities).

5. Conclusion

We acknowledge that there is likely no single, "correct" explanation for why Christians in many Western societies are underrepresented in STEM. Indeed, we have introduced two broad categories of explanations: factors more closely related to Christians themselves, and factors more closely related to societal representations of Christianity, science, or both. Although the bulk of the evidence we reviewed involves societal representations, this is in part because we want to draw readers' attention to the less-emphasized reasons behind Christians' underrepresentation in STEM. For a long time, scientists and public intellectuals have entertained the notion of an inherent conflict between religion and science (Draper, 1875; White, 1876). Only recently have researchers begun to take this notion a bit less for granted, in part by examining why religion and science are often *perceived* to conflict and how such perceptions of conflict affect religious individuals, particularly Christians (e.g., Preston and Epley, 2009; Rios et al., 2015; Ecklund and Scheitle, 2017; Scheitle and Ecklund, 2017; Rios, 2021).

We encourage researchers to treat the issue of religious underrepresentation in STEM with the same care and critical lens as our field has come to treat other groups' underrepresentation in STEM. Of course, these issues are not completely analogous: religious people are still a (shrinking) majority and in many ways the dominant group in the US (Pew Research Center, 2022), whereas women, people of color, LGBTQ individuals, and people with disabilities have historically encountered oppression and disadvantage. However, considering how scientists might make their fields more welcoming to religious populations has important advantages for multiple stakeholders. Not only would religious people benefit by feeling a greater sense of belonging in STEM, but the scientific community and general public would stand to gain if increased representation of a sizeable chunk of the population means that scientific engagement and literacy ultimately increase.

Author contributions

KR drafted the manuscript. CM provided feedback and revisions. ZC wrote an earlier (unpublished) paper that contributed to the ideas reported in this article. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author KR declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

Publisher's note

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