

The apparent resurrection of Jesus is consistent with natural science

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Some people have survived being underwater, without breathing, for tens of minutes. We draw an analogy between such near-drowning and crucifixion: because modern medical studies of crucifixion have generally concluded that the main cause of death was asphyxiation (induced by the position of the victim on the cross). The physiological mechanisms that enable some people to survive without breathing for tens of minutes are known from prior studies. We argue that some of those mechanisms could enable a person to survive crucifixion-induced asphyxiation for tens of minutes. The mechanisms are activated by known conditions—and those conditions are described in the biblical story of the crucifixion of Jesus. Witnesses to the crucifixion believed that Jesus had died, from asphyxiation. Thus, when Jesus was later found to be alive, they concluded that Jesus must have been miraculously resurrected. The apparent resurrection of Jesus, though, can be explained by natural science.

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1. Introduction

The core story of Christianity is that Jesus Christ was crucified, died on the cross, and then resurrected. The story is almost always interpreted as being either fictional or miraculous. Herein, we present a new interpretation that is verisimilar.

The story of how Jesus was crucified and (seemingly) died is told in the Bible. That story has been considered by several modern medical studies, which have attempted to determine the pathophysiological processes by which Jesus died: Barbet [1953], DePasquale & Burch [1963], Edwards et al. [1986], Holoubek & Holoubek [1994], DeBoer & Maddow [2002], Retief & Cilliers [2003], Brenner [2005], Zugibe [2005], Maslen & Mitchell [2006], Saliba [2006], Omerovic [2009], Bergeron [2012], Byard [2016], Kubala [2017], Bordes et al. [2020].

All such studies, however, are fundamentally irrational. If Jesus had actually died during the crucifixion, then the reports of his being alive afterward must be false, because a dead person cannot be resurrected. If those reports are false, though, then other reports related to the crucifixion should be assumed to be untrustworthy—in which case, studies of how Jesus died have little real basis. (Alternatively, if miracles are believed to have occurred, then scientific studies generally have little real basis.)

Nonetheless, those studies did make important discoveries about medical aspects of crucifixion. The present work builds on those studies. In particular, we review how those studies imply that Jesus was not breathing from the time that he seemingly died until the time that his body was taken down from the cross—which was roughly 20 minutes.

Medical science does know of a way in which a person can sometimes survive without breathing for 20 minutes. Indeed, there are well-documented cases of people surviving underwater for tens of minutes without drowning (as discussed in §5). The primary physiological mechanism that undergirds such surviving is the *diving response*. The diving response is known to be strongly activated in specific circumstances—and the biblical story describes those circumstances.

When a person has the diving response strongly activated, the person does not breathe. Moreover, blood flow to the periphery of the body is greatly reduced, and blood flow to the limbs can be near zero. Thus, if the person is unconscious, the person can seem to be dead.

We interpret the story of the resurrection of Jesus as follows. Witnesses to the crucifixion of Jesus, who were experienced with crucifixions generally, believed that Jesus had died. They did so due to an observed lack of breathing and a non-noticed heartbeat—among other things. What actually occurred, however, was not death but extended activation of the diving response. Hence, the apparent resurrection of Jesus can be reasonably explained by the diving response being deactivated.

In the following, though, we do not argue that our interpretation of the resurrection story is historical. Such an argument is not feasible, because there is not adequate evidence to determine historicity (as discussed in Excursus 1). What we argue instead is that our interpretation of the story is verisimilar.

2. The story of the resurrection

The story of the crucifixion and resurrection of Jesus is told, in the Bible, in four different reports. Those four reports, and no others, are called *gospels*.

There are problems with the texts of the gospels; for details, see Excursus 1. Despite the problems, though, the texts do tell a story which is broadly coherent. The story is well known; for a summary, see Excursus 2.

3. Medical aspects of crucifixion

A review of medical aspects of crucifixion is quoted below [Bordes et al., 2020].

The resting position of the victim's body was such that the arms were outstretched, the knees bent, and the trunk sagged forward. The tension applied to the pectoral muscles pulled the chest wall upward and outward, which decreased the work of inspiration and drastically increased the work of expiration. As vital capacity and expiratory reserve volumes decreased, the victim would have developed functional respiratory acidosis. In order to exhale sufficiently, the individual would have needed to straighten their knees, flex their elbows, adduct the shoulders, and push their body upward on the nail-impaled upper limbs. Over the course of hours to days, large-scale organ failure would have set in, muscles would have weakened, and lactic acid would have accumulated.... The victim would ultimately have been unable to lift their body enough to breathe sufficiently, leading to death by asphyxiation.

A struggle to breathe is emphasized by much of the medical literature on crucifixion. Another example from that literature is quoted below [Byard, 2016].

Crucifixion is specifically designed to cause severe and prolonged pain (hence the derivation of the word "excruciating"—"out of the cross").... The body is either tied or nailed to the cross beam.... The feet were either tied or nailed to the side or the front of the vertical post so that the legs bend.... This ensures that the weight of the body can only be lifted by constant painful extension of the legs. Failure to do so causes the body to sag and places a much greater burden on the diaphragm and intercostal muscles as they attempt to maintain respiration.

... Once on the cross a major issue would involve a struggle to breathe, as the weight of the body would make movement of the chest difficult. Victims would have to continually draw themselves up on their arms to exhale, leading to painful muscle cramping and exhaustion. ... the pain from cramped muscles, nailed limbs, and movement of the recently scourged back on the cross would be intense.

... Crucifixion interferes significantly with the ability to exhale, as the weight of the body tends to fix intercostal muscles in an inhalation state. The only way to overcome this is to lift the body by flexing the elbows and pushing down on the feet.

Concerning asphyxiation, the volume *Crucifixion in the Mediterranean World* draws a comparison of crucifixion with some executions at the Dachau concentration camp [Cook, 2019, §6.2]. At Dachau, sometimes a prisoner to be executed would have his wrists bound behind his back; he would then be suspended in the air by attaching his wrists to a pole. (A photograph showing that is at the World Holocaust Remembrance Center: Item ID 101245; available via <https://photos.yadvashem.org>.) The prisoner would then experience a weakening of muscles used in respiration. After some hours, the prisoner would die. An account of such an execution is quoted below [Barbet, 1953, App.I].

The condemned man was hung up by his hands.... The feet were some distance from the ground.

After quite a short time, the difficulty in breathing became intolerable. The victim tried to overcome this by drawing himself up on his arms, which allowed him to regain his breath....

After hanging for an hour, this drawing up became more and more frequent, but at the same time more and more feeble. Asphyxia set in, progressively and finally.

With such a Dachau victim, asphyxia would set in more quickly than with a crucifixion victim: because the position of the arms was different, causing muscle exhaustion more quickly. The slower death of the crucifixion victim was designed to extend the torment.

There was no standard method of crucifixion [Cook, 2019; van Wingerden, 2020]. With some crucifixions, asphyxia might have set in so slowly that the victim died of other causes—e.g. cardiac arrest or hypovolemic shock. For instance, some crosses had a seat or a footrest, to support the victim [Cook, 2019, §6.1.2]; in such cases, asphyxia would have set in slowly, or perhaps not at all. A related modern example occurred in China during 1863 [Cook, 2019, §6.2]: the victim was nailed to a cross, but was also standing on a board; after

3½ days, the victim was still conscious and suffering greatly; he was then strangled to death. (Some other modern examples are noted in Excursus 3.)

Regardless of the precise method of crucifixion, the victim was intended to suffer a slow tormented death. The Roman philosopher Seneca described crucifixion as a “lingering death ... wasting away in pain ... long-drawn-out agony” (*Epistulae Morales ad Lucilium* 101:13–14 [Gummere, 1971]). The Roman statesman Cicero considered crucifixion to be the “cruellest and vilest penalty” (*In Verrem* II.5:165 [Chapman & Schnabel, 2019, §3.6.1]). The first-century historian Josephus recorded crucifixion as being “the most pitiable of deaths” (*Jewish War* 7:196–206 [Hammond & Goodman, 2017]).

Sometimes a victim on the cross would have their legs deliberately broken. Several ancient records attest that doing so would induce death quickly [Koskenniemi et al., 2005]. Indeed, breaking the legs would have made it impossible to push the body up, and so the victim would be unable to breathe. Edwards et al. [1986] remark that “breaking the legs below the knees ... led to an asphyxic death within minutes”; similar remarks have been made by other medical researchers [DePasquale & Burch, 1963; Holoubek & Holoubek, 1994; Litchfield, 1997]. Thus, breaking the legs ended the torment of crucifixion; so it was an act of mercy.

4. The swoon hypothesis

Jesus seemed to die immediately after a wet sponge was put to his face, to drink from (as per the biblical story, quoted in Excursus 2). Several authors have proposed that Jesus did not actually die but instead merely became unconscious—perhaps due to being drugged by something in the sponge. That proposal is commonly known as the *swoon hypothesis*.

An early proponent of the swoon hypothesis was the theologian Heinrich Paulus, who proposed the hypothesis in his influential 1828 book *Life of Jesus*. Since then, there have been several other proponents of the hypothesis. A prominent example is Hugh Schonfield, who proposed the hypothesis in his popular 1965 book *Passover Plot*—which became a best-seller and was adapted into a Hollywood movie. In 1991, the hypothesis was proposed in a medical research journal [Lloyd Davies & Lloyd Davies, 1991]. Since then, it been proposed in more popular books.

Suppose, though, that Jesus had been merely unconscious. Then he would not be moving, and so he would die from asphyxia, within minutes. (The situation would be similar to when the legs of a crucifixion victim were broken.) Thus, the swoon hypothesis is untenable.

Moreover, the swoon hypothesis is highly implausible even without considering the medical issues. If, during crucifixion, it were possible to cheat death by becoming unconscious, then some other crucifixion victims would presumably have tried doing so. And the Romans, who

had generations of experience with crucifixion, would surely have known about it—and prevented it.

Regarding the 1991 proposal, the journal afterward published five comments, all highly critical [Mahler et al., 1991]. (For instance, one comment said that “Once Jesus had swooned he would no longer be able to breathe and death would rapidly supervene”.) Since 1991, there does not seem to have been any serious medical research that considers the swoon hypothesis to be viable.

5. Some exceptional near-drownings

Evidence

On a warm sunny day during 1998–2002, a man fell into a canal in Rio de Janeiro [Szpilman, 2006]. The man had consumed a small amount of alcohol. The water was brackish, dark, and 21 °C. The man was submerged, without breathing, for 22 minutes. When he was first brought to the surface, rescuers were unable to detect a heartbeat. The man survived, though, with seemingly no serious long-term effects [Szpilman, 2006].

On 10 June 1986, a girl fell into a creek near Salt Lake City, U.S.A. [Bolte et al., 1988]. Rescuers later found her underwater, wedged against the upstream side of a rock; they saw no evidence of an air pocket. The water temperature was about 5 °C. By the time the girl was brought to the surface, she had been submerged, without breathing, for at least 66 minutes. At the surface, she was cyanotic, with no palpable pulse. The girl survived, though, albeit with moderate neuropsychological sequelae [Kury Hughes et al., 2002].

There are hundreds of recorded cases of people who survived being underwater, without breathing, for over 10 minutes. Two examples are those above. The longest duration for which there is a reliable record is 83 minutes [Romlin et al., 2015].

There have been many studies of people who survived being underwater for long times—and comparing those people with people who drowned in similar circumstances. A meta-analysis of those studies was published in 2016 [Quan et al., 2016]. The meta-analysis concluded thus: “No difference in outcome was seen with victim’s age, water temperatures, or witnessed versus unwitnessed”.

The meta-analysis also concluded that survival was extremely unlikely when the time underwater was longer than 25 minutes [Quan et al., 2016]. The same conclusion has been made by other studies [Szpilman et al., 2012, tbl.2]. Thus, the cases of people surviving after being underwater for longer than 25 minutes are statistical outliers.

For those outlier cases, water temperatures do seem to be relevant: because in each those cases, the water was cold. Indeed, a review of the literature, published in 2011, was unable

to identify any case in which an individual survived for longer than 30 minutes submerged in water warmer than 6 °C [Tipton & Golden, 2011]. We know of no case published since 2011 that alters that.

What enables some people to survive for long times without breathing? The physiological mechanisms are considered in the remainder of this section.

The diving response and hypothermia

One of those physiological mechanisms is known as the *diving response*. The diving response has been found in air-breathing vertebrates generally. It is an evolutionary adaptation for defense against asphyxiation [Gooden, 1993; Foster & Sheel, 2005; Hagen, 2018].

There is no precise definition of the diving response that is standard in the scientific literature—in part because it applies to such a wide variety of species. The one essential characteristic of the diving response, though, is bradycardia (i.e. abnormally slow heart rate). In humans, when the diving response is strongly activated, the heart rate can be as low as 10 beats per minute [Arnold, 1985; Gooden, 1992].

With most air-breathing vertebrates, the diving response includes other characteristics, besides bradycardia. In particular, vasoconstriction (i.e. narrowing of blood vessels) profoundly reduces blood flow in much of the body [Gooden, 1992; Foster & Sheel, 2005; Panneton, 2013].

In humans, the diving response includes vasoconstriction that reduces blood flow in several portions of the body, including skeletal muscle and gut [Gooden, 1992]. Blood flows are especially reduced in the periphery of the body [Heistad et al., 1968; Foster & Sheel, 2005; Alboni et al., 2011; Bouten et al., 2020]; in limbs, blood flows of some people can be near zero [Gooden, 1992]. Blood flow to the heart itself can be 10% of usual levels [Gooden, 1993]. The brain, unlike other tissues, cannot tolerate anoxia [Lutz et al., 2003; Topjian et al., 2012; Fitz-Clarke, 2018, p.597,601; Hagen, 2018]; so blood flow to the brain is maintained—or even increased (thereby attempting to maintain the oxygen supplied to the brain, as the arterial oxygen content is reduced) [Pan et al., 1997; Hoiland et al., 2016; Bouten et al., 2020].

Thus, the diving response tries to sustain the aerobic metabolism of the brain and, to a lesser extent, the heart. It does so by using oxygen that is available in the blood, lungs, etc.

The human diving response is strongly activated by a combination of two things: apnea (i.e. cessation of breathing) and immersion of the face in a liquid [Campbell et al., 1969; Gooden, 1993, p.327; Foster & Sheel, 2005; Fitz-Clarke, 2018, p.595]. The diving response can be activated, in most people, just by immersing the face in water while breath-holding. Indeed,

in undergraduate physiology courses, it is common to demonstrate the diving response by having a student breath-hold and immersing his/her face: that student's heart rate and some other cardiovascular variables are then measured by another student.

The strength of the diving response is highly variable among humans [Arnold, 1985; Lindholm & Lundgren, 2009, p.285]. (The variation is partially due to genetics [Baranova et al., 2017].) In tests on volunteers, about 15% exhibit the diving response profoundly [Gooden, 1992].

Apnea and facial immersion stimulate different reflexes. When only one of those reflexes is stimulated, that can still activate the diving response in some people, albeit more weakly. In particular, extended breath-holding on its own commonly activates the diving response. When the reflexes are stimulated simultaneously, there is a greater chance of inducing a strong diving response [Marsh et al., 1995; Alboni et al., 2011; Elia et al., 2021, p.1554]. (Some literature refers to the diving response as the *diving reflex*: that is inaccurate, because more than one reflex is typically involved.)

It has sometimes been claimed that, to activate the diving response, the liquid must be cool. That might be true for some people, but it is not true for all: for an experimental illustration, see Figure 1. Experiments also found that when a person's face is separated from the liquid by a thin plastic sheet, the diving response is attenuated (even when liquid and skin temperatures are equal); so facial wetting itself is a stimulus for the diving response [Elsner & Gooden, 2009, p.95–96].

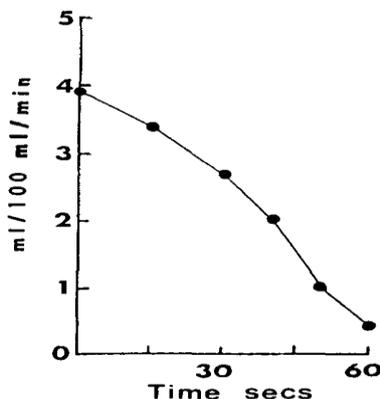


FIGURE 1. Blood flow to the forearm of a person who was submerged in water for 60 seconds (adapted from Gooden [1994, fig.1]). The person was exhibiting highly profound vasoconstriction in the limb. Water temperature was 34 °C.

Although the liquid does not have to be cool to activate the diving response, coolness does accentuate the diving response—at least down to 10 °C [Schagatay & Holm, 1996; Elsner & Gooden, 2009, p.95]. Why do water temperatures generally not affect the chance of survival

(as per the meta-analysis cited above) even though cool water accentuates the diving response? The reason seems to be that whole-body submersion in cool water also induces hypothermia, which decreases the chance of survival [Brown et al., 2012; Quan et al., 2014].

Some people can bear substantial hypothermia though. If such a person were submerged in cool water, and so became hypothermic, their diving response would be accentuated; that would facilitate longer apnea. Additionally, the hypothermia itself would decrease the metabolic rate (if the person is not shivering), and so also the oxygen consumption; that too would facilitate longer apnea.

Lastly, the diving response can be accentuated by other conditions, besides coolness of the liquid. One such condition is anxiety and fear [Hughes et al., 1981; Gooden, 1992].

Freediving

Freediving is the sport of diving in water without using any breathing apparatus, such as a snorkel or scuba tank. A freediver relies on breath holding—and the diving response.

In freediving competitions, one of the events is called *static apnea*: the freedivers are face-down in water, and they hold their breath for as long as possible. In the static apnea event, the longest times are greater than 10 minutes [AIDA, 2022]. The freedivers who endure those times, though, use a technique to put extra air in their lungs, before submerging (the technique is glossopharyngeal insufflation).

Some freedivers prefer to not use that technique, but instead to take a deep, but not maximal, breath—using roughly 80% of lung capacity. Those freedivers have times of up to 8 minutes [Pelizzari, 2019, chap.3]. Those freedivers have described the static apnea event as “not a matter of technique” and “mainly a mental effort” [Pelizzari, 2019, §3.1].

All freedivers use mental effort—i.e. willpower—to resist the urge to breathe. It is extremely difficult and uncomfortable to do that, but with practice, it can be done. One freediver commented on this as follows [Trubridge, 2017, chap.5].

T. E. Lawrence (of Arabia) had a famous party trick where he would pinch a burning match between his fingers to extinguish the flame. When a colleague asked him for the secret, Lawrence smiled and replied, ‘The trick, my dear fellow, is to not *mind* that it hurts’. This same concept can be applied to the urge to breathe: acknowledging it, but remaining impassive to it. This is the challenge....

Note that the urge to breathe does not come from hypoxia; rather, the urge comes from hypercapnia (i.e. abnormally high concentration of carbon dioxide in the blood). This hypercapnia, on its own, does not cause medical harm. Medical harm can be caused by

hypoxia, but that will not occur until many minutes after the onset of hypercapnia. This is the main reason that freedivers can remain submerged for so long without being harmed.

All freedivers do stretching and breathing exercises that increase their lung capacity. Additionally, practicing extended breath-holding induces changes in the body's metabolism that facilitates longer apnea. Without such exercises and practice, but with adequate willpower, a male freediver should theoretically be able to hold his breath for 5–6 minutes.

The static apnea event usually takes place in a swimming pool and freedivers can wear wetsuits. Hence, hypothermia does not arise, and so it does not affect recorded times.

We conclude that 5–6 minutes is the maximum duration of apnea that should be expected for a typical untrained healthy man who is not hypothermic—but who theoretically possessed adequate willpower. That maximum duration is obviously much less than the tens of minutes that some people have survived. That maximum duration, however, assumes *inter alia* that the man is fully conscious.

Loss of consciousness

Suppose that a person has their diving response activated. Then the oxygen that is available in their blood, lungs, etc. will be used to oxygenate their brain. After some time, the available oxygen will be insufficient for full oxygenation of their brain; so, their brain will become hypoxic. When the brain becomes hypoxic, it switches off consciousness—which much reduces the brain's oxygen demand (the vegetative function needed to sustain brain viability normally accounts for less than 15% of the brain's oxygen consumption [Fitz-Clarke, 2018, p.612–620]).

That is one of the reasons that people who are rescued from near-drowning are often found unconscious. (Some literature refers to the unconsciousness as *syncope*: that is inaccurate, because syncope implies a reduction in blood flow to the brain.)

Loss of consciousness, due to the brain being hypoxic, is a well-known issue in freediving competitions. In those competitions, loss of consciousness sometimes occurs, including in the static apnea event [Lindholm, 2007, tbl.1]. It occurs even though freedivers try hard to avoid it, because it results in disqualification.

Freedivers often train by holding their breath for as long as possible without body or facial immersion—called *dry training*. For competitive freedivers, loss of consciousness occurs during dry training as readily as when submerged in water [Nestor, 2014, chap.–10,000].

During dry training, freedivers sometimes have instruments that record their heart rate and some other cardiovascular variables. In one recorded case, a freediver, while dry training, lost consciousness due to hypoxia [Valdivia-Valdivia et al., 2021]. The instrumental record

demonstrated that the loss of consciousness was accompanied by a large strengthening of the diving response—as would be expected.

A loss of consciousness due to hypoxia is dangerous. It does, though, facilitate longer apnea: by reducing oxygen consumption of the brain; by intensifying the diving response; by removing the difficulty in resisting the urge to breathe.

Discussion

Consider the following hypothetical example. Suppose that a man has a highly profound diving response. Suppose further that he is underwater and that he rapidly loses consciousness (perhaps assisted by drugs or alcohol). Suppose too that, prior to losing consciousness, the man does not expend much energy, and thus oxygen, by flailing about in the water. Suppose, additionally, that the water induces mild hypothermia. Such suppositions will sometimes all be valid, albeit rarely.

We next roughly estimate the oxygen consumption of our hypothetical man. We assume that the man's brain consumes oxygen at 40% of its normal rate. We also assume that the man's body (ex brain) consumes oxygen at 10% of its normal rate. The brain normally accounts for about 20% of total oxygen consumption [McKenna et al., 2012]. Ergo, our hypothetical man consumes oxygen at about $(40\% \times 20\%) + (10\% \times 80\%) = 16\%$ of his normal rate.

A typical conscious non-hypothermic man, when submerged, will have no reduction in his brain's oxygen consumption. We assume that a typical conscious man's body (ex brain) consumes oxygen at about 5/8 its normal rate, due to the diving response. Thus, a typical conscious man consumes oxygen at about $(20\% + 50\%) / 16\% = 4.4$ times the rate of our hypothetical man. A typical conscious man can survive apnea for 5–6 minutes; so, our hypothetical man could survive apnea for 22–26 minutes.

The above calculations are rough, but they nonetheless indicate how our hypothetical man might survive apnea for about 25 minutes. Thus, we have a plausible explanation for most of the cases of people who have been able to survive underwater for long times.

That explanation, however, is inadequate for the statistical outliers who survived for much longer than 25 minutes. For those outliers, some additional mechanisms must have been at work. One such mechanism is severe hypothermia, due to the cold water. Another mechanism that has been proposed is this: the submerged person inhales cold water, which cools pulmonary blood, which is afterward pumped to the brain—thereby cooling the brain and so reducing the brain's oxygen consumption [Golden et al., 1997; Tipton et al., 2017, p.1339–1340]. Herein, the outliers are not considered further, because they are not needed for our study.

6. A verisimilar interpretation of the resurrection story

Activation of the diving response

According to the resurrection story, Jesus was not breathing for a long time. Under our interpretation of the story, he nonetheless survived. We draw an analogy with how some people have survived being underwater, without breathing, for tens of minutes. Thus, we assume that Jesus had a profound diving response.

We specifically propose the following. The sponge was held up towards Jesus' face; Jesus then pushed his face into the sponge—thereby meeting the facial-wetting condition for activating the diving response. When his face was pushed into the sponge, he did not have his body pulled up, because that would have been painful, especially with his hands/arms nailed; without his body pulled up, though, he could not exhale—thereby meeting the apnea condition for activating the diving response.

The sponge was soaked in sour wine. Was the sour wine cool? The seeming death was probably less than 100 minutes before sundown. The crucifixion must have been in early April—calculating via the date of the Passover festival, in AD 30 and AD 33 [Brown, 1994, App.II]. The weather is not described in the biblical story; so an assumption that it was chilly (e.g. 15 °C) is credible. Considering those points, the wine being cool seems to be reasonable. A cool liquid would have accentuated the diving response.

The diving response generally is also accentuated by anxiety and fear (as per §5). And Jesus would surely have been anxious and fearful.

How Jesus seemingly died

Jesus was sentenced to crucifixion, which is intended to be a slow tormented death (as per §3). Jesus seemingly died right after drinking the sour wine, though, thereby ending his torment. In such a situation, the Roman soldiers would surely have suspected that something had been put into the wine to cause Jesus to die—and thereby cheat the crucifixion of its full torment.

Despite that, there is no indication of such suspicion in the story. One possibility is that the soldiers were suspicious and the story does not report such. We propose another possibility.

We propose that something was put into the sour wine to cause Jesus to lose consciousness: it was expected that Jesus would then die quickly of asphyxiation. That was probably done with the centurion's acquiescence—because to do otherwise would have been dangerous—and the centurion acquiesced because of his sympathy for Jesus (as per the biblical story, quoted in Excursus 2).

We note that when Roman soldiers were ordered to crucify a person, they had to ensure that the person died: if the person was found to survive, the soldiers would be executed. Thus, regardless of how sympathetic the centurion was towards Jesus, the most that the centurion could have feasibly done to help Jesus was to allow a quick death.

When Jesus drank from the sponge, his diving response was strongly activated, as discussed above. Drinking from the sponge also caused Jesus to rapidly lose consciousness. In his physical position, Jesus could not breathe; so the diving response thereafter remained strongly activated. The loss of consciousness also accentuated the diving response. To summarize, we propose that Jesus remained alive, but non-breathing and with his diving response activated, from the time he seemingly died until the time his body was taken down from the cross.

We assume that it was chilly, as noted above. We further assume that there was a substantial breeze (e.g. 35 km/hr). The chilliness and breeze would have induced mild hypothermia, while Jesus was unconscious.

Note too that Jesus presumably took a deep breath just before lowering himself to drink from the sponge. Having his lungs largely full would facilitate non-breathing for a long time.

The total time that Jesus was non-breathing should be less than 25 minutes, to be verisimilar. That time seems to be reasonable; for details, see Excursus 4.

The people who witnessed Jesus' crucifixion would have had familiarity with crucifixions generally. Thus, those witnesses would have understood that once a crucifixion victim stopped moving around, the victim would be dead within minutes—indeed, that was why some victims had their legs broken. Ergo, once Jesus lost consciousness, the witnesses would have reasonably concluded that Jesus would die within minutes.

If anyone checked Jesus for a pulse, they would probably have found none: due to the diving response, especially peripheral vasoconstriction. (Possibly Jesus' pulse would have been palpable if someone had carefully checked the carotid artery; such checking would have been awkward, though, because Jesus was high up on the cross—so high that the sponge had to put on a stick/branch to reach his face.)

Several minutes after losing consciousness, Jesus' body would have become cyanotic and felt cool. Hence, witnesses would have inferred that Jesus was then dead.

To conclude this subsection, we note that the scenario described above is somewhat like the swoon hypothesis. The scenario, though, is medically verisimilar.

Entombment and apparent resurrection

Once Jesus was taken down from the cross, he was no longer in a physical position that prevented him from breathing. Hence, the diving response would have soon deactivated. The situation would have been similar to that of a person who was underwater for many minutes and was then brought to the surface. (With Jesus, though, there would have been no complications/danger arising from having aspirated water.)

After Jesus was taken from the cross, he was transported to the tomb. At the tomb, Jesus was wrapped in cloths. When wrapping him, the entombers would have noticed that Jesus was alive. The entombers would not have told anyone, because doing so would be dangerous. Instead, they would wrap the cloths loosely and come back later to rescue Jesus.

We assume that they would come back in the middle of the night, to lessen the chance of being detected. They could not come back that night (because it was an especially solemn Sabbath); so, they would come back the next night.

After they came back, they resuscitated Jesus. That took substantial time; so they were still there at dawn, when some of Jesus' followers showed up. The gospel authors did not identify them, because doing so would have endangered them.

7. Discussion and conclusion

Suppose that the gospels' story of the resurrection essentially reports what some people believed they had witnessed. Then the foregoing demonstrates that the story has a reasonable naturalistic interpretation. Some objections to that might be raised, based on secondary issues: on the Shroud of Turin; on the nailing of Jesus' feet; on guards at the tomb; on the stabbing of Jesus; etc. Each of those issues is considered in an Appendix.

To conclude, there is no need for belief in a miracle of resurrection. The apparent resurrection of Jesus was no more miraculous than the resuscitation of the people who were underwater for tens of minutes.

Supplement: Excurses and Appendixes

Excursus 1: Source texts

The four gospels are ascribed to authors named Matthew, Mark, Luke, and John. The gospels are denoted Mt, Mk, Lk, and Jn.

Each of the gospels started largely as an oral tradition [Court, 2006; Bird, 2014, chap.6; Bauckham, 2017] (for some caveats, see Eve [2016]). The gospels' texts were not written, in something like their present form, until decades after the crucifixion [Brown, 1994, p.4; Porter, 2016; Coogan et al., 2018, p.1380,1383,1431,1467,1519; Attridge, 2018].

The written texts were later copied by hand; the copies were themselves copied; etc. During copying, errors were introduced accidentally [Metzger & Ehrman, 2005, §7.I; Bird, 2014, chap.6 excur.]. Additionally, some changes were made to the texts deliberately: to support the religious doctrine [Metzger & Ehrman, 2005, §7.II.6; Birdsall, 2006; Bird, 2014, chap.6 excur.; Marcello, 2019]; to make the narrative a more engaging story [Brown, 1994, p.11–12; Licona, 2017]; for other reasons as well [Metzger & Ehrman, 2005, §7.II; Ehrman, 2006, chap.17–18; Parker, 2008, §10.10; Eve, 2016; Wallace, 2019]. Similar deliberate changes were presumably also made during transmissions of the prior oral traditions.

The original texts have been lost; so we are nowadays dependent upon the copied texts. The earliest extant texts are incomplete and fragmentary, and date from at least a century after the crucifixion of Jesus; complete texts are available only from much later still [Parker, 2008, chap.10; Hill & Kruger, 2012, chap.5–8; Bird, 2014, chap.6 excur.].

An example of how the gospel narratives might have been changed to make the story more engaging involves the “rule of three”—a guideline used in storytelling that says a story tends to be more engaging if things in the story occur in threes. There are many things in the story of Jesus' crucifixion that occur in threes: the night before the crucifixion, Jesus finds his disciples sleeping three times; later that night, Jesus' disciple Peter denies knowing Jesus three times; the main events of the crucifixion occur at the third, sixth, and ninth hours of the day (according to Mk); Jesus is mocked three times while he hangs on the cross; etc. Brown [1994, p.11–12] notes that biblical scholars (who generally regard the resurrection as real) “rightly assume that it is unlikely that everything happened so conveniently in threes”.

Another problem is that the four gospels tell four different narratives, which are sometimes mutually inconsistent. The texts of Mt, Mk, and Lk are similar enough, though, that their relationship is considered to be synoptic (meaning that the texts should be viewed together: *syn-optic*). The intertextual relationship between Mt and Mk is especially strong: about 80%

of the 661 verses in Mk are among the 1068 verses in Mt [Brown, 1997, p.111]. It is generally held that the principal source for Mt was Mk, or perhaps an early version of Mk [Ehrman, 2008, chap.7; Sim, 2011; Hagner, 2012, chap.9; Abakuks, 2015; MacEwen, 2015; Porter & Dyer, 2016; Allen, 2018; Burkett, 2018; deSilva, 2018, chap.4,6]. The intertextual relationship between Jn and the synoptic gospels is unclear [Smith, 2011; Borgen, 2014; Blomberg, 2016, chap.4–5; Porter & Ong, 2016; Attridge, 2018; deSilva, 2018, chap.9].

Another problem is that the gospels describe some events, beside the resurrection, that are not credible. For example, Mt^[27:50–53] claims this: at the moment Jesus died, tombs were opened and many bodies of saints were raised; afterward, those saints went into Jerusalem, where they were seen by many people. The claim of raising saints is generally regarded as a fictional embellishment of the resurrection story even by biblical scholars who accept some other miracles reported in the Bible [Davies & Allison, 2004, p.632; Nolland, 2005; France, 2007, 27:52–53 n.; Talbert, 2010, p.307; Allison, 2021, chap.7].

If some events in the story are regarded as embellishments, though, then other events could be as well. That obviously poses a problem, but the problem seems to occur mainly with Mt. Another example of non-credibility in Mt is given by Mt^[2:1–12], which claims this: magi came from the east, seeking a baby who was born to be king of the Jews; they did so by following a star; the star first went to Jerusalem, then it turned left and went to Bethlehem, where it positioned itself directly above the recently-born Jesus—thereby enabling the magi to find the baby.

Neither the claim about the star nor the claim of raising saints is mentioned by the other gospels. Nor is either claim supported by any Jewish records.

We argue herein that the story of the apparent resurrection of Jesus is verisimilar. In doing so, though, we must disregard some of the events claimed by Mt: in particular, the raising of the saints (mentioned above) and guards at the tomb (discussed in Appendix 3).

The foregoing is only a partial sketch of the problems with the gospel texts. It suffices, though, to justify this conclusion: the gospel texts should not be treated as being like modern eyewitness affidavits.

That conclusion has been underappreciated by many past scientific studies of the gospel story. Such underappreciation has led to criticisms by some biblical scholars. For example, one biblical scholar has noted that some scientific studies have a “major defect” due to being based on a “literalist understanding of the gospel accounts” [Brown, 1994, §42C]. And another biblical scholar reviewed a scientific study that showed a “sovereign disregard” for some of the problems with the gospel texts; the review concluded by noting that “logic exercised on false premisses produces distorted results” [Telford, 2015].

Despite the problems, though, the gospels do tell a story which is broadly coherent. Relevant portions of that story are presented in Excursus 2.

In presenting portions of the story, we include some quotations from the gospels. The gospels, though, were originally written in a dialect of ancient Greek [Brown, 1997, chap.3; Porter, 2006; Aland et al., 2012; Campbell, 2015]. Herein, the quotations are presented in English translation. The translations are taken from the *New Revised Standard Version Updated Edition Bible* (NRSVue) [NCC, 2021]. The NRSVue is regarded by many biblical scholars as the standard among English-language Bibles.

The Greek dialect of the gospels is sometimes ambiguous, and debates about its interpretation can be difficult and inconclusive. Partially for that reason, the translations of the quotations are occasionally disputable. Relevant disputes are noted with the quotations.

Excursus 2: Summary of the resurrection story

Introduction

The story unfolds during either AD 30 or AD 33 [Brown, 1994, App.II]. The story takes place in and near the city of Jerusalem. Jerusalem, at the time, was in the province of Judea, which was part of the Roman Empire. The governor of Judea was Roman: Pontius Pilate. A large majority of the people in Judea were Jewish.

Jesus was arrested and taken into custody, the night before he was crucified. While in custody, he was beaten and generally mistreated [Brown, 1994, §13–26]. He was seemingly also kept awake most, perhaps all, of the night. Early on the day of crucifixion, Jesus was flogged and further mistreated.^[Mt 27:26–30; Mk 15:15–19; Jn 19:1–3] (The biblical story gives no details on the flogging. Some authors have speculated about those details; we actually know almost nothing about those details though [Brown, 1994, p.851–853; Nicolotti, 2017].)

The governor, Pilate, was involved in some of the events with Jesus: e.g. he interrogated Jesus; e.g. he sentenced Jesus to death by crucifixion. The governor's residence and administrative headquarters was known as the *praetorium*. During the events with Jesus, Pilate was either inside the praetorium or just outside the praetorium.^[Jn 18:28–40,19:1–16]

Crucifixion, death, entombment

After Jesus was sentenced to crucifixion, he was taken to the place where was to be crucified; the place was called *Golgotha*.^[Mt 27:27–35; Mk 15:16–24; Jn 19:8–18] (The place is nowadays sometimes called *Calvary*, which is an English rendering of a Latin translation of *Golgotha*.)

At Golgotha, Jesus was crucified by Roman soldiers. The gospels give no details, saying only “they crucified him” and similar.^[Mt 27:35; Mk 15:24; Lk 23:33; Jn 19:18] Jesus was crucified along with two other men, who are identified as bandits.^[Mt 27:38; Mk 15:27; Lk 23:32–33; Jn 19:18,32]

The soldiers took Jesus’ clothes.^[Mt 27:35; Mk 15:24; Lk 23:34; Jn 19:23–24] It is unclear whether Jesus was crucified completely naked or wearing a loincloth (or similar); both practices seem to have been employed by the Romans at the time [Cook, 2019, §2.3.5.3,6.1.2].

After some hours on the cross, Jesus died. His dying is described by each of the gospels, as follows.

... Jesus cried with a loud voice, “Eli, Eli, lema sabachthani?” that is, “My God, my God, why have you forsaken me?” When some of the bystanders heard it, they said, “This man is calling for Elijah”. At once one of them ran and got a sponge, filled it with sour wine, put it on a stick, and gave it to him to drink. But the others said, “Wait, let us see whether Elijah will come to save him”. Then Jesus cried again with a loud voice and breathed his last.

Mt^[27:46–50]

... Jesus cried out with a loud voice, “Eloi, Eloi, lema sabachthani?” which means, “My God, my God, why have you forsaken me?” When some of the bystanders heard it, they said, “Listen, he is calling for Elijah”. And someone ran, filled a sponge with sour wine, put it on a stick, and gave it to him to drink, saying, “Wait, let us see whether Elijah will come to take him down”. Then Jesus gave a loud cry and breathed his last.

Mk^[15:34–37]

Then Jesus, crying out with a loud voice, said, “Father, into your hands I commend my spirit”. Having said this, he breathed his last.

Lk^[23:46]

... when Jesus knew that all was now finished, he said (in order to fulfill the scripture), “I am thirsty”. A jar full of sour wine was standing there. So they put a sponge full of the wine on a branch of hyssop and held it to his mouth. When Jesus had received the wine, he said, “It is finished”. Then he bowed his head and gave up his spirit.

Jn^[19:28–30]

NOTE ON TRANSLATION. For Mk, two other translations (both in the authoritative Anchor Yale Bible series) give a materially different last sentence. One gives “But Jesus, having given a loud cry, expired” [Marcus, 2009, p.1053,1056]. The other gives “But Jesus, having let go a loud cry, expired” [Brown, 1994, p.1031,1078–1080]. Both translations note that “loud cry” is probably a back-reference to the prior cry, “Eloi, Eloi, lema sabachthani?”, not a report of a second cry.

Thus, there seems to be some inconsistency among the four descriptions. Regarding the two cries of Mt versus the probable one cry of Mk, a proposed resolution is that Matthew misunderstood his principal source, Mk [Brown, 1994, p.1078–1080].

The Roman soldiers who were present at the crucifixion were led by a centurion (which is roughly similar to a captain in an army today). Mk^[15:39] reports that the centurion stood facing Jesus as Jesus died and then said “Truly this man was God’s Son!”. And Mt^[27:54] reports the centurion saying those same words. Lk^[23:46–47] reports that, right after Jesus died, the centurion praised God and said “Certainly this man was innocent”.

According to both the Hebrew Bible and rabbinical law, a body was not allowed to hang on the cross after sundown [Porter, 1992; Brown, 1994, p.1174; Evans & Monette, 2019]. Ergo, Jews attending the crucifixions would have been concerned about removing the body of Jesus before sundown.

Additionally, the crucifixions occurred the day before the Jewish Sabbath^[Mk 15:42; Lk 23:54; Jn 19:31] (for discussion of this, see e.g. Niswonger [1992, p.167–168] and Brown [1994, p.1350–1351]). On the Sabbath, Jews are prohibited from doing most work; and this particular Sabbath was especially solemn, because it occurred during the Jewish religious festival of Passover.^[Mt 26:2; Mk 14:1; Lk 22:7–13; Jn 18:28,19:14] Ergo, Jews attending the crucifixions would have also been concerned about what to do if the other two men being crucified died on the Sabbath, because they would have been prohibited from removing the bodies then.

A Jewish day began at sundown; so the Sabbath began at sundown. Thus, both concerns of the Jews needed to be dealt with before then. What happened is reported by Jn.

... the Jews did not want the bodies left on the cross during the Sabbath, especially because that Sabbath was a day of great solemnity. So they asked Pilate to have the legs of the crucified men broken and the bodies removed. Then the soldiers came and broke the legs of the first and of the other who had been crucified with him. But when they came to Jesus and saw that he was already dead, they did not break his legs. Instead, one of the soldiers pierced his side with a spear, and at once blood and water came out. These things occurred so that the scripture might be fulfilled, “None of his bones shall be broken”. And again another passage of scripture says, “They will look on the one whom they have pierced”.

Jn^[19:31–37]

NOTE ON TRANSLATION. The first word translated as *pierced* is, in the ancient Greek text, *ἔνυξεν*; the word translated as *they have pierced* is *ἐξεκέντησαν*. The *ἔνυξεν* can also be translated as *pricked*; the *ἐξεκέντησαν* definitely implies being pierced [Louw et al., 1989, §19.14–15; Brown, 1994, p.1177; Bauer et al., 2000, p.682b; Murphy-O’Connor, 2011]. Additionally, the word translated as *spear* is *λόγχη*, which is the Greek translation of the Latin *lancea*; *λόγχη* should be translated into English as *lance* [Bernard, 1928, Jn^[19:34]; Brown, 1994, p.1177; Murphy-O’Connor, 2011; Hart, 2017]. The *lancea* is short and could be used in hand-to-hand combat; it is distinct from the long spear (Latin *pilum*; Greek *ῥσσος*) that was also carried by Roman soldiers.

Jn continues.

After these things, Joseph of Arimathea ... asked Pilate to let him take away the body of Jesus. Pilate gave him permission, so he came and removed his body. Nicodemus ... also came, bringing a mixture of myrrh and aloes.... They took the body of Jesus and wrapped it with the spices in linen cloths, according to the burial custom of the Jews. Now there was a garden in the place where he was crucified, and in the garden there was a new tomb.... And so, because it was the [day before the Jewish Passover] and the tomb was nearby, they laid Jesus there.

Jn^[19:38–42]

NOTE ON TRANSLATION. The word translated as *garden* is, in the ancient Greek text, *κῆπος*, which can also be translated as *orchard* [Carson, 1991, §IV.E.9; Brown, 1994, p.1269; Harris, 2015].

An intervention by Joseph of Arimathea is reported by all four gospels. [Mt 27:57–60; Mk 15:43–46; Lk 23:50–53; Jn 19:38–42] Mt adds that the tomb belonged to Joseph (which seems verisimilar, in the context [Brown, 1994, p.1252–1254]). Mk adds the details below.

Joseph of Arimathea ... went boldly to Pilate and asked for the body of Jesus. Then Pilate wondered if he were already dead, and summoning the centurion he asked him whether he had been dead for some time. When he learned from the centurion that he was dead, he granted the body to Joseph.

Mk^[15:43–45]

Thus, according to Mk, when Joseph went to Pilate, Pilate did not know that Jesus was dead; yet according to Jn, Joseph went to Pilate after Pilate had granted the request to have the legs of the crucified men broken and the bodies removed. That seems to be an internal confusion in the story.

We know of three proposed resolutions for the confusion (besides dismissing the report of Jn). One resolution is that Joseph was the spokesman for the Jews who asked Pilate to have the legs of the crucified men broken etc. [Brown, 1994, p.1230–1231]. A second resolution is that Joseph was the person who was charged, by other Jews, with seeing to the entombment of Jesus [Lüdemann, 1995, p.21–24]. A third resolution is that Joseph had no involvement with Pilate nor with entombing Jesus; rather, it was just his tomb that was used [Murphy-O'Connor, 2011]. With each of the three resolutions, it is proposed that the story became corrupted during copying/retelling.

The tomb in which Jesus was laid had been hewn out of rock. [Mt 27:59–60; Mk 15:46; Lk 23:53] After Jesus had been laid there, a large stone was rolled in front of the tomb's doorway. [Mt 27:60; Mk 15:46,16:3–4; Lk 24:2; Jn 20:1] (A tomb comprising a hewn cave with a large stone blocking the opening was common at the time [Murphy-O'Connor, 2008; Marcus, 2009, p.1071–1072; von Wahlde, 2015; von Wahlde, 2018].)

Lk^[23:54] reports that by the time Jesus was entombed “the Sabbath was beginning”. Seeming to contradict that, Mt^[27:57–58] reports that Joseph went to Pilate “When it was evening”; similarly Mk^[15:42–43] reports that Joseph went to Pilate “When evening had come”, and also that “it was ... the day before the Sabbath”. The reports of Mt and Mk pose intrinsic problems: firstly, because they imply that Jews transported the body of Jesus after

sundown, i.e. on the Sabbath; secondly, because if it was after sundown then it would be the Sabbath, not “the day before the Sabbath”. Both those problems and the seeming contradiction with Lk^[23:54] can be resolved by noting that the word translated as *evening* is, in the ancient Greek text, *ὀψίας*, which can include late afternoon [Marcus, 2009, p.1070; Bauer et al., 2000, p.746b].

Resurrection and post-resurrection

The day after the Sabbath, at about dawn, it was discovered that the stone had been moved away from the tomb’s doorway.^[Mt 28:1–2; Mk 16:1–4; Lk 24:1–2; Jn 20:1] Subsequent inspection of the tomb showed that Jesus was no longer present.^[Mt 28:6–8; Mk 16:5–6; Lk 24:3,12; Jn 20:2–8] There remained the linen cloths with which Jesus had been entombed.^[Lk 24:12; Jn 20:4–7]

Mt^[28:2–3] reports that the stone had been moved by an angel, who wore “clothing white as snow”. Mk^[16] does not report about any angels, but does report that witnesses found “a young man dressed in a white robe” in the tomb. Lk^[24:2–4,23] reports that witnesses saw “two men in dazzling clothes” in the tomb; the two men are then referred to as constituting a “vision of angels”. Jn^[20:11–12] reports that a witness saw “two angels in white” in the tomb.

All four gospels report that the angel/man/men/angels talked with the witness(es). In particular, Jn reports that the angels talked with one of Jesus’ followers, Mary Magdalene.

[The two angels] said to her, “Woman, why are you weeping?” She said to them, “They have taken away my Lord, and I do not know where they have laid him”. When she had said this, she turned around and saw Jesus standing there, but she did not know that it was Jesus. Jesus said to her, “Woman, why are you weeping? Whom are you looking for?” Supposing him to be the gardener, she said to him, “Sir, if you have carried him away, tell me where you have laid him, and I will take him away”. Jesus said to her, “Mary!” She turned and said to him in Hebrew, “Rabbouni!” (which means Teacher).

Jn^[20:13–16]

Later that day, in the evening, Jesus met with some of his disciples. A report on that meeting is given by Lk.

While [the disciples] were talking..., Jesus himself stood among them and said to them, “Peace be with you”. They were startled and terrified and thought that they were seeing a ghost. He said to them, “Why are you frightened, and why do doubts arise in your hearts? Look at my hands and my feet; see that it is I myself. Touch me and see, for a ghost does not have flesh and bones as you see that I have.” And when he had said this, he showed them his hands and his feet.

Lk^[24:36–40]

NOTE ON TRANSLATION. The word translated as *hands* is, in the ancient Greek text, *χεῖρας*, which can include the arms [Brown, 1970, §69; Harris, 2015, 20:20]. (See too the next quotation of Jn.)

Another report of the same meeting is given by Jn. This report includes the only explicit mention, in the biblical texts, of nails.

When it was evening on that day, the first day of the week, and the doors were locked where the disciples were, ... Jesus came and stood among them and said, “Peace be with you”. After he said this, he showed them his hands and his side. Then the disciples rejoiced....

Jn^[20:19–25]

But Thomas ..., one of the twelve [disciples], was not with them when Jesus came. So the other disciples told him, “We have seen the Lord”. But he said to them, “Unless I see the mark of the nails in his hands and put my finger in the mark of the nails and my hand in his side, I will not believe.”

NOTE ON TRANSLATION. The prior note about *hands* also applies here.

Jn continues.

A week later his disciples were again in the house, and Thomas was with them. ... Jesus came and stood among them.... Then he said to Thomas, “Put your finger here and see my hands. Reach out your hand and put it in my side. Do not doubt but believe.” Thomas answered him, “My Lord and my God!”

Jn^[20:26–28]

After that, Jesus met with many more of his supporters. There are no records, though, of Jesus meeting with any outsiders or opponents [Allison, 2021, p.328–332].

Excursus 3: Examples of crucifixion in modern times

There have been some crucifixions in modern times. A few examples are considered in this excursus.

In the early 1800s, a Catholic nun was voluntarily nailed to a cross, as an act of religious devotion [Christmas, 1849, 1:325]. She endured on the cross for more than three hours, before asking to be taken down. The position of the cross was frequently changed, though: that would have reduced muscle cramping and made breathing easier.

A crucifixion experiment was conducted in the 1980s, with volunteers tied to a cross [Zugibe, 2005]. The experimenter claimed that the experiment demonstrated that asphyxia did not develop during crucifixion. The volunteers, however, “were suspended for periods ranging from 5 to 45 minutes determined by when they wished to come down”; moreover, the “major reasons for this decision was almost always due to the pain or cramping in the shoulders, arms and hands” [Zugibe, 1995]. Thus, the experiment was stopped before muscle exhaustion occurred. In such an experiment, there would indeed be no asphyxia.

In the Philippines nowadays, there are a few people who are voluntarily nailed to a cross, as an act of religious devotion; the crucifixions are done each year on Good Friday [Cabrera, 2013]. The longest time endured is half an hour [Carmichael, 2021].

There are news reports of people who were crucified by the Islamic State of Iraq and Syria. Some of those reports seem to be misleading, though: because most schools of Islam define crucifixion to mean affixing the body to a cross *after* execution [Peters, 2005, §2.4.11.3]. We have not found a detailed reliable report of ISIS executing a person *via* crucifixion.

Excursus 4: Duration of Jesus’ apnea

The total time that Jesus was non-breathing should be less than 25 minutes, to be verisimilar (as per §5). Was it?

To answer that question, first note that while Jesus was non-breathing, the following four events occurred: the issue was discussed with Pilate; the legs of the other two crucifixion victims were broken; Jesus was stabbed and un-nailed; the distance between Golgotha and Pilate was traversed four times (to go to Pilate; for a messenger from Pilate to summon the centurion; for the centurion to go to Pilate; to go back to Golgotha). Each of the first three events took only a couple of minutes—or so we shall presume.

To find the traverse time, we reasonably assume that Pilate was in, or by, the praetorium. There is a strong consensus on the location of Golgotha: see Figure S1. The site of the praetorium is generally believed to have been Herod's Palace; some investigators, though, have argued that it was Antonia Fortress [Brown, 1994, §31C; Knüppel Gray, 2017, chap.1; Schnabel, 2018, §2.12]. The difference is irrelevant for our purposes, because the distance from Golgotha to Herod's Palace is about the same as the distance from Golgotha to Antonia Fortress: 300 m (see Figure S1). Both those distances are straight-line distances; the actual traversal distance would have been somewhat longer. The traverses would have been in haste, because the Sabbath was about to begin. Hence, the total time for the four traverses can be reasonably assumed to have been about 15 minutes.

Thus, the total time that Jesus was non-breathing could reasonably have been less than 25 minutes.

Excursus 5: A quote ascribed to Quintilian

Quintilian was a Roman rhetorician who lived in the first century AD. A quote ascribed to him has sometimes been claimed to be relevant to the stabbing of Jesus. The quote is this: "As for those who die on the cross, the executioner does not forbid the burying of those who have been pierced". The quote has been claimed to be evidence that stabbing of crucifixion victims was done to provide some "death insurance", i.e. to be certain that the victim was dead [Craig, 2000, chap.2; Licona, 2010, p.309; Habermas et al., 2021]. If the claim were true, that would be evidence that the stabbing of Jesus was almost certainly fatal.

The claim is problematic for three reasons. The first reason is that the quote obviously provides only small support for the claim.

The second reason is that the English translation of the quote is uncertain. The quote is from a collection of stories known as the *Major Declamations* (§6.9). A standard translation of the *Major Declamations* gives the quote as this: "But bodies are cut down from crosses, executioners do not prevent executed criminals from being buried" [Sussman, 1987, p.75]. Thus, piercing/stabbing is not mentioned.

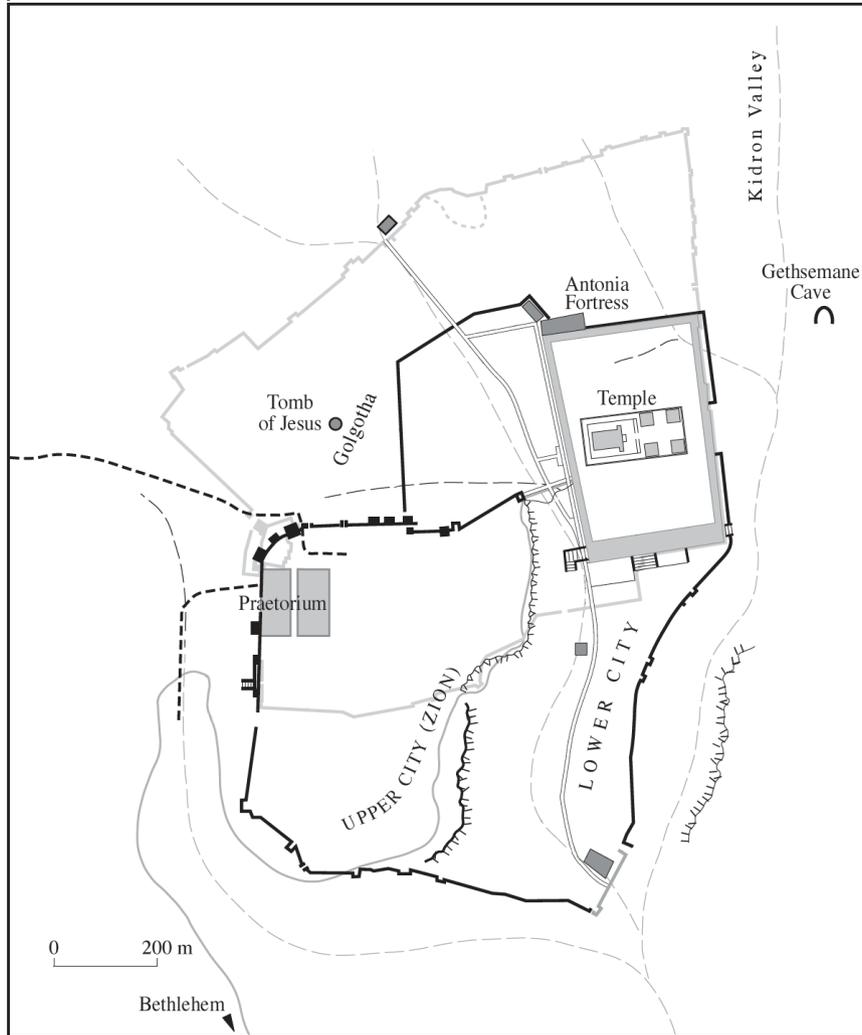


FIGURE S1. Jerusalem at the time of the crucifixion of Jesus (adapted from Gibson [2011]). Solid black lines indicate city walls. Regarding the site shown for the tomb of Jesus, it is regarded as very highly probable, but not certain [Bahat, 1986; Murphy-O'Connor, 2010; Gibson, 2011; Serr & Vieweger, 2016; Knüppel Gray, 2017; Moropoulou et al., 2018; Schnabel, 2018, §2.16; von Wahlde, 2018]. Essentially the same can be said about the site shown for Golgotha. (The sites shown for Golgotha and the tomb are nowadays underneath the Church of the Holy Sepulchre.) Regarding the praetorium, the location shown is the site of Herod's Palace [Gibson, 2011; Knüppel Gray, 2017, chap.1; Re'em, 2019]. Gethsemane Cave is where Jesus was arrested.

The third reason is the character of the stories in the *Major Declamations*. The stories are characterized by Connolly [2016]: “The *Major Declamations* are works of imaginative fiction—specifically, little melodramas—and like modern melodramas in novel, cinema, and television, they are best understood as ... experiments in suffering and its representation”. Indeed, the story containing the quote is about a man who was captured by pirates and then writes home to ask his family to pay his ransom: as a result, his wife cries so much that she becomes blind. Citing such a fictional melodrama as historiography is invalid.

Excursus 6: Was “blood and water” an embellishment?

Jn^[19:31–37] tells that “one of the soldiers pierced his side with a spear, and at once blood and water came out”. This excursus considers whether “blood and water” is an embellishment of the biblical story.

Jn^[19:31–37] also tells that Jesus was pierced so that a passage of scripture might be fulfilled. The passage of scripture is in the Hebrew Bible, Zechariah^[12:10]. The passage is interpreted as a prophecy: that the Messiah would be pierced [Brown, 1994, p.1184–1188; Ratzinger, 2011, §8.2]. Thus, a copier/editor of Jn would have motivation to embellish the story with details that supported purported fulfillment of the prophecy.

The volume *Death of the Messiah*, by R.E. Brown [1994], is often regarded as the most scholarly exegesis on the events of, and immediately prior to, Jesus’ crucifixion. The volume discusses “blood and water” at length [Brown, 1994, p.1173–1198]. The volume says that “John’s intent in speaking of blood and water is theological” and that the blood and water is a “revelatory sign of great theological import, fulfilling a prophecy of Jesus”.

The volume *Seeing Blood and Water*, by S.A. Carnazzo [2012], is a critique of the narrative of Jesus’ piercing. It (while advocating a theological perspective) concludes that the narrative is a deliberate reflection of the prophecy.

The report by Murphy-O’Connor [2011] is an analysis of the text of Jn^[19:31–42]. The report argues that the text’s claim about blood and water is an “editorial interpolation”.

We conclude that the reference to “blood and water”, in the biblical story, could well have been an embellishment.

Appendix 1: The Shroud of Turin

The Shroud of Turin has sometimes been claimed to hold an image that was imprinted from Jesus’ crucified body. The claim, however, has been repudiated by several lines of evidence

[Freeman, 2014; Borrini & Garlaschelli, 2019]. E.g. examinations of the “bloodstains” on the Shroud found no trace of blood or even potassium (an essential element of blood), but they did find vermilion [Freeman, 2014]. E.g. historical records indicate that the Shroud is a painting that was made in Europe during the 1300s—when blood was commonly depicted, in paintings, by vermilion [Freeman, 2014]. E.g. the cloth of the Shroud is of a type (three-in-one herringbone weave of Z-twist flax yarn) that was known in Europe during the 1300s and seems to have been unknown in the Near East during the time of Jesus [Freeman, 2014]. E.g. radiocarbon measurements of the Shroud are consistent with a date in the 1300s and inconsistent with a date in the first century AD [Freer-Waters & Jull, 2010; Bella et al., 2015].

To conclude, the Shroud is a painting from the 1300s (which has since faded and decayed). Hence, it is irrelevant for the study of how Jesus was crucified.

Appendix 2: Were the feet of Jesus nailed?

Popular depictions of Jesus being crucified invariably show Jesus with his feet nailed to the cross. If Jesus’ feet had been nailed, however, then after the apparent resurrection it would have been impossible for Jesus to walk or even to stand unaided; so a verisimilar interpretation of the resurrection story would be difficult to sustain.

With crucifixion generally, the feet were sometimes tied, rather than nailed, to the cross—as noted in §3. During the time of Jesus specifically, Roman crucifixion methods used ropes or nails or both to affix the victims to their crosses [Cook, 2019, §6.1.2]. Thus, having Jesus’ feet not be nailed is consistent with the Roman methods.

The only evidence in the biblical texts for Jesus’ feet being nailed is in the report by Lk^[24:36–40] of Jesus meeting with his disciples after the apparent resurrection. That evidence is obviously far from conclusive.

Additionally, it has been argued that Lk is reflecting a supposed prophecy [Bernard, 1928, Jn^[20:20]; Hewitt, 1932; Brown, 1994, p.949]. The prophecy is from the Hebrew Bible, in Psalms^[22:16–17]. It is interpreted as pertaining to the Messiah—i.e. the savior of the people, foretold in Jewish traditions. According to the prophecy, when the Messiah arrives, the Messiah’s hands and feet will be pierced/wounded. Jesus was claimed to be the Messiah (the word *Christ* is the English rendering of the Greek *Χριστός*, which is the Greek translation of the Hebrew word for Messiah). Hence, the author, editors, and copiers of Lk had motivation to have the story tell of the prophecy being fulfilled.

Consider also the related report by Jn^[20:19–28]—which is the only report to explicitly mention nails. The report refers to marks of nails in Jesus’ hands, as well as to Jesus’ side; yet it gives no indication of marks in Jesus’ feet. This suggests that Jesus’ feet were not nailed.

We searched in the literature of biblical exegeses: there are many claims that Jesus' feet were nailed. But we found no argumentation to support such a claim—excluding argumentation that relies on theology.

Why, then, do depictions of Jesus show the feet nailed? That question is studied by Hewitt [1932]. Hewitt cites the supposed prophecy of Psalms^[22:16–17], together with a theologically-motivated desire for more blood, and concludes thus: “the pictorial arts represent the crucifixion rather to satisfy certain theological requirements than to show the actual method of the historical event”. Hewitt adds the following.

... the church took advantage of the work of the painter to impart instruction in the Bible stories. But after all, mere enlightenment is comparatively useless, sometimes even dangerous. It is always inferior to devotion. As long as the masses could be inspired by art to perform more fully their religious duties, so long was art rendering to the church the services that were its due. If the actual facts, even as recorded in the Scriptures, stood in the way of the theological object, they had to be neglected, obscured, or denied. If by a false depiction religious feeling were aroused, there could be no doubt as to the value of such depiction.

We conclude that having the feet of Jesus not be nailed is verisimilar. The hands/arms, though, did have to be nailed, as per Jn^[20:19–28].

Appendix 3: Guards at the tomb

Mt^[27:62–66; 28:1–15] claims that, at the tomb, there were guards, who had been appointed by the Roman governor. Such guards would obviously have made it extremely difficult for anyone to rescue Jesus.

Such guards are not claimed to be present by the other gospels though. That raises suspicion that the claim is a fictional embellishment of Mt (as per Excursus 1).

A potential motivation for such an embellishment has been suggested by many commentators. There had apparently been a rumor that Jesus had not risen from the dead, but rather Jesus' body had been stolen by the disciples: the rumor is reported by Mt^[27:64; 28:13–15], and also by the Christian philosopher Justin Martyr, during the second century AD (*Dialogue with Trypho* 108 [Falls & Halton, 2003]). The guards are asserted, by Mt, to demonstrate that those rumors must be false.

The story about the guards has been considered by many commentators. Allison [2021, p.180] says that the story's “fictional character has been evident to many for a long time” and, in support of that, cites commentators dating back to the 1700s—when skepticism was

much less common than it is today. A 1984 review noted that the story “has been nearly universally rejected” [Craig, 1984].

There are, however, Christians who believe in scriptural inerrancy; so, they believe that the story about the guards must be non-fictional. Partly for that reason, the story has continued to be a topic of comments by biblical scholars. Among those comments, we will consider three prominent ones. (The author of each comment believes in the resurrection of Jesus.)

The volume *Death of the Messiah*, by R.E. Brown [1994], has been described as “the most authoritative and reliable guide” to the events of, and immediately prior to, Jesus’ crucifixion [Matera, 1994]; it argues that the story of the guards is fictional [Brown, 1994, §48B]. The 15-volume *New Catholic Encyclopedia* is intended to be a standard reference for the Catholic faith; it says that the story of the guards is fictional [Ceroke, 2003]. The volume *The Guards of the Tomb*, by M. Kankaanniemi [2010], is the most extensive treatment of the story; it concludes that the story is fictional.

Appendix 4: Stabbing of Jesus

Regarding the stabbing of Jesus’ side, that has been claimed to have been certainly fatal. We argue against that claim, in this appendix.

The Roman soldier who stabbed Jesus must have believed that Jesus was dead, because otherwise he would have broken Jesus’ legs. Why, then, did the soldier then stab Jesus?

Bernard [1928, Jn^[19:34]] says this: “If we are to press the use of λόγχη [*lance*, as distinct from *spear*] here, it would fall in with the idea ... that the soldier’s act was a mere gesture as he passed; that he perceived Jesus to be dead, and so, without any special purpose, prodded the body with his lance, the touch being possibly a light one”. Brown [1994, p.1177] explains similarly: “The action by the soldier ... has the illogic of ordinary life: Like the other soldiers he has seen that Jesus is dead, yet to make sure he probes the body for a telltale reaction by stabbing Jesus’ side. Probably that is what is meant rather than the delivery of a coup de grace aimed to pierce the heart....”. A similar point was later made by another commentator, who argued that the stabbing was to check for a reaction rather than to kill or mutilate [Murphy-O’Connor, 2011].

Partially against that, it has been argued that the stab wound was likely wide and deep, because Thomas stated he wanted to put his “hand in [Jesus’] side”. A counter-argument for that is given by Brown [1994, p.1177]: “Thomas ... is made [by Jn] to speak exaggerated language to illustrate his desire for crass physical proof”. Alternatively, the soldier could have probed in a way that was enthusiastic/malicious enough to leave a wound that was large but still non-fatal.

It has sometimes been claimed that a quote ascribed to Quintilian is relevant to the stabbing. The claim is extremely dubious: see Excursus 5.

Regarding the blood and water that came out of Jesus' side, they could well have been an embellishment of the story: see Excursus 6. If they were not an embellishment, then the fluid that came out could have been from a pleural effusion (i.e. fluid around the lungs). Such an effusion could well have been caused by the prior beating/flogging; and it would comprise blood and a water-like substance [Sava, 1957; DeBoer & Maddow, 2002; Zugibe, 2005, p.140; Bergeron, 2012]. A stabbing sufficient to release some effusion would not need to have killed Jesus.

Considering the foregoing, the claim that the stabbing must have been fatal is unjustified.

Appendix 5: Why Jesus was initially not recognized

On the day of the apparent resurrection, Jesus was seen but not initially recognized by Mary Magdalene at the tomb. That has sometimes been explained theologically. There is, though, a mundane explanation.

After Jesus left the tomb, he would have needed some clothes: because his own clothes had been taken by the soldiers and he had been entombed wrapped in linen cloths. The tomb was in a garden/orchard. Ergo, suppose that the garden/orchard contained a gardener's storage—which held gardening tools and gardening clothes. Then Jesus could have gotten attired in those clothes. That would partially explain too why Mary Magdalene initially mistook him to be the gardener.

Other factors might also have contributed to the initial failure to recognize Jesus. First, gardening clothes would presumably have included a sun hat, slightly obscuring Jesus' face. Second, Jesus might have partially disguised himself, because he would be in mortal danger if the Romans discovered him. Third, Jesus had been entombed wrapped in myrrh and aloes and spices, which might have changed the appearance of his skin etc. Fourth, Jesus would have looked somewhat different than earlier due to his ordeal. Fifth, since Jesus was believed to be dead, people would not have initially considered that the person they were seeing could be him.

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