The search for immortality and the extension of the lifespan are often culturally linked, although in concept they represent two somewhat separate activities (Figure 2.6). The transition to immortality requires a transformation in the spiritual realm to free the spirit from the earthly manifestation of the body. Extension of lifespan is tied more directly to the physical body as it experiences aging and senescence. In both cases though, various mixtures of ingredients—elixirs—may play an important role. Almost always ingested either as food, liquid, or in some cases smoke or vapor, elixirs have an important role in mediating and affecting the transition from life to death to afterlife, and potentially the transition to immortality.

The ancient spiritual and ritual practices that coalesced in the later Han period (206 BCE–220 CE) into a more formalized set of religious and philosophical beliefs that became Daoism evolved over centuries (Copp 2018). There are legions of Daoist deities, sages, and wise adepts that inhabit various forms and live in sacred places such as mountains, blessed islands, and celestial places such as the moon. They have achieved immortality either through divine intervention or by extensive study or an extraordinary life or talent. An ancient example is the Queen Mother of the West who lives in the moon with many attendants in the form of animals, including a magical rabbit who pounds elixirs in a mortar and pestle. Many immortals are based on historical or legendary figures. Of later appearance in Daoist literature and practice, a core set of several individuals known collectively as the Eight Immortals is among the most well-known. Drawn from various walks of life and life histories, the Eight Immortals include four pairs of opposites: male and female, rich and poor, military and civilian, and young and old. They reinforce a central idea in Daoism that anyone can pursue mental cultivation.

The nature of beliefs and practices surrounding death and the interest in immortality was more prominent at certain times than at others. Nevertheless, Daoism does recognize a richly detailed and diverse set of beliefs regarding immortality and how it may be achieved (e.g., de Bary and Bloom 1999). Proper burial and the attentive care of one’s descendants is important. Achieving immortality is difficult and requires many steps, such as mental cultivation, correct living, and a corresponding incorporation of, or surrender to, the Dao or the Way, a concept that loosely translates as the force and universality of energy that animates everything that happens, all of nature, and the cosmos (Ebrey 2010, 46–49; Watson 2007).

Understanding the Dao is the work of several lifetimes, and perhaps truly unattainable, but key concepts include the embeddedness of all things in nature, the interdependence of opposite states, and a focus on yielding to the flow of nature and energy (Watson 2007).

The search for immortality can also include the use of elixirs (e.g., de Bary and Bloom 1999). There is a long history of alchemical attempts to develop elixirs to extend the lifespan, to achieve immortality, or to preserve the mortal remains of the body prior to burial. Many preparations made use of minerals and elements such as cinnabar, gold, sulphur, arsenic, and lead, often in deadly combinations. Many preparations used plant and animal ingredients, of which several are still in wide use such as the lingzhi, otherwise known as the fungus of immortality or the mushroom of immortality (Figures 2.7–2.9).

The lingzhi, *Ganoderma lucidum*, is also known as the reishi in Japanese. It is widely cultivated and has been a component of traditional Chinese medicine for centuries. It has a glossy brown surface appearance with a firm or woody texture; the exhibition includes a botanical specimen, now dried. All parts of the lingzhi, such as the spores or the fruiting body, have medicinal uses. Many health benefits are ascribed to lingzhi, including longevity and improvements in energy, as well as regulation of blood sugar, liver function, and other systems. As with many products from nature with traditional uses, it is being investigated today for the degree to which there are clinically measurable effects. It is widely available and marketed as a supplement for longevity and general health, including immune system support.

Given its long association with medicinal benefits of such power as to include immortality in the right preparations, the lingzhi is also potent symbolically. Hiding in plain sight in many artworks from East Asia, and especially China, is a stylized depiction of the lingzhi. Often depicted as an upside-down heart or kidney bean shape, the lingzhi is part of the rich visual vocabulary of Asian art. It is often used both as a symbol of longevity and, due to its similarity in shape to a wish-granting scepter known as a ruyi, as a visual rebus that expresses the desire that a wish be granted (Bartholomew 2006).

In the examples from the exhibition, the lingzhi appears in several configurations. The rhinoceros horn cup (Figure 2.8) employs motifs of the lingzhi, as well as bamboo. Rhinoceros horn libation cups were highly valued gifts made primarily for scholars, but the horn itself...
was also considered by Daoists to have magical properties. The pewter tray (Figure 2.7) is surrounded by a border of auspicious motifs that include the lingzhi as a symbol of longevity. The ivory figure holds a fly whisk in one hand and a lingzhi in the other (Figure 2.9). In all these forms the lingzhi functions either as an auspicious symbol of longevity or as a visual rebus for the granting of a wish.

Daoism is certainly not alone in devoting energy and interest to the extension of life and the pursuit of immortality. The richness and detail with which Daoist practitioners have pursued these goals across centuries offers abundant evidence of our collective human desire to live on, to continue to experience the world, and to become a part of nature in a manner that transcends the body and escapes the boundaries of the human lifespan.

References
The unusually long average and maximum lifespan of humans is undoubtedly linked, among many other factors, to the universal occurrence of menopause in women—the abrupt cessation of fertility at about 50 years of age. Until recently, menopause was regarded as a unique feature of the human lifecycle in comparison to all other mammals. However, new research has revealed that five whale species (Foster et al. 2012) and the Indian elephant (Lahdenperä and Lummaa 2014) also show abrupt cessation of fertility long before the average age at death. Nevertheless, the mammals concerned are all large-bodied, long-lived species whose lifespans are about as long as would be expected for their substantial size, so the human case stands out as being especially unusual.

Death from natural causes is universal among mammals and longevity is fairly predictable, given the existence of a species-specific maximum lifespan for any particular species. Nevertheless, artificial extension of the lifespan—perhaps culminating in immortality—has long been a cherished goal in human societies (see Bekken in this volume). Throughout human history, humans have obsessively sought mechanisms to extend life through the use of elixirs, sacred substance, and favors to the gods; and the emergence of religion in itself could be related to this human deep desire (Hall 2003).

Nowadays, with the advent of modern medicine, it may seem as though long-term postponement of death has become a realistic prospect for the future. But this may well be a vain hope. The much-vaunted “improvement” in human longevity attributed to continued improvements in medical care may be an illusion. Whereas it is undoubtedly true that average human lifespan has tended to increase in industrialized societies (see Tuljapurkar, Li, and Boe 2000), this may simply reflect the fact that more individuals are living longer and approaching the natural limit more closely. However, across the board, average human lifespan is still well below the inferred maximum of 125 years, and there is no reason to expect that even the best medical care, if accessible, will allow anyone to live longer than that. Furthermore, it is important to remember that artificial extension of human life is only worthwhile if the additional years are relatively free of health issues. The total period over which any person enjoys good health without any kind of physical handicap is now called the healthspan. It is surely more rewarding to seek ways of increasing human healthspans than to maximize lifespans.

The issue of whether there is an upper limit to human lifespan is directly linked to a key question that has long concerned biologists: Why do senescence and death occur at all? (see also Kirkwood and Rose 1991). The Bible, Shakespeare, and healthcare practitioners all portray aging and dying as inevitable facts of human existence. But why should this be so? Why are we not immortal? As proclaimed in the title of Peter Medawar’s 1952 book An Unsolved Problem of Biology, this is a fundamental issue that has still not been definitively resolved. We know that various other organisms, notably viruses and bacteria, are potentially immortal, continuously propagating themselves. Individuals may succumb to lack of resources, accidents, predators, or disease, but they never die of old age. In principle, natural selection is expected to promote survival and continued reproduction of individuals. So it is not at all clear why humans and most multicellular animals have a relatively fixed maximum lifespan and do not simply survive indefinitely.

One simple view is that senescence is the unavoidable result of accumulated wear and tear and that we eventually die because we are well and truly burned out. As George Williams noted in a seminal paper in 1957, this view really stems from a simplistic analogy with disintegration of human artifacts. However, unlike a desktop computer or a washing machine, living organisms are equipped with an array of mechanisms for self-repair. So why should deterioration be inevitable? Williams proposed that senescence has actually been built into our genetic make-up through evolution so that we usually remain healthy throughout a standard period of active reproduction but then begin to decline and eventually die.

Numerous hypotheses have been proposed to explain the evolution of aging, but they generally fall into two categories (see Morley 1995). Error theories are based on the wear-and-tear notion of chance accumulation of damage to the body’s tissues. This may be either environmental—including disruption of DNA and cumulative production of noxious chemical agents in cells—or internal, resulting from progressive failure of genetic systems for maintenance and repair (Stearns 1977). Other theories, by contrast, are founded on the idea that aging has been pre-programmed by evolution and is regulated by biological clocks across the lifespan (Szilard 1959). Such regulation is attributed to changes in expression of genes governing systems responsible for maintenance, repair, and defense. A key point is that natural selection should generally become weaker as an organism ages. It is suggested that aging may have evolved because external causes of mortality (resource depletion, predation, disease, accidental death)—which are likely to be largely random—gradually decrease.

Figure 2.9. Daoist immortal holding a fly whisk and lingzhi fungus (FM 126823).
the probability that an organism will still be alive as age increases. Natural selection could hence favor developments leading to a higher reproductive rate at a young age and a shorter overall lifespan because the net outcome is a higher lifetime breeding success. This introduces the crucial notion, now well established in research into aging, that there is some kind of trade-off. It is proposed that aging occurs as a byproduct of investing in breeding rather than in upkeep of the body (Ossewaarde et al. 2005; Pavard, Metcalf, and Heyer 2008; Perls and Fretts 2001), because external causes of mortality will eventually kill an individual regardless of resources committed to maintenance of bodily functions (Harvey and Zammuto 1985).

In his “disposable soma” theory of aging (eloquently portrayed in his 1999 book *Time of Our Lives: The Science of Human Aging*), British biologist Tom Kirkwood proposed that pre-programmed mortality may have arisen as an energy-saving adaptation with reduced regulation of errors in body cells (also see Kirkwood 1999; Kirkwood and Austad 2000). He was particularly influenced by the observation that human fibroblast cells in culture have a finite lifespan, reflecting a constraint on the total number of divisions of any cell to about 60. Furthermore, the lifespan of cultured cells decreases with the age of the donor, indicating that a cellular clock of some kind has been ticking away.

Figure 2.10. Black Mamas Matter onesie that advocates for building awareness about Black maternal health, rights, and justice.
Serena Williams, one of the greatest athletes of all time, almost died while becoming a mother. Williams is a global superstar, one of the most dominant women to ever play in the WTA, who even won the 2017 Australian Open title while eight weeks pregnant. She is an entrepreneur, multi-millionaire, fashion designer, wife, sister, friend, daughter, and a mother. She is also a Black woman who, like far too many others in the United States, almost died because of her pregnancy. Williams delivered her daughter via an emergency C-section that initially seemed to go well. But the next day she began to feel short of breath, a worrying sign for a person with a history of blood clots and pulmonary embolisms. She assumed that the difficulty breathing indicated a coming pulmonary embolism. This world-class athlete, whose entire life has centered around being in tune with and control of her body, recognized worrying symptoms and immediately raised the alarm with a nearby nurse. Williams said that she needed a “CT scan with contrast and IV heparin (a blood thinner)” (Haskell 2018). The nurse suggested she was simply having a bad reaction to pain medication, but Williams did not back down. A physician at the hospital performed an ultrasound of her legs, not a CT scan, and found nothing. Still not satisfied, Williams insisted on the CT scan that she’d already requested. The medical team sent her for the CT scan, which revealed several small blood clots in Williams’ lungs. She was soon given the drip that she’d asked for and lived to tell the tale.

Black women die or experience significant injury during pregnancy, childbirth, or in the immediate postpartum period far too frequently in the United States (Figure 2.10). The names of these women appear in numerous news reports as the crisis in maternal mortality for Black women has become a more mainstream discussion. Women like Dr. Shalon Irving, a CDC epidemiologist who studied health disparities, who died from complications related to high blood pressure three weeks after giving birth to her daughter (Martin and Montagne 2017). Or Sha-Asia Washington, who died after going into cardiac arrest while in labor (Dickson 2020). Or Dr. Chaniece Wallace, a pediatric chief-resident who died due to complications from preeclampsia two days after giving birth to her daughter (Burke 2020). So much preventable death at a time that should be full of wonder and happiness.

The US is one of the most dangerous countries for a woman who is pregnant or giving birth. In this country, 700 women die annually due to pregnancy or delivery complications. Unsurprisingly, there are significant racial disparities in the maternal mortality rate. According to the Commonwealth Fund, Black mothers in the United States have been more likely to die than white mothers for 100 years (Declercq and Zephyrin 2020). Black women and American Indian/Alaska Native Women are two to three times more likely to die from a pregnancy complication than are white women—a disparity that increases with age. Though higher education levels typically lead to better health outcomes, that is not so when it comes to maternal mortality. Black college-educated women are five times more likely to die from pregnancy-related complications than are white women with similar levels of education (Petersen et al. 2019). Thus, the data alarmingly reveals that education exacerbates the maternal mortality gap. Maternal deaths are more common among Black mothers with a college education than they are among white mothers with less than a high-school education (Declercq and Zephyrin 2020). Even where death does not result, research shows that Black and Latina women experience significantly higher risk of severe maternal morbidity, such as preeclampsia, which is much more common than maternal death (Artiga, Pham, and Orgera 2020). Despite advances in medicine, Black women continue to die at shocking rates because of pregnancy and childbirth, and efforts to combat this disparity have been sporadic and decidedly ineffectual (Declercq and Zephyrin 2020).

To be a Black woman in America is to live within a system that does not invest in your well-being. The historical line of mistreatment of Black women’s bodies runs from the father of gynecology who experimented on enslaved women (Khabele et al. 2021), to the forced sterilizations of Black women across decades (Roberts 1999), to incarcerated women who have labored while chained to hospital beds (Goodwin 2020). The dignity of pregnancy and motherhood has frequently been denied to Black women, so it is no surprise to see persistent disparity in birth outcomes for Black women as compared to others.

Critically, it is racism, not race, that increases the risk of death for Black pregnant women. Research shows that the compounding effects of racism and the stress that it brings to the lives of Black women has a deleterious impact on health (Patterson, Becker, and Baluran 2022). Healthcare is an arena where Black women face deeply problematic interactions with clinicians who are blind to their own lack of cultural competence. One study found that, as compared with the white counterparts, Black women were more likely to report: unfair and disrespectful treatment from healthcare providers because of their race; being denied decisional autonomy during labor and delivery; and pressure to consent to a C-section. Low-income women on Medicaid, in contrast to women with private health insurance, were more likely to report no postpartum visit, a return to work within two months after the child’s birth, less access to postpartum support (emotional and practical); a lack of decisional autonomy during labor and delivery, and unfair treatment and disrespect because of their insurance status. As these findings illustrate, the experiences that women have with maternity care and childbirth differ significantly from preeclampsia two days after giving birth to her daughter (Martin and Montagne 2017). Or Sha-Asia Washington, who died after going into cardiac arrest while in labor (Dickson 2020). Or Dr. Chaniece Wallace, a pediatric chief-resident who died due to complications from preeclampsia two days after giving birth to her daughter (Burke 2020). So much preventable death at a time that should be full of wonder and happiness.

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