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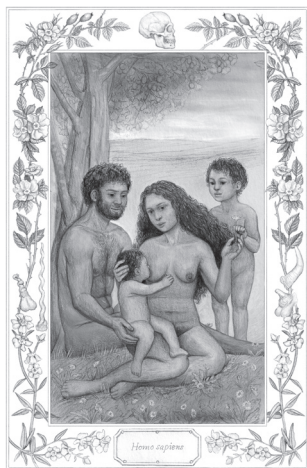
女性身體如何推動兩億年的人類演化

## EVE

How the Female Body

Drove 200 Million Years of Human Evolution

by Cat Bohannon



薄翰儂／著

鄧子衿／譯



## 延伸閱讀

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## 資料來源

### 引言 生而為人

接下來是個可怕的場景：Scott, 2012.

有證據顯示抗憂鬱藥物對不同性別的病人造成的影響可能不同：Eid, Gobinath, and Galea, 2019; Sramek, Murphy, and Cutler, 2016; LeGates, Kvarta, and Thompson, 2019.

處方止痛藥物的效果也被認為不受性別影響：Mogil, 2020. Note that although the underlying mechanisms driving these differences are likely complex, ranging from how we process these drugs in the digestive system and the liver to how our nervous system responds, it may also be tied to sex differences in how our nerves process pain in general (Ray et al., 2022).

女性更容易死於心臟病：Shehab et al., 2013; Shaw et al., 2008. Some of the disparity here can be attributed to age—women generally present in the clinic at older ages than men with these issues, and being old is itself a risk—but rates are increasing in younger women, too (Mozaffarian et al., 2015).

心臟病在兩性中的症狀並不同，因此女性和醫師可能都無法及時發現：McSweeney et al., 2016. For at least some good news on these issues as well as remaining problem areas, see the 2010 report from the U.S. Institute of Medicine Committee on Women's Health Research.

手術中使用的麻醉劑：Buchanan, Myles, and Cicuttini, 2009.

阿茲海默症的治療：Ferretti et al., 2018.

甚至公共教育課程，全都受到一種錯誤觀念的影響：van Hek, Buchmann, and Kraaykamp, 2019.

女性的身體就只是一般的身體……和男性的身體沒兩樣：For a recent review of sex and gender influences on health, which (rare for such efforts) actually considers both biological

sex differences and important issues around the social construct of gender, see Mauvais-Jarvis et al., 2020.

超過79%的動物研究只包括雄性個體：Mogil and Chanda, 2005; Beery and Zucker, 2011.

從小鼠到人類，實驗室研究的對象都是雄性的身體：Beery and Zucker, 2011; Hayden, 2010; Wald and Wu, 2010. Even the esteemed Francis Collins said as much in 2014, in a rather public effort to try to turn the tide, but sadly the number on the dial hasn't moved nearly enough (Clayton and Collins, 2014).

花時間控制女性生殖週期，被認為是困難且昂貴的：Prendergast, Onishi, and Zucker, 2014.

不論是小鼠還是人類，性別的不同已經滲透到哺乳動物身體的每一個主要特徵：There are simply too many papers to cite regarding the depth of sex differences in our mammalian body plan, but for one recent example Oliva finds sex differences in cellular gene expression present in numerous different tissue types in the human body (Oliva et al., 2020).

截至2000年，五分之一的NIH臨床藥物試驗，依然沒有納入女性受試者：Mazure and Jones, 2015; Heinrich, 2000.

藥物從臨床試驗到進入市場，通常需要耗費十多年時間：English, Lebovitz, and Griffin, 2010.

女性比男性更常服用止痛藥和精神藥物：Simoni-Wastila, 2000; Serdarevic, Striley, and Cottler, 2017; Darnall, Stacey, and Choi, 2012; Herzog et al., 2019.

是否需要為女性病人「調整」處方：One important caveat on the pain med claim: the FDA reports that women are more likely to be given pain meds and at higher doses and for a longer duration than men. However, it may take longer for them to get it; post-surgery, men are more likely to be prescribed pain meds, and women are more likely to be given sedatives and/or Tylenol (Hoffman and Tarzian, 2001; Miasowski, 1997).

現今市面上的許多止痛藥，臨床試驗時並未嚴格測試性別差異：More specifically, they failed to test for sex differences in reproductive-age women, and they failed to properly design an experiment to test for sex differences at any age. We do know they conducted one clinical trial on about 130 mostly elderly patients with osteoarthritis, 76% of whom were female—perhaps not surprising, given the older (and thereby more likely to be female) population with this disease. The degree to which the pain was reduced was somewhat better than placebo over the fourteen-day trial, with the 20 mg dose better than the 10 mg dose. The degree of effect was not analyzed for sex differences, though the adverse drug effect was analyzed for sex differences, showing nothing significant. (Note how much

larger the female signal would have been in the data here : with 76% of a meager 130+ mostly elderly people, it's going to be hard to tease out what the average male signal might be at varying ages.) Also worth noting : nearly a third (32%) of subjects who received the 20 mg dose dropped out due to side effects. But the study nonetheless recommended the 20 mg dose as the most effective one. The reason we know any of this, of course, is that legal documents made the clinical trial information public. We do not have access to the clinical trial data, nor the earlier rodent studies, in the development of the original drug (oxycodone) that OxyContin is made from, but it's safe to assume, given that it was so long ago, that female patients of reproductive age were unlikely to be a significant portion of that study population. As of 2022, anyone in the public can access information on the Oxycontin clinical trial here : [www.documentcloud.org/documents/6562785-21-Purdue-Docs-1-20-to-29.html](http://www.documentcloud.org/documents/6562785-21-Purdue-Docs-1-20-to-29.html).

1996年上市的奧施康定：The context of the OxyContin study is also worth noting. The company very specifically wanted to get this drug out into the non-cancer population and make it a common prescription. So the fact that the study is specifically studying an older chronic pain population who specifically did not have cancer isn't just a matter of cleaning up the science for confounds; it's literally whom they wanted to sell this stuff to (Chakradhar and Ross, 2019).

通常用於治療子宮內膜異位和子宮相關疼痛：Freire et al., 2017; Lamvu et al., 2019.

上癮女性通常會服用美沙酮來減輕戒斷時的症狀：Jones et al., 2010.

出生時就對鴉片類藥物上癮的嬰兒數量，在短短的十年之中，增加為三倍：Ko et al., 2016.

上述這個數字仍在持續增加：Hirai et al., 2021; Mossabeb and Sowti, 2021.

許多母親沒有瞭解到那些藥物可能會傷害嬰兒：Patrick et al., 2020.

女性都比男性更快醒來：Gan et al., 1999; Mencke et al., 2000; Kreuer et al., 2003; Sarton et al., 2000; Buchanan, Myles, and Cicuttini, 2009.

脂肪和肝臟與免疫系統的絕大部分，都是從相同的古老器官演化而來的：Parra-Peralbo et al., 2021.

2011年，《紐約時報》刊登了一篇關於抽脂手術的文章：Kolata, 2011. Kolata was reporting on Hernandez et al., 2011. While the Times's illustration mostly demonstrates larger arms, the study itself showed “redistribution” to the abdomen with only some redistribution to the upper arms, while the thighs remained smaller. (The text is more representative than the illustration, all credit to Kolata there!) All thirty-two subjects of the study were female and roughly in their

mid-thirties—suitably premenopausal, in other words, but not post-reproductive in the classic sense. The study doesn't mention whether these women had children already, nor how long it had been since those potential births, nor whether they were going to have any afterward. One assumes, at least, that they weren't pregnant or breastfeeding during the period of the study, because surely that would have ruled them out in terms of subjects' risk profiles for surgery—not to mention massive metabolic confounds for interpreting any data.

臀股脂肪充滿了不尋常的脂質：Phinney et al., 1994.

長鏈多元不飽和脂肪酸，大部分都需要從食物攝取：Cunnane and Crawford, 2003, 2014.

Cunnane is one figure in an ongoing scientific debate about whether our brainier Eves could have gotten enough of these lipids from terrestrial foods or aquatic sources (Carlson does a fun rebuttal in Carlson and Kingston, 2007). Cunnane is convinced our ancestors got brainy along the shore, but which particular shoreline might matter (Joordens et al., 2014); the fossil record shows brainy Eves in both near-water and more landlocked terrain; and it can be hard to tell in the fossil record whether things like catfish and turtles were part of the diet, because not all water food leaves an easy trace in the rock with evidence of butchering (Braun et al., 2010). I admit I care less about the aquatic story than I do about our presently fat behinds; wherever they originally evolved, the special features of these depots in the modern human body make a compelling case for leaving them well enough alone.

女性臀股脂肪會抗拒受到代謝：Rebuffé-Scrive et al., 1985; Rebuffé-Scrive, 1987; Guo, Johnson, and Jensen, 1997; Karastergiou et al., 2012; White and Tchoukalova, 2014.

女性演化出臀股脂肪，正是因為要專門為嬰兒的巨大腦部提供生長材料：Lassek and Gaulin, 2008; Haggarty, 2004. To be clear, no one would say this is all women's butt fat is for. For instance, mice show signs of prediabetes when you liposuction their rumps, which may imply some lower-body fat depots in mammals initially evolved as a way to buffer the body's general homeostasis against variable diets, with rare-lipid functionality as a later feature (Cox-York et al., 2015). The notion that different fat depots function differently is hardly controversial, with evidence even at the level of gene expression (Rehrer et al., 2012).

人類女孩的臀部脂肪，可能是預測第一次月經何時到來的最佳指標之一：Fredriks et al., 2005; Walker et al., 2006; Lassek and Gaulin, 2007. But there's an important caveat here : lots of things can trigger menarche, not just butt fat. For example, even outside potential genetic quirks—women with early periods tend to have children with early periods—continual exposure to things that tend to speed up growth in children, like slightly raised levels of cortisol, may be a contributing factor all on its own. Take Freedman et al.'s 2002



study of U.S. girls with a cohort divided by racial background—Black girls tend to get their periods sooner than white girls in the United States, which remains statistically significant even when controlling for height and weight and body fat%age. Considering the well-known differences in cardiovascular disease among these populations later in life, which is sometimes attributed to the “wear and tear” pattern associated with continual stress, the early onset of menarche among Black American girls may be yet another physiological cost that comes with exposure to the stress of lifelong racism.

每年光在美國，就有近十九萬名女性進行抽脂手術：American Society of Plastic Surgeons, 2021.

抽脂過程中，女性身體似乎受到劇烈的破壞：Seretis et al., 2015.

這可能解釋了脂肪組織、肝臟和免疫系統三者為何有如此多相同的特性：Parra-Peralbo et al., 2021.

任何對於女性的大規模描繪都屬於一個持續進行的故事：Leibovitz and Sontag, 2000.

夏娃們：All of the foundational papers on the Eves, whether exemplar or presumed true ancestors, will be cited in the individual chapters they're associated with. But this overview of the Eves is greatly in debt to both Dr. Advait Jukar, who did the enormous job of helping me find and select appropriate species for each trait and their associated ancient environments, and the fantastic work of the Smithsonian's Human Origins Initiative. One thing that's particularly wonderful in the Smithsonian's work is how they offer simple lists of what's known and what's still unknown about our hominin Eves. You can see these for yourself online at [humanorigins.si.edu](http://humanorigins.si.edu).

## 第一章 乳汁

洪水才剛剛消退：Rimbaud, 2011. “After the Flood,” from 1886, was inspired by Genesis 9. I'm translating here from the original French, with a heavy debt to Clive Scott (Scott, 2006) and John Ashbery.

「拿了牛奶嗎？」：The Got Milk campaign was massively successful, in no small part due to the extensive (and exclusive) photography of celebrities with milk mustaches taken by Annie Liebovitz. Her then-partner, Susan Sontag, even tagged along for one session so she could

“meet” Kermit the Frog (Hogya and Taibi, 2002, in Daddona, 2018). The campaign was originally conceived in 1993 by an advertising firm working for the California Milk Processor Board, then overtaken by the Milk Processor Education Program, then very clearly in possession of the American public's collective mind in the 1990s (Daddona, 2018).

身體只有人類拇指那麼大：Slater, 2013. Body masses provided in the supplement. For a nicely written overview of many features that I include in the Morgie scene, see Brusatte and Luo, 2016.

我們叫她「摩吉」：Kermack, Mussett, and Rigney, 1973; Kielan-Jaworowska, Cifelli, and Luo, 2005. Some of the nicknames I use for the Eves in this book are common in the paleo community already—the Smithsonian, for example, has called *Morganucodon oehleri* “Morgie” in its Behring Hall of Mammals, as does the National Museum of Wales in Cardiff—but some are done to personalize them. *M. watsonii* is the initial discovery in Wales in 1947, but the entire genus of *Morganucodon* is what I'm using for “Morgie.”

摩吉的精密身體結構中所有的小時鐘：Liu et al., 1997; Gerkema et al., 2013; Borges et al., 2018; Morin and Allen, 2006.

摩吉在看到昆蟲之前就聽到了牠們發出的聲音：Grothe and Pecka, 2014.

摩吉喜歡昆蟲幾丁質身體發出的美妙嘎吱聲：Gill et al., 2014.

摩吉像蜥蜴一樣在地道中爬行：See Luo, 2007, for a well-written overview of the increasing evidence for diversity in early mammaliaforms, including traits like burrowing. Most assume, however, that Morgie had burrows and, alongside other early mammal types, a sprawling pelvis.

侏羅紀的巨獸每天都會在摩吉的洞穴上方行走：Carrano and Sampson, 2004.

人類早期的夏娃大部分都在其他動物的腳邊演化：Luo, 2007; Gill et al., 2014. In fact, there were all sorts of mammal-like beasts of varying size, even in the Jurassic and prior; some of the earliest direct evidence we have for mammalian fur comes from what appears to be a medium-bodied, otter-like creature (Ji et al., 2006). But the idea that evolving “underfoot” (that is, in niches good for relatively small bodies) was a useful strategy for early mammals like Morgie is common thought in evolutionary biology.

從南威爾斯到中國南部，到處都發現了摩吉的化石：Kielan-Jaworowska, Cifelli, and Luo, 2005.

上帝對甲蟲的喜愛毫無節制：Gould, 1992. This quotation is often misattributed to Charles Darwin, who likely felt similarly (with perhaps greater belief in a Christian God), but

has never been confirmed to have said as much. As for Haldane, the exact phrase may be apocryphal, but his friend Kenneth Kermack provided the following, which seems appropriate to include here : “[Haldane actually said,] ‘God has an inordinate fondness for stars and beetles.’” Haldane was making a theological point : God is most likely to take trouble over reproducing his own image, and his 400,000 attempts at the perfect beetle contrast with his slipshod creation of man. When we meet the Almighty face to face he will resemble a beetle (or a star) and not Dr. Carey [the archbishop of Canterbury]” (Gould, 1993). Kermack and his wife were also instrumental in advancing our knowledge of Morgie.

摩吉會照顧自己的幼兒 : Benoit, Manger, and Rubidge, 2016.

身體大部分都是由水組成，成人身體65%是水，新生嬰兒則為75% : Shubin, 2013. Actually, the range seems to be 73 to 78%, depending which pediatrician you ask—my sister-in-law is a hospitalist pediatrician, so I had occasion to—but 75% seemed a suitable compromise. The reason newborns are so structurally wet is largely that their limbs are so very short and flimsy. Despite being born nearly as fat as a baby seal, the average human newborn's body is mostly chubby torso and big, fat head. At the tissue level, human lungs are roughly 83% water, while muscles and kidneys are about 79%, and the brain is about 73% (Mitchell et al., 1945). The reason most adult humans are only 60% water is that our childhoods and puberty built a lot of new bone, muscle, and fat. The average adult's legs, for example, from ankle to outer hip bone, make up nearly half of that person's height—another one of those things beginning art students tend to get wrong before they take a figure class. More on what we get wrong when our eyes look at bodies in the “Perception” chapter.

DNA 周圍有仔細排列的水分子，以維持適當的形狀 : Khesbak et al., 2011.

人類乳汁幾乎90%都是水 : Boquien, 2018. Note, however, that primate milk is especially watery, likely because we keep our babies so close for so long : primate mothers tend to have frequent nursing sessions “on demand,” and the babies have lengthy juvenile periods. Each species' milk is tailored both to the baby's developmental plan and to the mother's caretaking pattern. If human milk weren't so watery, the mother's body would be rapidly stripped trying to keep up with our thirsty babies (Hinde and Milligan, 2011).

摩吉如同所有的早期哺乳動物，也是產卵的 : Hopson, 1973.

摩吉的身體就像今天的許多爬行動物，柔軟而堅韌 : Stewart, 1997.

製作硬蛋殼的動物在繁殖前，會尋找含有許多鈣的食物 : Larison, 2001. Not all such

creatures live in places where enough calcium is readily available, however, and may store excess calcium in their leg bones, which is then depleted after egg laying. This idea probably sounds familiar to readers who've been pregnant : there's long-standing evidence that human pregnancy leaches calcium from the mother's bones (Kovacs, 2001). Making babies, in other words, however one happens to initially house them, utilizes every part of the maternal body, not simply her reproductive organs. This is true across the animal kingdom.

工業化產蛋農場的雞，經常患有骨質疏鬆症 : Janson et al., 2001. Janson's study usefully qualifies this fact with the possibility that differing genetic lines can produce different outcomes, but did establish that at least in terms of frequency and consistency of egg laying, there's a significant correlation. Because chickens in industrial farms are manipulated to produce more eggs, more often than they would in wild-type conditions, the birds' long-evolved mechanisms for compensating for the calcium costs of egg production aren't quite up to the task.

鴨嘴獸的蛋還具有額外的黏液層，其中含有大量抗菌物質 : Oftedal, 2012; Griffiths, 1978.

Mucus in general has ancient origins in our long war with microbes; there are good reasons our guts are lined with the stuff, and our respiratory passages, and a healthy wallop for our egg and birth canals, too (Bakshani et al., 2018).

當幼兒孵化出來時，有些幼兒會舔掉這種額外的東西 : Oftedal, 2012; McClellan, Miller, and Hartmann, 2008.

大部分哺乳動物都具備這種模式：首先分泌初乳，然後是富含脂肪的稀薄成熟乳 : Hinde and Milligan, 2011.

每個脂肪球都由一層含有黃嘌呤氧化還原酶的膜包圍 : Harrison, 2004.

初乳中含有特別豐富的免疫球蛋白 : Kunz et al., 1999.

初乳是腐爛的乳汁，或稱之為「乳膿」 : Colostrum was largely considered bad for children for centuries — an idea unfortunately owed to Aristotle (Yalom, 1997).

梅特林格撰寫了歐洲第一本兒科教科書 : Prühlen, 2007. Text was originally published in 1473. Quotation taken from the translation in Ruhräh, 1925.

哺乳動物分泌乳汁的模式，都是專門為新生兒的發育而設計的 : Hinde and Milligan, 2011.

In humans, the act of breast-feeding within an infant's first hour of life is a powerful predictor of that child's risk of death (Boccolini et al., 2013). That's one of the reasons modern maternity wards now promote immediate breast-feeding after birth.

初乳也是一種可靠的通便劑：Kunz et al., 1999.

類鐸受體就像社區裡的守衛一樣：Carr et al., 2021.

如果醫院可以獲得捐贈的母乳和濃縮初乳，會提供給新生兒加護病房的早產兒的原因之一：Underwood, 2013.

寡糖可以幫助阻止造成危害的病原體附著在腸壁上：Coppa et al., 2006; Kunz et al., 2000; Morrow et al., 2004. It's now widely accepted that milk oligosaccharides are “for” our commensal bacteria, in that they consume them, and also usefully work “against” our bacterial enemies in various ways, which naturally creates a less competitive environment for bacteria we've evolved to host (Marcobal et al., 2010).

藉由初乳送到新生兒腸道的6'-唾液乳糖，並不是母乳中唯一的寡糖：Though its presence continues significantly beyond the colostrum stage, and how much the baby gets seems correlated with its cognitive development by eighteen months of age (Oliveros et al., 2021). No one knows precisely how or why—unlike other oligosaccharides, the metabolites of 6'-SL (specifically, sialic acid) seem to reach infants' brains, while others may work via the gut-brain axis or via the vagus nerve. Other studies have demonstrated a connection between infants' gut microbiome and their cognitive development, which remains true to varying degrees in adulthood (particularly when associated with anxiety) (Foster and McVey Neufeld, 2013). NeuAc, the predominant form of sialic acid in humans, was approved as a food additive in the United States and China as of 2015, with the EU following in 2017, but its production remains incredibly inefficient (Zhang et al., 2019). The main thing to know here is that the human brain, at any stage, is deeply sensitive to our relationship with the local environment, and one of the most obvious sites of interaction lies in the digestive tract, constantly mediated by our many bacteria.

乳汁中第三多的固體成分就是寡糖：Coppa et al., 1999.

你需要益菌素，好讓整個系統發揮作用：Probiotic bacteria have also been found in human breast milk, and likewise are found to be beneficial (LaraVilloslada, 2007). Perhaps, then, one could think of some of those early colonizers of infant guts as coming with their own wagon of food and supplies, with some of them coming from the breast, some from the microbiome of the birth canal (Shao et al., 2019), and some from the placenta (Stinson et al., 2019, though controversial—see de Goffau, 2019). More on our birth-related microbes in the “Womb” chapter.

每天服用濃縮母乳產品可以幫助小病人的體重增加t：This is particularly true for preemie

babies infected with dangerous gut bacteria, which is naturally a risk for those patients for a variety of reasons (Mowitz, Dukhovny, and Zupancic, 2018). For a well-written overview of the economic side of this topic, including the typical cost of Prolacta's supplement, see Pollack, 2015.

其他生技公司正在嘗試自行生產人類類型的寡糖：Pollack, 2015.

科學家正積極努力，想弄清楚這些寡糖是否可以成為治療克隆氏症、腸躁症、糖尿病或肥胖症病人的藥物：Palsson et al., 2020; Xiao et al., 2018; Maessen et al., 2020. For fructose-type oligosaccharides (obviously easier to acquire than human milk derivatives) and applications for Crohn's, see Lindsay et al., 2006.

一些健身運動員現在會在黑市購買母乳：Easter and Freedman, 2020.

其實人類乳汁中的蛋白質含量遠低於牛乳：Boquien, 2018. In fact, it seems to have some of the lowest protein content of all mammalian milk; for example, rat milk has roughly ten times as much protein, while human milk has significantly more cholesterol and LC-PUFAs than most mammalian milk. This is sensible：human infants have a much slower growth trajectory. And of the proteins our milk does have, as compared with macaque milk, they seem largely geared toward gut, immune, and brain development, which aligns pretty well with the human pattern for somatic growth; we simply have more development to do in these areas while we're breast-feeding, and our species' milk is tailored appropriately (Beck et al., 2015). So if human bodybuilders are hoping to grow particularly fat and brainy, with guts specially trained to drink more breast milk for a long time, they're certainly welcome to drink human milk. But given that developmental pathways are timed, it's doubtful any good would come of it.

分娩不光只是繁殖而已：For more on the increasingly porous boundaries of the individual organism, I strongly recommend two books：Richard Dawkins, *The Extended Phenotype*—easily his most important work, despite how cranky he gets later in his career about overextensions of the phenotype—and Ed Yong, *I Contain Multitudes*, which is both wonderfully written and frankly just fun.

使用工業級抗生素的醫院病人，很容易感染困難腸梭菌：Cammarota, Ianiro, and Gasbarrini, 2014.

野生黑猩猩的乳汁與動物園黑猩猩的乳汁，有很大的不同：Milligan and Bazinet, 2008.

在靈長類的近親中，人類的乳汁含有的寡糖不但量最多，種類也最多樣化：Newburg et al., 1999; Tao et al., 2011; Urashima et al., 2001; Urashima et al., 2012.

管摩吉分泌乳汁的皮毛部位可能確實有「乳毛」：Ofstedal, 2002.

對於有乳頭的哺乳動物來說，大部分乳汁都是「共同生產的生物產品」：This phrase is drawn from Dr. Katie Hinde, a primate milk expert and director of the Comparative Lactation Lab at Arizona State University (though I originally met her at Harvard). I'm greatly indebted to Dr. Hinde's academic and public-facing work throughout this chapter.

泌乳激素刺激乳汁的生產：World Health Organization, 2009.

在魚類中，泌乳激素似乎主要與調節鹽分平衡有關：Dobolyi et al., 2020.

性行為之後體內的泌乳激素愈多，得到的滿足感和放鬆感就愈強烈：Brody and Krüger, 2006. Unfortunately, it seems the relative increase is far greater after (heterosexual) intercourse than masturbation, which is great if you actually have an orgasm during sex, but for many women I'm sorry to say that is frequently not the case (Shirazi et al., 2018).

「催產素讓你愛你的寶寶」：Drewett, Bowen-Jones, and Dogterom, 1982.

「催產素讓你愛你的男人」：Schneiderman, 2012. Higher levels of oxytocin in the initial stages of a relationship are predictive of the longevity of your relationship, assuming you're a college-age heterosexual person. Given that oxytocin is related to pair-bonding in other species, this isn't that much of a stretch. Causality is the question：Is it because you've got other mechanisms driving your attachment, and therefore you produce more oxytocin, or is your feeling of attachment something that comes about as a result of having more oxytocin on board? One presumes feedback loops, but one little peptide does not make you fall in love.

「一夫一妻制的男人製造的催產素，多過會出軌的男人」：Scheele et al., 2012. Or rather, men who self-identify as being in a monogamous relationship with a woman tend to stand farther away from non-partner women when they shoot oxytocin spray up their noses. The lab interpreted this as meaning the men reduced their signal of “availability” and potential sexual interest for the non-partner women when their noses were full of oxytocin. In prairie voles—a largely monogamous species—oxytocin does promote pair-bonding among females, while a different molecule does the job in males (Insel et al., 2010). Perhaps the most intriguing theory for oxytocin as a behavioral modifier is the notion that it better coordinates the many different motor and sensory patterns needed for reproduction. Or at least that's true in the nematode—surely the most ancient user of oxytocin studied in the lab. Male *C. elegans* are worse at looking for, recognizing, and having sex with potential mates when they don't have the right receptors for their version of oxytocin (Garrison et al., 2012).

較高濃度的催產素與更多的親社會行為有關：Goodson et al., 2009; De Dreu et al., 2010.

很難說催產素是讓人有善良本性的天使：De Dreu et al., 2010; Insel, 2010.

當嬰兒吸奶並且腦下腺分泌出更多催產素時，哺乳的母親也可能體驗到深刻的滿足感：

This is part of why breast-feeding is encouraged to cement mother-child bonding (and why nursing problems are considered a threat to that bonding process); another part, of course, is simply sexism—loads of mothers bond with their babies just fine, thank you, even if the breast-feeding thing doesn't work for that particular set of bodies. But it's true that the hormonal boost naturally involved in the nursing process can help it along. So long as the baby isn't unwittingly counteracting the process by mangling the poor nipple to a bloody mess (pain signals tend to ring a bit louder in the brain than oxytocin), nursing does help mammalian mothers feel bonded to their offspring, and vice versa.

性高潮後的男性和女性也有相同的感受，只是程度有別：Cera et al., 2021. Please note that people do all kinds of things during and after orgasms, including laughing outright, so whatever normative claims are made about oxytocin and orgasms, one should assume it's happening in a wide mix of physiological and psychological states (Reinert and Simon, 2017).

哺乳科學家稱之為「回吸」：Wilde, Prentice, and Peaker, 1995.

母親的免疫系統會製造對抗病原體的成分，並且經由乳汁帶到嬰兒的口中：Riskin et al., 2012.

如果乳房所哺育的嬰兒正處於壓力下，所產生的乳汁中，糖和脂肪的比例往往會改變：Gardner et al., 2017; Hinde et al., 2014.

還有止痛的效果，可抑制嬰兒的疼痛反應：Gray et al., 2002; Harrison et al., 2016. Note that this is a complex effect. Most studies are looking at infants breast-feeding, not simply drinking milk, so there are loads of confounds：skin-to-skin contact, pair-bonding with mother, olfaction, temperature, sound of the mother's voice. Nevertheless, this is a widely accepted phenomenon：nursing makes babies feel less pain.

嘗起來甜的食物，能帶來鎮痛的效果：Drewnowski et al., 1992; Lewkowski et al., 2003.

Note that the physiological pathways involved can backfire. For instance, there's some evidence that chronic stress greatly influences food type choice, and certain food types (namely, high fat and high carbohydrate), while down-regulating some of the physiological features of stress, can also create feedback loops that encourage those food choices as the body begins to rely on the food effects to feel less physical and psychological pain (Dallman et al., 2003).

大部分人類女性喜歡抱著嬰兒以左側乳房餵奶：Forrester et al., 2019.

其他靈長類動物也這樣：Tomaszycki et al., 1998; BoulinguezAmbroise, 2022. Interestingly, whether an infant is cradled on the left side also influences how likely that kid will grow up to be left-handed or ambidextrous—or at least that's true of baboons.

在不同的人類文化和時代中，皆是如此：Harris, 2010.

成人腦部的右半邊主要負責解釋人類的社交情緒線索：Though it may depend on which type of emotional processing you're talking about, with cross-hemisphere involvement partially depending on valence (Killgore and YurgelunTodd, 2007). In other words, we use the right hemisphere quite a bit to process emotional faces, with some boost presumably given by cradling on the left (the right brain processes left visual field thanks to the optic chiasm), but there's more going on than meets the eye (ahem).

含有大量皮質醇的乳汁，往往會使得幼兒變得比較不想去冒險：Hinde et al., 2014.

喝低皮質醇乳汁的嬰兒較愛積極探索：出處同上。

皮質醇濃度較高的乳汁，往往富含蛋白質：出處同上。

如果在母鼠的飲用水中添加低濃度的皮質醇：Casolini et al., 1997.

母親的皮質醇濃度超過某個值的時候，更有可能認為自己的孩子「害怕」或膽怯：Glynn et al., 2007.

用奶瓶餵養嬰兒的女性，並不認為自己的孩子常感到害怕：出處同上。

稍微有些挑戰的環境，可以讓兒童更能承受將來成年時受到的壓力：Crofton, Zhang, and Green, 2015.

如果女性持續處於壓力之中，讓皮質醇濃度飆高，她的孩子也可能會更為膽怯：Hinde et al., 2014.

母親會用唾液擦去孩子臉頰上的污垢，很可能正是人類的基本行為：Using your spit to clean a kid's pacifier is also common, and might even help lower the child's potential for allergies (Hesselmar, 2013). Having done this, however, I can also anecdotally report that this is a surefire way to make yourself sick with whatever the child has acquired from day care. Maintaining a unidirectional orientation of spit, barring whatever happens at the nipple, is better for the mother's health.

盲腸在維持大腸微生物群系的健康方面具有重要功能：Vitetta, Chen, and Clark, 2019.

有一群生活在剛果、自稱阿卡人的民族：Hewlett, 1991.

歷史上已知這種情況（男性並不分泌乳汁）發生在許多順性別男性身上：Not all of these cases are good, of course. Male victims of concentration camps during World War II were known to lactate after their rescue, presumably because starvation screws with the entire body, from glands to liver, and the glands recover faster than the liver; some men with advanced liver disease also begin to produce milk (Greenblatt, 1972; Diamond, 1995).

想要親自以母乳餵養孩子的跨性別女性，通常採用的方式和收養孩子或聘用代理孕母生孩子的XX者相同：Reisman and Goldstein, 2018; Wamboldt, 2021. Because of the obvious challenges of conducting a proper clinical trial for these issues, what exists in the scientific literature is a handful of case studies. But having personally interviewed a lactation consultant for trans women in Seattle, I've been told that there are far more cases in the field than there are reported in journals, and among clinicians who work with these populations, the Newman-Goldfarb protocol is the go-to, just as it would be for cisgender women who adopt and wish to breast-feed their new baby. What isn't clear is whether there are any unique risks for the trans population in adopting this treatment. More research is needed.

許多每天服用高劑量雌性素的跨性別女性，會發育出含有比較多脂肪的女性典型乳房：de Blok et al., 2017. Importantly, this seems to happen primarily in the first six months of hormone therapy, and development is modest, typically resulting in breasts a bit smaller than a AAA cup size. This is part of why “top surgery” is so frequently something trans women will choose, and shouldn't be seen as fundamentally any different from when a cisgender woman with smaller breasts might choose to have breast augmentation surgery. However, for both populations, such surgeries do not come without risk, including an increased chance of breast cancer (FDA, 2022).

豐胸手術：American Society of Plastic Surgeons, 2021. The number of procedures actually lowered for the first time in twenty years in 2020, but this was likely due to the pandemic rather than any global shift in breast opinions.

某一邊的乳房通常比另一邊的小，而且位置不對稱：Slight asymmetries are common in the animal kingdom—in humans, for example, one eye is typically “higher” than another on the face—but radical asymmetries are not. Significant breast asymmetry in humans is actually associated with higher risk of breast cancer (Scutt, Lancaster, and Manning, 2006), which may point to deeper problems in tissue development in those bodies. As always, if something concerns you, talk to your doctor.

一件名為《維倫多夫的維納斯》的藝術品：Weber et al., 2022.



胸部小的女性生下的嬰兒通常完全健康，這些女性也可以分泌出大量乳汁：While larger breasts can store more milk in between breast-feeding, the vast majority of milk is made on demand; thus, large breasts might allow a nursing woman to go for longer in between feeds, but this would put her at greater risk of mastitis (Daly and Hartmann, 1995). What's more, the size of a nursing woman's breasts isn't stable; they usually shrink six months postpartum (Kent et al., 1999). The authors attribute this to tissue redistribution in the breast and greater efficiency in what remains. This period is also associated with the introduction of solid foods, however, so the six-month cliff may also simply be a matter of needing to make less milk now that the child begins supplementing its feeds.

女性臀部與腰部的比例，要比乳房的大小更能預測出對於男性是否有性吸引力：Singh et al., 2010.

較大的乳房可能是宣傳雌性素較多的表現型：Jasieńska et al., 2004.

乳房形狀像淚滴，乳頭略微上翹，更有利於嬰兒的吸吮：Bentley, 2001.

這是雙腿步行帶來的問題：LeBlanc and Barnes, 1974.

從未接觸過胸罩並且餵養育過一個或多個孩子的大乳房，看起來往往像是又長又癟的氣球：This is common knowledge. But if you want documented evidence, just take a look at any old National Geographic magazine with pictures of topless, multiparous women over the age of, say, thirtyfive.

陰道平均只有七公分到十公分深：Lloyd et al., 2005.

人類勃起的陰莖平均長度只有約十三公分：Veale et al., 2015.

異性戀女性認為陰莖較長的男性照片更具性吸引力：Mautz et al., 2013.

關陰囊演化的「奔跑理論」：Chance, 1996.

即使是細心的解剖學家達文西，也在自己繪製的圖中，畫出了連接子宮和乳房的靜脈：Keele and Roberts, 1983; Di Stefano, Ghilardi, and Morini, 2017.

「經血靜脈」的想法可能還是來自於仔細的觀察：Galen is arguably the most to blame here. He discusses the transformation of menstrual blood into milk extensively in his work, even going so far as to say, “This is the reason why the female cannot menstruate properly and give suck at the same time; for one part is always dried up when the blood turns toward the other” (Galen, 170).

人類對於現實的看法可從根本上改變，有時這些變化是如此劇烈：Kuhn, 1970. For a useful clarification of the history of Kuhn's thought and contemporary applications, see Parker, 2018.

即使在科學家發現了微生物病原說之後，我們對於人體組成的認知，依然根深蒂固：

This is well trod in the history of science. One barrier, in the case of Robert Koch's postulates, was that viral infections weren't something that could be cultured and observed with the technology available at the time (Brock, 1988).

人體的微生物群系和複雜系統所突現的特性，將會成為生物學典範轉移的基礎：See anything the Santa Fe Institute is doing in systems biology, for example.

有一個存在很久的假設，說城市會出現是因為發明了農業：This is the dominant story in paleoarchaeology, at any rate, though it's possible social innovations came about independently (Emberling, 2003). As with all things in human history, the agricultural revolution came in fits and starts, with “domestication” arriving on a very long on-ramp before true agricultural societies took form (Fuller, 2019). And beyond the typical story of cereal crops, our human Eves also returned to their deep relationship with trees, which further drove growth of urban centers, because the long-term investment of orchard keeping required more complex urban social structures (and more obvious permanence) than the short-term gains that come from emmer wheat (Fuller and Stevens, 2019). More on the difficulties of becoming agricultural in the “Menopause” chapter.

城市愈大，城市生活的壓力對人口成長的抑制程度就愈高：Infection being the most obvious case here, though presumably ancient societies had similar difference of effect between social classes. Throughout history, the poor are radically more devastated than the wealthy, a pattern that continues today with COVID19 (Wade, 2020).

不知何故，大城市確實出現了：Interestingly, in societies where agriculture was widely adopted, evidence of a fertility increase shows up in the historical data (Bocquet-Appel, 2011). Or at least an increase in children's bones found in graveyards. The usual assumption is caloric：having to work less for the same amount of food, female bodies in such societies might have been more able to reproduce. So long as they didn't poison themselves with undercooked tubers, that is.

現今在非洲的朱／霍安西人狩獵採集部落中，婦女定期哺乳孩子到三歲大，平均生育間隔為4.1年：Konner and Worthman, 1980.

這些婦女一生中平均生育四個到五個孩子：出處同上。Among the Hadza, it's four to six (Blurton Jones, 2016; Marlowe, 2010).

不哺乳的婦女平均生育間隔為1.3年：Howie and McNeilly, 1982.

哺育母乳是天然的避孕藥：This is well known to those in the medical field and biologists alike, but for specific mechanisms that might underlie this phenomenon among today's hunter-gatherer societies, see Konner and Worthman, 1980.

當靈長類動物演化到每一次懷孕時產下的後代更少：Jones, 2011.

許多女性有充分的能力，可以同時餵養超過兩個孩子：Macy et al., 1930.

難怪有關於奶媽哺乳的規定，寫入了以漢摩拉比為名的法典中：Hammurabi, 2250 BCE.

十八世紀的法國，不只是富人，連大量的中產階級都雇用了來自農村的奶媽，使得許多寄養在農村的嬰兒死亡：Fildes, 1988.

法國人在第一次世界大戰期間繼續雇用奶媽：出處同上。

非裔美國婦女經常哺育美國南方白人的嬰兒，直到二十世紀中葉：West and Knight, 2017.

This practice of obliged wet-nursing extended well beyond American borders, of course, and likely into antiquity. For a comparative view of the naturally traumatic effects of these practices in America and Brazil, see Wood, 2013.

巴比倫人有奶媽：Gruber, 1989.

古印度的摩亨佐達羅有五萬人：Clark, 2013.

羅馬家庭會在城市廣場的「哺乳圓柱」周圍，徵求奶媽的服務：Fildes, 1986.

蘇美的諸神很懶惰：Though many versions of the Sumerian flood myth exist (Spar, 2009), the one I'm working with most here is the myth of Atrahasis, composed in Akkadian, produced roughly during the reign of Hammurabi's great-grandson, Ammi-Saduqa, around 1640 BCE. That text highlights how the gods created humans so they wouldn't have to work so much and how, when the cities were overpopulated and became noisy, the gods were annoyed, with the invention of death (and rules for which women could have sex, in which contexts, and with whom) as a useful population control after the waters receded (Dalley, 1991).

乳癌占女性所有癌症中的30%：American Cancer Society, 2020.

女性因癌症死亡的人數中，乳癌排名第二：Siegel et al., 2022.

美國女性一生中罹患乳癌的機率是八分之一：American Cancer Society, 2020.

## 第二章 子宮

第二位天使吹號：Translated from the Greek, presumably itself translated from either Aramaic or Hebrew. Many biblical scholars think that the book of Revelation is a deeply coded political document and that it's best understood within its historical context (Pagels, 2012).

火山灰一直如雪般落下：Bardeen et al., 2017; Vellekoop et al., 2014.

就像其他夠小或是挖地洞深到足以躲藏起來的生物那樣：Robertson et al., 2004.

那些能以死亡生物維生的生物，也存活了下來：Lowery et al., 2018; Robertson et al., 2004.

昆蟲宛若從天而降的美食：Donovan et al., 2016, 2018.

大部分人認為是小行星：Though from where has been under debate, which has lent credence to the comet camp of late. A handful of prominent astrophysicists have been leaning away from a more local origin (that is, the asteroid belt between Mars and Jupiter) toward the Oort cloud, where any of a host of things could have hurtled the rock toward us, from Jupiter acting as a massive attractor for “sun grazers” to a plane of dark energy sheering a comet off course (Siraj and Loeb, 2021; Randall, 2015).

威力超過十億枚投在廣島的原子彈：Gulick et al., 2019.

裡面充滿了銨元素：Schulte et al., 2010.

世界陷入大火之中：Kring and Durda, 2002; Robertson et al., 2004; Bardeen et al., 2017.

各大洲都有野火席捲，持續了好多天：Robertson et al., 2004.

極少數和哺乳動物親緣關係很遠的魚類和蜥蜴會這麼做：Farmer, 2020. Technically, viviparity has arisen more than 150 times in the history of life on Earth (Blackburn, 2015), most of them squamate reptiles (some lizards and snakes). That sounds impressive, but the range of time involved for these uterine eureka spans nearly 400 million years.

身為溫血動物的身體：Though there are a number of cold-blooded animals who give birth to live young (certain sharks, for example), live birth is mostly attached to creatures who have endothermy, and the control of developmental temperature may be one of the bigger drivers for the evolution of live birth in general (Farmer, 2020). One thing about those sharks, though：they may swim in warmer waters when they're pregnant.

陰道通常只有約七點五公分長：Lloyd et al., 2005.

大約在兩億年前（也就是摩吉出現前不久）：O'Leary, 2013. Timeline depends on whom you ask. Luo et al. (2011) are interested in about 160 million years ago and are also fond of the idea that tree dwelling might have been a useful ecological edge for early placentals, thereby “keeping clear of the dinosaurs below.”

研究人員利用超音波觀察到小袋鼠在出生前幾天，會在子宮裡練習攀爬：Drews et al., 2013. Please note that you can actually watch this for yourself in ultrasound video published online at [youtu.be/Cig30jSw0ZY](https://youtu.be/Cig30jSw0ZY).

有原始陰莖並不會危及生命：Nor are such bodies unusual in human history (Reis, 2009). Of course, this statement holds only so long as the patient lives in a place where it's unacceptable to violently punish one's child or wife for violating gender expectations. So-called honor killings, which are obviously gender based, have yet to disappear from the human world (Kulczycki and Windle, 2011), and the gender gap in countries like India and China strongly suggests gender-selective abortions, infanticide, and/or human trafficking (Hesketh et al., 2011), and that's happening to people with bodies that already meet gender expectations. Meanwhile, in the United States, surgical “correction” for atypical genitalia became popular in the 1960s and has only recently fallen out of favor, despite the widespread negative consequences of forcing gender assignment on these “intersex” infants (Dreger, 1998; Reis, 2009).

撞擊後漫長的冬季殺死了有袋類動物的祖先比較多，而不是胎盤動物的祖先：Luo, 2007; Luo et al., 2011.

多達十分之一的女性在自然分娩之後，會有尿失禁症狀：Norton and Brubaker, 2006. This is a low estimate; some studies put it as high as 40%, depending how long it's been since the birth. Women who have C-sections can have incontinence, too (all pregnancies can damage one's pelvic floor and, to put it simply, rearrange things down there), but vaginal delivery is a strong, independent risk factor. I'm afraid the urethra isn't the only space that can be damaged down there, either：mothers who suffer damage to the supporting structures of their anal sphincters (something that can happen with third and fourth-degree perineal tears, which occur in roughly 6% of vaginal births for first-time moms) report issues with fecal incontinence as much as twenty years later, and the impact appears to be cumulative, with more than one such birthing injury nearly doubling the risk for long-term problems (Jha and Parker, 2016; Nilsson et al., 2022).

有些女性甚至可能會動手術關閉陰道口：這種手術稱為陰道封閉術（colpocleisis），僅用於嚴重病例。

不論任何年齡的女性，都只有 25% 在陰道性交期間確實體驗到性高潮：Mahar et al., 2020. Note that I particularly mean cisgender, heterosexual, penis-involved sex about which nearly all studies on the subject have been conducted, which is obviously problematic in this regard. Women self-reporting orgasm during sex often exclude receiving oral sex, which is more likely to produce an orgasm for many women.

用四號駱駝毛畫筆刺激雌鼠的陰蒂：Parada et al., 2010; Parada et al., 2011.

陰蒂刺激對於實驗小鼠的健康有益，就像對人類女性的健康一樣：Jannini et al., 2009; Kruger et al., 2012.

泄殖腔接吻：Herrera et al., 2013.

所有羊膜動物都是具有可勃起陰莖的古代亞當的後代：Sanger et al., 2015.

現行理論是「擇偶」行為導致沒有陰莖會變得更好：Herrera et al., 2013.

陰莖骨（一塊支撐用的小骨骼）：Though the baculum might have originally evolved not simply to support an erect penis but to stimulate the female：male rats with a bigger baculum have more success impregnating females, so long as they thrust a bunch (André et al., 2022). Because female rats are essentially in control of sexual events (they're the ones who solicit), one presumes they like this stimulation (Parada et al., 2010). Human women are quite varied in their preferences for vaginal stimulation, so the lack of a baculum in the human penis doesn't seem to be an issue in that regard.

犀牛通常必須經過兩個半小時的交配：These are measures from observation in the wild. In captive breeding environments, mating can take as little as half an hour, but other impediments, like uterine cysts or other reproductive woes, also take their toll (Nicholls, 2012). It certainly doesn't help that some species seem to ovulate in response to mating with a male, leading many conservation programs to rely on IVF (Foote and Wiese, 2006).

動物園很難讓犀牛懷孕：Felshman and Schaffer, 1998; Foote and Wiese, 2006. What's more, because only a smaller portion of captive rhinos successfully reproduce, it's messing with species' genetic diversity (Edwards et al., 2015).

打造出一個機械子宮：Partridge et al., 2017.

編碼產蛋所需蛋白質的特定基因：Brawand et al., 2008.

古代胎盤可能在二億年前到一億五千萬年前之間演化出來：Though rudimentary on-ramps to the structure might have come about earlier and true lineage diverges much later. For a good overview of how incredibly contentious it all is, particularly between the “rocks and

clocks,” see Foley et al., 2016. Among the better “clocks” studies, a recent Stanford paper argues for closer to 120 million years and finds species-specific gene expression in mature placentas, which speaks to the many ways placentas have evolved to meet their hosts' specific developmental plans (Knox and Baker, 2008).

把未受精的卵排入輸卵管，給等待食物的飢餓幼鯊：Miller et al., 2022.

幼鯊在子宮裡吃掉弟妹，也就是在同個家庭中的暴力同類相食行為：Chapman et al., 2013.

鏽鬚鮫的胚胎會在母親的兩個子宮之間游動：Tomita et al., 2018.

中華侏羅獸：Luo et al., 2011.

唐娜原蹄獸：O'Leary et al., 2013.

每三百五十個人類女孩中，就有一個出生時，在正常的單一陰道末端有兩個子宮和子宮頸：Grimbizis et al., 2001; Saravelos et al., 2008.

每二百名女性中，就有一個天生具有「心形」子宮：Saravelos et al., 2008.

每四十五個女孩中，有一個出生時具有「中隔」子宮：出處同上。

每十個女孩中，有一個出生時子宮頂端輕微「凹下」：出處同上。 Note that these are simply rounded estimates based mostly on findings in clinical settings, which are naturally vulnerable to sampling bias: more women who have problems with their reproductive organs have them examined, and women who do not are unlikely to, which could skew both how commonly women with funky sex organs have difficulty making babies and/or enjoying sex and how common it really is in the general population (Chan et al., 2011).

每年出生的四千五百個女孩中，就有一個沒有子宮：Fontana et al., 2017.

多達20%的人是同性戀：Coffman et al., 2017. Kinsey's original estimate from the mid-twentieth century was closer to 10%, but accurate self-reporting in the face of bias is incredibly tricky to obtain.

同性戀是與生俱來的人性之一：I admit this is an anecdotal claim based on my knowledge of other scientists and how such things are talked about in the community, and I was unable to find an appropriate survey of the scientific community's beliefs on the matter. Still, the truly massive array of research into the biological underpinnings of homosexuality, bisexuality, and general queerity is, I believe, sufficient evidence here. For one recent review paper, see Bogaert and Skorska, 2020. The authors unfortunately note that studies on women subjects in these areas are woefully thin on the ground, as are studies of subjects who aren't cisgendered.

生物學家已在無數物種中觀察到同性戀現象，包括了哺乳動物和鳥類：Savolainen and Hodgson, 2016.

2021年，一家實驗室成功讓小鼠胚胎在一個旋轉瓶中存活，並且正常發育：Aguilera-Castrejon et al., 2021. Note that the goal here was not to find a technological way out of our mammalian uterine hell but to develop powerful new ways of studying embryonic development without all the muss and fuss of actually having to impregnate living bodies, mouse or otherwise.

世界上只有少數動物有月經：Emera et al., 2012.

授課者是一個沒有受過解剖學、醫學或人類性行為方面專業訓練的人：I wish this weren't common for American schools, but I'm afraid it's all too often true. Things have improved (a bit, in some places) since the 1990s in this regard, but I'm not going to sugarcoat this for you. In the United States, requirements for sexual education—whether to have it at all, how much professional training a person has to have to teach it, what the curriculum should be, how it's funded—are almost entirely left up to state governments rather than any federal law. As of 2022, only seventeen of the fifty states require sexual education in public schools be medically accurate (AGI, 2022).

我瞭解我的月經次數很多，是因為我沒有像祖先那樣經常懷孕：Strassmann, 1997; Eaton et al., 1994.

懷孕不夠早，可能會讓我罹患某些癌症的風險提高：Eaton et al., 1994.

遲至三十多歲才懷孕，可能會使我的嬰兒畸形：This is largely tied to increased risk of chromosomal abnormalities, which is far more significant over age forty than age thirty-five (Frederiksen et al., 2018), but don't forget the trials of pregnancy itself, which is simply harder for older bodies to bear, with most obstetric outcomes becoming an issue from age forty on (but most OBs will tell you anyone aged thirtyfive and up should receive additional monitoring and care).

二十多歲就懷孕的歐洲女性比起更晚才懷孕的同儕：Or at least they get less of a happiness boost, though that might be because of many miscarriages prior to first children in women's mid-thirties and later (Myrskylä and Margolis, 2014).

人類的月經可能是一種對抗病原體的機制：Profet, 1993.

月經之後，陰道內的外來細菌似乎並沒有減少：Strassmann, 1996.

女性的月經可能是做為社會訊號而演化出來的：Knight, 1991.

有些女性在月經期間性慾會增強：Though such women may be “outliers,” they certainly exist, and the mechanisms underlying human sexuality have repeatedly proven to be complex in the lab. The only reliable peak in sexual desire/motivation for normally fertile women lies around ovulation, with a decline toward menstruation, but while progesterone closely tracked the decline in desire toward the start of women's periods in one study, researchers couldn't locate a predictable measure for the rise in desire toward ovulation (Roney and Simmons, 2013). We have some idea what sex hormones are involved in turning women off, in other words, but less for what turns us on.

有一位野心十足的研究員，在1991年耶魯大學出版的著作中主張：Knight, 1991.

在唐娜的後裔中，這種特質非常罕見，然而已經各自演化出了三次：O'Leary, 2013.

2014年，一位美國女性在做頭髮時，感到背部深處有受到壓力造成的疼痛：Goldman, 2014. Please note that the cardiac surgeon Dr. Omar Lattouf performed a heroic surgery that saved this woman's life and deserves all praise for it. Please also note that in interviews about this case he repeatedly says he was motivated to succeed because he wanted to make sure that newborn baby had a mom. By all indications, he surely wanted his patient to live because she deserved to have life all on her own merits. But I'm concerned that whether or not a woman has children continues to be a motivating factor for saving her life. Call it a trolley problem, call it sexism, call it whatever you like, but it's true that pregnant women regularly suffer when clinicians hesitate to treat the woman over the fetus, which is a strong factor in maternal mortality rates, so these moments do not exist in a vacuum (MBRRACE-UK, 2016).

這些因素同時也都會增加心臟病的風險：Duckitt and Harrington, 2005.

接受體外受精的母親，體內植入多個胚胎的情況並不少見：Le Ray et al., 2012. Notably, older mothers who use donated eggs have a higher rate of preeclampsia, which may be an immunological issue. Think of organ donation：the fetus created with the mother's own genetic material is a semi-allogenic graft, while fetuses made of donated eggs are a total allogenic graft. Normally, a placenta made from the mother's own egg has to “persuade” the mother's immune system to think it's not a foreign body only some of the time. With a donated egg, the placenta presumably has more work to do to distract and deceive that mother's immune system.

同時懷多個胎兒的女性中，有三分之一會罹患子癲前症：Bergman et al., 2020. Notably, women who have preeclampsia in a singleton pregnancy have an increased risk of

cardiovascular disease later, while women who have twin pregnancies do not. That implies women who have preeclampsia with just one baby may also have underlying cardiovascular problems, whereas in twin pregnancies the preeclampsia is more likely a direct result of the immuno-active placenta and the extra burden of an extra-large pregnancy.

研究人員成功分離出胎盤產生的兩種蛋白質：Mutter and Karumanchi, 2008.

2011年，以色列海法的一組研究人員檢查了正常懷孕後十四週前流產的胎盤：Kliman et al., 2012. s0s0a0y w “eL're p' lanning to rob a bank”：Kliman, in Rabin, 2011; Kliman et al., 2012.

正常健康的懷孕期間，PP13進行戰爭時所發生的情況：PP13 is now being targeted as a potential therapy for preventing preeclampsia in women with higher risk, as well as a potential measure to predict that risk, because women with low circulating levels of PP13 in the first trimester are more likely to develop preeclampsia later (Huppertz et al., 2013).

母胎衝突（真獸類每次懷孕都會自然發生的衝突）：Haig, 2015.

從未懷孕過的女性比至少懷孕過一次的女性，罹患自體免疫疾病的可能性更低：For female-typical autoimmune diseases this is particularly true. Parity actually increases your risk by 11%, and the effect is particularly strong if you miscarry (Jørgensen et al., 2012). The theory holds that in miscarriage more immune-triggering material may enter the mother's bloodstream, though it's also hard to disentangle the miscarriage from any preexisting conditions that might have contributed to both the miscarriage and the eventual autoimmune disease.

如果女性在二十幾歲時懷孕並且分娩，那麼罹患某些癌症的風險低於從未懷孕過的女性：

The data are all over the place for this. The latest research indicates that barring the first five years after your pregnancy, breast cancer risks do seem to be lower if you've ever been pregnant and breast-fed an infant, though it's quite small and the effect doesn't kick in for a good long while (Nichols et al., 2020). More important, breast-feeding amount and duration greatly reduce your risk of ovarian cancer (Babic et al., 2020). That might be because breast-feeding reduces the total number of menstrual cycles your ovaries endure; however, having a longer reproductive life means your lifetime risk for thyroid cancer is higher (Schubart et al., 2021).

最安全的事情或許就是永遠不要懷孕：This is so incredibly obvious to anyone who studies mammalian biology that it's difficult to know which papers would be best to cite. Let's put it this way：in the United States, the risk of death for a pregnant person is fourteen times the risk of death associated with legal, safe abortions (Raymond and Grimes, 2012). Or at least



that number was true in 2012; unfortunately, now that many women in the United States have to travel significant distances and wait longer to receive legal, safe abortions (if that option is even realistically available to that person), one presumes the numbers are going to change. There's a big difference between a legal, safe abortion obtained at eight weeks and one obtained (at great expense and hardship) much later. That's because the duration of pregnancy has a direct relationship with the degree of risk—not simply the relatively minor risk of medical complications from the later-stage abortion, but the far greater risk of simply being pregnant for longer.

在懷孕期間和懷孕後，幾乎所有女性都會遭受肌肉撕裂：Frohlich and Kettle, 2015. What's more, depending on one's risk profile, the pattern of long-term injury persists for at least a year and potentially for one's lifetime (Miller et al., 2015).

孕婦如果罹患了瘡疾，病人有50%會死亡：Schantz-Dunn and Nour, 2009.

每十萬例合法墮胎中，只有0.65例會導致婦女死亡：Kortsmit et al., 2021.

每十萬例分娩中，仍有26.4名美國婦女死亡：Kassebaum et al., 2016.

美國所有孕婦死亡中，有17%到18%是由於非法墮胎造成的：出處同上。

目前仍有瘡疾肆虐的國家中，孕婦死亡案例中，有四分之一和瘡疾有直接關聯：Schantz-Dunn and Nour, 2009. Please note, however, that another 30–50% of maternal deaths in sub-Saharan Africa are due to unsafe abortions (AGI, 1999; Henshaw et al., 1999). Some of those dead women and girls were also infected with HIV, some malaria, and some neither. But their immediate cause of death was complications from unsafe abortions. Given that legal restrictions for abortions do not reduce the number of abortions performed in those communities, but simply drive women who need them to whatever's available, including qbuacac-kasllaenyd self-harm (Henshaw et al., 1999), what actually killed those women and girls were antiabortion laws. More on why that's both predictable and incredibly bizarre in the “Tools” and “Love” chapters.

### 第三章 感知

新的知覺器官是出自於需求的結果：Rumi, 1270/1927. It's probably impossible to properly convey the prosody of Rumi's work in English—the Persian poetic tradition he was

working in was something sung as much as spoken or read, so the meter of the original is deeply embedded in both the aesthetic experience and meaning-making for its listener. Nevertheless, as someone who thought deeply about human perception, I thought he'd serve well here.

最早回歸的植物是蕨類：Berry, 2020.

後來取而代之，從火山灰中長出來的是能結出果實的樹，加上這些樹木形成的樹冠層：Carvalho et al., 2021; Benton et al., 2022. It's not true, however, that large fruiting trees only came about after the asteroid; in fact, angiosperms were mixed in with conifers and other types of trees during the late Cretaceous (Jud et al., 2018). Rather, massive spreading canopies of fruiting trees—the thing one usually thinks of when you think of a forest canopy, and particularly when thinking of the evolution of primates—come later. As for the rise of angiosperms in general (not just forests, but all fruiting plants), that comes in the midCretaceous, and might well have been stressful for mammals who weren't well-suited to a changing ecology, thereby favoring small-bodied insectivores (Grossnickle and Polly, 2013).

普爾加托里猴，世界上已知最早的靈長類動物：Chester et al., 2015.

在地獄溪聯合堡地層中發現了更多普爾吉眾多姊妹的骨頭：Van Valen and Sloan, 1965; Clemens, 2004.

普爾吉也吃水果：Wilson Mantilla et al., 2021.

從她的腳踝來看，我們也知道普爾吉很多時間都待在樹上：Chester et al., 2015.

靈長類動物的手和姿勢是從直立坐在樹上、用前爪仔細處理食物而演化出來的：Or at least, emphasizing balance and stability functions in the hind paws, which may free the forepaws for other tasks as needed (Patel et al., 2015). We know a lot more about primates in this regard than other tree mammals, but the trait is clearly present in other arboreal mammals, too, with the more fruit-heavy eaters like kinkajous having particularly dexterous, grasping hands (McClern, 1992).

普爾吉就藏身樹葉中，彼此幫助對方：Sussman, 1991; Rasmussen, 1990; Sussman et al., 2013; Benton et al., 2022.

近兔猴型亞目：Purgi herself was most likely a basal plesiadapiform, but there's considerable debate around this still (Clemens, 2004). For our purposes, this doesn't matter so much: like many of the Eves, Purgi should be considered an exemplar for the Eve of our primate sensory array.

後代分支逐漸沒落減少，到最後滅絕了：Sussman et al., 2013.

陸地動物多樣性最高的地方：Benton et al., 2022.

白鐘雀的鳴叫聲高達125分貝：Podos and Cohn-Haft, 2019. Bizarrely, this was produced in close range of a female, who quickly moved from her spot on a branch to avoid the full force of the noise.

吼猴發出的聲音可以達到140分貝：Dunn et al., 2015. Please also note that the louder one's calls, the smaller one's testes.

靈長類動物進入了森林的樹冠層：Coleman, 2009. Note, however, that social features can put their own pressure on hearing systems, particularly when you've got an increasingly social set of species like later primates (see Ramsier et al., 2012). We don't actually know how social Purgis and other basal primate-like Eves were, so it's hard to say when, exactly, this would become a factor.

靈長類動物這兩種方式都用到了：Mitani and Stuht, 1998. This model is controversial, however, and when you look at all mammals with suitably tested hearing ranges, primates fall under the general curve (Heffner, 2004). Generally speaking, the smaller primates hear higher pitches (which also happen to be better for up-close communication), and the larger primates (particularly those who spend quite a lot of time on the ground) lose some of that sensitivity to higher pitches (Coleman, 2009). Ancient australopithecines, however, show a distinct transition to more human-type pitch sensitivity (same low end as chimps but more ability in the higher end) by the time savanna living was common, in a presumed adaptation to both social communication and ecological shift (Quam et al., 2015).

女性的耳朵對於更高的音更敏感，通常是高於2 kHz的音調，那恰好符合嬰兒哭聲的標準音調：Not to be outdone by the audible portion of maternal experience, it's also been shown that the ultrasonic portions of baby cry also, quite without the mother's awareness, change the amount of oxygenated blood in the listening mother's breast—something that doesn't happen when the ultrasonic portions are left out (Doi et al., 2019). However, the mother does need to hear the audible portions for this to work; simply jazzing her with inaudible ultrasonic waves doesn't have the same effect.

女性的耳朵能保持高音的聽力：Pearson et al., 1995.

女性對嬰兒的哭聲更為警覺：Messina et al., 2015. Please note, however, that responding to infant cries is something all mammals do, and even deer have been known to respond to the cries of other species' babies, including our own (Lingle et al., 2014). So even if males

respond less obviously in the human species, it's simply not the case that they've somehow escaped the entirety of mammalian hard wiring for the care of our young.

最近的一項研究，讓受試者聆聽嬰兒哭聲或是更為中性的噪音：Parsons et al., 2012.

各種常見的聽力損失，出現在男性身上的比例高於女性：Gordon-Salant, 2005.

大部分二十五歲以上的男性聽不到17.4 kHz或更高的聲音：出處同上。

中年和老年男性在人多吵雜的環境中，更不容易聽清對話：Dubno et al., 1984.

女性比較少從事會產生大音量而損傷耳朵的工作：Like many such assumptions, this is increasingly undermined or complicated by results in the lab. One of the more recent studies demonstrates that even when exposed to equivalently dangerous noise levels, male subjects had considerably more hearing loss (Wang et al., 2021). So if men jackhammer more than women, they're also significantly more at risk of losing their hearing by doing so—which, to my mind, is another solid pitch for female drummers in any given band.

電玩《異塵餘生4》：The soundtrack is fantastic. And the gaming company, Bethesda, is famously good. Let's just say Boston is a bit less interesting than Tamriel.

女性的耳聲傳射往往比男性更強，也更為頻繁：And this “weakening” of the cochlear amplifier seems to be present across Mammalia, presumably due in part to exposure to prenatal androgens (McFadden, 2009).

不僅是人類如此，甚至狢猴也有女性化的耳聲傳射：出處同上。

大部分人類女孩的食指與無名指的長度比，低於大部分男孩：Gillam et al., 2008.

造成這些差異的原因肯定更為複雜：van Hemmen et al., 2017.

更有可能具有「男性化」的耳聲傳射：McFadden et al., 2011.

如果女孩與男孩在一個子宮中長大，那麼女孩更有可能具備男性化的耳聲傳射：McFadden et al., 1996.

如果你閹割一隻比較年長的羊，耳聲傳射的性別模式並不會改變：McFadden, 2009.

可能有一種「超男子氣概」在驅動這個系統：Williams et al., 2000.

男同性戀者依然需要忍受的「娘娘腔」那種刻板印象：Sadly, even to the level of scientific understanding of sexual orientation, biasing findings that favor a feminized model of male queerness over the hypermasculine model (Gorman, 1994).

撇下那些沒有功能的基因，其他基因也占了哺乳動物基因組的2%：Firestein, 2001.

男性的鼻子不擅長這種細緻的工作：Cain, 1982.

懷孕雌性有香蕉味的尿液：Rosen et al., 2022. It also makes the male feel less pain, oddly enough, but it's unclear if that's simply a normal stress response or if it's uniquely beneficial : pregnant rodent mothers will violently attack males nearby, presumably in part because the males are known to be infanticidal.

對雌性齧齒動物來說，雄性尿液的氣味會激起好奇心：Roberts et al., 2012.

靈長類動物在演化道路上走得愈遠，臉就愈平坦：Barton, 2004.

在古老靈長類動物演化成猿類時，嗅覺系統已經嚴重退化：Yoder, 2014; Gilad et al., 2004.

沒有了其他哺乳動物所具備的神經或是與腦部的連結：Trotier et al., 2000. However, this region may still play a role in the prenatal phase of development, in yet another case of evolution's rule of innovating in the later stages of development but leaving deep structural patterns in early body building well enough alone (Smith et al., 2014).

更有可能享受在快速約會活動中與男性對話：Saxton et al., 2008.

下視丘更有可能表現得特別活躍：Savic and Berglund, 2010.

唾液中的皮質醇濃度更有可能增加：Wyart et al., 2007. This was androstadienone—a similar musky compound, also present in sweat, and naturally produced in the testes of human and pig alike. Importantly, not every human nose is even able to smell this at all (Keller et al., 2007), which naturally narrows any olfactory study of the stuff among human subjects.

如果你測試男同性戀者對雄二烯酮的反應：Savic et al., 2005. However, in one study utilizing PET scans, Swedish lesbians seem to process AND in olfactory networks rather than the anterior hypothalamus (Berglund et al., 2006).

女性更喜歡男同性戀者的腋下氣味：Sargeant et al., 2007. Importantly, subjects came from cultures in the U.K. where regular bathing and deodorant are the norm, and given that the complexity of pit odor is produced by both the body and the microbiome of the armpit in question (Bawdon et al., 2015), one's ongoing hygiene habits may well influence the sorts of smells one produces over time, as would one's dietary choices and a host of other influences. It's not, in other words, clear that straight women in the U.K. are more attracted to gay men because of some kind of differing physiology, but rather that they may prefer the sorts of body odors a gay male lifestyle tends to produce in its associated armpits. Or at least the lifestyles of the nine gay men who participated in this study. Hedonics is a messy business.

男性變女性的跨性別者，下視丘的表現與異性戀女性相似：Berglund et al., 2008. Note that these women did not self-identify as homosexual and also had not undergone gender-

affirming surgery before the study was conducted. Similar results were produced in minors (both younger children and adolescents) in the Netherlands in 2014, although importantly these were children diagnosed with gender dysphoria; not all people in the trans community have gender dysphoria, nor should the trans experience automatically be equated with a medical disorder or mental illness.

脫衣舞孃在排卵期演出，從男性收到的小費會比平常更多：Miller et al., 2008.

男性也喜歡排卵期女性的運動衫：Lobmaier et al., 2018.

男性不喜歡經期女性和免疫力較低的女性的腋下氣味：Roberts et al., 2008.

幾乎所有人都不喜歡女人眼淚的味道：Gelstein et al., 2011. It also made men notably less horny, both in self-reporting and in the extremely sexy environment of an fMRI machine.

除臭劑和避孕藥正在破壞人類嗅覺天生的能力：Roberts et al., 2008; Lobmaier et al., 2018.

The most famous, which largely kicked off the trend, was a 1995 Swiss study looking at subjects' MHC and whether olfaction helped select for immunologically compatible mates (Wedekind et al., 1995). Women who weren't on birth control preferred smelly T-shirts worn by men who were ostensibly more compatible—for two days, with no deodorant or soap—over similar shirts worn by less compatible men, while women on birth control did not show those preferences.

女性更擅長偵測微弱的氣味：Cain, 1982; Sorokowski et al., 2019; Cherry and Baum, 2020; Oliveira-Pinto et al., 2014.

這種雌性優勢也存在於其他哺乳動物物種中，普爾吉可能也是如此：Kass et al., 2017; Doty and Cameron, 2009. Because other species aren't quite able to report what they're smelling, much of this is behavioral work, though some progress has been made in studying mechanisms. In mice, for instance, females seem to transmit more signal to the olfactory bulb (Kass et al., 2017). One possible driver may be sexual selection : male scent markings in many mammals seem to be more complex than female markings (Blaustein, 1981), which would naturally give females an advantage if they're better able to discern the complex features of those scents. That's above and beyond the basic survival benefit afforded by females who are good at avoiding toxins, which, as I've mentioned, is particularly critical for the female placental.

一個普通的青少年男性鼻子，會比一個普通的同齡女孩的鼻子大10%左右：Holton et al., 2014. This trait only kicks in around puberty; children's noses are roughly the same across

the sexes. The larger male nose is also independent of the generally slightly larger facial features (and body size) of males in general, and is thought to be tied to the more expensive muscle mass of post-pubertal male bodies. In many ways, the nose should be thought of as both a part of our sensory array and an extension of our lungs; adult male lungs are also, on average, a titch larger. More on respiration in the “Voice” chapter.

2017年，一項可愛的小型小鼠研究：Kass et al., 2017.

人類女性的嗅覺在排卵期間會更敏銳：Doty and Cameron, 2009.

懷孕可能改變了女性感知氣味的能力：Or rather, enhanced her conscious attention to the fact that she'd noticed the smell—there isn't a lot of consistent evidence that women's baseline olfactory capabilities rise during pregnancy (in fact, during the third trimester she'll smell less well, likely because of a stuffy nose), but there is a wealth of both anecdotal and scientific evidence for women having stronger feelings of disgust for certain smells, rating many smells as less pleasant, and generally having strong emotional reactions to scents across pregnancy, but particularly in the first trimester (Cameron, 2014).

女性的嗅球結構與男性不同：Oliveira-Pinto et al., 2014.

演化科學家往往認為，我們對食物的渴望和缺乏的營養有關：The actual scientific support for this concept, however, remains controversial (Cameron, 2014). It does appear that having anosmia (an inability to smell) is associated with reduced nausea in pregnant women (Heinrichs, 2002), but more research is needed in this area. More clearly, a heightened emotional response to olfactory cues seems to happen in the pregnant body (Cameron, 2014), and so the links between pregnancy, nausea, and olfaction may lie instead in the brain itself, rather than the nasal passages.

如果你按時間順序排列頭骨化石，可以看到眼窩向頭部前方移動：Barton, 2004.

立體視覺可以為你提供非常好的3D視覺影像：Heesy, 2009.

眼睛的位置愈有助於立體視覺，頭蓋骨就愈大：Barton, 2004.

雙眼立體視覺是一種趨同演化的特徵：Heesy, 2009.

晝夜節律的週期幾乎嵌入哺乳動物身體的每個系統中：And among these systems can be found multiple sex differences (Yan and Silver, 2016).

我們消化食物的方式、修復傷害的機制，甚至更為擅長的各種認知能力，都會根據時刻的不同而改變：Segers and Depoortere, 2021; Hoyle et al., 2017; Santhi et al., 2016.

上夜班的女性比較有受孕方面的問題：Fernandez et al., 2020.

上夜班的男性也會出現與女性相似的代謝和免疫問題，但是對生育能力的影響不大：

Perhaps this is due in no small part to the fact that unlike ovaries testes don't show much circadian influence (Kennaway et al., 2012).

轉變為雙色性的時間，大約發生在胎盤夏娃唐娜的時代：The notion of nocturnality driving mammals' dichromacy is mostly due to Walls (1942). These ideas have since been complicated. For instance, there is some controversy around whether it was a total switch to daylight vision or rather an emphasis on dim light, like twilight and dawn or, occasionally, a full moon (Melin et al., 2013). It's also unclear if dichromacy was a basal state for mammals or if a change to nocturnality is what drove the shift (Jacobs, 1993).

負責我們紅綠色視覺的基因，是在大約四千萬年前產生的：Hunt et al., 1998.

靠聞的判斷水果是否成熟：Hiramatsu et al., 2009.

具有混合色覺個體的群體，似乎在集體覓食方面略勝一籌：Osorio and Vorobyev, 1996; Caine et al., 2010. Dim-light advantages for the dichromats also carry to insect foraging (Melin et al., 2007), while there's greater parity for fruit in bright-light conditions (Vogel et al., 2007), which may imply that not only fruit eating but time shifts for foraging in general can provide differing advantages to differently sighted group members, depending on that species' environment. It's also possible dichromats simply spend longer foraging for the same amount of food, as they seem to do in zoos.

當你在嘈雜環境中聽到人說話的聲音時，耳蝸會抑制放大聲音的構造：In auditory research, this is often called the “dinner party problem.” But it's not just a matter of boosting one noise over another; differing sensory systems also influence one another as attention shifts. For example, paying attention to visual information makes the cochlea become less responsive; mammals really do “tune out” as needed (Delano et al., 2007; Marcenaro et al., 2021).

即使你當時沒有注意到外在世界，瞳孔也會放大：Zokaei et al., 2019.

成年女性往往有更多的跳視，在人臉的不同部位和眼睛之間移動，而男性則傾向於凝視鼻子周圍：Heisz et al., 2013; Sammaknejad et al., 2017.

具有看到那些額外顏色的遺傳傾向的女性，通常看不到那些額外的顏色：Jordan et al., 2010.

有多達12%的人類女孩可能是天生的四色覺者：出處同上。

## 第四章 腿部

我們應該本著永遠不死的冒險精神：Thoreau, 1862.

關於女性走出家門所代表意義的一些看法：Lemire, 2009. Zilpah White was a former slave who lived near Thoreau's bean field in the woods by the pond. Unlike many former slaves who stayed in the same house that had enslaved them, their daily lives largely unchanged, Zilpah struck out on her own when she became legally free. But the soil by the pond was sandy. It didn't grow things well. And someone burned down her little house in 1813, so she had to rebuild that, too. She lived into her eighties by that pond, making brooms—paid for it this time, but not much (ibid). Much has already been made of the ways Thoreau's mother and others (reminiscent of Hrdy's Mothers and Others) enabled his particular philosophical tramping on a little pond in Massachusetts—some of it good (Solnit, 2013; Shultz, 2015), some of it less so. But should we care more about the invisible labor of women and former slaves here? The lying? The wild racism? (Read for yourself.) No, I think what's most interesting in Thoreau is the notion that the Wild belongs to the masculine leg, ever striding, which becomes America's e'er-westward stride, when the real story of humanity's great walk is probably northward and outward and significantly taken in stride by a feminine, endurance-enabled leg—as I'll address in this chapter.

士兵稱之為「糟糕透頂」：The phrase “welcome to the suck” is probably best known from the marketing campaign for Sam Mendes's 2005 film, *Jarhead*. While various versions of and references to the suck are used throughout the military, most I've spoken to (and read) think it took root in the early years of the twenty-first century in the war in Iraq (though the author of the book *Jarhead* is based on was a marine, included the phrase, but served instead in Saudi Arabia and Kuwait during the Gulf War in the 1990s). The author of the screenplay for Kathryn Bigelow's *Hurt Locker*, Mark Boal—himself an embedded journalist in Iraq in 2004—likewise used “the suck” to describe the daily realities of combat, presumably having picked up the phrase from the soldiers around him. For a general insider view of the Army Ranger School and its general alignment with the suck, see Lock, 2004.

百分之六十的人在第一個星期就因為落後而退出：Spencer, 2016.

格里斯特上尉是女性：A cisgender woman, to boot. My portrait of Griest is based on a number of different journalists' interviews and her own public commentary during this period and later, most of which are available online. In particular, I leaned heavily on reportage done by

The New York Times, CBS News, The Washington Post, the Army Times, private interviews with members of the military, and military reports to Congress on the issue of gender integration in the armed forces (for example, Oppel and Cooper, 2015; Kamarck, 2016; CBS News, 2015; Tan, 2016). In more recent news, Griest wrote an op-ed in 2021 in which she rejected a proposal for a change in standards to include more women in the military, which subjected her to no end of online bullying, including accusations that she'd somehow “internalized sexism” (Lamothe, 2021). But for Griest, such changes would not only diminish her own accomplishment but jeopardize the battle readiness of combat troops (Griest, 2021). As for the notion of internalized sexism, please see the “Love” chapter herein, though I don't actually think Griest is participating in sexism by asking for standards to remain as they lie.

在樹上的生活很美好：Fleagle, 2003.

五百五十萬年前，全球氣候已經改變：Senut et al., 2009.

大陸裂開，會對氣候產生許多影響：Sepulchre et al., 2006; Pik, 2011; Wichura et al., 2015.

人類與現在的黑猩猩和巴諾布猿，在DNA上有將近99%是相同的：The latest numbers show our genome sharing 98.7% with bonobos and 96% with chimpanzee, but given issues with overlap, insertions, and deletions, most folk in the know—the Smithsonian, for instance—generally say we share 99% with them both (Prüfer et al., 2012; Waterson et al., 2005; Mao et al., 2021).

當樹木比較矮、用手吊掛要比坐在樹枝上支撐更穩定：Hunt, 2015.

阿爾迪是我們所擁有的最佳證據，指出了男性和女性肌肉骨骼系統性別差異的根源：Lovejoy et al., 2009. Many papers were released essentially simultaneously on Ardi's discovery, a handful of which can be found in the bibliography.

這也是人類很容易出現拇趾外翻（拇囊炎）的重要原因：Latimer, 2005.

阿爾迪的步態可能有點生硬和搖晃：For an excellent overview of the current literature on gait mechanics and ancient hominins—what we know and what we could know from fossils of the pelvis and lower limb and contemporary anatomical experiments on living humans, see Warrenner, 2017.

女性進行的膝關節置換手術，通常比男性多得多：Maradit Kremers et al., 2015. Women also have more hip replacements, and while aging is an independent factor for these joint surgeries, women's hip replacement is more closely tied to age than the knee (that is, more older people have hip replacements and more older people are women, but even at younger ages more women have to get their knees worked on or replaced than men).



鬆弛素濃度在排卵期、懷孕早期、以及懷孕末期達到更高：And when levels stray from the normal, relaxin may even have a role in preterm birth (Weiss and Goldsmith, 2005).

所有胎盤哺乳動物都會製造鬆弛素：This is an understatement; its analogues are also found in fish, and the relaxin family of peptides should be considered wildly ancient in the animal kingdom. Like many useful molecules, one presumes relaxin's role in placental reproduction was largely a repurposing of existing systems. For instance, while it's now known to have a role in early pregnancy in marmosets, a big part of that role may be the growth of new blood vessels (Goldsmith et al., 2004).

女性脊椎演化成與黑猩猩不同的結構，會透過彎曲脊椎來保持重心更穩定：Whitcome et al., 2007.

這種拉扯與鈣化，和骨骼組織的生長方式關係密切：This is, of course, a simplification, and there are a few different complex systems at play, but the central concept here is that load bearing as mediated through muscle directly affects bone growth throughout the life span and that it's deeply flawed to try to think about the skeleton fully independently from the musculature it interacts with (Tagliaferri, 2015). It's also true, however, that male and female bones build themselves slightly differently, with typical male bones building more of an internal layer and a thinner outer layer, while female bones build a thicker cortical layer and a thinner core, effectively making female-typical bones more slender. This makes them particularly vulnerable to fracture as that outer layer thins after menopause. For a good overview of what's known about aging musculoskeletal systems, see Novotny et al., 2015.

上半身的骨骼肌似乎受到男性性激素的調節：Round et al., 1999. For one recent study specifically on muscle effects in trans men receiving hormonal genderaffirming therapy, see Van Caenegem et al., 2015.

黑猩猩的新陳代謝和肌肉組織是為爆發性出力而設計的：O'Neill et al., 2017.

一旦達到極需要耐力的距離，女性甚至可以擊敗男性：Ronto, 2021.

與特殊的脂肪代謝相關的基因，在年輕女性肌肉細胞中的表現高於男性：Maher et al., 2009; Maher et al., 2010.

阿爾迪很可能生活在廣大莽原中的河畔森林裡：Cerling et al., 2010; Cerling et al., 2011; Louchart et al., 2009; White et al., 2009; White et al., 2010; WoldeGabriel et al., 2009.

我們空出了雙手來攜帶武器：This is well trod enough in the field, but I think an old analogy by David Pilbeam provides the most articulate critique：much as our dexterous hands didn't evolve in order to play violin, the hunting capacities of our bipedalism are likely a

later add-on, with bipedalism itself essentially “preadaptive” in this regard—evolving first in ways that most likely involve plant-focused feeding behaviors and only later utilized for things like running and hunting (Pilbeam, 1978).

我們的演化是為了超越敏捷的有蹄類動物，像是鹿、馬、野牛：Lieberman is probably the most vocal advocate of this theory among academics, and his arguments for the evolution of endurance running are particularly persuasive (Bramble and Lieberman, 2004). In the popular press, Christopher McDougall gained traction with his *Born to Run* in 2009, which highlighted the evolutionary theories around endurance running and bipedalism alongside his more contemporary stories. As for whether sweat was particularly necessary, Lieberman also proposes that hominin locomotion and cooling systems evolved separately and only became tied (ability to run and ability to sweat to cool off while running) later (Lieberman, 2015).

時而用後肢站立，時而用指關節朝前，齜牙咧嘴，大聲高叫：This is a commonly known behavior among extant apes, chimps particularly. Jablonski makes an interesting twist for the “display” theory of bipedalism, however：in competitive environments, having regular threat displays (standing up, puffing your chest, being threatening on two legs) and regular appeasements might do well for ancient hominins. In simple terms, that means the difference between blustering and actual war. One costs lives; one costs pride (Jablonski and Chaplin, 1993).

雌性可能正在照顧日益需要幫助的嬰兒，因此無法自己走路，而成為這種交易的對象：White et al., 2015. I admit it's odd to have Dr. Lovejoy be one of the very few scientists I name outside the notes. Given the sheer mass of scientists' work underlying these chapters, I purposefully chose to let the ideas speak for themselves rather than build a hero's story out of one lab or another. (Science is, at its core, a collaborative process, and many science writers are guilty of erasing that process in the desire to name heroes.) But given how very important Dr. Lovejoy's work is to the field, and given that I'm disagreeing with him—or at least gently pointing out the unlikelihood of ancient primate monogamy being linked with bipedalism (which is hardly the focus of his major contributions in *Ardipithecus*, but nevertheless a behavioral interpretation he leans on)—it seemed more respectful to name him directly. For further evidence of the difficulty involved in creating a mostly monogamous primate society, much less a patriarchal version of such a thing, see the “Love” chapter.

夏娃身上可能依然有毛髮，讓幼兒的小手可以攀附：The best argument I've heard for when we must have been hairless is the divergence of our head and body lice, which dates to

roughly 190,000 years ago—leaving our nonhuman Eves rather furry and lousy, I'd say (Reed, 2007; Toups et al., 2011).

在現今的黑猩猩社會中，許多雌性也會用性來換取肉類和其他珍貴的食物：Gomes and Boesch, 2009.

這就是現今黑猩猩對珍貴食物的處理方式：Carvalho et al., 2012.

人族為什麼演化成直立行走的最令人信服的論點，並非關於運動的短期表現，而是關於耐力：Resistance to fatigue is a big part of how you take a chimp-like body of our ancient Eves and make her walk around all the time. But not that walking isn't the only thing we were necessarily doing that required endurance. For example, digging up tubers all day long also requires the sort of resistance to fatigue and general metabolism that can produce sufficient endurance to make such activities worthwhile, and a number of extant human food-sourcing behaviors likewise lean on our species' unique ability to endure (Kraft et al., 2021).

博利士官長：Lemmon, 2015.

從國際太空站返回的太空人，都出現了明顯的肌肉萎縮：Perhonen et al., 2001.

太空人的肌肉組織會轉換，從慢縮肌組織轉變為快縮肌組織：Fitts et al., 2001.

一些男性花了兩個多月的時間，才完全恢復因手肘屈曲運動而失去的力量：Semmler et al., 1999; Sayers and Clarkson, 2001.

女性一旦休息一下，就可以比處在類似情況下的男性，還要快再次上工：Interestingly, even a report from the U.S. Marines recently found evidence of this phenomenon, quite without meaning to：In a gender-integrated unit, the female soldiers suffered higher rates of musculoskeletal injury (40.5% versus 18.8%). However, while they were therefore more likely to be unavailable for training due to the injury, they also were out for fewer days than males who'd suffered injuries. In other words：more injuries, but faster recovery times (USAMEDCOM, 2020). The general availability for training, however, came out rather similarly in the end：98.4% available for the males versus 96.8% for the females, implying a rather small difference in global readiness. For both sexes, most of these injuries were tied to load-bearing activities.

在常規的遊騎兵訓練課程中，34%的候選人必須重複至少其中一個階段的課程：Tan, 2015, quoting Colonel David Fivecoat, commander of the Airborne and Ranger Training Brigade.

格里斯特上尉主動提出要幫他拿：DVIDS, 2015; Oppel and Cooper, 2015.

他當時在那兒完全累垮了，而格里斯特上尉依然體力充沛：DVIDS, 2015. Two stories, in fact,

exist from Rangers who completed the course with Griest and other women, both similarly reporting that women would take heavy loads from their fellow male rangers when they'd become too tired, notably when other male recruits simply couldn't. You can hear them for yourself in the DVIDS 2015 video, starting at minute marker 13:06.

「這是我們的武器，他們不喜歡被我們殺死」：Lemmon, 2021. For a more general overview of the situation of women and war among the Kurds, also see Sankey, 2018. The author is a scholar housed in the U.S. Air Force Air War College. Neither of these books will tell you everything you need to know about the Kurds, not by a long shot, and Sankey's entry glosses rather quickly over the Marxist influence on the rise of the PKK. But for those who want to dip a toe, they do put Rehana's story in perspective; the conflict of how one should deal with gender, you see, is very much a part of the conflict between Turkey and the Kurdish people. For a deeper analysis of how gender is enmeshed in the rise of the PKK, see Açık, 2013.

伊斯蘭國2014年在推特上發布了一些照片：Rakusen et al., 2014; Silverman, 2015. There is also a large Twitter history related to Rehana, some of which includes Silverman's tweet thread about the Rehana story and how Carl Drott, the Swedish journalist who met the woman in the photograph, is pretty sure she didn't kill a hundred members of ISIS, nor was she even a sniper. I, too, was unable to track down this ghost of a woman, and I hope deeply that she is well and living comfortably somewhere and is not, in fact, murdered, unlike her father. For the citation work, meanwhile, it just so happened that while this book was going into copyediting, Elon Musk had just finalized his purchase of Twitter, so I hesitated to cite Twitter sources directly, instead leaning on secondary sources where I could. I admit I don't know what will become of the public record this odd little social media company has produced, and I'm not the only one worried about that：even the U.S. Library of Congress is struggling to keep up (Stokol-Walker, 2022).

國防部長卡特建議，所有女性都有平等機會在軍隊中擔任戰鬥角色：Pellerin, 2015.

混合性別軍事團體的歸屬感與單一性別團體一樣高：And on especially challenging cognitive tasks, mixed-sex groups in the U.S. Marines apparently perform better (MCCDC, 2015).

整個美國軍隊都存在性虐待和性侵犯問題：Morrall et al., 2015. For one good argument about why gender-integrated basic training might be particularly good for reducing these issues across the military, see Lucero, 2018.

## 第五章 工具

我寧願在戰鬥中重新站起來三次：The translation varies. It should probably read “stand three times with a shield,” as in David Kovacs's translation, meaning she'd rather go to war (ostensibly on the ancient Greek version of the front lines, in tight battle) than give birth even once. While it's tempting to think Euripides had some prescient insight into postpartum depression here, or a deep intuitive knowledge of our Eves' suffering, I think it's instead a reminder that his central character—a woman!— should be understood as equally heroic (or at least equally experienced in danger) as the typical heroes Greek audiences would watch in other plays on the same stage. She's also a woman oppressed and scorned in a foreign land. As Countee Cullen writes of her in 1935, the fact that she takes her dead sons away on the chariot is as much “saving” them as depriving Jason of joy. “I will not leave my children here to die by other hands than mine,” she says. “I will bury them myself where no hostile hand can dig them up to defile their little bones” (Cullen, 1935, 54, 61). So off she goes in her chariot, given to her by the gods, to later cure Herakles of his god-given madness, which had led him to murder his own wife and sons. There's just a lot of son murdering going on in Greece. Just a lot.

章魚的觸手會使用工具：Finn et al., 2009.

烏鴉非常喜歡使用工具：Rutz et al., 2018.

早期人族大多吃草、蟲子、水果和塊莖：Notably, the presumed Habilis diet was less varied than the diet of Homo erectus, implying a much broader food strategy involving a range of harder things and softer things, which speaks to both their remarkable ability to migrate and their general opportunistic omnivory (Ungar and Sponheimer, 2011).

用來挖出某種古代蕪菁的尖銳棍子：Harmand et al., 2015.

在塞內加爾的某個地方，有一隻黑猩猩正在狩獵：Pruetz et al., 2015.

巧人在兩百八十萬年前到一百五十萬年前居住在坦尚尼亞的草原高地上：Leakey et al., 1964. Please note that there's current debate as to whether Habilis even belongs in Homo, or if she's instead an australopithecine, or even her own genus (Wood, 2014). Using Habilis as an exemplar species isn't meant to erase that debate, but is more an homage to Leakey and the obvious choice, together with Erectus, for Eves that had all the right pieces in place for the origins of human gynecology.

巧巧經常成為獵物：Brochu et al., 2010; Arriaza et al., 2021.

人類顯然比黑猩猩和巴諾布猿更為互助合作：I don't think it's possible to overstate the influence of Sarah Hrdy's work on the scientific understanding of alloparenting and why it matters so much for human evolution. Her book Mothers and Others (2009) is probably the most famous, and terribly readable—do spend the time if you haven't already. In fact, one of the reasons I focus on the pregnancies and post-birth recoveries of our Eves isn't simply that it's a topic that's been neglected thus far and has such an obvious effect on our species' evolution; it's also that what happens after the postnatal recovery period is already discussed so beautifully by Hrdy that I'd simply spend all my time waving her flag.

這些爭論通常忽略了嬰兒出生之前發生的事情：Trevathan makes a bid for the obstetric dilemma (and bipedalism in general) as the starting gun for our race toward midwifery (and as such, toward assisted birth becoming not only a basal hominin behavior but an imperative for complex rules around the birth, thereby setting the stage for implicit power structures around female bodies in hominin societies). It's a fascinating argument, but it admittedly attends primarily to the act of midwifery during labor and delivery, leaving most of what comes much before or after by the wayside (Trevathan, 1996). As any good ob-gyn will tell you, what happens in that moment is profoundly shaped by the prenatal care you've received prior, and while one needs to be ready for any of a host of ways the birth could go sideways, even perfectly normal births are still quite dangerous in the days after the birth has already occurred.

當巧巧出現時，讓繁殖伴隨難以逆料風險的特性，可能已經出現了：The problem of the narrow birth canal was in place, by most estimates, by the time Lucy was walking about her furry day, although unlike humans her babies at least didn't have to rotate quite as much to get out (Rosenberg, 1992; DeSilva et al., 2017; Laudicina et al., 2019). Neanderthals, meanwhile, had roughly the same difficult births as we did, though their mechanisms were a bit more primitive than ours (Weaver and Hublin, 2009). The problem of the invasive placenta is harder to date, but may be tied to encephalization (growing brains are hungry) or climate instability (it's good to have fat babies in a wasteland), both of which have a bursty, extended history that begins some time after Lucy and her fellow australopithecines and really hits its peak by the time we arrive at Homo (Potts, 2012). For more on climates and our giant heads, see the “Brain” chapter.

如果你不能繁殖，血脈就會滅絕：This is a self-obvious statement. However, I'd also like to point out that maternal mortality is a particular problem for primates of many stripes：not

only does early maternal death make it more likely for a female's offspring to die before reproducing, but should those offspring survive to have children of their own, they're also less likely to be able to produce offspring (that is, dead mom's grandbabies) that survive to reproductive adulthood (Zipple et al., 2020). In other words, the primate reproduction model leans so heavily on the mother that having the mother crippled and/or dead has even more of an effect on evolutionary fitness than it would in other species. That makes the clearly bonkers human reproductive system that much more unlikely. Without behavioral innovations around these problems, we'd be kaput.

澳洲毛鼻袋熊通常每兩年才繁殖一次，一次只生一個孩子：Not to rag on these gals, but they also prefer to dig their burrows in very particular, sandy soil near ancient dry creek beds in Australia, and even then, particularly in the spreading root ball of one particular tree (Queensland Government, 2021). Ever met somebody who'll basically date only one very specific, mostly nonexistent type of person? A person who complains about how annoying dating is and maybe has an extensive collection of bubble-gum wrappers, carefully ironed and kept in plastic, from the 1980s? This person doesn't really want to date someone. This person is, in fact, a closeted northern hairynosed wombat.

古代鐵製陰道擴張器：Hargest, 2020; Milne, 1907.

人類女性因為妊娠併發症而死亡的比例為1%到2%之間：What would this number be in ancient humanity? We have some windows, but they're complicated. For example, certain premodern human populations lacking modern medical care have low rates of death during childbirth (less than 3%), but this is a particularly narrow window to test, because it doesn't count death during pregnancy nor during the extended postpartum period (Lahdenperä et al., 2011). But more important, even “premodern” populations (whether the Finn and Canadian represented in this study, or even hunter-gatherer communities studied elsewhere in the world) have gynecology of the sort I mean here：they have midwives and shared knowledge of female reproduction. They have long-established medical practices and pharmacology associated with female fertility. And as I'll discuss in the “Love” chapter, they also have other behavioral interventions around female fertility—established cultural rules around when women are to become pregnant and give birth (a part of the evolutionary perks of sexism). So that 3% represents what you can get to once you have gynecology at all. What the death and complication rates would have been at the dawn of the hominin line is hard to say, but if gynecology has an on-ramp of a sort among the australopithecines, it's certainly going to be well in gear by the time we arrive at *Habilis*, and by the time you

arrive (much later) at *Homo sapiens*, it should probably be considered part of our species' basal social-behavioral suite.

要把西瓜塞進檸檬大小的洞裡是很困難的：Wittman and Wall, 2007. Some have recently argued the obstetric dilemma used to be more variable than it is now, which might be an agriculture thing (we make bigger babies now because we have the food to do so) (Wells et al., 2012), but even with some variability in effect stemming from direct obstruction in the birth canal, that doesn't really eliminate that it's a part of our species' broader reproductive woes (Haeusler et al., 2021), including all the various ways we have heart attacks and/or strokes and/or hemorrhages and/or kidney damage and/or liver failure and/or ongoing metabolic problems because of our clearly terrible human pregnancies rooted in our deeply invasive placentas (Abrams and Rutherford, 2011).

黑猩猩分娩過程大約四十分鐘：Elder et al., 1931; Hirata et al., 2011.

現代人類的懷孕時間，比體型和人類相同的猿類，估計約多出了三十七天：Dunsworth et al., 2012. Thurber even aligns human pregnancy and lactation with arctic trekking and other “extreme metabolic activities” in order to calculate the maximum human threshold for metabolic load (Thurber et al., 2019). It's a convincing paper. It also provides an interesting perspective on why human women do so well in ultramarathons.

2013年的一隻滇金絲猴：Ding et al., 2013.

哺乳動物主動助產的第一個明確證據：Pan et al., 2014.

雌性黑猩猩分娩後會等待一段時間，才在關鍵的初期幾個小時裡哺乳孩子，這段期間會保持安靜，並遠離群體：Nishida et al., 1990. Notably, it's not just the females who might murder the newborn; even local males might snatch away the baby and eat it if she gives birth where others can see her (Nishie and Nakamura, 2018).

主宰的雌性黑猩猩會殺死地位較低的雌性黑猩猩後代：Goodall, 1986, 1977, 2010; Pusey et al., 2008.

有助於主宰的雌性黑猩猩維持自己的社會地位：Pusey and SchroepferWalker, 2013.

2014年，剛果的研究人員終於目睹巴諾布猿分娩：Douglas, 2014.

2018年，研究人員又有了三個觀察巴諾布猿助產的案例：Demuru et al., 2018.

一群雄鴨會圍困、輪姦一頭雌鴨：Prum, 2017. This is true of a good many duck species, in fact, though the mallard is probably the most talked about, in part because the species is so common and visible in American suburbs and their associated lakes and ponds and

little rivers. Learning that mallards are prolific rapists feels, to an American mind, a bit like browsing the U.S. registry of sex offenders to learn how many live in your neighborhood. You're welcome to try it, but fair warning, it won't make you happy : www.nsopw.gov.

你可以在所有需要把陰莖插入陰道進行繁殖的動物中，看到這種共同演化：Hosken et al., 2019.

雄性海豚成群結隊，阻止當成目標的雌性浮出水面呼吸，讓她筋疲力竭、窒息屈服：These behaviors are typically called herding, which calls to mind the Australian cattle dog, but I'm afraid the reality is decidedly more rapey (Smuts and Smuts, 1993; Connor et al., 1992; Connor et al., 2022). Due to the obvious problems with direct observation, most dolphin sexual coercion is inferred after the fact, such as through tooth-rake marks (Scott et al., 2005). Meanwhile, the female dolphin's vagina seems to have evolved rape countermeasures of a sort, commonly seen in other species with a significant history of rape (Orbach, 2017).

布魯斯效應：Bruce, 1959. For a nice framework to understand both infanticide and the Bruce effect, see Zippel et al., 2019, which puts both under an umbrella of “male-mediated prenatal loss.”

齧齒動物有布魯斯效應：Mahady and Wolff, 2002; de Catanzaro et al., 2021; YolesFrenkel et al., 2022.

馬也有布魯斯效應：Bartos et al., 2011.

獅子似乎也有布魯斯效應甚至靈長類動物也布魯斯效應：Bertram, 1977.

甚至靈長類動物也有布魯斯效應：Roberts et al., 2012.

獅尾狒：出處同上。

若要避免自然流產，你必須讓母馬與熟悉的雄馬繼續發生性關係：Bartos et al., 2011.

大約三分之一的小馬不是由主宰雄馬所生：Bowling and Touchberry, 1990.

美國5%的強暴案導致了懷孕：Holmes et al., 1996.

其他地區的人類社群的比率與美國相似：One Ethiopian study did report a much higher rate (17%), but it's unclear if that's because it involved an anonymous, self-reported questionnaire of high school students, which might not have controlled for things like how many sexual events were involved close to the rape and subsequent pregnancy (Mulugeta et al., 1998).

一次性交導致懷孕的機率只有9%，而在不容易受孕的日子裡，這個機率幾乎為零：In other words, being raped doesn't make you less likely to become pregnant than if you'd had

the sex consensually, nor does it make you more likely to become pregnant (as discussed at greater length in Fessler, 2003).

與某一男性經常發生性關係的女性，比起只在排卵期間進行一兩次性行為的女性，更有可能懷孕：Kenny and Kell, 2018. She'll also have a lowered risk of preeclampsia if she's lived with him—and had sex on a semi-regular basis during that time—for at least twelve months (Di Mascio et al., 2020).

壓力大的女性更有可能流產，但是這並不像布魯斯效應那樣可預測：Qu et al., 2017.

剛果民主共和國女性懷孕是因為受到強暴的比例，要比世界上幾乎其他任何地方都來得高：This is the natural conclusion given that forty-eight women are apparently raped every hour in the DRC (Peterman et al., 2011) and women refugees are significantly more likely to be victims of sexual violence compared with the general population (Hynes and Lopes Cardozo, 2000). This is also true of the men and children in refugee populations, but of the adult men, much less.

許多動物（包括靈長類）似乎也在尋找含有「能幫助改善自身健康的化合物」的植物：Huffman, 1997; Fruth et al., 2014.

患有腸道寄生蟲病的黑猩猩會花長達八分鐘的時間，仔細剝去扁桃斑鳩嫩芽的外皮與外層：Huffman, 1997; Huffman et al., 1997.

在整個靈長類動物界，都發現了類似的自我服用藥草的行為：Huffman, 1997.

在烏干達，有一群紅疣猴會依照季節，吃含有雌性素的植物葉子：Wasserman et al., 2012.

直立人是有史以來最成功的人族之一：Potts and Teague, 2010. e0'v0e0fouWnd charred remains : Berna et al., 2012.

直立人發明了阿歇爾工具：de la Torre, 2016.

最小可存活族群：Shaffer, 1981. By definition, any species that's managed to survive geographic expansion and the resulting founder effect did somehow manage to reach their MVP in at least some of their new territories, and the strength of that effect can be tied to both recency and speed by examining genetic loss of diversity in current populations (Peter and Slatkin, 2015). For humanity, analyses like these are generally used to support current models for ancient human migrations out of Africa (Ramachandran et al., 2005).

人類受孕後，實際上只有50%能生出嬰兒：March of Dimes, 2017. This number remains mysterious in no small part because it's likely only a few human pregnancies are actually known to the person carrying them, much less that person's clinician. If you count



pregnancies that are known to have implanted, the miscarriage rate seems to be around 30% (Hertz-Picciotto and Samuels, 1988). It's also true that “pregnancy” only begins after successful implantation in the uterus; a fertilized embryo is not yet a pregnancy, even though development has already begun. If you count all the fertilized human embryos that briefly exist in human pelvises, the number would be significantly higher.

在排卵日發生性行為的健康女性，懷孕的機會只有9%：Wilcox et al., 2001.

和其他族群隔離長達一百五十年的人類族群，如果要繁衍下去，最小可存活族群需要有一萬四千名成員：Smith, 2014.

奠基者效應：Amos and Hoffman, 2010.

由於女性的生理特性，茲卡病毒對女性來說，可能成為一種不同的疾病：Lee et al., 2021.

孕婦罹患瘧疾而出現重症的機率，是非孕婦的三倍：Schantz-Dunn and Nour, 2009.

病原體常躲在胎盤中：Schantz-Dunn and Nour, 2009; Fried and Duffy, 2017.

## 第六章 腦部

小女孩靠在座位上，繃著臉不肯喝牛奶：Jackson, 1959/2006. Like much of Jackson's work, the book is solidly about the Feminine Condition in Jackson's time. You're welcome to disagree, but a hell of a lot of people are going to fight you on that one. The insanity is America's, but the House is Hers. For what it's worth, Jackson used the money from the book's film rights to buy curtains, a piano, and a washing machine (Franklin, 2016). For the author, too, domesticity continued.

在睡覺時會忙著分配脂質，有些是為了自己腦部的成長：My portrait of the brainy hominin Eve leans heavily on research in early hominins as a prey species and the brain-eating habits of local carnivores (Brain, 1981; Hart and Sussman, 2005; Arriatza et al., 2021), as well as conversations with various scientists in the field, including Rick Potts at the Smithsonian. Though Brain's work focuses particularly on skull punctures in australopithecines by felids, later work also shows hyenas doing the same (Arriatza et al., 2021). And of course, ancient hominins did this, too, transporting the heads of already-dead animals over long distances to crack open and share the brains back home (Ferraro et al., 2013). It's unclear whether later hominins, like Erectus, would have prey as often as the australopithecines, given their

capacity for running and hunting, but the notion that our Eves grew increasingly large brains simply because they became so dominant in their local food web never sat right with me. It also seemed useful, right at the start, to point out how very juicy hominin brains would be to their predators：sopped with sugar, run through with blood and fat, and increasingly expensive to build and maintain. Big-brained hominins' bodies (potentially with a lot of adipose tissue to support that lengthy brain growth and buffer against inconsistent food supply) would also have been rewarding to any predator that managed to get their teeth into one.

前額葉皮質一直一直變大：Ruff et al., 1997. And it seems particularly on the left side, which may be a generalized trend for the ape lineage, making the later hominin Eves an extreme example of Ape Brains at Large (Smaers et al., 2011; Smaers et al., 2017). The human-type globular shape, however, continued to evolve as late as 100,000 to 35,000 years ago, which may be mysteriously tied to modern human behavior (Neubauer et al., 2018), but some features of the braincase may evolve independently from internal organization of the brain itself, making endocasts harder to interpret (Alatorre Warren, 2019). What is abundantly clear, however, is that the degree of encephalization radically increased across the hominin lineage.

腦組織是身體最為飢渴的部位：How expensive? The modern human body dedicates roughly 20 to 25% of its resting metabolic rate to brain activity (Leonard et al., 2003).

在齧齒動物中，腦中與焦慮有關的部位似乎存在顯著的性別差異：Premachandran et al., 2020.

大部分物種的雄性，會比雌性更常表現出冒險行為和攻擊性：Trivers, 1972; Byrnes et al., 1999; Apicella et al., 2017; Campbell et al., 2021.

一般雄性哺乳動物腦部的某些部位，具有的雄性素受體也比雌性多：Goldstein et al., 2001; Sato et al., 2004; Dart et al., 2013. However, see Eliot's recent threedecade meta-analysis of sex dimorphism studies, which notes that while androgen receptors do vary in density in ways that are sexually dimorphic, the most robust finding across the sexes in humans is largely tied to size (Eliot et al., 2021).

雄性小鼠經由輕微的負面刺激而學習的能力，稍遜於雌性小鼠：Yokota et al., 2017.

人類女性診斷出患有焦慮症的機率更高：Kessler et al., 2012.

人類男女性的腦部總是一樣：Eliot et al., 2021. In fact, the general cognitive functionality between the human sexes is so bewilderingly similar that some even thought to name it the “gender similarities hypothesis,” the implications of which I explore in this chapter (Hyde, 2005).

成年人的平均新陳代謝要比黑猩猩高得多：Pontzer et al., 2016.

男性是否演化得比女性更聰明：At least adults and children alike seem to think intellectual brilliance is a male thing (Storage et al., 2020).

到了青春期的平均智商開始略高於女孩：Lynn and Kanazawa, 2011; Ellis et al., 2013.

智商可以預測你在學校的學習進度、你可能的收入範圍：McCall, 1977; Deary et al., 2007; Strenze, 2007; Griffiths et al., 2007. Note, however, that your adult wealth is decoupled from your IQ, while your income is not—meaning plenty of smart folk fail to save much money as they go along, and of course your parents' wealth continues to be the strongest predictor of your wealth as an adult (Zagorsky, 2007). Please also note the difficulty in excluding known eugenicists from short lists like these in an endnote—for example, I've deliberately excluded Richard Lynn's research, despite how often he's cited regarding the fertility issue. I do so, in fact, not for the sake of politics (though I'd obviously personally prefer that such ideas be wrong), but because problems frequently lie in both those studies' interpretation of data and in their frameworks, as shown in subsequent research and analysis by others (for example, Rojahn and Naglieri, 2006; Savage-McGlynn, 2012). For a usefully scientific critique of Lynn's work on IQ and fertility, please see Nicholas Mackintosh's review (Mackintosh, 2007). I can say that while it may be true that there's a link between fertility and IQ in the twentieth century, it doesn't appear to be easily disentangled from general socioeconomic influences or any of the other messy things that influence a woman's likelihood to have children at one age or another.

因收養而分開的同卵雙胞胎，往往具有相近的智商分數：Segal, 2000; Deary et al., 2009; Lee et al., 2010.

智商的遺傳程度在50%到80%之間，最新研究顯示接近80%：Deary et al., 2009; Lee et al., 2010; Panizzon et al., 2014; Lean et al., 2018.

美國白人的平均智商分數往往高於非裔美國人：Dickens and Flynn, 2006.

如果你測試足夠多的非裔美國人群體，其中的分數差異會大於該群體與美國白人或亞裔美國人群體之間的分數差異：This idea is well trod. I don't mean to wade into the IQ controversy much in this book, but suffice to say that Black Americans have significantly increased their in-group average IQ relative to white Americans in the last half century, which undermines the idea that genetic drivers are the sole cause of between-group differences (Dickens and Flynn, 2006). No one who works in the science of human intelligence assumes IQ is driven purely by nature or nurture, but some amalgam of both. For instance, IQ seems oddly more heritable in adulthood than early infancy, but then declines again in very old age

(Lee et al., 2010). Maybe that's because until recently, most of us didn't survive into old age, or maybe it's because the complicated factors that drive human senescence aren't entirely genetic, and aging is associated with cognitive decline (ibid).

一般的女性和男性都會位於鐘形曲線高高拱起的部位之中。你往往會發現，最大差異的地方是左右尾部：Deary et al., 2003; Johnson et al., 2008.

男性考生的變化程度要比女性大得多，鐘形曲線的某一端尾巴有更多數學天才，而另一端則有更多的數學白痴：Deary et al., 2003; Johnson et al., 2008.

男性與男孩在涉及空間推理的測驗中，表現往往比較好：Halpern et al., 2007.

男孩可能在很大程度上，能更快回答有關3D物體旋轉的問題：Maguire et al., 1999. Another way of saying this, as applied to math, is that male and female test-takers deal with certain kinds of math questions using different strategies, and you're more likely to find differences in scores where questions reward only certain strategies (Spelke, 2005).

如果空間測驗的物體形狀類似人形，則女性的表現與男性一樣好：Tarampi et al., 2016.

Importantly, this inclusion is also framed as a social task, advertised as being something women are better at, which potentially included stereotype threat as a factor in subjects' performance (ibid).

某些智商測驗問題的設計似乎獎勵了男性的腦部：This is counterintuitive, in part, because IQ tests are largely designed to produce gender-equal results, selecting questions in development that are more likely to produce gender-neutral scores and scuttling ones that are strongly gender-biased (Halpern et al., 2005). So it's a bit unclear why we've ended up where we are in today's datasets. The answer might be simpler than you think : why not simply assume there are some minor sex differences in brains, which naturally produce sex-differentiated strategies for certain cognitive tasks, with certain strategies more rewarded in current IQ test questions? Thinking about the mental rotation tasks, for example, and what mechanisms might undergird these sex differences, many point to the parietal lobe, which seems to have a different proportion of white to gray matter between the sexes. In one study, such proportions were, even within-sex, strongly linked to performance on mental rotation tasks (Koscik et al., 2009). But as the authors note, it's likely a matter of strategy and efficiency : perhaps the males rotate the whole object in an imagined space, while females (or rather, people with female-typical parietal lobe organization, who tend to be otherwise female) instead rotate the object piecemeal, as suited to their particular parietal wiring. The latter strategy is less efficient, but not necessarily less accurate, given enough

time; time vs. strategy discussed in greater detail by Peters, 2005; Halpern et al., 2007; and Voyer, 2011). Do we assume, then, that's a difference in baseline general intelligence? Or simply an odd little glitch in an otherwise sex-same functionality? And how, exactly, should one design an IQ test to allow for such quirks between the sexes, without quickly being accused of writing tests for Kurt Vonnegut's Harrison Bergeron?

在許多與語言相關的測驗中，女性和女孩表現確實優於男性：Hirnstein et al., 2023; Halpern and LaMay, 2000.

當測驗涉及寫作時，尤其明顯：Adams and Simmons, 2019; Pargulski and Reynolds, 2017.

Please note, however, that the effect sizes we're talking about here are small, particularly in IQ tests, and only show up more significantly on tests that aren't already controlling for gender difference, like national writing assessments (Reilly et al., 2019).

許多數學問題要求用解釋性句子寫出答案……男孩在這些問題上的成績，通常比其他問題要差一些：Halpern and LaMay, 2000. It may depend on how, exactly, the question is asked in these short-answer format math problems—styles that favor mental rotation to determine a solution may favor a male-typical brain, regardless of how much writing that brain is then required to do—but again, across a broad swath of such things that require articulate writing skills as part of the tester's performance, boys seem to do a bit more poorly, particularly if the tester is required to write at length.

測試出的能力差異，遠小於誰獲得工作的差異：Spelke, 2005.

很少科學研究能夠精確測量一天中，男性和女性使用的單字數量：One study from 2007, using undergraduates at the University of Arizona, established that both men and women speak an average of sixteen thousand words a day. However, the males had the wider spread, from one guy who spoke only about five hundred words, to a guy who said about forty-seven thousand (much to the chagrin, one presumes, of his friends) (Mehl et al., 2007).

在有男性出席的專業會議中，女性往往發言較少：Kendall and Tannen, 1997. Importantly, they also speak less at scientific conferences in general, but that may be because women are less likely to request a long-form talk session than men; both are equally likely to be awarded the slot (Jones et al., 2014).

在課堂環境中，也是如此：This is a well-known and replicated finding over the last forty years of research in this area. But it may have as much to do with professors' class structure as male interruption—though male voices tend to occupy the sonic space in a classroom roughly 1.6x compared to female voices, it's also true that they speak without raising their hands more often (Lee and McCabe, 2021).

當我們聽到一個男性和一個女性對話時，通常會認為女性說的話比她實際上說出的還要多：Cutler and Scott, 1990.

女孩說出第一個字和第一句話的年齡，都比男孩小：Eriksson et al., 2012. Fascinatingly, four-year-old human boys also seem to have lower levels of FOXP2 protein in their left hemisphere cortex than in same-age girls, but as with all such studies, larger subject pools would give better insight (Bowers et al, 2013).

在最近的一項大規模國際評估中，女孩在言語測試中的得分全都比較高：Hirnstein et al, 2023.

要求考生建構不同事物之間的關係概念圖，而男性在該測驗中的得分高於女性：Spelke, 2005.

美國教育部的大量數據支持了這點，這種差異在其他國家也存在：Peterson, 2018.

購買和閱讀小說的人當中，男性僅占20%：Weiner, 2007, citing Nielsen Bookscan surveys in the United States, Canada, and U.K.

男孩在這兩方面都不擅長，而寫作成績又比閱讀成績低得多：Scheiber et al., 2015. Because writing isn't tested as often as other types of verbal skills, knowledge of this gap isn't as widely supported as other verbal ability gaps, but it deserves more attention (Reilly et al., 2019).

長時間默讀文字有困難，應該是我們這個物種的常態：Despite global gains in education in the last twenty years, even basic literacy—the mere ability to read text in one's native language—remains at a stubborn 86% worldwide (UNESCO, 2014). If that seems low, consider that forty years ago, it was 68%, which again might seem reasonable, until you realize that in the early 1800s, roughly 12% of the adult human world had any ability to read and write, and the entire nineteenth century improved that number by only about 9% (UNESCO, 1953; UNESCO, 1957). Even Ancient Rome, considered among the more literate of ancient societies, seems to have had a literacy rate that never rose above 10%, and most of that was clustered in the cities (Harris, 1991). Reading is simply not something the human species has done much of, anywhere, ever. I'm saying this in an endnote in an already-long book, which is an odd thing to do, but it's still deeply true.

男孩患有閱讀障礙的機會是女孩的兩倍到三倍：Rutter et al., 2004; Quinn and Wagner, 2015.

研究人員發現閱讀能力不全的學生中，只有不到20%的學生在學校中歸類為「學習障礙」：Quinn and Wagner, 2015.

閱讀能力隨著男孩年齡增長，差距也會擴大：Reilly et al, 2013.

從青春開始，女性比男性更有可能診斷出患有重度憂鬱症：Baxter et al., 2014. Please note, however, that in global data, the gap between male and female MDD diagnoses seems to narrow as societies become more gender-equal, which could reflect both a reduction in female gender role stressors and women's access to birth control, which itself might work to reduce depression by controlling hormone cycling and, of course, reducing the number of times a woman's brain is at risk of postpartum depression (Seedat et al., 2009).

來自美國的資料顯示，男孩和男性在遇到心理困擾時，往往會表現出來，而女孩和女性則傾向於藏在心裡：Eaton et al., 2012. Who suffer from depression : Soares and Zitek, 2008.

有雙極性患疾的女性，有時也會在經期中，出現更為顯著的狂躁和憂鬱的波動：Rasgon et al., 2003.

年輕女孩似乎不比年輕男孩更容易憂鬱：Cyranowski et al., 2000.

女性接受精神疾病治療的機率高出約 12%：Terlizzi and Norris, 2021.

男性診斷為思覺失調症的可能性略高：Aleman et al, 2003.

男性更有可能患有嚴重的藥物和酒精成癮：NIDA, 2020. Women are just as likely to develop substance abuse disorders, in fact, but men have much higher rates of use and dependence.

男性和女性診斷出強迫症的機率是相同的：Though females tend to be diagnosed later in life, both are roughly equal in diagnosis and treatment outcomes (Mathes et al., 2019).

在雙極性疾患中，女性病人似乎確實更常出現憂鬱發作：Arnold, 2003.

女性自殺率大約為男性的三分之一：Krysinska et al., 2017.

女性擁有更強大的社會支持網絡：This is notoriously tricky to measure, of course, because it's all self-reported; saying someone has a strong social support network is as much about that person's feelings of support as the actual people potentially involved, and both depressive and suicidal patients are rather known for being bad at positively perceiving the opinions others may have of them. Nonetheless, it's true that one either does or doesn't have a friend to call, or family members, or significant others. And women generally report both higher feelings of social support and larger numbers of people involved in those groups. When they grow older, this is also strongly tied to how long they're likely to live (Shye et al., 1995).

儘管只有女性才有產後憂鬱症，但是身為母親，因為憂鬱症產生自殺傾向的可能性要小得多：Dehara et al., 2021. Sadly, this is not the case for mothers whose children are

taken into Child Protective Services (Wall-Wieler et al., 2018). And among pregnant and postpartum women, whether or not that woman has experienced abuse is a strong risk factor for suicidal ideation—much more, in fact, than issues of social support, though women without much social support were still more likely to attempt to kill themselves than other mothers (Reid et al., 2022).

兩性之間這種親密關係的外在特徵可能看似有所不同，但是「親密」的整體感覺似乎大致一樣：Machin and Dunbar, 2013.

男性更有可能因嚴重的腦外傷而送往急診室，而女性更有可能從嚴重的腦外傷中康復：

However, in the small amount of published data available for TBIs properly analyzed for sex differences, it oddly seems women fare a bit worse (Farace and Alves, 2000), despite clinical opinion siding with the idea that women patients fare better and the overwhelming evidence that female rodents in the lab likewise do better on most measures. This paradox may have a few different things driving it : First, the few published studies that properly present and analyze for sex differences here may be too poor a selection—one meta-analysis in 2000 counted 8 (ibid). Second, modern human women experience more menstrual cycles than they would have historically, which includes monthly withdrawals from peaks in progesterone.

腦部重創的男性病人往往需要一年的時間，才能重新開始做一些事情：Please note that this is primarily for severe TBI. Mild to moderate TBI actually seems to have worse outcomes for women patients (Gupte et al., 2019). Thus, there's a bit of a gap between clinical expectation and patient outcomes, perhaps due in part to the differences in post-concussion syndrome in women, which presents differently (and seems to persist for longer) than it does in men (ibid). One key to these differences might be that in mild (concussive) cases of TBI, what's more at stake is less the widespread edema and cell death that one sees in severe TBI, and more how local axons respond in the brain around and in the injury site, which might be influenced by the pre-injury structure there, which is now known to have sex differences (Dollé et al., 2018).

男性腦部損傷部位周圍的發炎和病變範圍，似乎比女性更廣：This is particularly true for severe TBIs, seen in both rodent and human, and the link between sex differences seen in animal models and human clinical reports clears up a bit in meta-analyses, with the greatest effect seen in severe TBI (Caplan et al., 2017).

如果你在實驗室裡對大鼠的腦部做了可怕的事情：O'Connor et al., 2005.



人體臨床試驗正在進行，以確定給予女性性激素是否可以幫助創傷性腦損傷的病人穩定和康復：Two such trials completed in the last decade show mixed results (Skolnick et al., 2014; Wright et al., 2014). It may depend when and how the progesterone is administered：quite soon after injury, with no hormonal follow-up, doesn't seem to help, and slightly increased the chance of a stroke (Wright et al., 2014). But that might be, in part, because giving a quick dose of progesterone with no follow-up may risk withdrawal from PG afterward, which itself puts brains at risk—as seen in menstruating women—of a number of bad brain outcomes, including mood destabilization. In fact, when a woman suffers from a TBI during the luteal phase, when progesterone is naturally high and then drops off, she'll fare worse than women who are on birth control (who have consistently high PG) and women who are in a different phase of their cycle (Wunderle et al., 2014). Annoyingly, menstruating women and girls are also more likely to suffer such injuries during the luteal phase, potentially due to more lax joints, which might be part of what's driving women patients' poor outcomes in the data (Wunderle et al., 2014). In sum, progesterone shows promise for severe TBI, but it matters when you give it, and how much, and for how long, and it might simply help more for male brains than female brains, in the end.

雌性素似乎確實可以穩定血腦障壁：Sohrabji, 2007. This may be particularly important for out-of-hospital (rural/battlefield) stabilization after injury, with females (as usual) surviving better than males (Mayer et al., 2021).

黃體素似乎也在抑制發炎上發揮作用：Roof and Hall, 2000; Sayeed and Stein, 2009. For a solid review paper highlighting confounds and the overall mixed results of such studies, see Caplan et al., 2017. Microglia may play an important role, perhaps under the influence of progesterone particularly. Sex hormones can't be dismissed out of hand, given that postpubertal girls and women have better survival for severe TBI or males of any age and prepubescent girls (ibid). However, the age at which injury occurs doesn't indicate only hormonal status. While authors like Caplan tend to look at pre and post-pubescent pediatric groups to look for hormone signal, it's also true that developing brains respond to injury a bit differently precisely because they're on a developmental pathway, which is an independent confound (Arambula, 2019).

女性病人似乎對受傷和生病調養時該有的限制，也更有自覺：Turkstra et al., 2020; Rigon et al., 2016. They're also known to be more proactive in seeking medical care and rehab (Chan et al., 2016).

男性更容易罹患帕金森氏症：Gillies et al., 2014.

現代河馬的夏娃非常喜歡河流：There are a number of these in the fossil record, but the most obvious case would be Hippopotamus gorgops, a massive beast roughly twice the size of the modern hippo. Interestingly, this ancient hippo and ancient hominin Eves seem to have migrated at similar times (roughly 1.9 mya), when increasing humidity made for bigger lakes and rivers, which made the Sahara possible to cross (Zhang et al., 2014; van der Made et al., 2017). Given how many humans today's hippos slaughter, however, it's not likely the two would have been friends (van der Made et al., 2017). In fact, Erectus also had the habit of butchering them, when possible (Hill, 1983; Lepre et al., 2011)—a far cry from the adorable baby hippos we admire and protect in today's zoos.

歐氏獅尾狒：Diet was a major factor in their extinction, though not merely from climate change：competition with local ungulates also probably mattered, as there's only so much grass to go around (Cerling et al., 2013). The last surviving members of their genus, the geladas we met in the “Tools” chapter aren't as large and don't have as many ancient proto-antelope to contend with in the Ethiopian highlands. Please also note that our Eve Erectus may have also contributed to their extinction, given the large number of butchered juveniles found at Olorgesailie in Kenya (Shipman et al., 1981). Given that today's chimps commonly hunt other primates when the opportunity presents itself, it's not that much of a stretch to think that Erectus may have hunted the more vulnerable members of a local troop of grass-eating baboons. It's not that bigger brains couldn't have made our Eves more dominant in the local food web; it's more that hunting, on its own, seems unlikely to be the central driver.

大約在七百萬年前到六百萬年前，時值我們的夏娃與黑猩猩的祖先分開，氣候變遷加速了：I'm leaning heavily on Potts's work on variability selection here. In particular, see his paper with Faith from 2015.

人類出生時，腦部的大小大致等於新生黑猩猩的腦部大小：DeSilva and Lesnik, 2006.

黑猩猩從子宮裡出來時，腦部發育得顯然比人類嬰兒的腦部更完整：出處同上。

人類的腦部直到二十歲出頭，內部組織才完善：Goddings et al., 2019.

男孩比女孩更容易扭動和踢腿，並且更早做出使用到大肌肉群的標準身體動作：Fausto-Sterling et al., 2012. Importantly, we're really talking about early infancy here, predominantly in the first four months of life. These sex differences in motor skills then seem to drop off, only to pick up again after twelve months, which may have as much to do with the child interacting with gendered expectations for play as it does the body itself (ibid).

男嬰更有可能稍微早產一些：Blencowe et al., 2012. Unfortunately, preterm babies also don't



do as well if they happen to be male, despite tending to weigh more, which is otherwise thought of as an advantage for preemies (Peacock et al., 2012).

某些類型的自閉症病人的腦部，有些部位修剪過度或修剪不足，其他部位則沒有修剪：This is a broad field, and what we presently call the autistic spectrum will likely end up representing many different disorders with a variety of underlying mechanisms. But for a solid paper specifically tying autism to synaptic pruning, see Tang et al., 2014.

尼安德塔人的腦部更大，也具有黑猩猩的童年模式：One tooth study does indicate they may have entered adulthood roughly three years earlier than *Homo sapiens* (Smith et al., 2010), while another suggests they were better able to process supplemental foods by age two (Mahoney et al., 2021). As ape developmental patterns go, that puts Neanderthal childhoods somewhere in between the average chimp and the average human.

青春期的腦部「生長」並不像兩歲孩子那樣大幅度：Goddings et al., 2019.

重要的神經途徑會額外再追加髓鞘：Chavarria et al., 2014; Genc et al., 2023.

雖然女性和男性的腦部自我修剪幅度大致相同，但是男性修剪發生得比較晚，而且速度更快：De Bellis et al., 2001; Neufang et al., 2008.

## 第七章 聲音

這裡的歷史是口傳的：Kapusinski, 2001. I love much of this man's writing. His thoughts on “Africans” maybe less.

我也入戲頗深：Solnit, 2001.

有人在鄉間公路邊的土堆上發現了他：My portrait of this accident is drawn from a report on telemedicine in Vermont and upstate New York in 2001 (Rogers et al., 2001).

我們可能早在一百七十萬年前，就開始說話了：Everett, 2017. Even more controversially, one recent paper decides none of the most popular anatomical restrictions on speech capabilities are particularly unique in the hominin line, and thereby pushes the dawn of speech back to over 20 million years (Boë et al., 2019). Others stick to the guns, perhaps well fed on Chomsky, and maintain human specialness, comfortable only with 200,000 years or so—after the dawn of our species but before strongly symbolic behavior.

有些人認為在五萬年前才開始的：Lieberman, 2007.

人族最早也只在幾十萬年前，才擁有現代發聲器官：Barney et al., 2012.

創新的擴散速度讓大部分科學家認為，這必須使用到語言：Aiello and Dunbar, 1993; Dunbar, 1993, 1996.

人類最早的藝術主題是什麼？是打獵！：Well, unless you count handprints (Sharpe and Van Gelder, 2006; Bednarik, 2008; Zhang et al., 2021; Fernández-Navarro et al., 2022). Using a reed filled with red ochre dust, a number of cultures have made ghostly hand impressions on the walls of ancient caves. Other times tiny handprints have been found in soft mud. We only recently discovered, however, that many of these hands likely belonged to children—some as young as two or three years old—which rather puts a damper on the theory that ancient art is all about hunting or god (Langley and Litster, 2018). While it might be a kind of religious christening ceremony or a case of including children in normally adult activities (that is, tantrum avoidance under duress), it might also have been a bit like what mothers do with young children today : give them some art project to make it from breakfast to freakin' nap time.

較老人族中最有可能成為大型獵物狩獵者的直立人：And because many big carnivores that lived alongside them, like the felids I portray in the opening scene of the “Brain” chapter, just so happen to leave large amounts of meat on their prey, the number of such creatures living alongside our hominin Eves in any given ancient Eden might well have provided enough such nutrition for creatures like *Erectus* (Pobiner, 2015).

警告叫聲是如此靈活，以致只要改變聲音的順序，似乎就能如同原始的文法般發揮作用：Ottara et al., 2009.

人類受試者喜歡聽男性的聲音，而非女性的聲音：And masculine (i.e., lowerpitched) voices in women, too, in certain leadership roles (Anderson and Klostad, 2012) but not necessarily in the case of dating, which is more culturally and individually shaped.

希拉蕊·柯林頓即將做一件美國女性從未做過的事：Video of this event is available free online through PBS NewsHour at [youtu.be/pnXiy4D\\_I8g](https://youtu.be/pnXiy4D_I8g).

每公斤體重的絕對肺容量，男性要比女性多 10% 至 12%：Bellemare et al., 2003

我們說話時，呼吸道中的空氣力量非常高：Nishimura, 2006; MacLarnon and Hewitt, 1999; Lieberman, 2007; Ghanzafar and Rendall, 2009.

當我們說話時，女性的腦部比男性的腦部更頻繁向橫膈膜和「吸氣」肌肉發送訊號：That finer control may be part of why women's diaphragms also seem to be more protected

from fatigue (Geary et al., 2019) and both may be part of why women do so well in endurance sports.

希拉蕊實際上呼吸了五次，才說出了這段至關重要的話：You can watch her do this, if you like, because video of this moment is widely available on the internet.

如果你是一位專業上要使用聲音的女性，那麼你比從事同樣工作的男性，更有可能因聲帶拉傷而去看醫師：Hunter et al., 2011.

人族失去了喉囊：de Boer, 2012.

不久之前，人族依然有喉囊：出處同上。

言語因沒有了喉囊而受益：出處同上。

飼養靈長類時，喉囊感染是維持動物健康的主要難題之一：Lowenstine and Osborn, 2012.

從直立人時代開始，人類的喉頭在喉嚨裡下降的位置更低，為舌頭騰出了更多的空間：Lieberman, 2007. Please note that, as with many things in academia, the debate around whether or not the human vocal apparatus is the essential feature for the evolution of human speech is contested. W. Tecumseh Fitch (surely the best-named scientist in the field) disagrees with Lieberman as to whether macaques could produce speech sounds based on their anatomy—Fitch says yes and only neurological evolution holds them back, while Lieberman thinks the less-electric wetware still matters (Fitch et al., 2017). To some degree this is probably a simple intergenerational kerfuffle, but it also represents deeper divides in how scientists approach these questions：what can we learn from fossils (Lieberman) vs. living mammal physiology (Fitch) to model how our Eves evolved to make something as complex as human speech?

人類的雄性能夠發出通常只有體型是三倍大的動物，才能夠發出的低音：Fitch and Reby, 2001.

當雄性紅鹿發出叫聲時，陰莖也會上下擺動：出處同上。

女性較高頻率的聲音更令人嚮往、更討人喜歡：Zuckerman and Driver, 1989.

天生聲音較低的女性，身體中的雌性素濃度往往較低：出處同上。

女性喉頭的內壁，似乎會隨著月經週期而改變：Ryan and Kenny, 2009.

經前症候群症狀比較嚴重的人，在月經前後的聲音品質更有可能發生明顯的變化：Banai, 2017; Ryan and Kenny, 2009.

大部分女性也會注意到更年期的聲音變化：Schneider et al, 2004.

就收縮壓力而言，子宮是體內最強的肌肉：This is both for constricting pressure in general and by potential force compared to the muscle's weight：the average adult uterus weighs about forty ounces but can exert a force of up to four hundred newtons with each contraction during labor. That's about eighty-eight pounds of downward pressure.

南猿的舌骨基本上與黑猩猩的位置相同：Capasso et al., 2008; Steele et al., 2013.

舌頭位置往下移動是使得言語可能出現的原因之一：Steele et al., 2013.

與男孩相比，女孩出現口齒不清和其他功能性言語障礙的機會比較小：Black et al., 2015.

我們獨特的人類基因，已經事先把腦部設定好了，讓腦部能夠學習語言：So much has been written on this subject that providing a single citation feels silly. But if you want to read a nearly perfect book, see Steven Pinker's The Language Instinct. I may differ from his position on motherese, but otherwise I'm an obvious student of his work. An acolyte, really.

法國新生兒的哭泣是上升的旋律：Mampe et al., 2009.

對於流利使用第二語言，依照不同的研究結果，學習的最佳年齡範圍在十歲到十七歲之間：Hartshorne et al., 2018.

斑胸草雀的父母與後代之間的溝通方式，似乎特別有利於教牠們如何唱歌：Gobes et al., 2019; Chen et al., 2016.

關鍵時期中的最關鍵時段，發生在孩子每天通常在母親懷裡的時間：Friedmann and Rusou, 2015.

在大部分文化中，女性特別傾向使用兒語：Piazza et al., 2017. However, in same-sex couples, male heterosexual couples show no disadvantage (or even any particular difference) in their child-directed speech patterns, though there were some differences between primary and secondary caregivers within-couple (Grinberg et al., 2022). Given that male babies are likely exposed to these speech patterns in their own infancy, there's no reason to assume adult men wouldn't be perfectly adept at using it. Perhaps the dominance of female use of motherese, then, reflects a more cultural norm：women are usually the primary caretakers of human babies and may therefore have more occasion to practice.

母親在嬰兒周圍「說話」時……這對於吸引嬰兒的注意力似乎特別有效：Slonecker et al., 2018.

松鼠猴也會以不同的音調曲線，來呼喚自己的寶寶：Biben et al., 1989.

海豚媽媽與嬰兒的交流方式，也不同於與海豚群中其他成員的方式：King et al., 2016.

能聽到母親風格歌曲的雛鳥，似乎比那些只聽到成鳥互相唱歌的雛鳥，更具有生存繁衍的優勢：Chen et al., 2016.

如果母親極為清晰的表達詞彙音調，並且更強調區分「音素」，兒童在語言測驗中會表現得更好：Han et al., 2018. These mothers also change the degree to which they modify their speech as the child gets older, as is often seen in other language cultures that use motherese (Liu et al., 2009).

母親如果比較重視母音的發音，嬰兒在以後使用語言時，會表現得更好：Fascinatingly, this works for computers, too：a computer model presented with samples of speech was better at identifying the vowels when the samples were motherese (de Boer and Kuhl, 2003).

音素還能幫助我們區分字串中的不同單字，也幫助我們學習母語：Thiessen et al., 2005.

兒語的典型音域範圍，恰好與孩子特有的聽力範圍相符合：Among British folk, meanwhile, “fatherese” differs a bit from “motherese” in that fathers manipulate the prosody of their speech to infants than the mothers do (Shute and Wheldall, 1999).

只需改變時態，你就開始理解在其中你所處時間的位置：And that understanding can be interestingly language and culture-specific. Speakers of Mandarin and English seem to understand time slightly differently, which may be in part because their use of their respective languages orients them to slightly different constructs of temporality (Boroditsky, 2001).

語言是在一段很長的演化過程中，斷斷續續出現的：As a number of prominent scientists have gently pointed out, anatomically modern humans were living in the world for a good long time without any particular evidence of symbolic culture. The body was there. The brain was there. The mouth and throat and tongue and hypoglossal nerve canal, all of it. But if symbolic culture is rooted in the sort of narrative cognition we associate with linguistic, symbolic story making, those Eves didn't have much to speak of.

欺騙之事很久以前就有了：King, 2019.

## 第八章 更年期

但是，但是……否認時間的連續性、否認自我、否認天文宇宙：Borges, 1962/2007.

可惡，我失控了：Borges, 1978. He seemed fond of this anecdote after she died, though the

precise birthday seemed to change depending on the interview—sometimes ninety-five, sometimes ninety-eight. Borges's mother was quite famous as his companion; his memory, unfortunately, was not (Alifano, 1984).

沒時間管這副老舊身軀發出的抱怨了：It seems at least one genetic mutation associated with our departure from Africa greatly increased the risk for osteoarthritis. It shortened our bone growth, which was great for colder climates, but rather crappy for longer-term wear and tear (Capellini et al., 2017). The same mutation was found in the Neanderthals and Denisovans. By the time our Jericho Eve came about, the likelihood that she, too, might have carried this ancient risk of aching joints was significant—yet another way our Eves' journeys carry on in our bodies long after their Edens fade away.

女孩的母親去年在一場洪水中喪生：Floods were a regular problem for ancient Jericho and might well have been the reason the walls were built in the first place (Bar-Yosef, 1986).

每個人似乎都想幫忙：There's a strong link between grieving and task fulfillment, after all, and in times of crisis the feeling that one has agency can be incredibly motivating and soothing (Riches and Dawson, 2000).

一位婦女的嬰兒在子宮中反轉，她把手伸進去，把孩子反轉：Because so many human fetuses aren't yet head-down before thirty-seven weeks, breech births are a particular risk for preterm babies (Bergenhengouwen et al., 2014), but they remain a problem—as they presumably were throughout human history—for women today. In the 1600s in London, quite a business was made of advice for midwifery, and the issue of how to deal with breech births was nearly always included (Walsh, 2014). These days, C-sections are generally recommended when possible, but the likelihood of the mother surviving such a thing in ancient Jericho would have been slim.

年長女性特別容易產生骨質疏鬆症的原因：Karamangla et al., 2018. However, the three-year period around the final menstrual cycle is when the most rapid bone loss occurs, setting the stage for later osteoporosis.

對於研究演化的科學家來說，停經期真的是詭異到不行：Ellis et al., 2018.

這就是祖母假說的起源：Hawkes, 2003.

每年使用高劑量激素避孕，似乎都會讓更年期提早約一個月到來：de Vries et al., 2001.

捐贈卵子是否會讓我提早進入更年期（數據確實顯示我不會）：Longitudinal studies of egg donors are a bit thin in the literature, of course, given how recently egg donation (and IVF in

general) became popular. But the general theory holds that what is recruited during an egg-harvesting cycle is not “extra” eggs, but rather eggs that would otherwise be normally lost to atresia.

哺乳動物的卵可能有保存期限：Double-strand breaks may even be tied to ovarian aging, it turns out (Oktay et al., 2015) but given that some other long-lived animals continue to give birth into their old age (elephants, for example), human menopause seems less likely to be tied to an innate property of mammalian eggs.

即使是黑猩猩，也能在六十多歲的時候生育：Thompson et al., 2007.

大部分黑猩猩似乎和人類一樣，在五十歲左右就停止排卵：Hawkes and Smith, 2010; Herndon et al., 2012.

黑猩猩奶奶非常有性吸引力：Muller et al., 2006.

靈長類卵巢看來是以相似的速度老化：Hawkes and Smith, 2010; Alberts et al., 2013. Note that Alberts rightly finds that across a larger swath of primates, the most important signal is less that “primate ovaries clock out at age 50” (many species simply don't live that long, but also experience some amount of reproductive senescence at differing points) and more that human bodies radically outlive ovarian production：so long as she has normally functional ovaries, the rest of a woman's body ages at a much slower rate across the lifespan than those ovaries will.

在人口較稠密的農業城鎮興起之前，可能無法創立並且持續維持的「停經後奶奶」這個階層：While extant hunter-gatherer societies have women who live into their postmenopausal years, the numbers are smaller. Consideration of “menopause” as both a physical and a social phenomenon requires different measures. However, it should be noted that because many of these women's lives are more vigorous over the life span, some of the menopausal symptoms women in agricultural/ urban lifestyles suffer may actually be less of a bother. For instance, hot flashes are more likely to be a problem for women in New York than for women in hunter-gatherer communities (Freeman and Sherif, 2007), which might be tied to lower amounts of adipose tissue and/or general cardiovascular health.

「過客虎鯨群」是唯一經證實具有更年期的非人類社會性哺乳動物：Marsh and Kasuya, 1986.

停經後的虎鯨不會花更多時間照顧孫子或其他年幼的後代：Brent et al., 2015

祖母虎鯨的職責是在危機時刻教導虎鯨群：出處同上。

有位名叫阿貝朵的阿富汗女性：Ehsan, 2011.

現在警察和軍隊裡的年輕人沒有作戰經驗，很容易在戰鬥中死亡：出處同上。

一旦發明了農業，就應該存在一種老年人與農業的回饋循環，彼此互惠：Austad, 1994.

One important pressure I haven't mentioned—which could be a good argument for pushing the usefulness of menopause earlier—is the Last Glacial Maximum (LGM) associated with the last great ice age on our planet. Half of Europe was covered in glaciers. Climate changed back in Africa, too, and the Middle East, and really anywhere one happened to be on the planet. Human populations retreated to refugia along the Mediterranean (Posth et al., 2023). Climate changed pretty quickly and proved deadly for many. Though humans were hunter-gatherers then, the LGM provided ample opportunity for the usefulness of intergenerational know-how in severely challenging environments. How many of those potentially older females even survived then, I couldn't say. It's known that our global population contracted considerably in the face of climate change, so somewhere after the ice receded (14,000 years ago) seems, to me, a better bet for when societies of elderly women would have a chance to get going.

## 第九章 愛

在靈長類動物中，有兩個身體特徵通常與一夫多妻制有關：Plavcan and van Schaik, 1992; Lindenfors et al., 2007; Plavcan, 2001, 2012b.

雄性有很大的犬齒，以及身體比雌性大得多、重得多。狒狒和大猩猩都是這樣：Plavcan, 2012b.

三億年前的化石也有這些為了性而「露出」的牙齒：Benoit et al., 2016. s0s0ta0rt wLietth' the weight class：Plavcan, 2001.

南猿雄性和雌性之間的體型比例與現代人類大致相同：Reno et al., 2003; Reno et al., 2010.

如果你把人族的頭骨隨著時間先後排列起來，雄性的犬齒會變得愈來愈小：Suwa et al., 2009; Plavcan, 2012a. Though it's possible the canines were already quite small in males by Ardi's time (Suwa et al., 2021), which implies at least some of this pattern of reduction seen in later hominins may be a kind of mosaic evolution (Manthi et al., 2012) or a problem of statistical method in prior studies (Suwa et al., 2021).

牙齒的大小似乎受到Y染色體突變的調控：Alvesalo, 2013. Exposure to androgens in the womb may also matter (Ribeiro et al., 2013).

男性的身體愈來愈輕，不再那麼有威脅性，而女性的身體則愈來愈大：Plavcan, 2012a; Reno et al., 2010; Lovejoy, 2009.

亂交的靈長類動物有巨大的睪丸：Shultz, 1938; Anderson et al., 2007; Kappeler, 1997.

雄性山魈彼此會爭奪統治地位，獲勝者的睪丸會明顯增大，臉上的斑紋也會變得更有色彩：Setchell and Dixon, 2001.

在靈長類動物中，愈是會亂交的物種，阻塞用的精液就愈黏稠：Dixon and Anderson, 2002.

人類的精液也會變稠：Zaneveld et al., 1974. The “spunk” of spunk, in other words, is quite temporary.

人類精液接觸到女性生育期的子宮頸液時，液化速度比在空氣中更快：Suarez and Pacey, 2006.

巴諾布猿、狒狒、山魈、甚至大猩猩，強暴卻非常罕見：de Waal, 2022.

雄性黑猩猩在追求交配機會時，通常採用哄騙、關心、甚至友善的舉止：出處同上。

靈長類動物學家稱這些舉止為「伴侶守衛」：Muller et al., 2007.

雌性巴諾布猿具有非常緊密、相互依賴的社交網絡，甚至可能把攻擊性太強的雄性趕出群體：Tokuyama and Furuichi, 2016.

巴諾布猿不太會採取伴侶守衛的做法：Smuts and Smuts, 1993; de Waal, 2022.

人類與黑猩猩、巴諾布猿這兩種動物的親緣關係相等：Mao et al., 2021.

以強暴做為繁殖策略的物種，雄性通常具有更複雜的陰莖：Brennan et al., 2007; Orbach et al., 2017; Brennan and Orbach, 2020.

人類的陰道只有一點點皺褶，在絕大部分情況下是直直通往子宮頸：The folds we do have are called rugae and seem largely to be about having enough tissue to properly expand when we're aroused and a large, intruding member might be about to make an internal visit (or a large-headed baby might be about to make a violent exit), which is also one of the better arguments for why the human penis is wider and longer than other apes' (Bowman, 2008).

有個實驗室甚至製造了人造陰道和一些人造陰莖，研究人員把精液般的稀燕麥泥填到人造陰道中：Gallup et al., 2003.

陰道的酸性環境其實對人類的精子有害：Brannigan and Lipshultz, 2008.

受孕期的子宮頸黏液，pH值是很適合精子的：Ulcova-Gallova, 2010.

男性在性行為中要射精所花的時間，平均來說是黑猩猩的四倍以上：McLean et al., 2011; Reno et al., 2013

黑猩猩的更像是布滿疙瘩狀的圓點。圓點愈大，造成的效果愈強，性交時射精的速度就愈快：McLean et al., 2011.

智人DNA大約有五百一十個刪除片段：Suntsova and Buzdin, 2020.

其中一個刪除片段是能刺激男性體內某類發育的雄性素受體，那可能是人類陰莖棘消失的原因之一：McLean et al., 2011; Reno et al., 2013. For a recent overview of penile spines in primates, see Dixon, 2018.

進行強暴的雄鴨生下後代的機率只有2%，遠低於雌性願意交配的情況：Snow et al., 2019.

古代人類開始實行一夫一妻制，不必為配偶競爭：Lovejoy, 2009; Dixon, 2009; Leigh & Shea, 1995.

在生物學中，這稱為「父親不確定性」：Hrdy, 1979. In fact, in one recent model, the more likely the infanticide in a given primate community, the longer the female's sexual receptive period becomes (until, one presumes, you arrive at something like the chimpanzee or the bonobo, where sexual receptivity happens essentially all the time) (Rooker and Gavrillets, 2020).

在母系社會，女兒從母親那裡繼承了社會地位：Melnick and Pearl, 1987.

所有雌性巴諾布猿都會照顧幼兒，她們形成了關係緊密的女性聯盟：Furuichi, 2011; Tokuyama and Furuichi, 2016; de Waal, 2022.

莽原狒狒會有殺嬰行為，兇手通常是雄性：Alberts, 2018. It seems to strongly depend on local culture and demographic pressures, with some groups having as little as 2.3% of infant deaths tied to infanticide, and others anywhere between 38% and 70% (de Waal, 2022; Zippel et al., 2017). Infanticide is more reliably true among the chacma baboon, where males killing babies seems to be a deep part of male reproductive strategy (Palombit et al., 2000). Among all baboons, it's more likely for immigrant males to commit infanticide than residents (Alberts, 2018), and those cases are more reliably deterred by groups of resident male coalitions, who are presumably motivated by paternal uncertainty (Noë and Sluijter, 1990).

雌性會與嬰兒建立關係，靈長類動物學家在野外多次看到這種情況：The literature on agonistic buffering and male infant-carrying runs pretty consistently from the 1970s forward and is frequently observed in the field. It's also present in other social primates：Gelada males also carry babies around as a strategy to decrease conflict (Dunbar, 1984) and macaques seem



to do this agonistic buffering, as well (Deag and Crook, 1971). For macaques, this might be tied to a “care-then-mate” strategy, wherein a male helps a lactating female with childcare and then gets a chance for himself once she ovulates again (Ménard et al., 2001).

這可以稱之為猴子世界中，與保母發生外遇的性別翻轉版本：Such couplings will typically be concealed through one or another sort of deception, in order to avoid the rage of the dominant male (le Roux et al., 2013), though he may tolerate it to some degree in exchange for the parenting help and/or assistance in defense of his harem (Snyder-Mackler et al., 2012). 在狒狒社會中，無論你是否是主宰的雄性，對雌性狒狒的後代愈友好，就愈有可能與她發生性關係：Smuts, 1985. Please note that males and females that form bonds also live longer, potentially because of the stress reduction of receiving extended grooming (Campos et al., 2020). In fact, they're 28% less likely to die, no matter their age. There are, in other words, many perks to cross-sex relationships among primates, and not all of them are directly reproductive.

在美國和英國，男性施暴者的比例更高，而且更有可能頻繁施暴，遠遠超過女性：Leemis et al., 2022; ONS, 2020; Hester, 2013.

如果他們的社會既是母系社會，又有走婚制度：Here I should tell you that if our hominin Eves were matrilocal, that would have been a very, very long time ago. Recent research indicates females traveled far more widely than males for many thousands of years back, which strongly indicates a patrilocal history during humanity's global expansion (Dulias et al., 2022), though males also traveled quite a bit throughout Eurasia, so different forces may be at play depending on the culture at the time (Goldberg et al., 2017). But as I've mapped throughout this chapter, the shift from prior mating strategies to one with less male competition has evidence throughout the hominin line, so the start of the devil's bargain should be a very long time ago, indeed.

雌性最喜歡的雄性會為孩子們提供更多幫助，因此這些傢伙能進行的性行為更多，讓他們助人與合作的好好先生的基因傳遞下去：It's hard to know which “genes” these would be, exactly, that lend a male to be more solicitous and friendly toward females and their offspring. But there was one famous case of a troop of baboons radically shifting from competitive to friendly behavior：a bunch of aggressive, dominant males died suddenly from infection, and the males that remained were friendlier. It didn't take long for the entire group's general behavior to shift to friendly collaboration over competition, which remained true in subsequent generations (Sapolsky and Share, 2004).

與友好的雄性黑猩猩待在一起的時間愈多，雌性黑猩猩就愈不可能因為殺嬰而失去後代：Lowe et al., 2018. This is particularly true if those males have higher social rank, and particularly during times of social instability in the troop.

有些黑猩猩殺嬰行為是由其他雌性進行的：Townsend et al., 2007.

研究證明，女性使用「蕩婦」這個詞的頻率和男性一樣多：Bartlett et al., 2014; Armstrong et al., 2014.

大部分女性不會只和一個男性發生性關係：Should I cite common sense? Formally, let's look to Kinsey, 1948, and simply assume the little scrap of history that the prior one thousand years represents doesn't bear much weight on the three-hundred-thousand-year history of our species.

在以大男人主義聞名的地方，男性持續使用保險套的比例非常低：Felisbino-Mendes et al., 2021; Fernandez-Esque et al., 2004; Kim and Cho, 2012; Harrison et al., 2008.

美國邁阿密地區的拉丁裔男性會依照當前狀況，判斷是否要戴保險套：Sastre et al., 2015. 如果其中亂交程度較低的人是女性，那麼她們比男性更有可能感染各種性病：Newman et al., 2015.

美國疾病防制中心一直在全美國追蹤性病：CDC, 2015.

路易斯安那州的梅毒發病率在2012年到2014年間增加了兩倍：Bowen et al., 2015; CDC, 2015.

大部分的披衣菌感染，並不會產生明顯的症狀：Wiesenfeld et al., 2012.

每年大約有六千二百萬人感染淋病：Kirkaldy et al., 2019.

從《舊約》的時代以來，淋病就已經存在了：Because gonorrhea doesn't leave skeletal traces, it's a bit harder to find—one is left more with ancient texts than hard evidence. One scraping of dental plaque, at least, places it solidly in the twelfth century (Warinner et al., 2014). For an amusingly thorough account of the search for ancient gonorrhea, see Flemming, 2019.

最近一種針對披衣菌的疫苗，看起來很有希望：Abraham et al., 2019.

大多數女孩要到十六歲或十七歲才達到性成熟：Howell, 1979/2017.

年齡是預測女孩是否可能只是因為懷孕而死亡的唯一且最準確的因素：Raj and Boehmer, 2013.

在青春前期之前結婚的女孩，經常會遭受骨盆感染和創傷：Nour, 2006.

古希臘的結婚年齡為十六歲，古代中國也是如此：Baber, 1934; McClure, 2020.

在古羅馬，年輕的新娘往往很富有，並且出於政治利益交換的目的而結婚：Frier, 2015.

It's likewise true that even in medieval Europe, wherein stories of royals marrying off at twelve was common, the average age of marriage for a woman outside of the nobility was twenty to twenty-five (Shapland et al., 2015).

在最近十年中，美國孕婦和新手媽媽的死亡率比以前更高了：Hoyert, 2022.

美國孕婦死亡的地區大多在哪裡？是貧困社區，尤其是德州、美國南部、以及明尼蘇達州的貧困社區：Martin and Montagne, 2017.

孩子的父母能賺到多少錢，不僅決定了孩子成年後可能擁有多少財富，也決定了孩子成年後維持生育能力的可能性有多大：Currie and Goodman, 2020.

為女性提供經濟支持，通常會使整個家族變得更加富裕：The impacts are seen in both large-scale developmental programs (Woetzel et al., 2015) and in data from the world of microloans (Quigley and Patel, 2022; Mahjabeen, 2008), but it's also reshaping how some economists model historical trends in the United States and Europe (Diebolt and Perrin, 2013).

當印度婦女有機會擔任地方政府的部長或官員時，這些政府會在公共服務和基礎設施上投入更多資金：Chattopadhyay and Duflo, 2004.

在美國和歐洲的女性投票習慣中，也可看到類似的趨勢：Hessami and da Fonseca, 2020.

當女性在地方政府中能夠得到權力時，會比男性政客更有可能支持當地的基礎建設：De Araujo and Tejedro-Romero, 2016; Stanić, 2023. In the United States Congress, female lawmakers also send roughly 9% more discretionary funds back to their home districts than their male colleagues (Anzia and Berry, 2011).

很多著名的經濟學家對此發表了許多文章：給女性更多錢，讓她們有權力決定把錢花在哪裡，她們所在社區的經濟生產力通常會提高：IMF, 2018.

對女孩進行投資，對女孩本身和當地社區可能得到的收入，有更顯著的影響：Autor, 2014. Though in the United States, the cost of student debt rather complicates the picture (ibid).

女孩每多受教育一年，平均終身薪資就會增加18%：Wodon et al., 2018.

世界銀行估計，每受教育四年，一名母親就會少生一個孩子：Caldwell traced this trend in historical data back in 1980. To dig a little deeper in the WHO data, see Pradhan, 2015.

喀拉拉邦的女性受教育程度較高，比哈爾邦的女性有二分之一沒受過教育：Nair, 2010; Nussbaum, 2003.

上中學的女孩數量愈多，該國的每人平均所得就愈高：Wodon, 2018.

即使在農業社區，受教育的女性也能促進當地經濟發展：出處同上。

如果你十一歲時的智商，比平均智商高出15個百分點，那麼你能活到七十多歲的機會就會增加21%：Whalley and Deary, 2001.

在印度的許多邦，年輕女性和新娘最後吃飯是常事：Hathi et al., 2021.

印度女性懷孕第三期時的平均體重，比非洲撒哈拉以南地區大部分女性第一次懷孕時的體重還要低：Coffey, 2015.

幼年時期營養不良與智商較低有關：Northstone et al., 2012.

營養不良的嬰兒長大後，自青少年時期起，在自我控制、長期規劃、暴力衝動和反社會攻擊行為方面往往會出現問題：Galler et al., 2012.

營養不良的母親更有可能生出營養不良的嬰兒，也可能生出體重不足的新生兒：Li et al., 2016.

即使女孩能受到正規教育，在十歲以後還能夠繼續下去的機會，也是小得多：Wodon et al., 2018.

伊斯蘭哲學家魯世德寫道，女性在所有方面都應該與男性平等，包括教育和就業機會：Belo, 2009. I would like to mention, however, that he also wrote that despite women's equal nature and general potential to men, "since women in these cities are not prepared with respect to any of the human virtues, they frequently resemble plants. Their being a burden upon the men in these cities is one of the causes of poverty" (Averroes, 1974). One is tempted to mention that women's unpaid labor is, of course, a great contribution to the ability of others to engage in paid labor, however educated and prepared in virtue those women may be—witness the ever-climbing cost of child care in the United States!—but modern ideas about poverty and income (and even money generally) are rather different from anything that existed in Averroes's time. And again, Islam did rather better for women than Christianity in this period, by many measures.

直到工業革命之後，公立學校教育才在歐洲和北美的基督教地區流行起來：Consider, for example, the Elementary Education Act of 1891, wherein England only then made primary education free. It cost about 10 shillings a head (Boos, 2013). Two years later, the British government bumped it up to age eleven or so, and decided it'd be a good idea for deaf and blind children, too. Dickens would be proud.

到了1989年，許多阿拉伯國家已經變得極為富有，但是只發表了4篇經常受到引用的科學論文：United Nations, 2002, 67.

社會性靈長類動物非常擅長把「親屬關係」的行為加以拓展：Vigilnt and Groeneveld, 2012. For brilliant insights into why this matters for alloparenting, see Hrdy, 2009. For a nuanced insight into altruism and primates' “motivations,” see de Waal and Suchak, 2010.

黑死病殺死了歐洲三分之一的人口：Courie, 1972.

1918年的西班牙流感也留下了嚴重的後果：Barry, 2005.

歐洲所以能夠發展出前現代中產階級，是因為黑死病期間有許多窮人死亡：Courie, 1972.

文化往往會透過更強化當地的文化認同，來應對壓力和威脅：Morris et al., 2011.

# 夏娃

## 女性身體如何推動兩億年的人類演化

EVE  
How the Female Body Drove 200 Million Years of Human Evolution

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