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There is no 'obstetrical dilemma': Towards a braver medicine with fewer childbirth interventions

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Abstract

Humans give birth to big-brained babies through a bony birth canal that metamorphosed during the evolution of bipedalism. Humans have a tighter fit at birth between baby and bony birth canal than do our closest relatives the chimpanzees. And, humans are incapable of grasping onto caregivers as early as infant chimpanzees develop the skill. Since the mid-20th century, these observations and more have been linked together into the "obstetrical dilemma" (OD): human babies are helpless because they are born early to escape before they outgrow the mother's pelvis, the expansion of which is prevented by natural selection for bipedalism. The OD continues to be a popular idea, often expressed as incontrovertible fact, but it no longer deserves its popularity. There are better explanations for gestation length, childbirth difficulty, and the developmental biology of newborns than mainly or only *because of natural selection's constraints on women's hips.* And humans are not *born early* either, as is widely assumed. This all-too-powerful human evolutionary narrative deserves our skeptical consideration. Bias from OD thinking is likely amplifying the perceived risk of cephalopelvic and fetopelvic disproportion during labor—contributing, even if slightly, to medicine's underestimation of women's bodies and over-implementation of childbirth interventions.

Introduction

I never set out to prove anyone wrong. What I am about to describe started just over a decade ago when I simply wanted to learn more about what fascinates me most, which is human evolution. Where it goes, I hope, is towards ongoing efforts to improve maternity and childbirth care, particularly when it comes to supporting physiologic birth ("Supporting…" 2013).

As a freshly minted Ph.D. in biological anthropology and a postdoctoral researcher, I had the spark and the freedom to look into the evidence behind a textbook example of natural selection in human evolution: the "obstetrical dilemma" (OD). Though the ideas were already floating around in the early days of the field of physical anthropology—like in Wilton Krogman's paper "The Scars of Human Evolution" (1951)—Sherwood Washburn (1960) is usually credited for the obstetrical dilemma. It is a well-known idea by now, even if not by name. Here is the OD in all of its straightforward, intuitive glory: *Humans are born underdeveloped. We are born early in order to escape just in time before we outgrow the birth canal. This early birth was caused by antagonistic natural selection. While our brains got bigger and bigger over time, the evolution of bipedalism prevented our birth canals from expanding too. Difficult, dangerous childbirth of underdeveloped, helpless human babies are both evidence of, and solutions to, this obstetrical dilemma.*

The OD is a staple in anthropology, evolution, and anatomy curricula. It has been canon in anthropological research and scholarship and has spilled over into evolutionary medicine and evolutionary psychology. For scientists, academics, and beyond, the OD has been a welcome antidote to the *Book of Genesis*. Difficult labor, dangerous childbirth, and sinful, suffering, helpless babies are no longer Eve's fault, they're evolution's (Dunsworth 2016a).

To appreciate how far OD-thinking has spread beyond the academy, we can read the popular science literature where, for example, Meredith Small wrote in *Our Babies Ourselves* (1999) that "women couldn't walk" if the birth canal were widened to accommodate a more developed neonate. In *Paleofantasy* (2013) Marlene Zuk penned, "You can't give birth to large-brained infants and also walk on two legs trouble-free…" And there is the vast influence of Harvey Karp's "Happiest Baby" enterprise, where he advises parents to treat their newborns like fetuses, asserting that human babies are 'evicted' early. To further demonstrate the reach of the OD, we can listen to the opening verse of the title track to Father John Misty's 2017 Grammy-nominated album "Pure Comedy":

> The comedy of man starts like this:
> Our brains are way too big for our mother's hips
> So, nature, she devised this alternative:
> We emerge half-formed and hope whoever greets us on the other end
> Is kind enough
> To fill us in
> And, babies, that's pretty much how it's been ever since

OD thinking is everywhere, and I helped with that. As a graduate student at Penn State I taught this narrative to my students while I was also enshrining it in a small reference volume, *Human Origins 101* (2007), which I was writing alongside my dissertation. About our narrow-hipped direct ancestors of the species *Homo erectus*, I wrote how they "may have shortened gestation (i.e. the period of fetal development in the uterus) [in order] to be physically capable of giving birth to large brained babies through [their] relatively small birth canal. An earlier birth results in a more helpless, less developed, altricial infant. " (p. 139) After that passage I listed all the

significant aspects of being human that may have evolved as consequence of the evolution of this hips-induced earlier birth: Paternal investment, food-sharing, home bases, loving adult relationships, free time, elaborate language, singing, music, wit, dancing. Wow.

At that time, a peer in my graduate program told me that when he teaches the OD he sees glowing light bulbs over students' heads: *Why is childbirth so difficult and dangerous? Because there must be selection against changing the pelvis and alleviating some of that risk.* He said the idea is so powerful that students cannot deny our evolutionary history and he quipped that it "converts creationists."

I don't know about any conversions, but given what I wrote in my book about music and wit, the powerful part was true for me as well. Long before I dedicated my professional life to human evolution, I have vivid memories of learning the OD as an undergraduate. It made an indelible impression, perhaps because it was undeniable proof of evolution in our daily lives. My own birth story boils down to my being an only child because of how traumatizing it was for my mother. To someone like me who had just begun to hear about the e-word from my college professors, the OD struck a nerve, having been told by so many of my childhood teachers that evolution was a preposterous, and even evil, idea. And, learning the OD in college also resonated with what I was reluctantly coming to terms with at that tender age: my looming fertility and mortality.

As a student, I never heard anyone call the "obstetrical dilemma" a "hypothesis." I am the first person I know of to refer to it consistently as such and I think that matters a great deal. Without explicitly tagging hypotheses, we are luring others into giving them more credence than they deserve. The OD certainly was a fact to my postdoctoral mind when I dove into the literature to

learn for myself about the facts behind the fact. When I surfaced, I didn't just have a "hypothesis," I had a bad one.

Human babies are not born early, but if one insists that they are, then it is not because of women's hips

The first part of the OD that I wanted to see for myself was how short our pregnancies are compared to other primates. I found very easily that they are not. Our pregnancies are as dreadfully long as chimpanzees', bonobos', gorillas', and orangutans' and even a bit longer. Of all the primates, the great apes have the longest pregnancies (ranging across species from roughly 30-39 weeks; Animal Diversity Web), and among them humans lie at the long end, with maybe a few weeks more. This long, not truncated, human pregnancy defied my OD expectations and sparked my doubt of the entire story.

When you read the scientific literature that covers birth-related variables across primates, humans don't stick out as strange save for four traits. First, there is that detail about us having the longest pregnancies. Second, we are the fattest baby primate (Kuzawa 1998) and this contributes to our absolutely largest neonatal size. Third, we are born with the absolute largest brains of all baby primates. And, fourth, for a baby primate, we are *relatively* small-brained at birth (DeSilva and Lesnik 2006; for all four traits see also Dunsworth et al. 2012). Notice how a fifth trait is not the tight fit at birth. There are monkey species that have tight fits at birth.

Despite having absolutely long gestations, large bodies, and big brains at birth, the relative view of neonatal brain size is what convinces people that we are born early and seduces them over to the OD. By "relative" brain we are talking about newborn brain size divided by adult brain size—that is, the proportion of the adult brain that a baby has at birth and, by extension, how

much of a brain the baby will need to grow. Born with the smallest relative brain size, roughly only 30% of our adult brain size, it necessarily follows that humans have the most postnatal brain growth to accomplish of all the primates. But why should the perinatal proportion of our adult brain size be evidence that we're born early?

One answer dominates the thinking but it is not a perspective I share any longer. It is this: Chimpanzees are born with 40% of adult brain size, eclipsing our mere 30%. This difference requires an explanation. And so, the thinking goes, humans *should* be born with just as much growth accomplished towards their adult-sized brain as those apes, but that we are not means that something must be preventing it. Tradition assumes that something is the bipedal pelvis.

On his website for The Happiest Baby, Harvey Karp explains how, "I always tell my patients that babies are born too soon" and how, "your baby's brain was so big that you had to 'evict' her after 9 months, even though she was still smushy, mushy and very immature. As a result, she isn't quite ready for the big, bad outside world. So, for the first months, it can help to think of her like a fetus…outside the womb." This is the basis for the "fourth trimester" concept he uses to advise parents in how to care for their newborns. This is very much out of the academic tradition that emphasizes, despite the absolute large, "so big" size of the newborn human brain, how relatively small it is—a focus that has been strongly influenced by classic works of Adolph Schultz (1949), Adolf Portmann (1969), and Stephen Jay Gould (1977), whose book *Ontogeny and Phylogen*y was read beyond anthropological and human evolutionary biology circles. In the tradition of their great influence folks continue to assume that humans really should be gestating our fetuses longer.

Portmann even described humans as "secondarily altricial," a term that has long populated lists of uniquely human traits. Primates as an order are precocial. For an example of a typical, and extreme, precocial mammal, "consider the horse," as Mr. Foster in Huxley's *Brave New World* said. 'Precocial' describes how horse foals and primate infants are far more developed at birth than species on the other side of the spectrum dubbed "altricial," like most carnivore and rodent species—which are extremely helpless as newborn pups and cubs, usually furless, blind, parked in a den or nest, and incapable of clinging to their mothers except to suckle. Deeming humans "secondarily altricial" suggests we share significant traits in common with wolves and rats to hold us apart from the rest of the primates and that the *Homo* lineage has reverted back to a deeply ancestral altricial condition after a precocial phase in our more recent primate ancestry. And, what was powerful enough to cause this major, unique evolutionary shift in human evolution towards altriciality? A pelvic constraint due to bipedalism, so the OD thinking goes.

But, by having the largest adult brain of all the primates, doesn't it just make sense that we would be born with the smallest *relative* brain size, regardless of the pelvis? Maybe it does not now, but it will after a closer look at other primates.

Chimpanzees and bonobos (closely related apes of the genus *Pan*) have the largest adult brains and the smallest relative brains at birth out of all the nonhuman primates. Born with roughly 40% of their adult brains, as mentioned above, chimpanzees have the most postnatal brain growth to accomplish of all the nonhuman primates. What is the explanation? Not the OD. Chimpanzees do not have a tight fight between bony birth canal and neonate and they are not habitually bipedal. But, of all the primates except for humans chimpanzees are also the most helpless as infants (they are intensely coddled by their mother because they cannot strongly cling to her, cannot walk independently, and are only active for a small portion of the day). With only 40% of their

brain growth achieved at birth, they have the longest period of postnatal brain development of all the nonhuman primates. Those circumstances are significant "solutions" to the OD for humans, but there is no special explanation for them in our ape relatives. No one to my knowledge is suggesting chimpanzees are born "early." No one is suggesting that, given the roomy birth canals, they *should be* born later when they're more developed and easier to care for. No one is suggesting that they should be born with more brains, or that they should be born with 50% of adult brain size like capuchin monkeys are. No one is offering up an elegant hypothesis for chimpanzee gestation length and infant helplessness that is unique to their lineage's evolution, and that conveniently links up to bony anatomy that fossilizes so the hypothesis can extend back to scientific interpretations of relics from their ancient past.

For humans to mimic chimpanzees and birth our babies with 40% of their adult brain size, we would need to lengthen gestation seven more months to a pregnancy of 16 months. At seven months of age, we have 40% of our adult brain size. [Past estimates by Portmann, and then echoed by Gould put our pregnancy at 21 months! But based on updated knowledge of neonatal brain growth in chimps and humans, 16 months is a better number (DeSilva and Lesnik 2006).] Could our pelves accommodate this slightly larger infant head, with its 3-4 cm increase in diameter? It is difficult to say with certainty. However, women already vary by this magnitude in dimensions of the bony birth canal and no one has correlated this to meaningful variation in their walking or running ability. Further, no one has demonstrated that increasing the present average in bony birth canal dimensions by 3-4 cm would ruin bipedalism. While many reactions I've received to this thought experiment highlight the very real trouble our broad neonatal shoulders and large neonatal body size can cause, the point is to shine light on the weak assumptions of the OD.

The simple act of searching what is known and what is unknown about the very simple, seemingly straightforward assumptions and assertions in the obstetrical dilemma hypothesis convinced me that it is flawed. If OD thinking sees the shortest kid in class as a unique biological circumstance, then I now saw her as being short for basically the same reasons as the next shortest kid in class. Human gestation is much more like other primates' and other mammals' than OD thinking had led me to believe—a realization which led me to doubt our pelvis was a unique influence on its duration.

As I pored over published charts of primate and placental mammal pregnancy length I learned how it scales nicely with maternal body mass. The larger the mother's body, the longer the pregnancy, which explains why the great apes have the longest pregnancies of all the primates. Body mass is often a proxy for metabolic rate, which factors greatly into both enabling and constraining a species' average gestation length and fetal growth. I was delighted to see that maternal mass was just as fundamental to pregnancy in whales and dolphins which lack bony birth canals (Sacher and Staffeldt 1974).

What jumped out to me was that maternal-fetal physiology is the primary constraint on placental mammal gestation and fetal growth, including the construction of costly brains. That constraint in humans is not reached until we grow our fetuses right up to the size of the bony birth canal, which is usually just big enough. In other words, the tight fit at birth makes it seem like we are stuck in this uniquely human obstetrical dilemma, when really, we are just basically doing what placental mammals do—albeit with an often terribly laborious labor at the end of it.

With our relatively small brains at birth human newborns are given an "early" introduction to the world. But with our absolutely large brains and bodies at birth and our absolutely long

pregnancies, surely our gestation was not cut short. [If humans are exceptional then perhaps it is our souped up metabolisms compared to our closest relatives (Pontzer et al., 2016).] And, surely our pregnancies were ending due to the fundamental metabolic constraints and energetic costs of growing a fetus shared across species, not because of a uniquely human premature evacuation of the fetus. . It was difficult from this point on for me to imagine what, if anything, the bony birth canal could have to do with the evolution of human gestation length and fetal size. But I had to keep searching, just in case I was missing something.

Women's hips are as adapted as men's

Now, I am not so skeptical of the OD that I am blind to the tight fit in human childbirth and its potential dangers. I am sure that species with tight fits, like ours, experience more stringent selection than others because of it. That is, because we have a bony birth canal, it is surely an upper limit on fetal size. And, large fetal size is surely a mortality risk for mothers with bony birth canals that are too small. But, even if it becomes possible to determine that humans have the highest tight-fit-induced mortality at childbirth of all the primates, then that is still not logical support for the idea that our pregnancies end early or that they end because of pelvic constraints. It is also not ipso facto support for the hypothesis that something, like bipedalism, is preventing the pelvis from expanding to reduce the tight fit and the risks that come with it. But as a colleague said to me, matter-of-factly, just after I presented my work on the OD at a conference several years ago, "It's obvious that we're at a maximum and optimally sized birth canal that we can't exceed because of selection for bipedalism." It wasn't obvious to me then and it's not obvious to me still.

Unfortunately, these ideas are not just difficult to tease apart in casual dialogue, they're difficult to tease apart in the scientific literature and that is largely because they are difficult to test. Evolution is true, but many of the details remain elusive.

Try thinking of a way to test the hypothesis that our bony birth canals are at the maximum that natural selection for bipedalism will allow.

It may help you to know that on average, women have roomier dimensions that make up the birth canal than men do. That is speaking absolutely, not just relatively. So despite men having, on average, wider pelves overall, because that's linked to their having, on average, larger and taller bodies overall, women are absolutely roomier in birth-related dimensions inside the pelvis.

So, knowing about sexual dimorphism, how would you test if humans are, right now, at the maximum bony birth canal that natural selection will allow? Ideally we might try to correlate bipedalism-related death to birth canal size, but that seems impossible on more than one count.

Instead, we could look to see if women's hips are less efficient or costlier or somehow worse than men's in a biomechanical or kinematic context. This might lend support to the OD-supporting notion that women's hips are maxed out, as if they could not get any worse at bipedalism than they already are, and definitely not any wider for childbirth.

This thinking plays into everyone's awareness that, on average, men outperform women in athletics. Scientists who have focused on skeletal and fossil anatomy have seen the male body as the one more adapted to being bipedal, to running, to hunting, to throwing, making tools, to dominating others. Avoiding a long tangent into a discussion of the culture of science and the centuries of bias we have yet to overcome, let's stick to the problem at hand: would anyone actually reduce sex differences in athletics to bony pelvic anatomy? Can anyone do this? I tried

to find studies that could. I failed. Instead I found a fellow recent Ph.D. like me, Anna Warrener, running experiments with men and women and not finding that their varied pelves were good predictors of how well they walked and ran (see her latest in Warrener et al. 2015).

Although it is not a direct test of natural selection, linking variation in pelvic anatomy to some measure of efficiency, or cost, or performance remains the best way to try to get at OD assumptions. But, so far, no one has been able to demonstrate experimentally that wide or women's hips are significantly worse than narrower ones or men's. Grounded in theory and predictions, arguments that women's pelvic anatomy is constrained by selection for bipedalism are still alive (for the most recent, carefully considered example see Ruff 2017), but experimentally it has not worked out.

In OD terms, small sex differences in pelvic anatomy are assumed to correlate to small differences in performance and health, which are hypothesized to have been and to presently be on selection's radar, keeping women's pelves from expanding and forcing a shortened gestation. This approach is rooted in fundamental assumptions about significant functional/behavioral consequences of skeletal variation and is frequently motivated by the promise of paleontological applications. So, assumptions that a wider birth canal would buck the "necessary requirements for bipedalism" (as it's often phrased) are the necessary requirements for a certain branch of science.

Bony pelvic anatomy is highly variable around the world, not just between the sexes, but geographically. There are varied ways to build a pelvis and still be a good biped, which includes being an actively foraging, parenting, and socializing pregnant biped. And, increasing fossil

evidence suggests that pelvic variation has been a friend, not a foe, to evolving bipedalism over the last seven or so million years (Dunsworth and Eccleston 2015).

So, for now, regardless of any sound theoretical arguments for biomechanical weakness or health risks associated with large bony birth canals, the only pelvic prerogative I see as scientifically sound is one where women's hips are just as adapted as men's. And, if one were so inclined, one might say that women's hips are *more* adapted than men's given selection did not just build them as cornerstones of bipedalism but also as gateways for the ever-evolving species. Women's bodies are highly adapted for complex functionality, and they are not "compromised" unless the narrator is stuck in OD thinking (see also Wall-Scheffler 2012 and Kurki 2013).

In science, one does not convincingly argue against an idea like the OD merely by demonstrating its weaknesses. To effectively argue against an evolutionary hypothesis one should offer a different idea to take its place. So, thanks to the assistance of some colleagues, I did.

We're born when we're born because of physiology, not osteology

Because none of the literature that revealed to me that the OD was a bad idea was actually engaging with the OD, I looked harder for literature that did. So I took Peter Ellison's book *On Fertile Ground: A Natural History of Human Reproduction* (2001) with me on a paleoanthropological expedition to Rusinga Island, Kenya one summer and read it voraciously in my tent each night after our days collecting early Miocene fossils. While Ellison steered clear of the OD, he outlined his idea for the timing of human birth in humans that jibed well with what I had already learned about species level phenomena. Ellison's' "metabolic crossover hypothesis" has nothing to do with the bony birth canal. He proposes that human pregnancy ends when the fetus can no longer continue growing inside mother, constrained by her metabolism and that this

explains variation between human pregnancy lengths and newborn sizes. I was high after reading it. All I had to do was incorporate Ellison's idea into what I was calling my "nixing the OD" paper and to somehow extrapolate his detailed, human hypothesis more broadly to the differences between primate species, including humans, and maybe across all placental mammal species.

At the time, I was already helping Herman Pontzer investigate basic, non-reproductive metabolism in nonhuman primates, so I enlisted his expertise regarding the OD. Based on published data for humans, he modeled fetal and maternal metabolic rate and energetic use throughout pregnancy and then, after birth, through the first six months of infant growth. We could see how just as the fetal needs are overshooting what the mother can provide the two are hitting the 9-10 months mark of pregnancy. Leading up to the end of pregnancy, mothers have already reached what looks like a limit on sustained, daily elevated metabolic rate at about 2.1 times the basal metabolic rate and they never increase it—suggesting that mothers can only sustain a growing fetus at this constantly elevated metabolic rate for so many weeks before birth needs to happen so that the fetus can continue growing, rather than starving inside of her. A mother is growing and pumping an additional 50% blood volume during pregnancy, and feeding the growth of the fetus and placenta through her own diet. She is also breathing for the fetus, embodying the limit to the fetus's available oxygen supply, so constraints on fetal growth during pregnancy cannot be lifted by merely increasing a mother's dietary intake of calories or glucose. Once the infant is born he can breathe on his own and, paired with a diet of milk and eventually much more, can grow to surpass what was physiologically possible in utero. During lactation, the mother's metabolic rate never exceeds that same apparent limit on sustained elevated metabolic rate (Dunsworth et al. 2012).

We do not know yet if the same particular magnitude of elevated metabolic rate is limiting other species as it is in humans, but we hypothesize that a similar constraint on pregnancy is occurring in other primates and placental mammals. We are currently performing the first test of this hypothesis in pregnant and lactating marmoset monkeys, measuring their metabolic and energetic parameters using the doubly-labeled water technique paired with urine analysis.

We were advised to name this hypothesis, so we decided on the "EGG hypothesis" for energetics of gestation and fetal growth. I wanted to call it HAM & EGG to emphasize how humans are mammals, but did not follow through (for perhaps obvious reasons). I regret titling our paper "Metabolic hypothesis for human altriciality." The working title had been "Metabolic hypothesis for the timing of human birth" but we worried that the species-level perspective was lost. Then, one co-author suggested the title that ran and I thought it was a good idea at the time. It evokes the evolutionary perspective of the paper and I assumed that readers would discover how we make a good case against considering humans to be literally altricial. But in hindsight I wish we had kept our nod to our discipline's traditional but problematic verbiage out of the title.

To be clear, we have only superficialities in common with actual "altricial" mammals like rat pups and wolf cubs. Our helplessness at birth is largely determined by our small relative brain size (constrained by the EGG hypothesis) and its relationship to motor-neuronal development. We also lost our grasping feet by 3.6 million years ago (see the Laetoli footprints in Tanzania that lack grasping big toes; see Ward and Hammond 2016), which changed how we carry babies and how they cling (or not) to us. As toddlers, we develop bipedalism when it is expected for a mammal, based on brain mass, which is a good predictor of the time it takes to develop the brain (Garwicz et al. 2009). And unlike actual altricial animals that are born prior to peak brain growth rate, we are born after that peak like precocial mammals (Halley 2017). Humans do have a long

developmental period during which we grow our enormous brains and during which we wire them up in wonderful ways, like for music and wit and other wows of humanity. But it does not deserve a uniquely human explanation. All big-brained primates take longer to develop than their smaller-brained relatives, and while they do so, they learn complex behaviors, just not as complex as ours.

Fans of *Brave New World* have long been aware of the consequences of our species' stretched out life history: "...at thirteen a man is not yet sexually mature; and is only full-grown at twenty. Hence, of course, that fruit of delayed development, the human intelligence." In this vein, Portmann (1969) and others have argued that we are born early, not because of the hips, but because of selection for additional extrauterine stimulation and its intellectual fruit (see Dunsworth 2016b). But like the OD, that idea is also misguided because of its unfounded assumption of our early birth. So far it is strongest to assume that we are living proof of a birth canal that is large enough to accommodate what mother's metabolism can grow in utero. Neither bipedalism nor selection for a longer postnatal learning period are significant determinants of gestation length or fetal growth—at least, we have no such evidence at this time.

I learned over the years that academic arguments can get personal. But the OD is not a person and it surely is not God, so I hope to offend no one when I repurpose Enlightenment lore here: We have no need of that hypothesis.

So if it's not *because natural selection for bipedal hips causing a woman's body to be compromised*, then why is childbirth so hard?

Humans have created a childbirth dilemma and humans can solve it

The answer to the question of birth difficulty extends far beyond the scope of this essay. But, briefly, they include both ancient and recent developments in our species, and are largely and inextricably linked to culture, rather than genetic destiny.

One of the first papers I first read in my deep-dive into the OD was "The Obstetrical Dilemma Revisited" (Rosenberg and Trevathan 1995) where the authors laid out some implications for their more insightful view of childbirth than had been part of the human evolutionary literature up until that point. Shoulders, they pointed out, are a problem too, not just the big human head. And what's more, humans assist one another in birth. From our mere presence alongside a laboring woman all the way to our active involvement in the birthing process, we are more meddling than any other primate. Perhaps, this should be considered something that natural selection for childbirth has counted on, relaxing selection on physical traits that would make a lone birth less risky, thereby making a lone birth riskier and assisted birth more of a requirement, if you will, or part and parcel with our humanity. Based on the few nearly complete and deeply ancient fossil hominin pelves on record, it looks like the tight fit may have begun as early as three or four million years ago (DeSilva 2011).

While it may be ancient, it's likely that more recent culture (over the last few thousand years) has led to increased childbirth difficulty as well. Pamela Stone (2016) and Jonathan Wells (Wells et al. 2012; Wells 2015) are two anthropologists who are contributing greatly to this discussion which includes, for example, consideration of how the effects of malnutrition (and other health risks during a woman's life) on pelvic under-development are often coupled with her healthy pregnancy supporting a large baby. Corsets worn during skeletal development and even during pregnancy have also been obstacles to successful childbirth. Diabetes, gestational diabetes, and preeclampsia encourage the growth of extremely large fetuses. Even without metabolic disease, a

glut of energy during pregnancy which is increasingly common in our modern world (due to lifestyle, diet, and lower stress and disease burden) could be supporting larger fetuses over longer gestations than women's developing skeletons, even in ideal conditions, could anticipate. A mother's behavior and body positioning during pregnancy and labor are likely factoring into her level of childbirth difficulty, and perhaps her behavior over her entire life leading up to her first pregnancy too—which is occurring in increasingly older women. And the amount of quality experience of childbirth attendants and caregivers is also factoring into childbirth difficulty, especially as measured by use of medical interventions. That is only a surface treatment, but all of the difficulty—which is largely in the domain of maternal physiological health and healthcare—has perpetuated the illusion that impossibly tight fit (cephalopelvic and fetopelvic disproportion) is a bigger risk and more insurmountable problem than it is. By extension, the amplification of perceived risk can lend credence to the idea of the 'obstetrical dilemma' in human evolution, which lends credence to the perception of women's bodies as being compromised, all of which is likely contributing, even if slightly, to medicine's over-implementation of childbirth interventions. This is our childbirth dilemma.

As I've shared these views over the last seven or so years, anthropology and evolutionary biology departments are polite but not as receptive as medical schools. In reaction to one of my presentations on the EGG hypothesis, a prominent paleontologist with a fancy title said, "Nice talk, but it's not evolution." I half-grinned and moved toward the pizza rather than responding with, "If metabolic and energetic constraints on pregnancy and fetal growth are not evolution, what are they? Magic?" Many awkward moments like that have helped me to realize what an omnipotent idea the OD is, and to believe that it must have some impact on how we approach pregnancy and childbirth.

One fairly recent study to come out of obstetric medicine is a fantastic illustration of how the OD biases medical thinking about childbirth (Lipshuetz et al. 2015). The title of the study seems straightforward, "A large head circumference is more strongly associated with unplanned cesarean or instrumental delivery and neonatal complications than high birthweight," but close inspection reveals the opposite. The researchers' data show that normal "HC" (head circumference) babies get born vaginally more often than ones categorized as large HC, but the HC measure is taken on babies who are already born. Plastic neonatal heads get squeezed and molded in the birth canal, and consideration of this phenomenon is absent from the study. So pitting the heads of babies plucked from the uterus against the heads of babies born vaginally is not necessarily a fair comparison of actual head size between the two birth types, but a fair comparison is required to make the claims in the paper. Further, the differences between large and normal head categories were only around 1 cm in diameter which seems like a reasonable range for the role of cranial crunching during vaginal birth. So, this high-profile professional study, theoretically grounded in the OD, supports caesarean sections, but that support is based on the differences in head size measures that were very likely caused by caesarean sections in the first place.

Big, difficult newborns don't just obfuscate scientific logic, they have recently inspired a public debate among prominent obstetricians over whether to induce all pregnant women at 39 weeks. The result has been overwhelming support for this hypothetical practice. In reaction, Cristen Pascucci, a vice president of the advocacy group Improving Birth, told *The Washington Post* that, "It's as if women and their babies are fundamentally in opposition to each other and the female body is dangerous by design," adding how this brand of medicine, "reinforces a century-old pre-feminist American obstetric view that birth is pathological and the doctor's job is to

extract the fetus from the incubator" (Margulies 2016). Whether or not it is explicitly stated, OD thinking is subsumed into the medical tradition and it is helping to overestimate risk and to underestimate women's bodies. Framing nature as a dilemma pits women's bodies as problems to be solved, rather than as humans to be cared for and assisted.

Time, elementary to nature doing what nature does, is perhaps what laboring women need more than anything else from their helpers. But time is deceptively difficult to abide, to share, to allow, and there is so much more women need too. Based on her ethnographic study of women's birth experiences, sociologist Alana Bibeau (2014) concluded, "Within the context of maternity care, it is clear that there is a need for competent and respectful providers who value women as partners, understand their fears, provide evidence-based care, encourage the use of low-risk interventions like childbirth education and doula support, and facilitate authentic, informed choice for women." Coaxing out women's natural strengths in childbirth, that is, recreating nature with culture, will not be easy, but facing difficulty is something humans have always done well. Many such humans have long been hard at work on this challenge (see for example "Supporting…" 2013), guiding and urging others towards fewer childbirth interventions like inductions and caesareans. While the science and medicine of childbirth forges ahead, we should actively, openly, energetically allow laboring women the right to struggle, to labor. Surely I am not the only reader of *Brave New World* to side with the Savage who, in reaction to compulsory medical interventions for achieving comfortably perfect health, said, "But I don't want comfort. I want God, I want poetry, I want real danger, I want freedom, I want goodness. I want sin… I'm claiming the right to be unhappy."

While The Happiest Baby's evolutionary philosophy doesn't have a bipedal leg to stand on, it can work wonders for families. Something equally as supportive (but better anchored in the

evolutionary perspective) could be equally as effective and wonderful—something like "The Unhappiest Childbirth." Such an approach would appeal to folks who value difficulty, poetry, real danger, freedom, goodness, sin, and are seeking to maximize our species natural capabilities. Women would labor as their best selves (not as evolution's consolations), under the care of empathetic, wise, broadly experienced, and rigorously educated attendants and assistants. For its results, and thanks to hindsight's talents, such a program would deserve to be called The Happiest Childbirth.

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