

Humans Will Require Assisted Reproduction, Mechanical Wombs

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✓ Fact Checked

STORY AT-A-GLANCE

- › Certain aspects of the modern world, especially hormone-disrupting chemicals, are not only threatening sperm counts but also altering reproductive development in males and females
- › If sperm count declines continue on the current trajectory, a significant part of the global population may not be able to reproduce without technological assistance come 2050
- › Environmental chemicals that interfere with hormones — known as hormone disrupters — are at the crux of the problem; phthalates, bisphenol A, atrazine and flame retardants are among the most problematic
- › Scientists are already working on how to grow life outside of a human womb and, for the first time, grew a mouse embryo in a mechanical womb for a time period equal to a human embryo at 5 weeks
- › The researchers hope to use the mechanical womb to grow a human embryo to 5 weeks, raising serious ethical questions

From 1973 to 2011, men experienced a 50% to 60% decline in sperm counts, according to a 2017 study by Shanna Swan, Ph.D., an environmental and reproductive epidemiologist at Icahn School of Medicine at Mount Sinai in New York, and colleagues.¹

For more than two decades, Swan has been warning of an impending fertility crisis, one that's often blamed on lifestyle or the choice to delay childbearing but which she says is

being driven by environmental chemicals.

“I am not saying other factors aren’t involved. But I am saying chemicals play a major causal role,” she told The Guardian.²

Her book, “Count Down: How Our Modern World Is Threatening Sperm Counts, Altering Male and Female Reproductive Development, and Imperiling the Future of the Human Race,” goes into detail about how the modern world is not only threatening sperm counts but also altering reproductive development in males and females,³ and in so doing “imperiling the future of the human race.”⁴

Infertile World: By 2045, Sperm Counts Could Be Zero

According to Swan, if the curve of **declining sperm counts** from the 2017 study continues, by 2045 the median sperm count will be zero. “It is speculative to extrapolate, but there is also no evidence that it is tapering off. This means that most couples may have to use assisted reproduction,” she said.⁵

One reason why Swan believes environmental chemicals are to blame is that her research has shown younger women have experienced greater declines in the ability to have children than older women.^{6,7} This suggests that it’s not only aging or choosing to put off starting a family until later in life that’s involved. Miscarriage rates have also been on the rise, increasing at a relative rate of 2% per year from 1990 to 2011.⁸

“Count Down” brings some disturbing findings into the spotlight, like the fact that a significant part of the global population may not be able to reproduce without technological assistance come 2050.⁹ And, the book suggests, men today have about half the number of sperm compared to their grandfathers.

“In some parts of the world, the average twenty-something woman today is less fertile than her grandmother was at 35,” Swan wrote in her book. “The current state of reproductive affairs can’t continue much longer without threatening human survival ... It’s a global existential crisis.”¹⁰

Environmental Chemicals Wreaking Havoc With Hormones

Environmental chemicals that interfere with hormones – known as hormone disrupters – are at the crux of the problem. The worst chemicals, Swan told *The Guardian*, are “those that can interfere with or mimic the body’s sex hormones – such as testosterone and estrogen – because these make reproduction possible. They can make the body think it has enough of a particular hormone and it doesn’t need to make any more, so production goes down.”¹¹

Chemical exposure during pregnancy has been found to affect both masculinization and long-term fertility in males. In the wild, fish, frogs and reptiles are also increasingly being born with both ovaries and testes.¹²

Research published in *PLOS Genetics*¹³ also found that exposing male mice to ethinyl estradiol, a synthetic sex hormone found in birth control pills, causes developmental problems in the reproductive tract, thereby lowering sperm counts (men may be exposed to birth control pills through contaminated water and other sources).

Part of the problem is that hormone-disrupting chemicals are ubiquitous and are found in everything from food, drinking water and household goods to personal care products, cleaning products, nonstick cookware and plastics.

Much of the damage occurs in early pregnancy during crucial developmental windows, when the fetus is first forming and cells are rapidly dividing. Exposure then continues with accumulating exposures throughout life, and, worse still, the damage that occurs can be passed on to future generations.

“A female fetus, in utero,” Swan explained, “is growing the eggs that she will use to have her own children. These chemicals can make their way to those germ cells, too.”¹⁴ The *PLOS Genetics* study also demonstrated generational effects of hormone-disrupting chemicals, with effects worsening with each subsequent generation until, by the third generations, some of the animals could not produce any sperm.¹⁵

The 1% Effect

An alarming synergy is occurring as well, which “Count Down” dubs “the 1% effect,” because sperm count, testosterone and fertility are dropping, and testicular cancer and miscarriage are rising, all at about 1% per year.¹⁶ Erectile dysfunction and the rate of gestational surrogacy are also increasing by about 1% a year, while the global total fertility rate dropped by close to 1% from 1960 to 2018.¹⁷

All of these concerning reproductive changes occurring in unison are not a coincidence, according to Swan. “They’re just too synchronous for that to be possible,” she wrote in *Scientific American*.¹⁸ Male babies may be particularly vulnerable to toxic exposures that occur during the reproductive programming window in early pregnancy.

Phthalates, chemicals used to make plastic soft, are known to lower testosterone and women’s exposure to phthalates during pregnancy is linked to male babies’ anogenital distance (AGD) – the distance from the anus to the base of the penis – with higher exposure associated with shortened AGD.¹⁹ Later in life, shorter AGD is linked with a smaller penis²⁰ and poorer semen quality, such that Swan believes AGD at birth is predictive of adult reproductive function.²¹

Exposure to hormone-disrupting chemicals in utero also increases the risk that male babies will be born with undescended testicles or a malformed penis, both of which increase the risk of low sperm count and testicular cancer in later life.²²

Along with the dropping sperm counts, changes in sexual development pose a threat to human survival, according to Swan, who also notes that human beings already meet three of the five criteria for what makes a species endangered.²³

Phthalates Among the Worst Hormone-Disrupting Chemicals

Swan cites phthalates, bisphenol A (BPA) and flame retardants as among the worst chemicals for reproductive health. Regarding phthalates, she told *The Guardian*:²⁴

“They are in everybody and we are probably primarily exposed through food as we use soft plastic in food manufacture, processing and packaging. They lower testosterone and so have the strongest influences on the male side, for

example diminishing sperm count, though they are bad for women, too, shown to decrease libido and increase risk of early puberty, premature ovarian failure, miscarriage and premature birth.”

An estimated 8.4 million metric tons of plasticizers, including phthalates, are used worldwide each year,²⁵ with phthalate production amounting to about 4.9 million metric tons annually.²⁶ The Norwegian Institute of Public Health found that 90% of those tested from 2016 to 2017 had **eight different plasticizers** in their urine.²⁷

Aside from their risks to reproductive health, phthalates can also **impair brain development**, increasing children’s risk of learning, attention and behavioral disorders. In one example, children born to mothers that were in the highest quintile of urinary phthalate levels (specifically, DEHP metabolites) during the second trimester of pregnancy were nearly three times more likely to be diagnosed with ADHD compared to children born to mothers in the lowest quintile.²⁸

Prenatal exposure to phthalates, especially metabolites of DBP and DEHP, has also been linked to a range of additional problem behaviors such as an increased likelihood of delinquent behaviors and more aggressive behaviors,²⁹ along with reductions in child perceptual reasoning, lowered IQ by seven points, anxiety and poorer working memory.³⁰

The widespread use of face masks could be accelerating the problem, as research accumulates that microplastics in masks, which may contain phthalates, are ending up discarded in the environment³¹ and may be inhaled by the wearer.³²

BPA, Atrazine and Flame Retardants Also Problematic

BPA is another prevalent hormone-disrupting chemical used to harden plastics, line metal cans and make receipts. This toxic chemical has been found to change the timing of puberty, reduce fertility, increase body fat and affect the nervous and immune systems.³³

“It is estrogen mimicking and so is a particularly bad actor on the female side, increasing risks of fertility challenges,” Swan told The Guardian, “but likewise it can

affect men. Men occupationally exposed to BPA have shown decreased sperm quality, reduced libido and higher rates of erectile dysfunction.”³⁴

The **pesticide atrazine** is another culprit. Early research by Tyrone Hayes, Ph.D., an integrative biologist at the University of California, Berkeley, hypothesized that atrazine turned on an enzyme (aromatase) that caused testosterone to be converted into estrogen.³⁵ If you’re a male, this means that you won’t make sperm, but you will make estrogen, even though you shouldn’t.

Flame retardants are also notorious and ubiquitous toxins that have been linked to hormone-disrupting effects³⁶ with serious repercussions for fertility, reproductive health and brain development.

Animals Grown in Mechanical Womb

Scientists are already working on how to grow life outside of a human womb and, for the first time, grew a mouse embryo in a mechanical womb for about half of a typical gestational term – a time period equal to a human embryo at 5 weeks.³⁷

Growing mouse embryos “ex utero,” the researchers said, is a valuable tool to investigate embryonic development in detail,³⁸ but it comes with serious ethical questions, including might humans be next?³⁹

The answer is yes, as lead researcher Jacob Hanna, a developmental biologist at the Weizmann Institute of Science, already told MIT Technology Review, “This sets the stage for other species. I hope that it will allow scientists to grow human embryos until Week 5.”⁴⁰

For those interested in protecting their own fertility – and that of future generations – as much as possible, **avoiding hormone-disrupting chemicals** is essential. Toward this end, Swan recommends some simple solutions, like eating unprocessed foods that you cook yourself as much as possible, as this will reduce your exposure to plastic food packaging. She also advises:⁴¹

“[W]hen cooking, don’t use Teflon or anything coated and don’t microwave in plastic. For personal care and household products use a minimum of simple products and try to avoid those that are scented; phthalates are added to hold scent.”

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