

## Why Dad's Environment Before Conception Matters

**Narrator:** For years doctors and scientists have known that exposure to harmful chemicals during pregnancy can cause health problems for a baby early in development and throughout its childhood. Now other important periods in human development, called windows of susceptibility, are getting more attention.

I sat down with Doctor Rick Pilsner to talk about preconception, the period before a baby is conceived, as one of these windows. He's an associate professor of environmental health sciences at the University of Massachusetts, Amherst.

**Pilsner:** Classically, I guess we've defined windows of susceptibility primarily focused on what's happening in utero, so right after pregnancy, because you do have this fetus that's developing very quickly. New types of cells are being programmed. So, different environmental conditions, diet, chemical exposures, smoking, these things could have a downstream effect of reprogramming these cells. This can influence health and development of that fetus. In the last five years or so, there's been a nice reevaluation of other windows of susceptibility. What my lab is working on is the preconception period.

I ended up getting in this line of research when my wife and I started thinking about having children. I ended up discussing with my wife, "All right, you need to be careful about different chemicals, pesticides, and plastics that you're being exposed to." My wife basically came right back to me and said, "Well, what about you?"

**Narrator:** Pilsner explained that it takes 74 days for a sperm cell to grow from a small round cell into a mature sperm. This complex process is largely driven by epigenetic changes, which alter the expression of genes without changing the genes themselves.

His research is shining light on how a father's environment can affect epigenetic changes in his sperm and, in turn, play a critical role in early-life development.

**Pilsner:** Our sperm epigenome is highly malleable, and different environmental conditions, if it's weight loss, if it's chemical exposures, really, the sperm epigenetics can carry a legacy of environmental exposures.... What we're trying to piece together is that sperm epigenetics may be a biological pathway by which certain environmental exposures can influence early life development.

**Narrator:** Pilsner and his team have followed a group of couples undergoing in vitro fertilization (IVF) through the Sperm Environmental Epigenetics and Development Study (SEEDS). In this study, they are looking at men's exposure to a group of chemicals called phthalates and how that may impact reproductive outcomes. Phthalates are widely used in products from vinyl flooring to cosmetics and perfumes. He explained that phthalates are endocrine disrupting chemicals, some of which are known to interact with male hormones, like testosterone, that play an important role in reproduction.

**Pilsner:** What we've found using our SEED study, is that male exposure to these phthalates were associated with diminished embryo quality. And that was independent of female exposures. And our subsequent research then investigated the mechanism by which that could occur, and we found that

those same phthalates that were associated with diminished embryo quality were also associated with changes in the sperm epigenome. Thus, suggesting that there could be a link, or a biological pathway, by which sperm epigenetics is mediating the effect of male phthalate exposure on diminished embryo quality.

**Narrator:** Pilsner explained that embryo quality is important because it can determine the likelihood of a successful pregnancy and healthy baby.

Pilsner and his team are collaborating with other researchers, such as Doctor Russ Hauser at Harvard University, to look at sperm epigenetics in another group of couples undergoing IVF. They are also looking at couples from the general population to see if the changes they see in sperm are consistent across the different groups.

So, what can couples who are planning families do to improve their preconception health? Pilsner says it's important for men to be aware of and reduce exposure to potentially harmful chemicals that may impact fertility. He also stresses the importance of positive lifestyle changes, such as not drinking alcohol or smoking, maintaining a healthy diet, and exercising, during the preconception period.

**Pilsner:** My take home message for folks is, "It takes two to tango." There's been an emphasis on women's environmental health, without really appreciating what's going on in the male. So as I discussed before, sperm takes 74 days to develop, so people have to take into account preconception environmental health, and that starts two to three months prior to conception. And there just needs to be an appreciation of what you're consuming, how you're behaving, your exercise level, that really could shape your sperm epigenome, which has the potential to pass along to your offspring.

**Narrator:** You can learn more about preconception and other windows of susceptibility by visiting our Environmental Health Chat web page.

Thanks to today's guest, Dr. Rick Pilsner, for joining us.

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