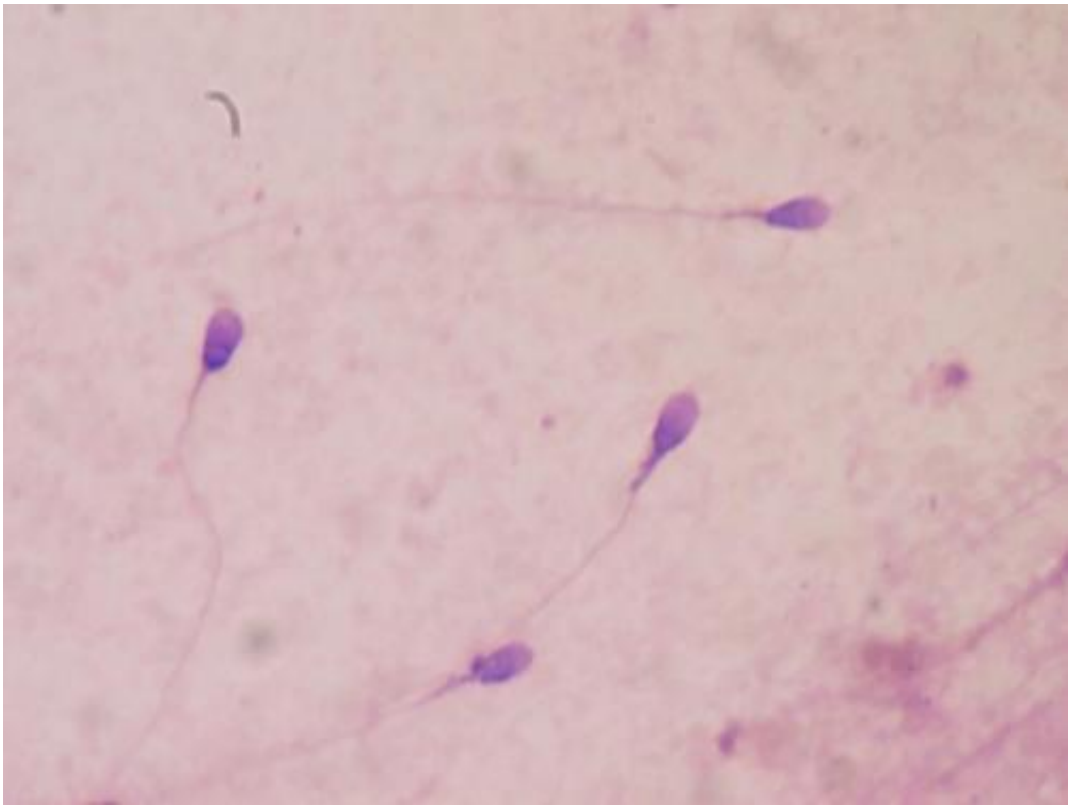
Sperm changes documented years after chemotherapy

February 1 2017



Human sperm stained for semen quality testing in the clinical laboratory. Credit: Bobjgalindo/Wikipedia

A Washington State University researcher has documented epigenetic changes in the sperm of men who underwent chemotherapy in their teens.

The changes can influence how genes are turned on an off, potentially affecting the health of tissues in subsequent generations, said Michael Skinner, a professor in the WSU School of Biological Sciences and Center for Reproductive Biology. He is suggesting that teens about to undergo chemotherapy have some of their sperm preserved for when they would like to start a family.

"I'm not suggesting that you shouldn't use chemo," he said. "In fact, I would suggest that you probably should use the chemo. I'm just saying that there are some preventative things that may need to be put in place before you use the chemo if possible."

Skinner is a leading expert in the field of epigenetics, which looks at changes in how genetic information is passed between generations. While certain environmental exposures can leave DNA sequences unaffected, he has documented how epigenetic change—alterations of small chemical groups attached to the DNA—affects how genes are turned on and off. His earlier work has found epigenetic effects from a host of environmental toxicants, connecting plastics, pesticides, fungicide, dioxin and hydrocarbons to diseases and abnormalities as many as four generations later.

Reproducible pattern of molecular changes

For the current study, published Wednesday in the online journal *PLOS One*, Skinner collaborated with researchers at the Seattle Children's Research Institute and the Fred Hutchinson Cancer Research Center. They include colleague Margarett Shnorhavorian, surgical director of the differences in sex development program at Seattle Children's and associate professor of urology at the University of Washington.

She obtained sperm from 18 men who had undergone chemotherapy as adolescents and 18 untreated men whose sperm served as a control.The

sample size was small, Skinner acknowledged, but all the sperm from the former chemotherapy patients had a similar pattern of molecular changes.

"It was very reproducible," he said. "That in and of itself was very surprising to me."

Next step: Effects in offspring

Direct exposure to chemotherapy could affect a lot of cells, Skinner said, but those effects should have disappeared within months. The testes take 75 days to make sperm, which remains in the body for 20 or 30 more days. So for effects to be seen 10 years later, cells in the testes must be "permanently altered," he said.

Skinner and his colleagues plan to investigate what effects, if any, these changes are having on subsequent generations. Shnorhavorian has received funding to look at the epidemiology of chemotherapy patients and their offspring, and Skinner hopes to look at similar changes in rodents.

Previous rodent studies have seen epigenetic alterations leading to prostate and breast cancers, kidney disease and decreases in male and female fertility in second and third generations, Skinner said.

"Those are things that I would predict, but I have no idea in this situation if that's the case," he said.

Skinner is founder of the WSU Center for Reproductive Biology. His groundbreaking work has been highlighted in documentaries by the BBC, Smithsonian and PBS. He became a member of the American Association for the Advancement of Science in 2012 and received a Smithsonian Ingenuity award in 2013.

More information: *PLOS One*, journals.plos.org/plosone/arti … journal.pone.0170085