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Researchers identify growth factor that stimulates adult stem cells

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(PhysOrg.com) -- A researcher in Penn State's College of Agricultural Sciences, collaborating with researchers at the University of Pennsylvania's School of Veterinary Medicine, has identified for the first time a critical growth factor that stimulates the stem cells that produce sperm to thrive and renew themselves.

The finding, published online in the March 6 issue of the journal *Development*, shows that testicular stem cells are influenced to increase divisions by a growth factor — called colony stimulating factor 1 — and shows these cells interact with their microenvironment, called the "niche." The study also identified the cells responsible for creating the growth factor.

Although the research involved mice, the discoveries have major scientific implications for future research involving stem cells in other animals and humans, according to Jon Oatley, Penn State assistant professor of reproductive biology, who was the lead author of the paper.

"This appears to be the first identified factor of the testicular stem cell niche with a specific effect on self-renewal," he said. "Stem cell self-renewal is critical for maintaining male fertility throughout life. The growing recognition of the profound control the niche has on stem cell function, including aging, makes our results of interest to scientists not only in reproduction but in all adult stem-cell systems."

All stem cells reside in a microenvironment generated by the cells that

surround them, known as the stem cell niche, Oatley explained. The stem cell and niche interact and influence each other, forming an interdependent, functional unit that results in stem cell self-renewal, differentiation and aging, in addition to stem cell death.

"We were previously able to show in mice that the stem cells in the testes are basically immortal, and that degenerative disease occurs as a result of the failure of the niche and not the stem cell," he said. "At least in testes, it appears that stem cells do not age."

Oatley, who had started working on stem cells in the testis as a doctoral candidate at Washington State University in 1999 and continued the work as a post-doctoral fellow at the University of Pennsylvania's School of Veterinary Medicine when he arrived there in 2004, completed the current study at Penn State.

Oatley is a member of Penn State's Center for Reproductive Biology and Health, a recently established center that includes a group of faculty committed to the improvement of reproductive health and function.

"At Penn, I worked in the laboratory of Ralph Brinster, professor of physiology, who has been a founder and leading researcher in the field of testicular stem cell biology," Oatley said. "I did about half of the work after I arrived at Penn State in 2007."

Adult stem cells in a lot of our tissues share similarities, Oatley pointed out. "We found this in the testis, but it may be that the cells in other tissues -- such as the liver, bone marrow and the brain -- share similar mechanisms, so it may be that the stem cells in other tissues respond to that same growth factor as well," he said. "The whole crux of stem cell research, of course, is regenerative medicine."

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Development of the National Institutes of Health, as well as the Robert J. Kleberg Jr. and Helen C. Kleberg Foundation, with additional funding from Penn State, the research also has implications for male contraception, according to Oatley.

"One potential application is in the field of male contraception, whether it is in humans or livestock," he said. "Almost all of the contraception work done to date has been on female contraception. It may be that if we establish targets, we could design drugs to restrict the production of sperm, perhaps reversibly.

"But male contraception is an extraordinarily complex prospect because every time a human man's heart beats, he produces 1,300 sperm -- so a man produces millions of sperm a day," Oatley added. "The challenge of impairing or inhibiting sperm production in testes is significant."

Reproductive biology research involving animals is responsible for many of the breakthroughs in human reproductive medicine, noted Oatley. "This kind of research in agricultural colleges has application for human and livestock health and biology," he said. "In this study we used rodents as a model, but we can apply what we learn to a lot of animals, including humans and livestock."

Researchers can make more and faster progress using rodents as models because of the ease of getting tissue, according to Oatley. "We make findings in rodents and then they are confirmed and translated in other species and even humans," he said. "A lot of what we know about human reproductive biology was learned by studying cattle and other livestock and was later confirmed and translated to human health."

Provided by Pennsylvania State University (news : web)