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Flatworms guide stem cell research

Flatworms may seem an unlikely star in the world of stem cells, but planarian research is yielding exciting insight into cell differentiation and regeneration. Néstor J. Oviedo and Michael Levin of the Forsyth Institute (Boston, MA) identified a protein in *Schmidtea mediterranea* flatworms that is expressed in the gap junctions between the worms' adult stem cells and may be involved in their regulation.

In worms engineered to not express the protein, regeneration was inhibited and stem-cell maintenance failed. In addition, expression of the protein was required for proper expression of other stem cell-specific markers (*Development* **134**, 3121–3131; 2007).

The results indicate that gap junction proteins are involved in controlling stem cell behavior. Taken together with recent studies in fruit flies, rodents, frogs and other vertebrates, the data suggest that gap junction communication might be an ancient means of mediating the interactions between stem cells and their differentiated neighboring cells in multicellular organisms. Further analyses of gap junction components should help to elucidate these interactions and identify new targets for controlling stem cell behavior. This line of research has biomedical applications in the treatment of diseases such as cancer, Parkinson's disease, spinal cord injuries and muscle damage.

Girls will be boys

What are little girl mice made of? According to researchers at Harvard University (Cambridge, MA), the vomeronasal organ, an olfactory organ responsible for detecting pheromonal cues, is a crucial component (*Nature*, published online 5 August 2007; doi:10.1038/nature06089). Catherine Dulac and colleagues disabled this organ in a group of female mice by genetically engineering them to lack the gene *TRPC2*, which is essential to its function. Modified females acted exactly like males, attempting to mount intruder mice, intensively investigating other mice's rears and displaying behavior highly unusual to females such as pelvic thrusts and ultrasonic mating calls. These females gave birth to pups but seemed to lack maternal instincts, readily abandoning their litters to explore outside territory.

Dulac's team compared these mice to another group of females whose vomeronasal organs were surgically removed. The physically altered mice displayed similar male-like behavior, suggesting that male tendencies do not need to develop from birth, but can be activated later.

Though sex hormones are currently accepted as the primary regulators of sex-specific behavior, the Harvard study suggests that reality may be far more complex: circuitry for both male and female behaviors may be present in the brain of each sex, and switched on or off by gender-specific sensory modulators.

Old flies may be younger at heart

Many of us are all too aware that the function of organisms deteriorates with age. But a new study of fruit flies (*Drosophila melanogaster*) led by Sige Zou of the NIH National Institute on Aging (Baltimore, MD) shows that different tissues in an organism age differently.

Using flies of six adult ages, Zou's group analyzed gene expression profiles in seven fly tissues representing various physiological systems (*Genome Res.* **17**, 1236–1243; 2007). In each tissue, they found hundreds of genes whose expression changed significantly with age. Fewer than 10% of these age-related genes were present in more than one tissue, and more than 80% of the biological processes in which they participated were tissue-specific. Nonetheless, the few overlaps between aging processes in various organs suggest that some mechanisms may be conserved across tissues.

Zou and colleagues also identified different temporal aging patterns in each tissue. The brain and testis, for example, changed substantially between middle and old age, whereas in muscle tissue the change was less pronounced.

As similar tissue-specific patterns have been observed in humans, this study may help provide insight into our own aging processes.