Figure 1: Model for epigenetic inheritance of odor fear conditioning.

From

Lamarck revisited: epigenetic inheritance of ancestral odor fear conditioning

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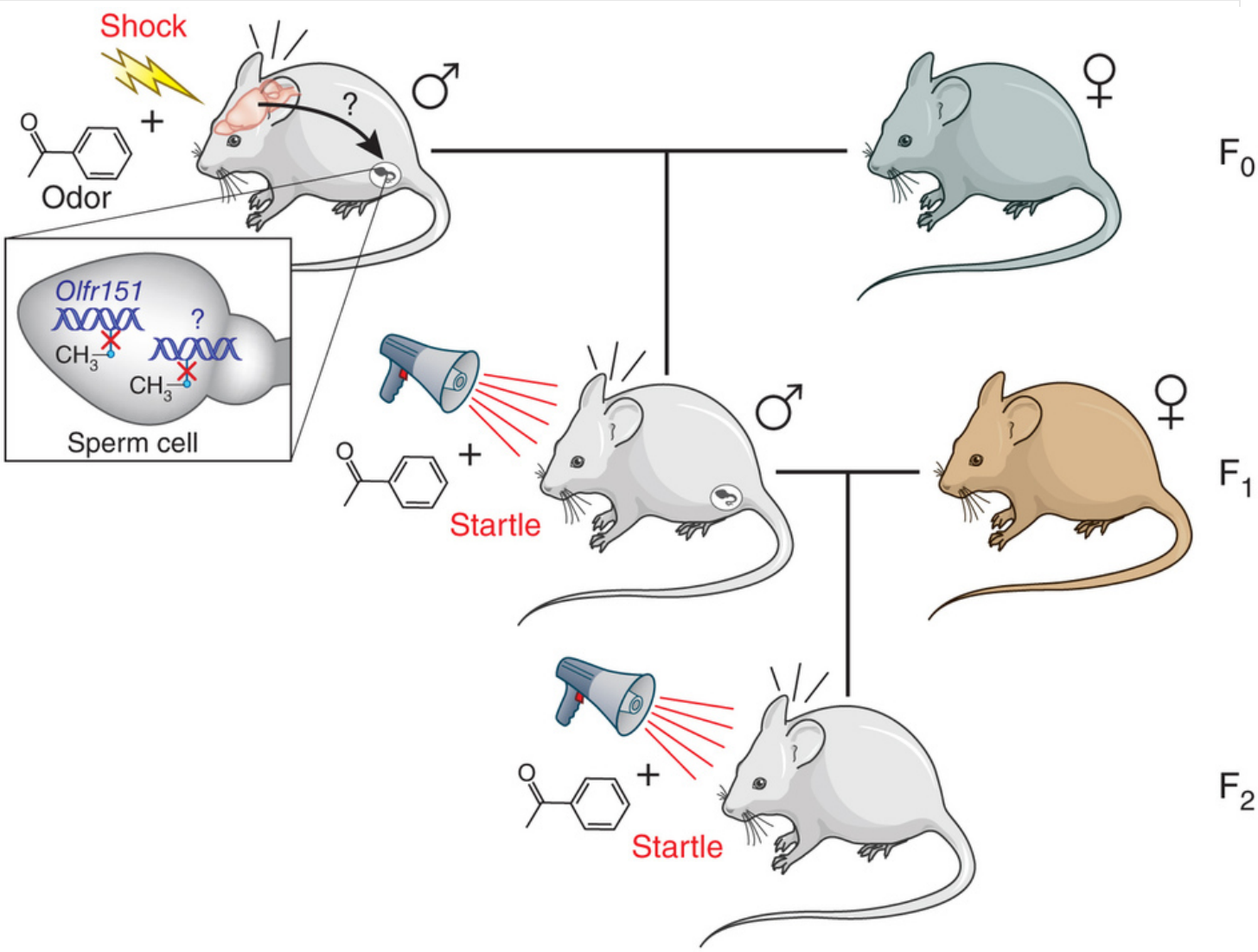

Association of acetophenone odor with an electrical shock conditions the mouse for an enhanced acetophenone startle response. Although the mechanism is unknown, this may trigger the release of circulating molecule(s), such as microRNAs or glucocorticoids, that act on spermatogonia to direct DNA methylation changes in both specific olfactory receptor genes, such as *Olfr151*, and other genes, as yet unknown, that are involved in the fear conditioning circuitry in the brain. When the demethylated sperm fertilizes a naive female, the methylation pattern is maintained in the fertilized eggs and may guide the differentiation of fear circuitry. The adult F_1 mouse exhibits enhanced startle in the presence of acetophenone. During primordial germ cell differentiation in the F_1 mouse, the methylation pattern triggered by the conditioned exposure to acetophenone is preserved. When the resulting marked sperm fertilizes a naive mouse, the offspring F_2 will develop the same conditioned fear response circuitry in the brain, using the epigenetic information in the F_1 sperm to guide differentiation. The adult F_2 mouse likewise shows a heightened startle response in the presence of acetophenone.

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