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Journal club

BREAKING THE GERM LINE–SOMA BARRIER

August Weismann proposed that hereditary information moves only from germline to body cells and never in reverse. The concept proposed by Weismann did not support the Lamarckian view of the inheritance of acquired characteristics. However, Weismann's idea of a strict germ line–soma barrier can now be challenged with research on mammalian germ cells using induced pluripotent stem cells (iPSCs) derived from somatic cells.

Primordial germ cells, which are the mammalian precursors of sperm and eggs, are set aside early during mouse and human development. This early developmental decision that separates the germ line from the soma forms the basis of a fundamental concept of development, in which the soma perishes with each generation, whereas the germ line is considered to be 'immortal', as it passes genetic — and possibly epigenetic — information from one generation to the next. This demarcation between the germ line and the soma is apparently never breached, which is known as the Weismann barrier. Indeed, under normal circumstances, somatic cells in mammals are not known to contribute to the germ line after the lineage is specified.

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This was the case until it became possible to reprogramme somatic cells into iPSCs. Using cumulative knowledge from advances in mammalian germ cell biology, Hayashi *et al.* managed to manipulate mouse cells so that they breached the Weismann barrier, demonstrating that it is possible, in principle, to take adult somatic cells and — via iPSCs — convert them into functional gametes from which live animals can be produced. They showed that iPSCs could be made competent for primordial germ cell fate, and that when these cells are exposed to the bone morphogenetic protein 4 (BMP4) signalling molecule, they undergo specification into primordial germ cells.

Irie *et al.* have recently shown that it is also possible to convert human skin cells into primordial germ cells via iPSCs, which paves the way for major advances in human germline biology. As well as advances in reproductive biology, this opens up an opportunity to investigate contentious issues, such as whether or not epigenetic information induced by environmental factors (as envisaged by Lamarck) can be transmitted to the next generation. It will also be possible to explore new gene-editing techniques for germline modifications, and above all, this research will advance our knowledge of early human development.

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ORIGINAL ARTICLES Hayashi, K. *et al.* Reconstitution of the mouse germ cell specification pathway in culture by pluripotent stem cells. *Cell* **146**, 519–532 (2011) | Irie, N. *et al.* SOX17 is a critical specifier of human primordial germ cell fate. *Cell* **160**, 253–268 (2015)