Patient Information Document for Studies on the establishment and properties of germ cells and gametes

Primordial germ cells (PGC) are the precursors of both sperm and eggs. The founder population of PGCs develop very soon after embryos implant in the womb, and therefore they are amongst the earliest specialised cells to be formed during embryonic development. These cells are unique and immortal since they have the potential to generate a whole new organism, and therefore all subsequent generations. As such, they play the crucial role in transmitting genetic (and epigenetic) information to a new generation.

Currently, we have little or no knowledge of how human PGCs become established, since they form in very early embryos and have never been investigated. It is important to know precisely how the founder population of sperm and eggs are formed since errors in their specification could contribute to human infertility. Development of these cells can also go awry occasionally, and result in the formation of testicular germ cell cancers. Above all, defects in the formation germ cells may also lead to infertility, or abnormality of embryos that develop from them after fertilisation. As transmitters of genetic information to subsequent generations, we also need to improve our knowledge of their precise properties to determine if certain environmental factors and diet alter their properties resulting in fetal and placental malformations.

Using our increasing knowledge of how PGCs develop in laboratory animals, we now have the means to establish an informed programme of research to identify and study the emerging founder population of PGCs in early human embryos. Following culture of early blastocysts, it will be possible to dissect out specific fragments of tissues where we expect to find the emergence of the first cells to undergo changes for PGC specification. Once early PGCs are examined and well characterised, we have a possibility to culture them further. In the future, it may even be possible to culture them until they develop to form mature gametes.

This knowledge of how PGC develop, may pave the way to designing procedures for generating PGCs and possibly even gametes from pluripotent stem cells, which are derived from blastocysts. This would obviate the need to use more embryos for research. Now, with the ability to convert adult cells, such as skin cells, directly into pluripotent stem cells (so called induced pluripotent stem cells, or iPS), we also have the prospects of using iPS for studies on human germ cells. For example, we can make iPS cells from patients that may have mutations that affect germ cell development resulting in infertility or abnormal development. In this way, we can directly examine how specific mutations affect germ cells, and based on this knowledge, we can potentially develop therapeutic agents to overcome the effects of such mutations. At the same time, we can also directly examine how environmental factors affect germ cell development. More importantly, this work may also pave the way to understand how environmental factors might affect development and properties of germ cells, which could in turn result in defective genes and their transmission, resulting in diseases in, potentially in the long term in subsequent generations.