Journal of Assisted Reproduction and Genetics (2018) 35:353
https://doi.org/10.1007/s10815-018-1177-6

EDITOR'S COMMENTARY

On the confluence of reproductive and regenerative medicines

David F. Albertini [1]
Published online: 10 April 2018

© Springer Science+Business Media, LLC, part of Springer Nature 2018

Stem cell mania continues to capture the attention of patients, entrepreneurs, physicians, and scientists but for very different reasons. The energy powering curiosity and imagination today parallels the global warming of attitudes and public perceptions occurring in response to a cloned sheep and the production of the first human embryonic stem cells a fortnight ago. Then, as now, and beyond the optimism consequential to such announcements, arrive fears of what might lie ahead if the technologies of cloning and stem cell derivation were to find their way into the wrong hands.

With Dolly and the not-so-coincidental emergence of embryonic stem cells launching the biomedical enterprise into a new era, is it much of a surprise today that these seemingly disparate technological advances would become so intertwined as to build a nexus between regenerative and reproductive medicine? Beginning with the harnessing and application of so-called gene editing to modify human embryos as an experimental and yet ethically charged appetizer, tackling mitochondrial diseases along the way with Dollyesque donor egg enucleation genome swapping, we arrive at a turning point in reproductive medicine that may forever change the way ARTs are publicly perceived and professionally practiced, beyond its origins in the treatment of infertility [1].

Peering into the future is risky business. And bearing in mind that we are at the dawning of gene editing, it is fair to ask where all of this might be going in a world advocating an admixture of regenerative potential and manipulating what has become a very accessible commodity: human gametes. 2017 provided contributions to the literature that plot out very different pathways of opportunity.

In one case, the target was clearly therapeutic. Putting an "affected" male genome in an "editing-competent" ooplasm waiting for the signal to drive embryogenesis, Ma and colleagues offered much more than a proof-of-principle series of experiments: setting the stage for curing an ailing genome [2].

Quite to the contrary in intention was the landmark publication of Fogarty and friends. Aiming their scissoring technology at a core component of the genetic machinery that drives early development allowed them to define timely events leading to lineage specification in the human embryo, all the while uncovering just how we hominids diverge from our murine model systems, which until now form the basis for much of what we know about mammalian embryogenesis [3, 4].

While these papers evoke the *Frostian* metaphor of two roads leading to very different places, their confluence somewhere down the line will hopefully be brought together for the benefit of patients in need for both genetic or fertility reasons. As pointed out recently, our present state of knowledge regarding early development in the human remains at a rudimentary level on both genetic and epigenetic grounds [5, 6].

And just as the events of the late 1990s were not foreseen to have become united as they are today, what the confluence of reproductive and regenerative medicines will finally bring about will in no small way build upon the foundations of human ARTs and the shrewd use of technologies for the purpose of family building.

References

1. Vassena R, Heindryckx B, Peco R, Pennings G, Raya A, Sermon K, et al. Genome engineering through CRISPR/Cas9 technology in the human germline and pluripotent stem cells. Hum Reprod Update. 2016;22(4):411–9.
2. Ma H, Marti-Gutierrez N, Park SW, Wu J, Lee Y, Suzuki K, et al. Correction of a pathogenic gene mutation in human embryos. Nature. 2017;548(7668):413–9.
3. Fogarty NME, McCarthy A, Snijders KE, Powell BE, Kubikova N, Blakeley P, et al. Genome editing reveals a role for OCT4 in human embryogenesis. Nature. 2017;550(7674):67–73.
4. Fogarty NME, McCarthy A, Snijders KE, Powell BE, Kubikova N, Blakeley P, et al. Erratum: genome editing reveals a role for OCT4 in human embryogenesis. Nature. 2017;551(7679):256.
5. Ruzo A, Brivanlou AH. At last: gene editing in human embryos to understand human development. Cell Stem Cell. 2017;21(5):564–5.
6. Condic ML. Totipotency: what it is and what it is not. Stem Cells Dev. 2014;23(8):796–812.

✉ David F. Albertini
eicjarg@gmail.com

[1] Center for Human Reproduction, New York, NY, USA