**Comment on WSJ "Should Heritable Gene Editing Be Used on Humans?" George Church 11-Apr-2016

Comments on Marcy Darnovsky's section.

I fully agree on the need for caution. Indeed, I feel that regulatory agencies world-wide are empowered to do this for therapies of all sorts. Gene therapies should not be exceptions. Below are a few points which merit clarification and embedded references to the underlying facts.

"Gene editing in humans ... past experiments with this approach have been disappointing"
Clinical trials for gene editing -- for Leukemia and HIV-AIDS seem to be described as quite promising. It seems important to mention a source that discusses in what manner these are "disappointing".

"in ways that we can't possibly predict because of the complexity of the human genome."
Editing from a harmful DNA state (the example given was Tay-Sachs) to a healthy DNA version seems quite possible to predict. Indeed, nearly all human have a healthy version of Tay-Sachs DNA state.

"nearly every nation with an advanced biotechnology sector, have passed laws prohibiting heritable human genetic modification."
A 2007 Survey lists 79% of countries have no such prohibition, including US, China and Mexico. The term "advanced biotechnology sectors" is ill defined, and numbers of countries is not necessarily a better metric than total populations represented (since many of the countries with prohibition have very small population size).

"preimplantation genetic diagnosis ... less biologically risky and socially consequential than attempting to manipulate future children's genes"
This gives the false impression that "preimplantation" methods (like IVF-PGD) do not manipulate future children's genes. This could have a much larger impact than editing, since editing of sperm would result in 50% carriers, while IVF-PGD can be used to eliminate both disease and carriers. It also understates how biologically risky PGD-IVF can be (e.g. 2-5% ectopic pregnancy) Those who champion the "right to life" of all embryos may not agree that halting the life of "preimplantation" embryos is less "socially consequential" than a method which would prevent such embryo deaths.

"A few advocates of gene editing for reproduction are openly enthusiastic about "enhancing" future generations."
You can find "a few advocates" of many ideas, but the FDA (+ EMA, CFDA, etc.) requires safety testing for new medicines. The approval of new therapies eliminating deadly diseases are not typically impacted by the larger challenges of getting new medicines of lesser impact approved.

Comments on WSJ components.

Giving references as embedded web links (as done in this note) is not that cumbersome, and is very important for the Wall Street Journal to set a good example and to enable decision-makers in business and in politics -- making it easy for them to find the facts (and encouraging the expert WSJ authors to stay close to those facts).

"2015 The cost of sequencing an individual's genome falls to $1,245 from $16 million a decade

earlier."
The cost of an individual's genome in 2014-2015 was $1000. The cost a decade earlier was not "$16 million", because there was no individual's genome completed in 2005. The first such genome was reported in Oct-2007 and estimated to cost $200 million -- an underestimate since it depended somewhat on a $3 billion tech investment.

--George Church 11-Apr-2016

(Media inquiries, contacts & resources: Harvard Medical School & Wyss Institute).