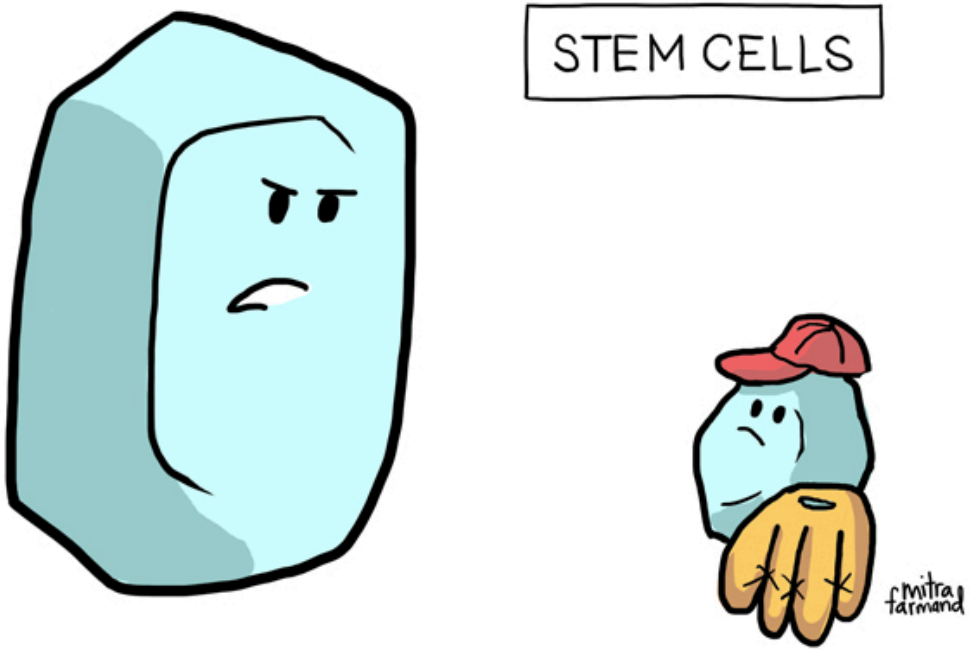
Stem Cells

Bioengineering 100

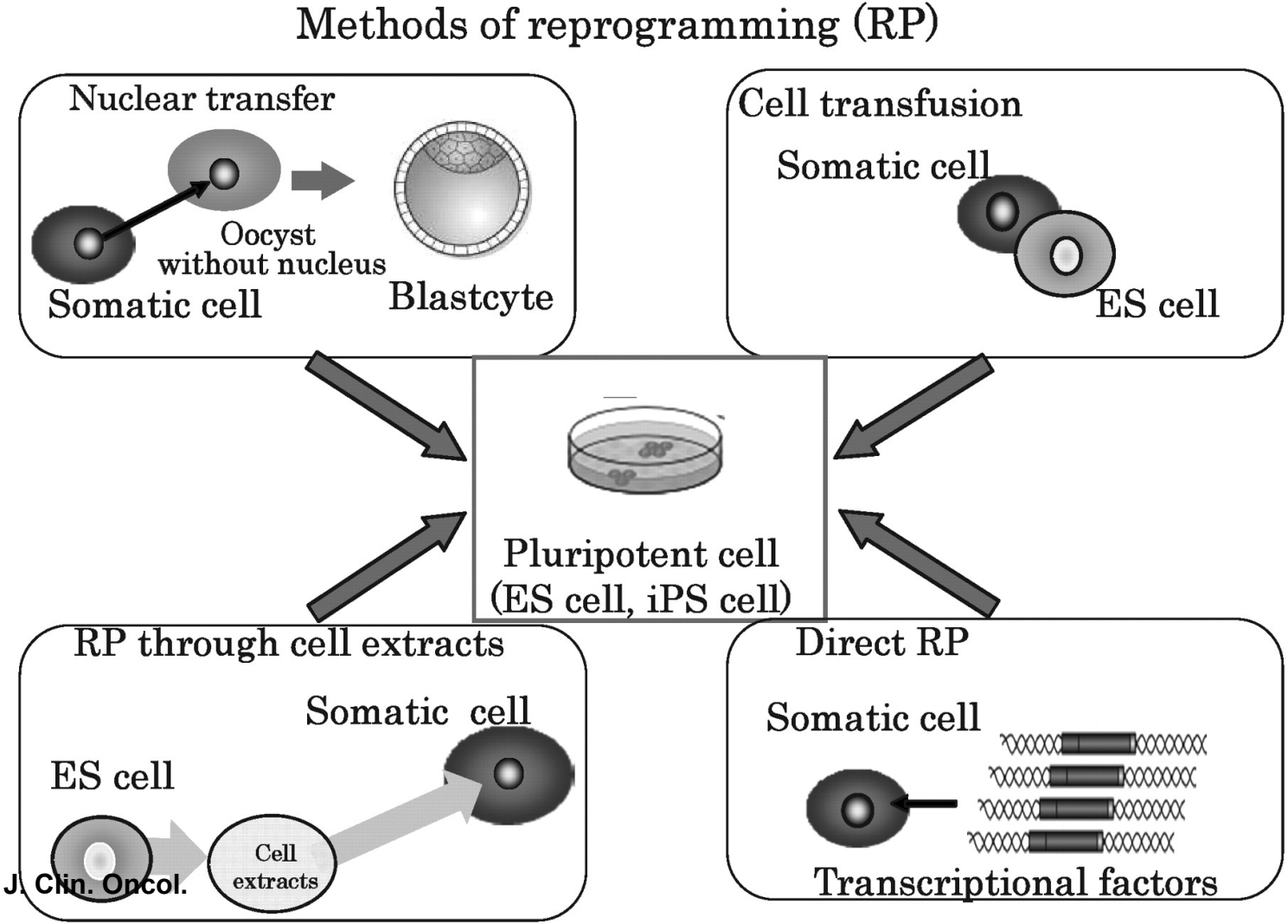
Fall 2016



http://wlrn.org/post/south-florida-likely-see-small-scale-zika-outbreaks; Jentavery/flickr

2001 Bush issues executive order restricting stem cell research


SCIENCE
ARE THESE PICTURES OF STEM CELLS?
THOSE ARE MY KIDS.
PLEASE CHECK YOUR MORALS & ETHICS AT THE DOOR
Lisa©2009 3/13



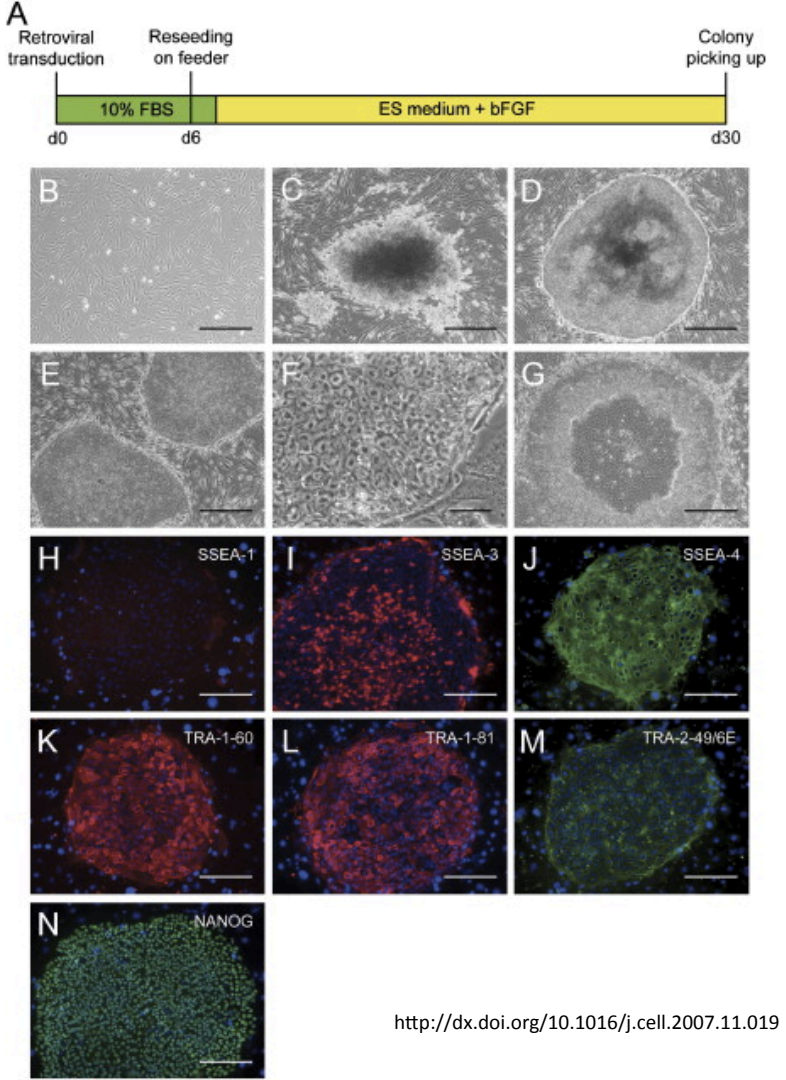
Susumu Miyazaki et al. Jpn. J. Clin. Oncol. 2012;42:773-779

August 2006: mouse iPS paper

Shinya Yamanaka
Kyoto University and The Gladstone Institutes for Cardiovascular Disease, University of California, San Francisco

Nov 2007: human iPS paper

(A) Time schedule of iPS cell generation.
(B) Morphology of HDF.
(C) Typical image of non-ES cell-like colony.
(D) Typical image of hES cell-like colony.
(E) Morphology of established iPS cell line at passage number 6 (clone 201B7).
(F) Image of iPS cells with high magnification.
(G) Spontaneously differentiated cells in the center part of human iPS cell colonies.
(H–N) Immunocytochemistry for SSEA-1 (H), SSEA-3 (I), SSEA-4 (J), TRA-1-60 (K), TRA-1-81 (L), TRA-2-49/6E (M), and Nanog (N). Nuclei were stained with Hoechst 33342 (blue). Bars = 200 μm (B–E, G), 20 μm (F), and 100 μm (H–N).



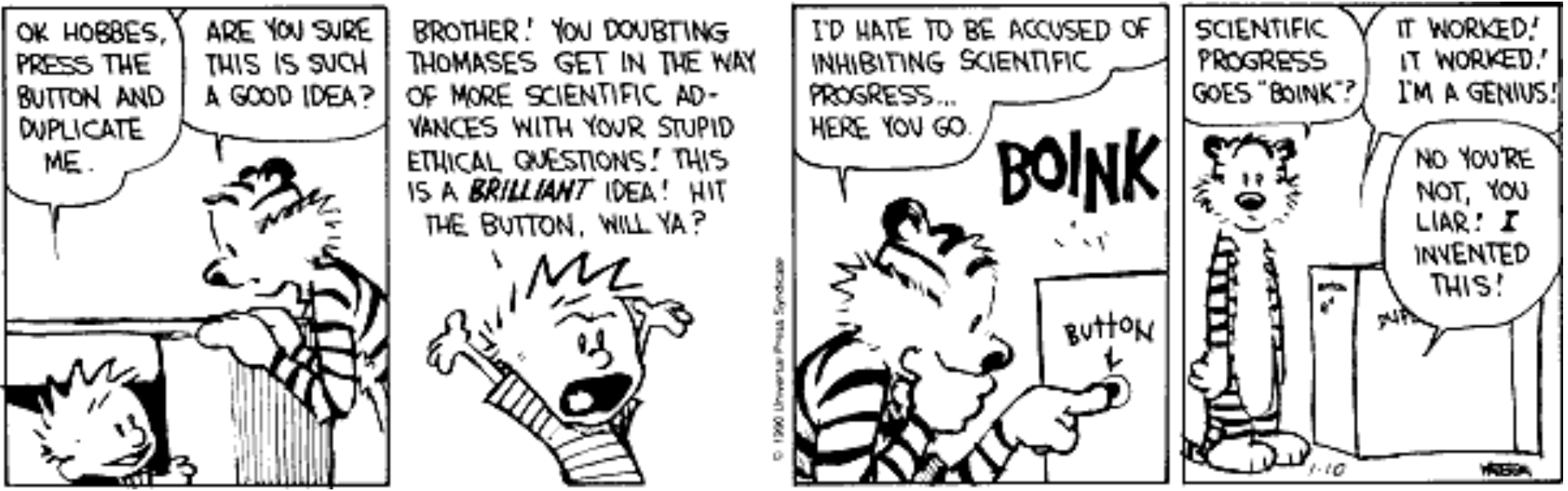
http://dx.doi.org/10.1016/j.cell.2007.11.019

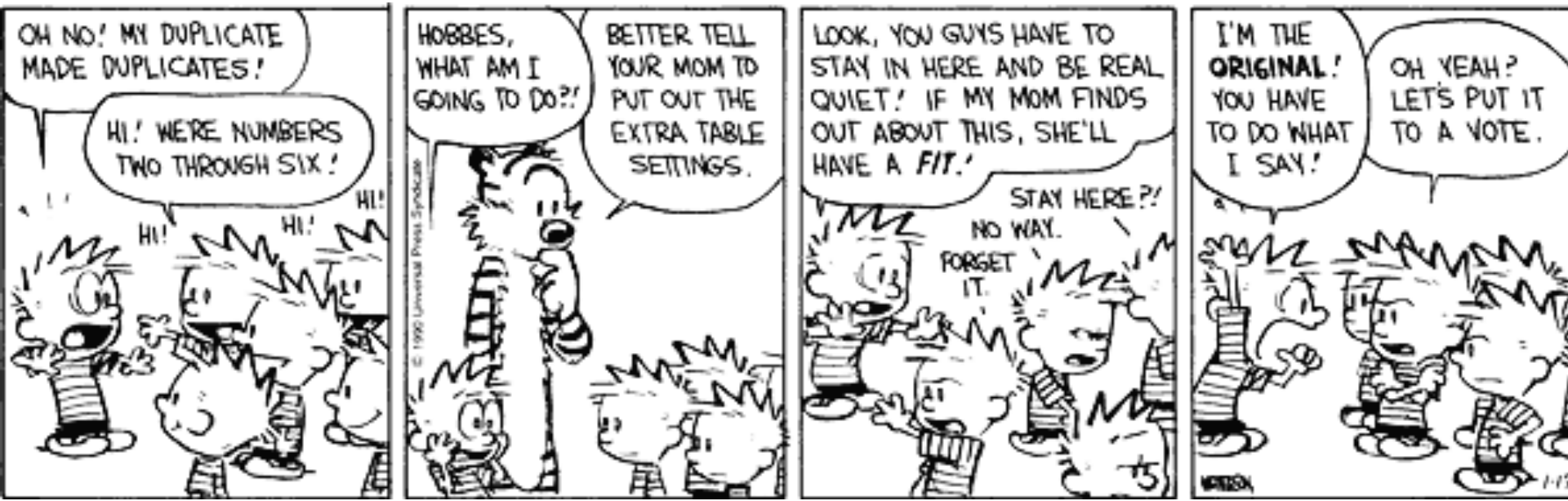
2009 Obama reverses ban

Stem Cells & Cloning

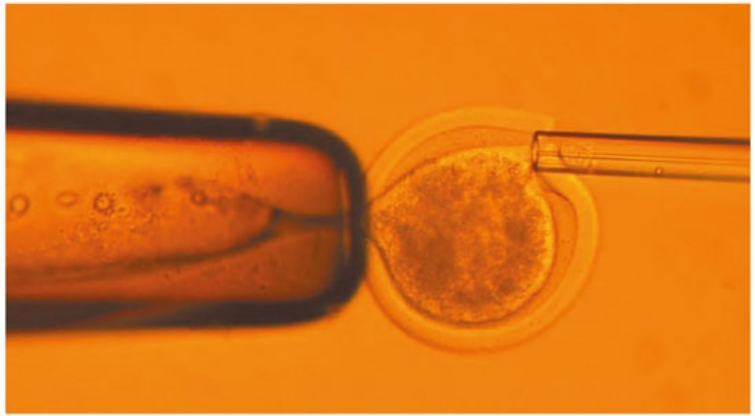
Bioengineering 100

Fall 2016


OK HOBBES, PRESS THE BUTTON AND DUPLICATE ME.
ARE YOU SURE THIS IS SUCH A GOOD IDEA?
BROTHER! YOU DOUBTING THOMASES GET IN THE WAY OF MORE SCIENTIFIC ADVANCES WITH YOUR STUPID ETHICAL QUESTIONS! THIS IS A BRILLIANT IDEA! HIT THE BUTTON, WILL YA?
I'D HATE TO BE ACCUSED OF INHIBITING SCIENTIFIC PROGRESS... HERE YOU GO.
BOINK
BUTTON
SCIENTIFIC PROGRESS GOES "BOINK"?
IT WORKED! IT WORKED! I'M A GENIUS!
NO YOU'RE NOT, YOU LIAR! I INVENTED THIS!
© 1990 Universal Press Syndicate


OH NO! MY DUPLICATE MADE DUPLICATES!
HI! WE'RE NUMBERS TWO THROUGH SIX!
HI!
HI!
HI!
HOBBES, WHAT AM I GOING TO DO?!
BETTER TELL YOUR MOM TO PUT OUT THE EXTRA TABLE SETTINGS.
© 1990 Universal Press Syndicate
LOOK, YOU GUYS HAVE TO STAY IN HERE AND BE REAL QUIET! IF MY MOM FINDS OUT ABOUT THIS, SHE'LL HAVE A FIT.
STAY HERE?!
NO WAY.
FORGET IT.
I'M THE ORIGINAL! YOU HAVE TO DO WHAT I SAY!
OH YEAH? LET'S PUT IT TO A VOTE.

THE RISE AND FALL AND RISE OF WOO SUK HWANG



FEBRUARY 2004
Woo Suk Hwang describes the first stem-cell line, NT-1, derived from a cloned human embryo.

MAY 2005
Hwang's group publishes a second paper reporting 11 further human embryonic cell lines.

AUGUST 2005
Hwang's group is the first to clone a dog.

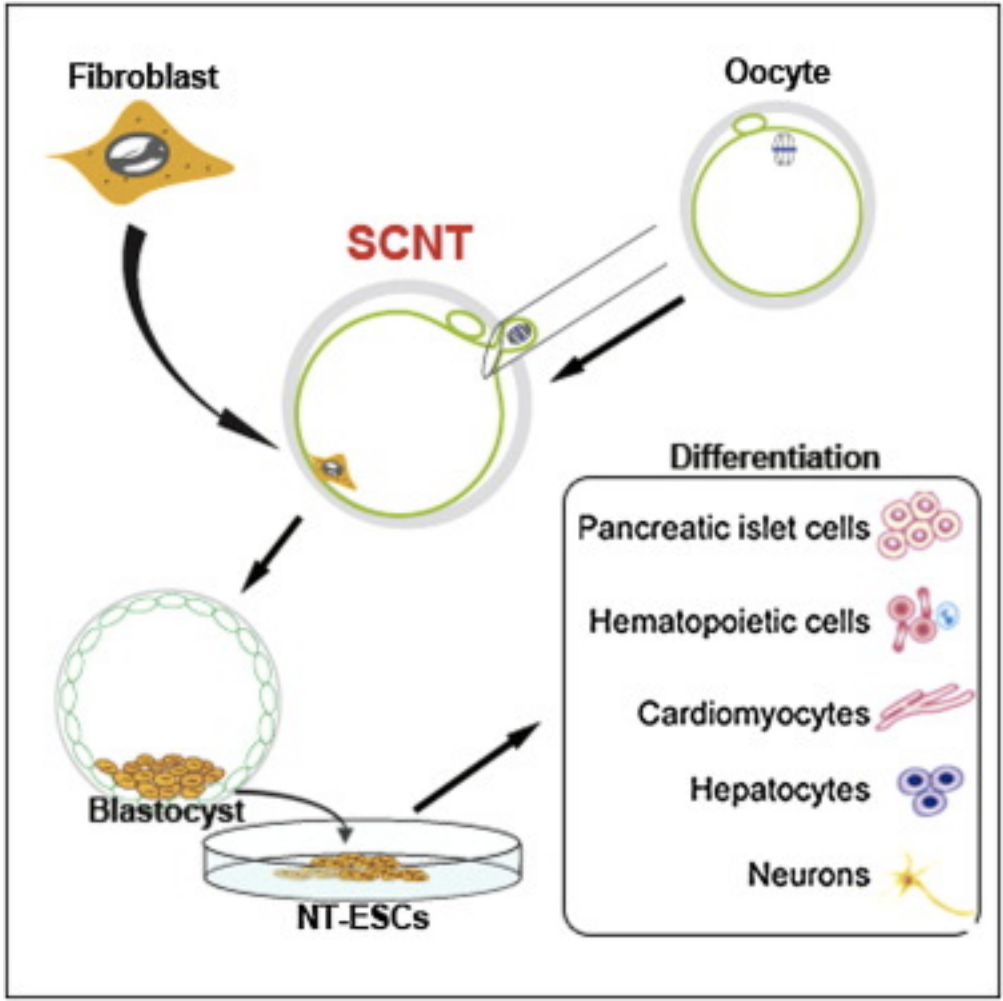
NOVEMBER 2005
US collaborator Gerald Schatten splits with Hwang, citing ethical problems in getting human eggs.

DECEMBER 2005
Pushed by increasing evidence, Seoul National University (SNU) launches an investigation.

JANUARY 2006
Hwang's human-cloning research is deemed fraudulent by SNU. His dog-cloning claims are upheld.

http://www.nature.com/news/cloning-comeback-1.14504

Somatic Cell Nuclear Transfer (SCNT)



http://dx.doi.org/10.1016/j.cell.2013.05.006

Women: Would you donate your eggs?

242 eggs from 16 donors: 30 embryos and 1 cell line (SCNT-hES-1)

2004 Science paper

doi:10.1126/science.1094515

Egg donation bioethics

“The donors were anonymous, but one PhD student in the team, Ja Min Koo, initially told Nature that the donors included herself and another woman in the lab. She subsequently called back and said that she had not donated eggs, blaming her poor English for a misunderstanding. But in the initial interview, she named the hospital where her donation was carried out, and explained that she had been happy to donate eggs because she already has two children.”

doi:10.1038/429003a

11 new SCNT hES cell lines, x=~17 eggs used per cell line. *What changed to increase the efficiency??*

2005 Science paper

doi:10.1126/science.1094515

nature Vol 438|1 December 2005

NEWS

Clone star admits lies over eggs

After a year and a half of denials, Woo Suk Hwang admitted last Thursday that his stem-cell research used eggs from paid donors and junior members of his team. Although planning to continue his research, Hwang said he would quit his other positions.

Despite the confession, which shocked South Korea and the global stem-cell research community, many have remained supportive

have serious side effects. Paying donors is now illegal in Korea, although it was not at the time of Hwang's study. And receiving donations from subordinates raises a variety of ethical problems, including the spectre of coercion.

Until 24 November, Hwang had denied everything. Then, in a press conference aired live on all three of the country's main television networks, he admitted that eggs from his

the eggs. "I don't need any rewards," he says. Hwang has not disclosed his expenditures or budget for the project, saying only that all funds came from private sources.

The extent to which a junior member of his laboratory might have felt pressure to donate is also under debate. The student spoken to by *Nature* last April showed no signs of having been coerced by Hwang. During a 28-minute

2005: Hwang admits to using eggs from paid donors and junior members of his research team; resigns

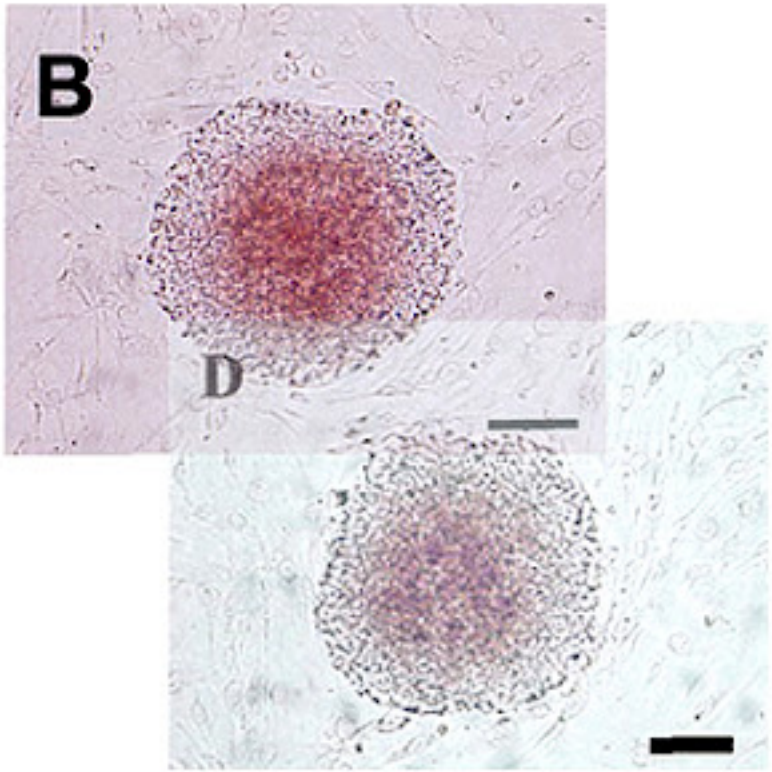
2006 Seoul National University Final Report

- NT-hES-1 from 2004 paper data fabricated
- All 11 lines from 2005 paper data fabricated

"does not possess patient-specific stem cell lines or any scientific basis for claiming to have created one."

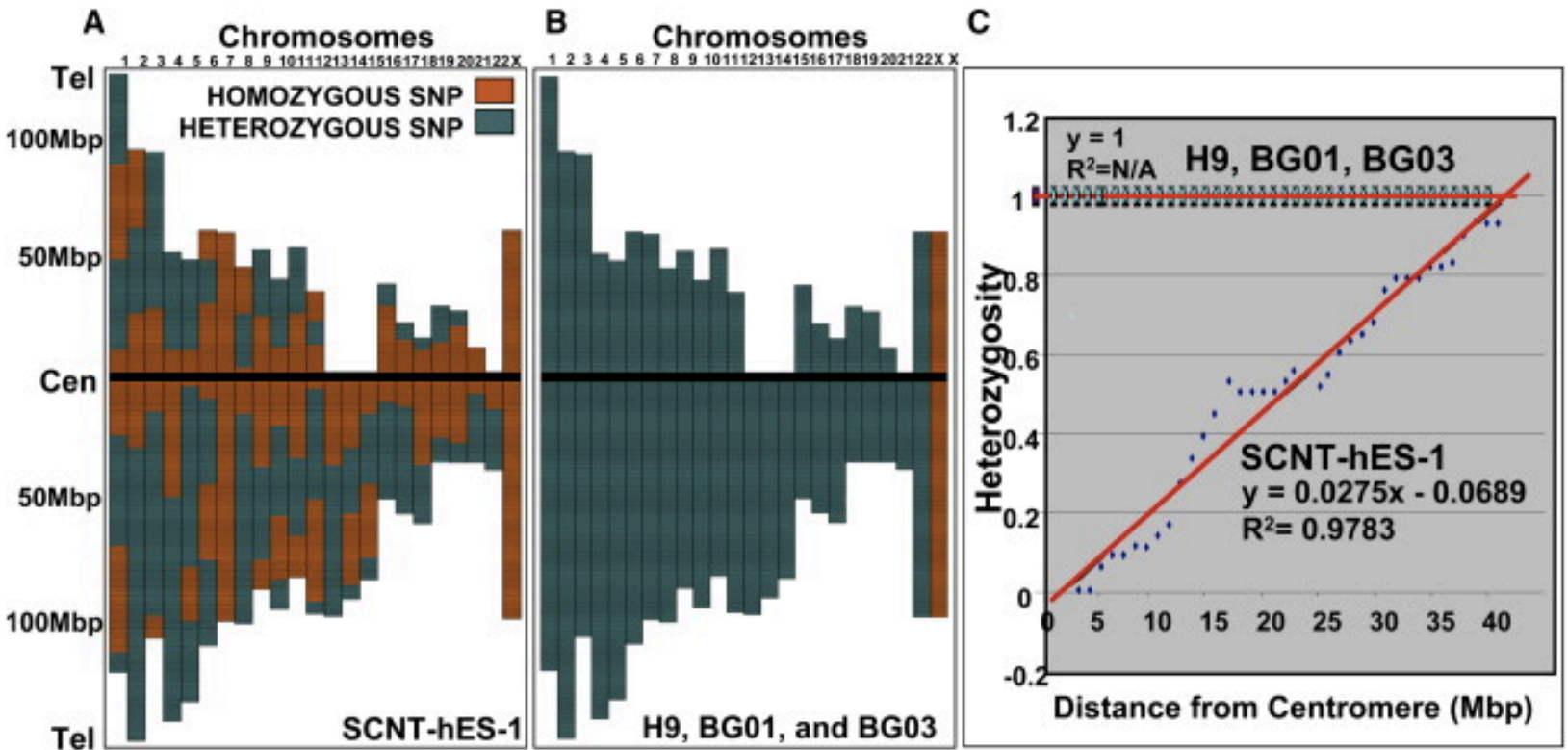
10.1126/science.1124926

Example



- ‘B’ from 2004 paper
- ‘D’ from a totally different paper that was not related to NT-hES cell lines

2007: NT-hES-1 most likely a parthenogenic line



http://dx.doi.org/10.1016/j.stem.2007.07.001

JULY 2006
Sooam Foundation starts up, with US$3.5 million from Hwang's supporters.

2007
The Korean health ministry grants Sooam the right to do human-embryo and cloning research.

OCTOBER 2009
Hwang is found guilty of embezzlement and bioethics violations. Appeal continues.

2011
Canada grants Hwang a patent for the NT-1 cell line.

2012
Sooam scientists clone a coyote using a dog egg-cell donor and surrogate mother.

2013
Court tells the Korean Centers for Disease Control and Prevention to register the NT-1 cell line.

http://www.nature.com/news/cloning-comeback-1.14504

Would you clone a favorite pet?

Snuppy & Sooam

- First cloned dog (2005)
- Sooam Foundation (2006) now clones dogs and other animals
- ~$100,000 USD for a dog clone

http://www.dailymail.co.uk/news/article-2601265/

2013: SCNT hES cells.. finally!

Cloning provides human embryonic stem cells with promise for personalized medicine

For the first time, a team of scientists has used SCNT to produce human embryonic stem cells

By Mary Beth O'Leary Posted on 15 May 2013

Print PDF

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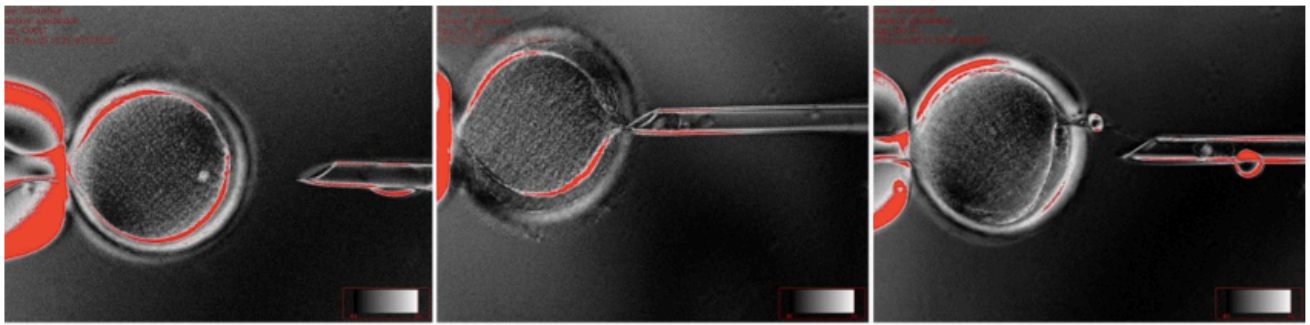

Nuclear extraction of a donor egg. The first image shows the egg cell (the large circular object being held in place by a pipette to the left.) Later shots show the egg nucleus being extracted from the egg cell (by a different pipette) — all in preparation for its fusion with a skin cell to kick off the cloning process. Click to enlarge. (Photos courtesy of Oregon Health & Science University)

http://dx.doi.org/10.1016/j.cell.2013.05.006

https://www.elsevier.com/connect/major-advance-provides-human-embryonic-stem-cells-with-promise-of-use-in-personalized-medicine