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Why we ask for skin samples? Human stem cell models for Alzheimer and Parkinson/ DLB research

Why do you want skin in the game?

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Participant Appreciation Day
November 2, 2023

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What happens with your skin biopsy in the lab?

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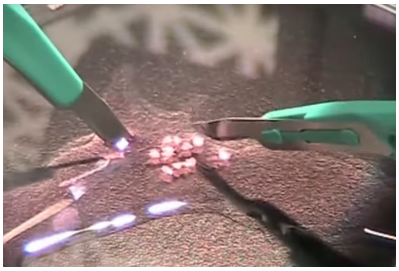
Skin biopsy processing in the lab

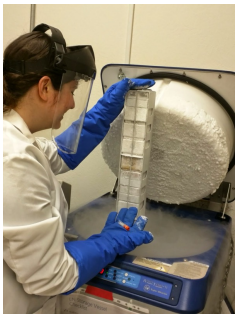


Cut skin into small pieces

Skin grows in dish for 4-6 weeks

Skin cells grow in incubators at 37° C (body temperature)

Skin cells 'hibernate' in liquid nitrogen (-190° C)



Alex's skin cell blog (http://skincellblog.blogspot.com)

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Skin cells in-a-dish

Alex's skin cell blog (http://skincellblog.blogspot.com)

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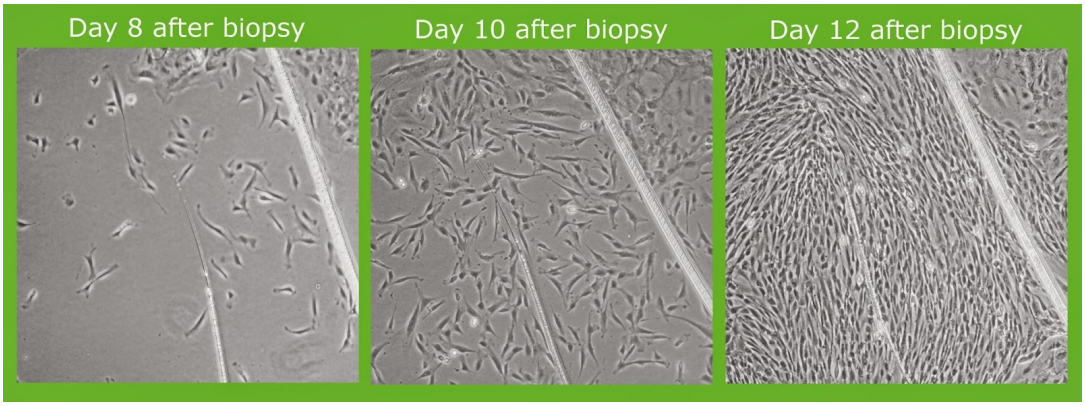
Grow, bank, share, and make discoveries



Grow = divide and multiply

Alex's skin cell blog (http://skincellblog.blogspot.com)

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…but, skin cells are not neurons in a brain

How do you model Alzheimer and Parkinson's disease in the laboratory?

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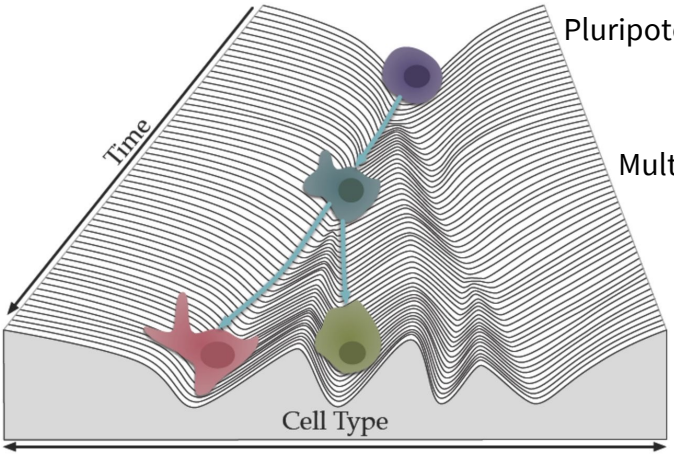
Mammalian development was thought to be unidirectional



Pluripotent embryonic stem cells

Multipotent or progenitor cells

Mature cell types

Waddington model, 1957

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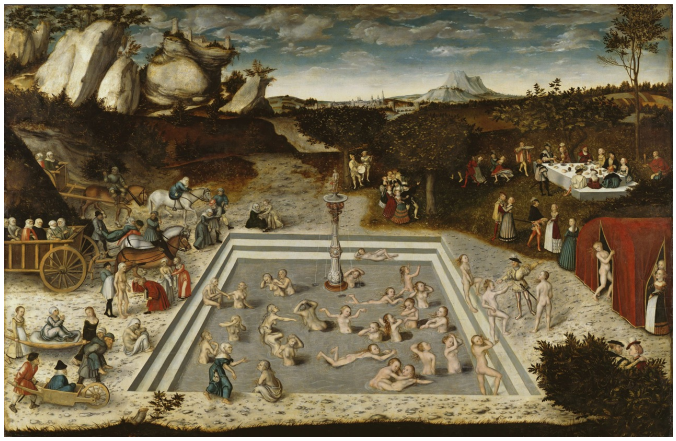
Scientists discovered fountain of youth in 2007

= Reprogramming of mature cells into induced pluripotent stem cells (iPSCs) *in a dish*



Lucas Cranach d. Ä., 1546

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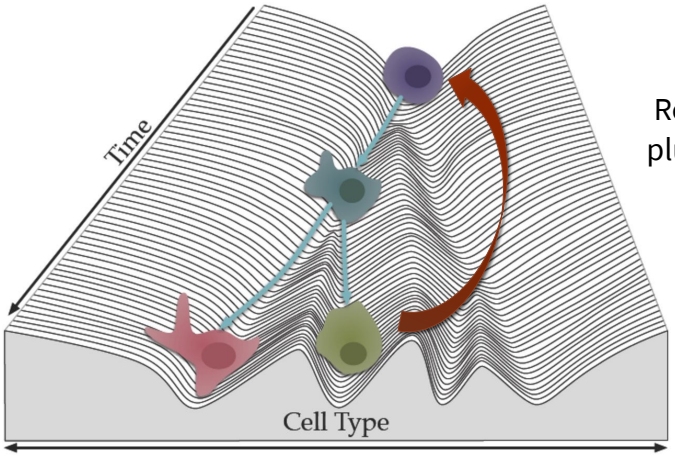
Cell fate is flexible and reversible



Reprogramming into induced pluripotent stem cells or iPSCs

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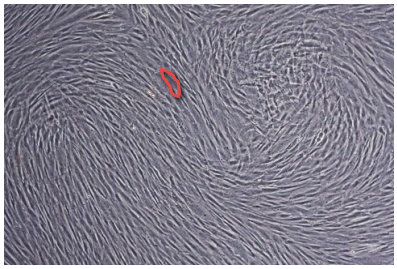
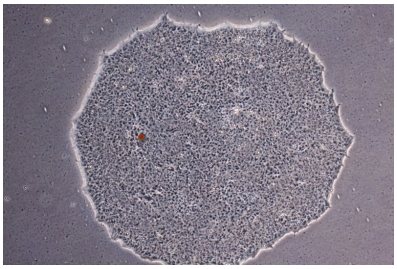
How do human stem cells look under the microscope?



Skin cells

Reprogrammed into stem cells



Stem cell colony (consisting of thousands of cells)

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What can iPSCs be used for?

MODELING NEURODEGENERATION **IN A DISH**

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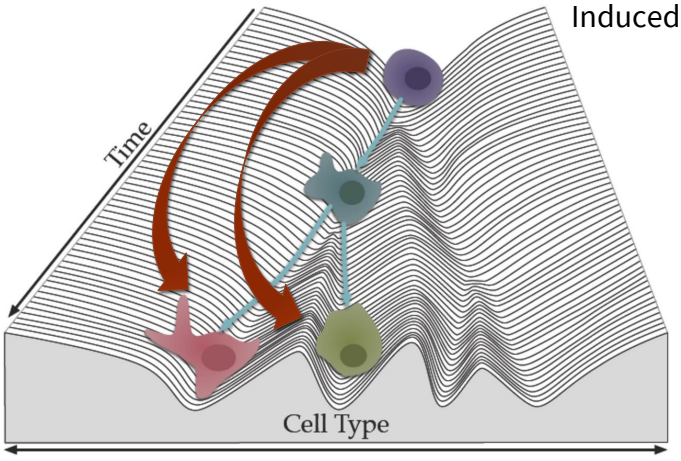
In vitro differentiation – making neurons in a dish



Induced pluripotent stem cells

"Scientific pixie dust"

Differentiated neuronal and non-neuronal cell types

Mimic human development in a dish

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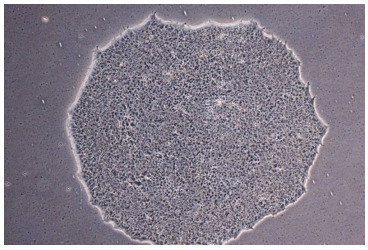
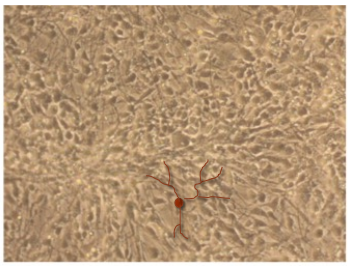
How do neurons look under the microscope?



Stem cell colony

Differentiation into neurons over several weeks or even months



Neurons

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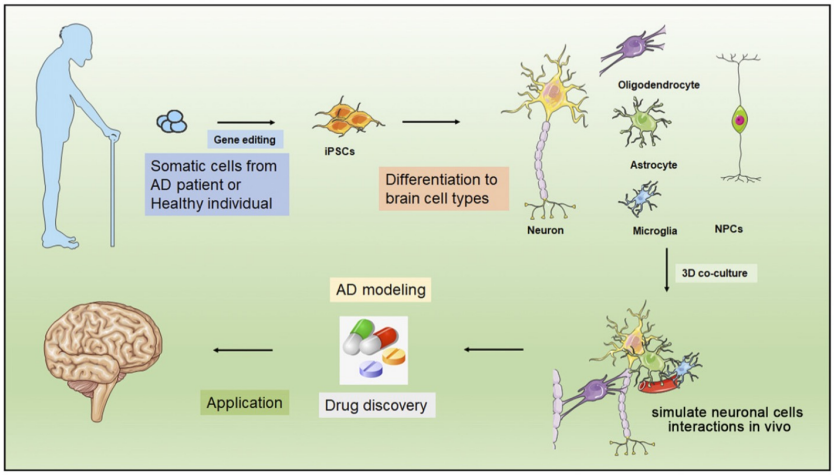
AD and LBD disease in-a-dish for understanding mechanisms & drug discovery



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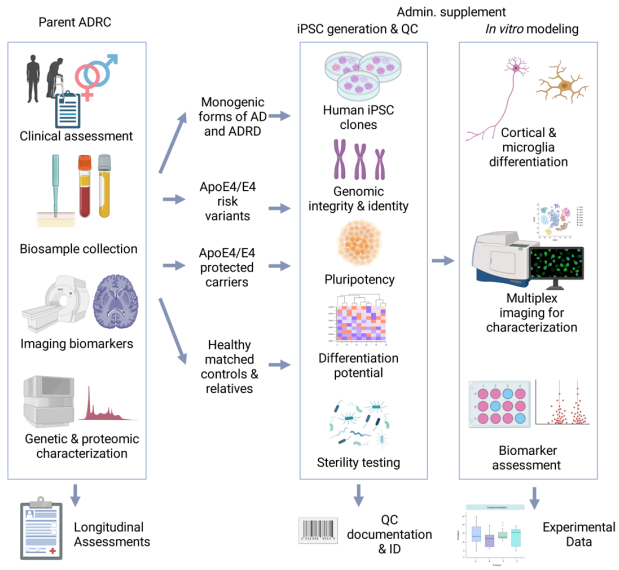
Human stem cell program in Healthy Aging Study at Stanford ADRC



Advantages over other models:

- Human genetic background
- Patient-derived
- Genetic mutations or risk factors
- Environmental factors can be modeled in a dish
- Introduce genetic modifications

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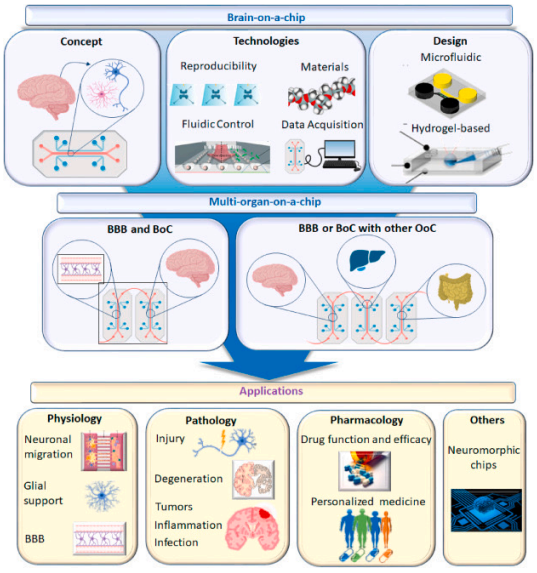
Next frontier: Brain-on-a-chip modeling

- 3D modeling
- Blood-brain-barrier
- Combine with other organs
- More physiological readouts
- Potential to replace animal models



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Thank you for your attention!

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