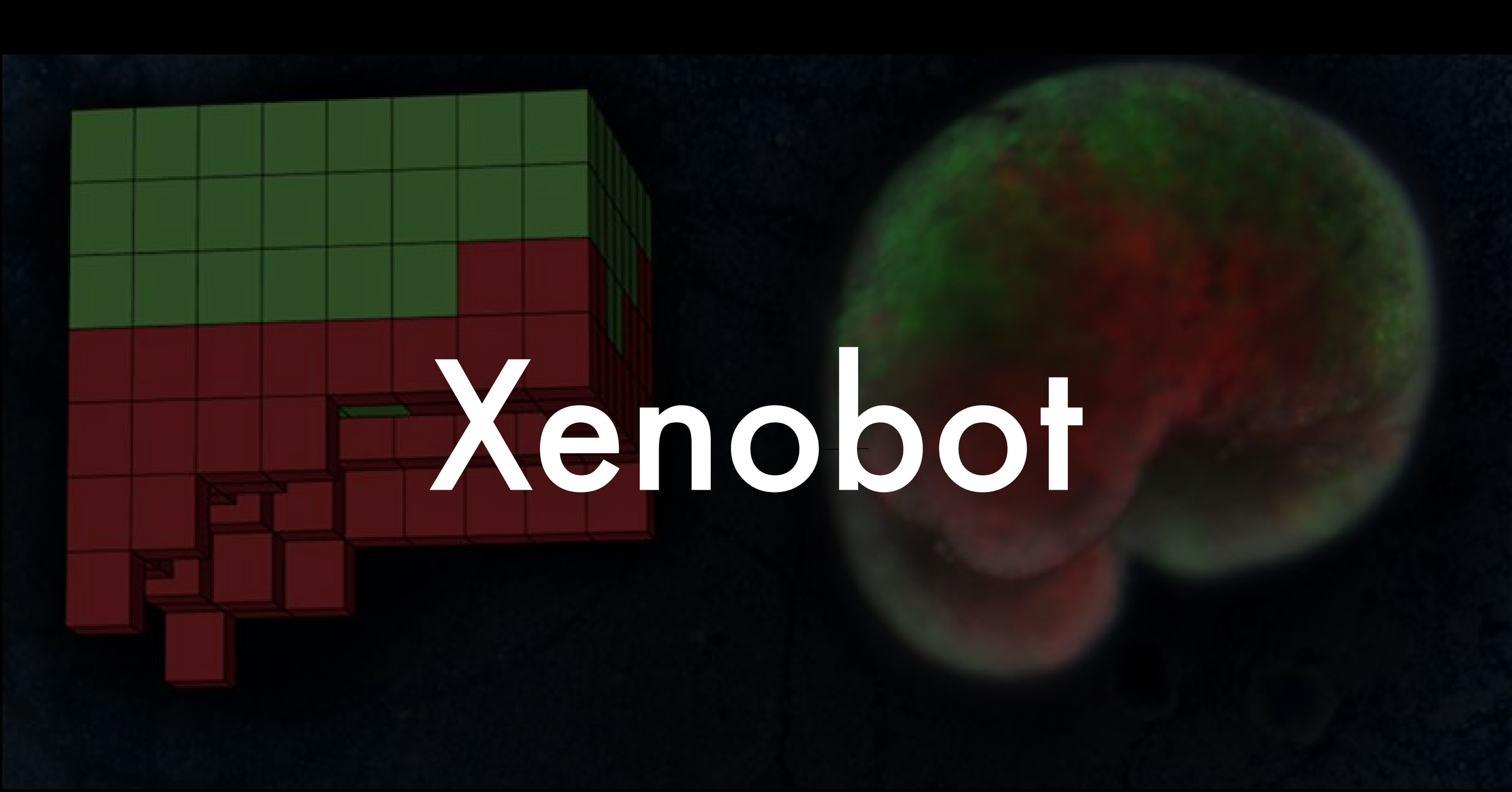
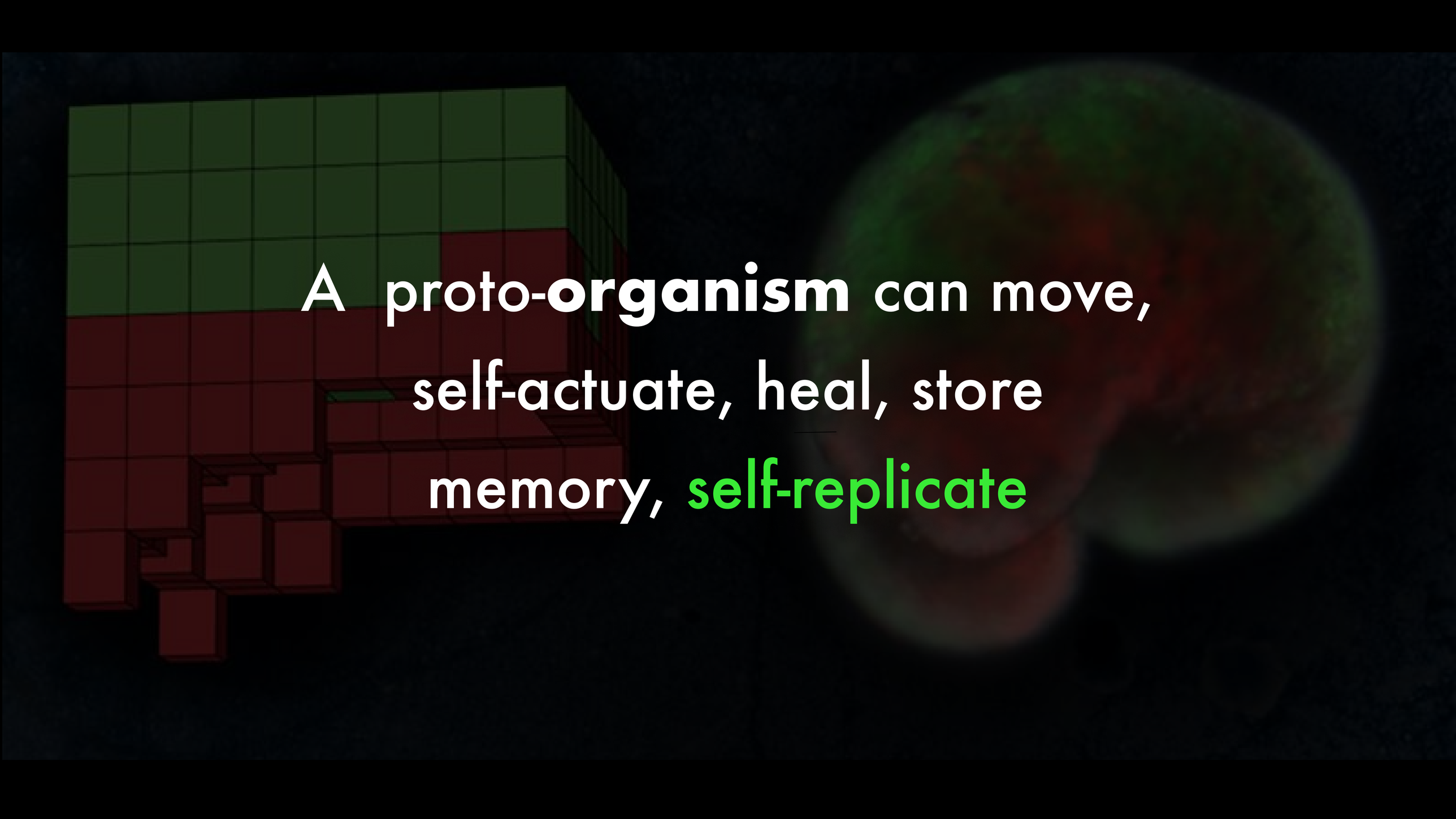
BIOROBOTICS

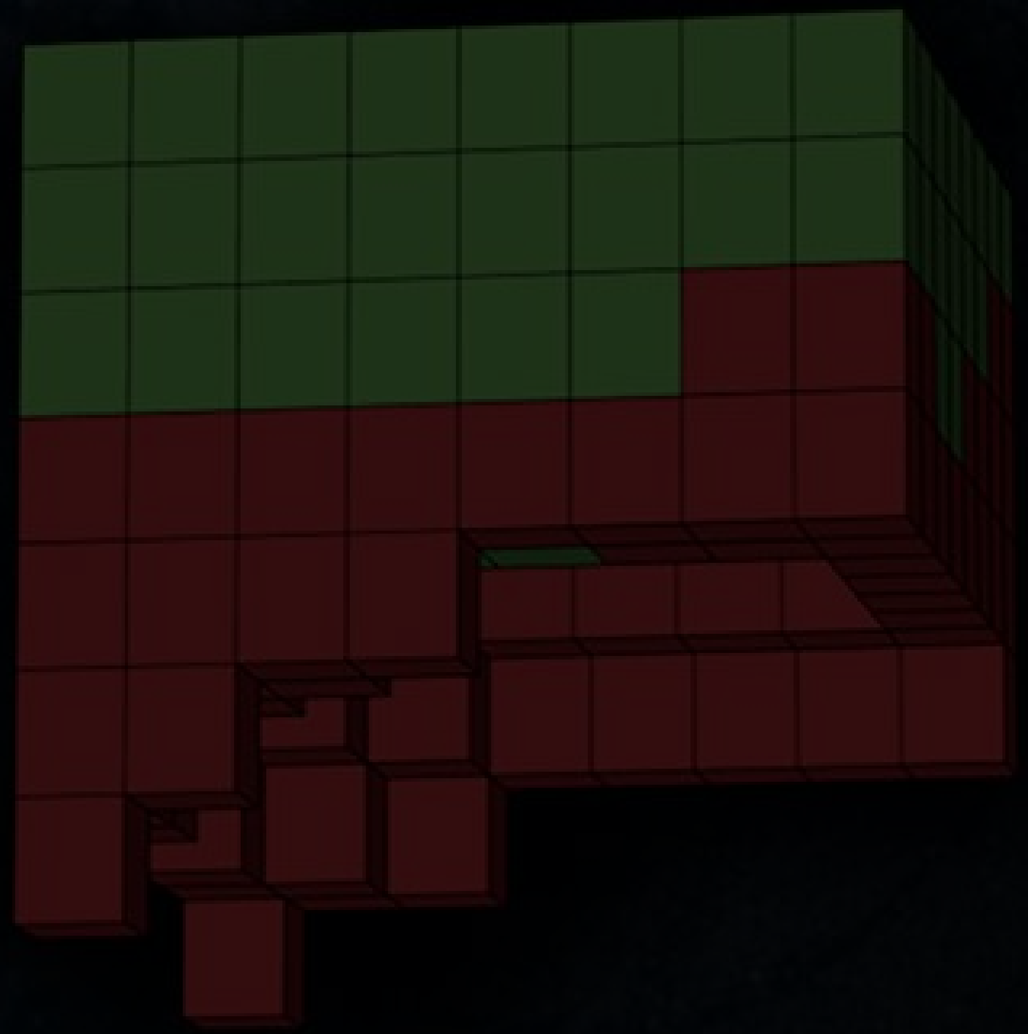
Xenobots and Robot Reproduction.

What happens when AI Meets biotechnology?

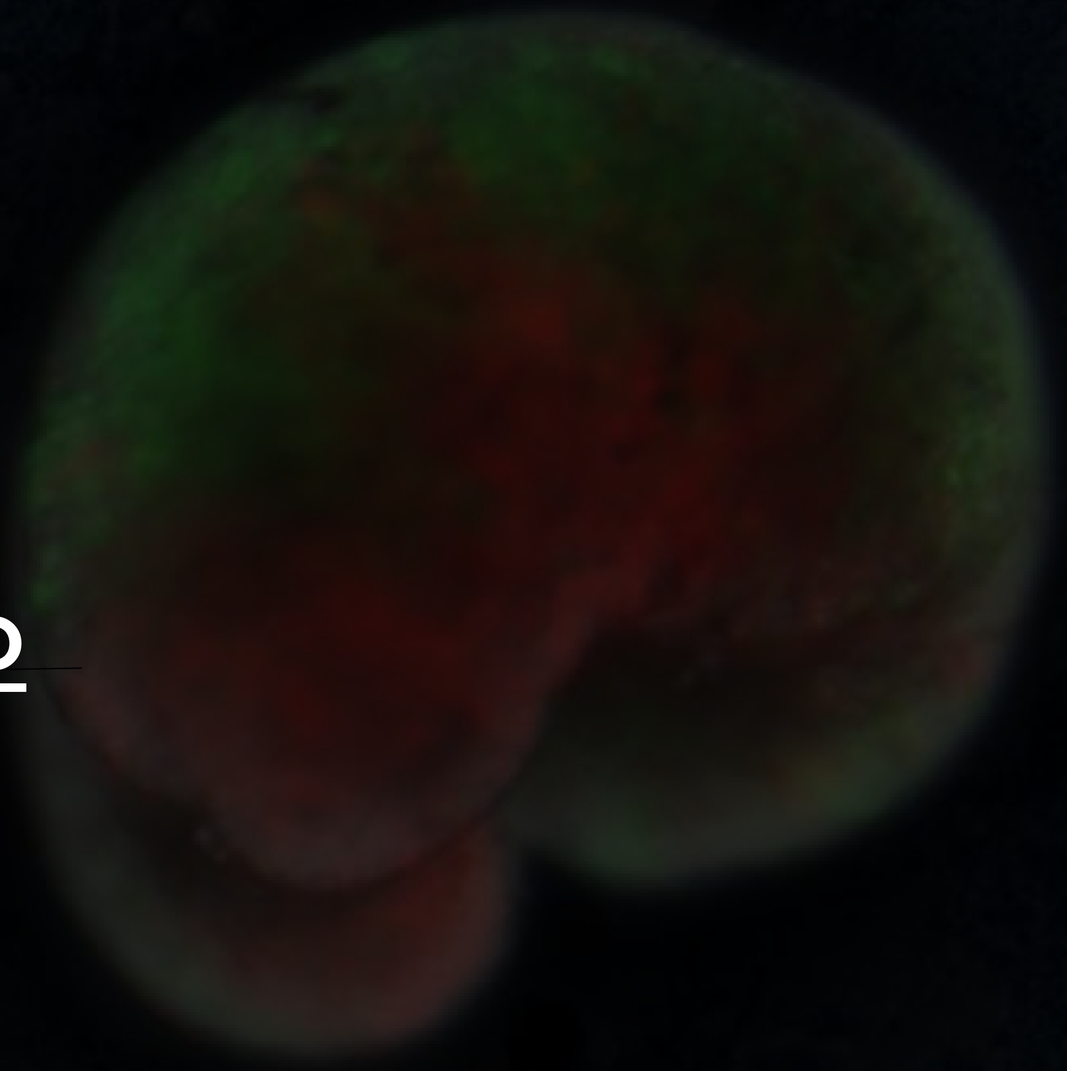
Yeji Kwon

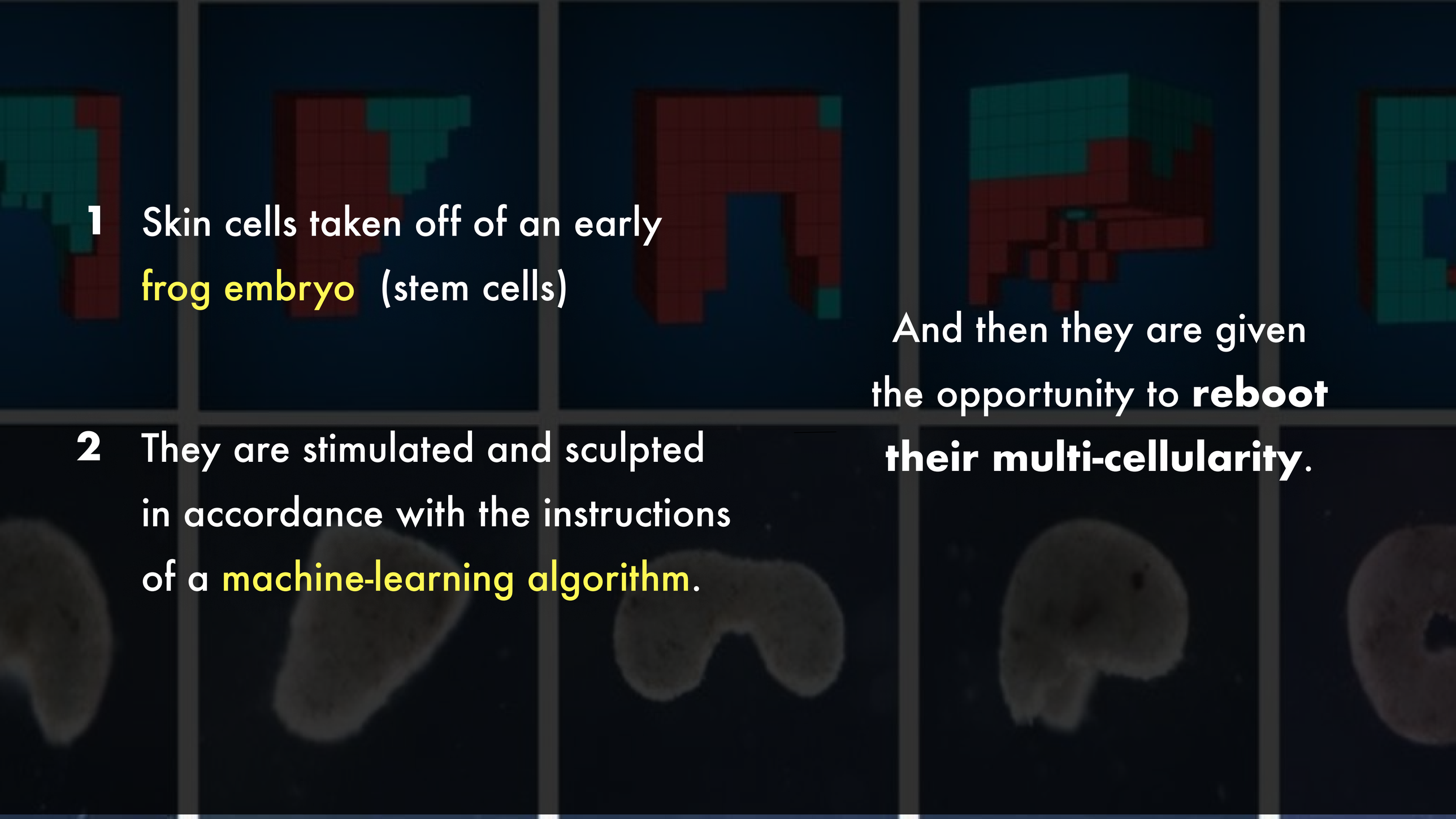

Xenobot


A proto-**organism** can move,
self-actuate, heal, store
memory, self-replicate



video

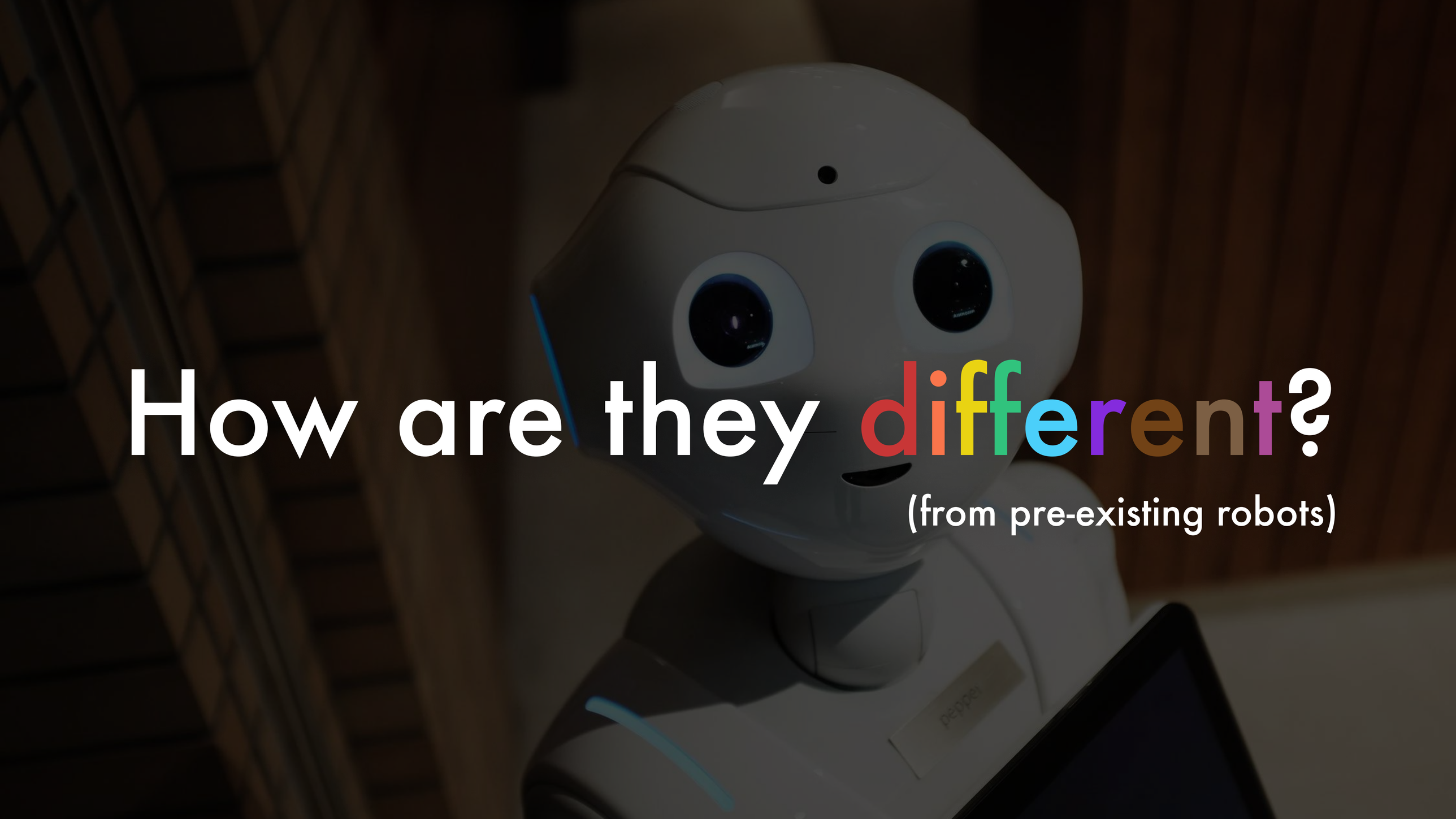




1 Skin cells taken off of an early frog embryo (stem cells)

2 They are stimulated and sculpted in accordance with the instructions of a machine-learning algorithm.

And then they are given the opportunity to **reboot their multi-cellularity**.



How are they different?

(from pre-existing robots)

made of cells!

"robots are metallic and come from factories"

an okay definition when dealing with the limitations of robotics in the materials that we had (no longer the case)

self-replicate

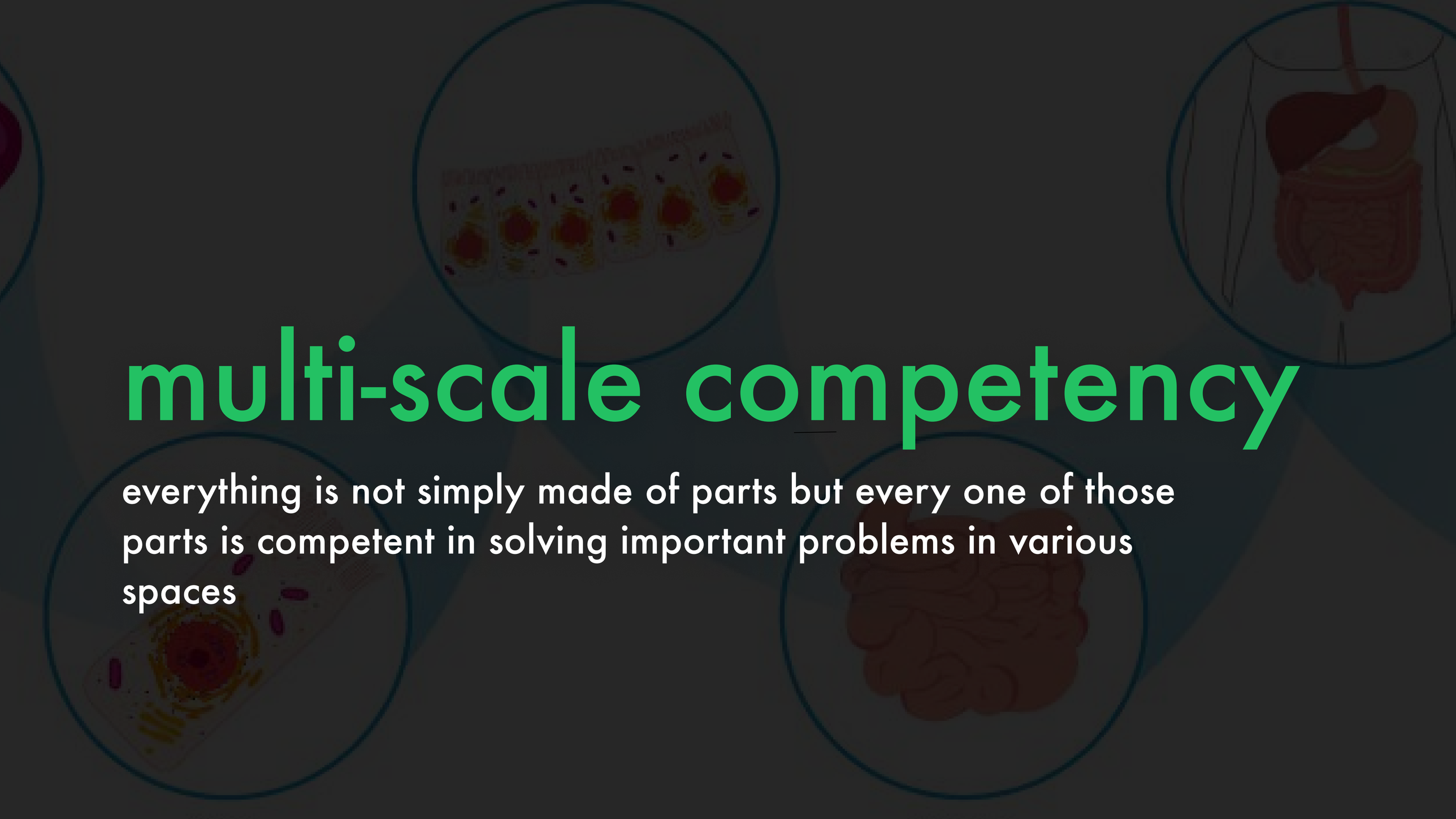
xenobots collect stem cells separate from themselves and aggragate them to create new xenobots.

“they look like robots building other robots”

solipsism

(Most robots are solipsists, xenobots are not!)

a theory in philosophy that your own existence is the only thing that is real or that can be known



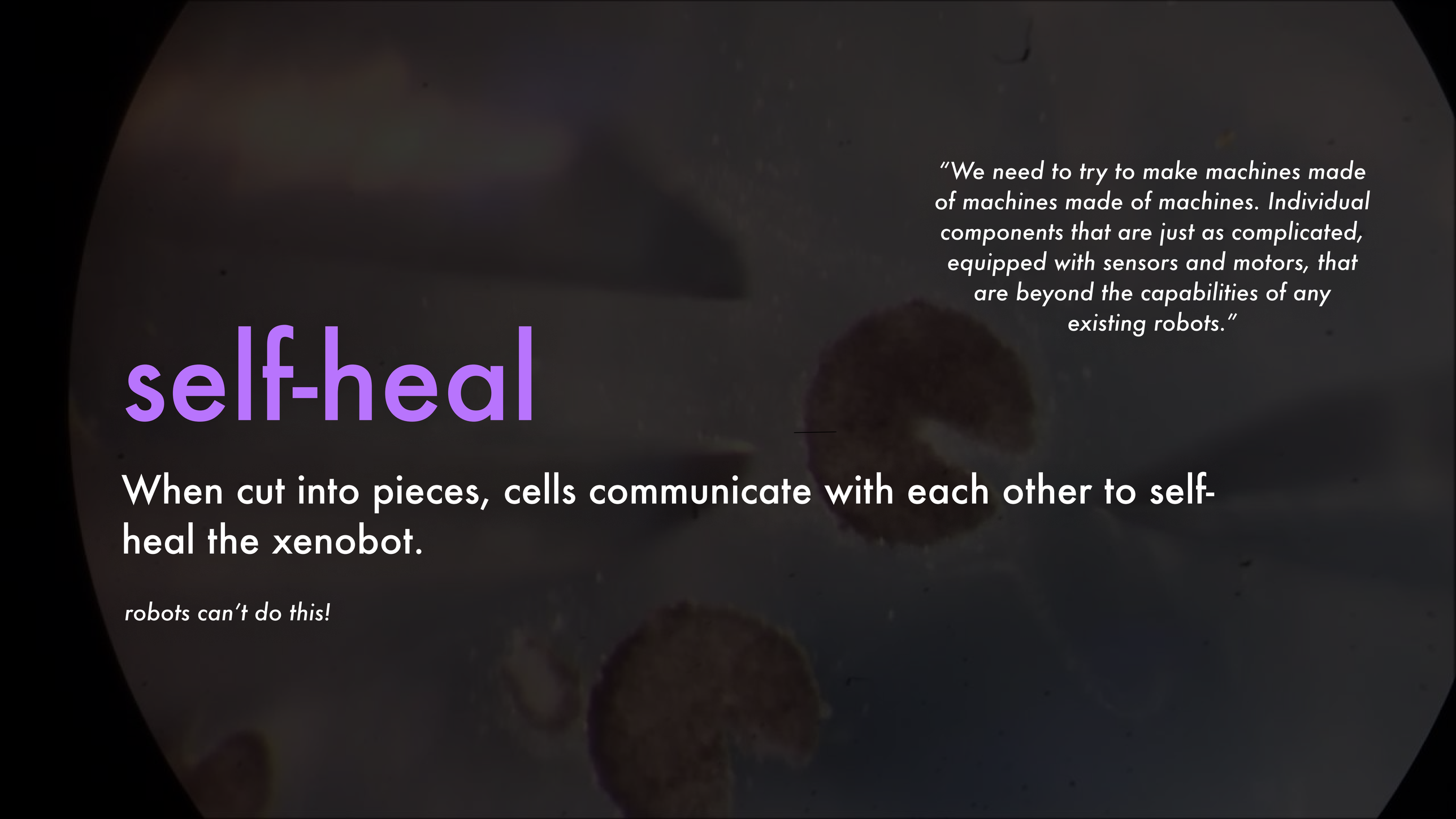
multi-scale competency

everything is not simply made of parts but every one of those parts is competent in solving important problems in various spaces

flexible

These skin cells exhibit different behaviors based on a change in environment

Who knew frog skin cells could become little robots…?

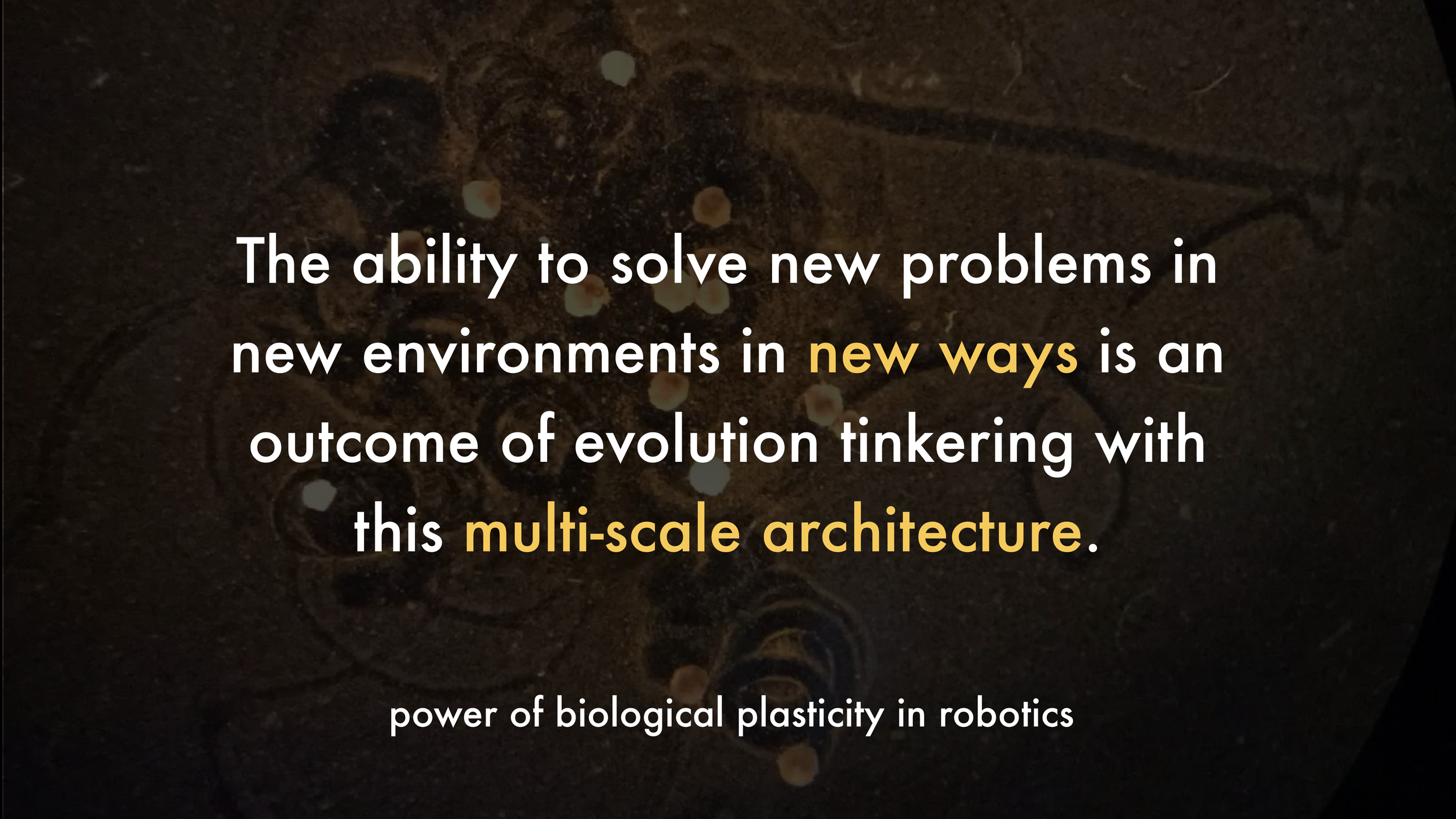


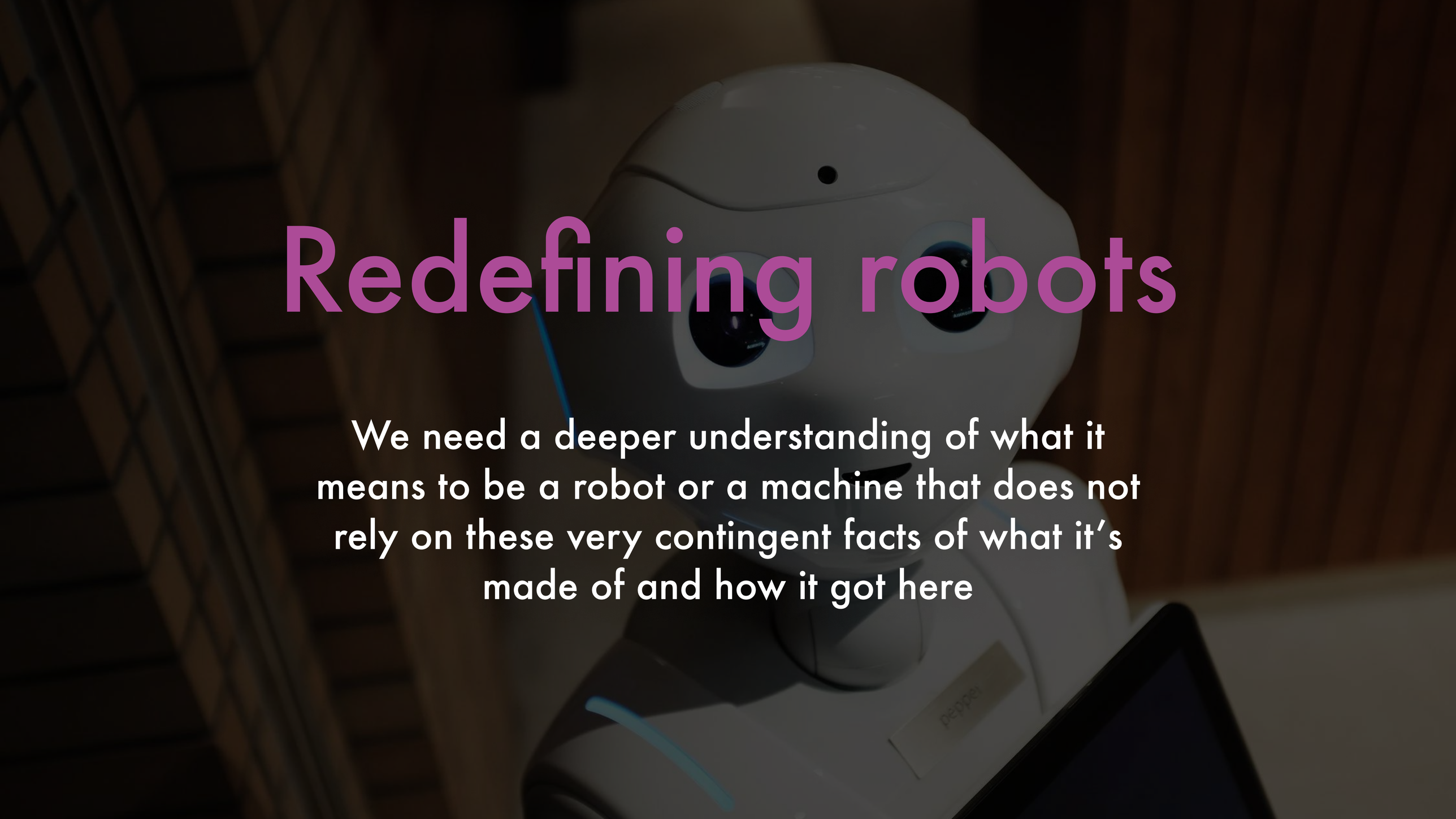
"We need to try to make machines made of machines made of machines. Individual components that are just as complicated, equipped with sensors and motors, that are beyond the capabilities of any existing robots."

self-heal

When cut into pieces, cells communicate with each other to self-heal the xenobot.

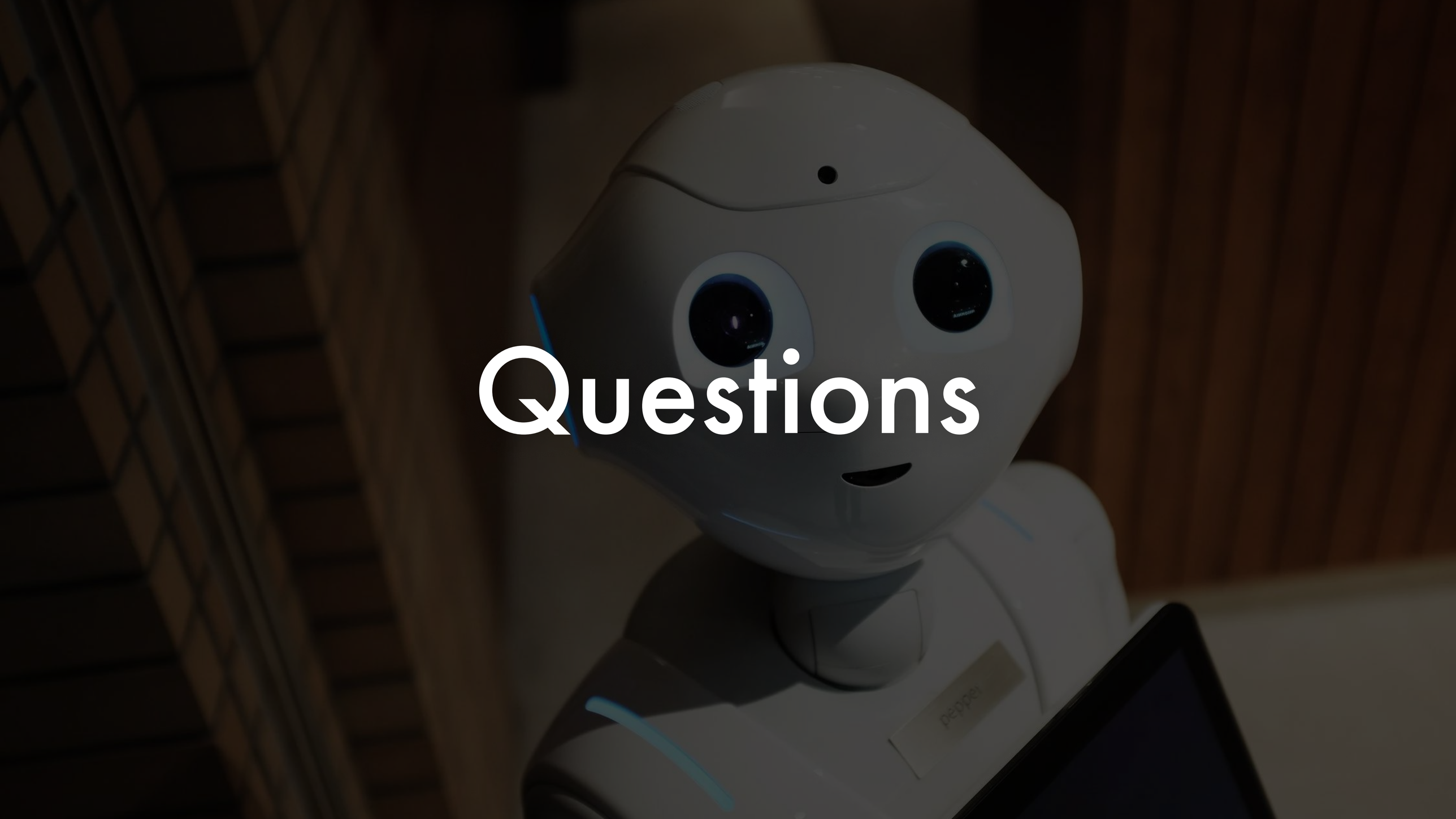
robots can't do this!


The ability to solve new problems in new environments in new ways is an outcome of evolution tinkering with this multi-scale architecture.
power of biological plasticity in robotics



Redefining robots

We need a deeper understanding of what it means to be a robot or a machine that does not rely on these very contingent facts of what it's made of and how it got here


Questions

- If the synthetic material of the robot is not enough to define a robot, what exactly makes a robot, a robot?
- How do biorobots differ from humans?
- How do xenobots change our idea of robots?
- Xenobots do not have brains yet they display a form of intelligence in their behaviors. What exactly is intelligence and where does it come from? Is it just in the brain?
- Could integrating biomaterials in robots make them less prone to mistakes or the opposite? Are xenobots more capable than regular robots?
- Would you say xenobots are alive? Are they conscious?

https://now.tufts.edu/news-releases/scientists-create-next-generation-living-robots
https://www.pnas.org/doi/10.1073/pnas.2112672118
https://wyss.widen.net/s/nccjpfqtwl/unanswered-xenobot-webinar-questions
https://wyss.harvard.edu/news/team-builds-first-living-robots-that-can-reproduce/
https://www.youtube.com/watch?v=FqkfBish_Ic

Thanks for listening

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