Growth!

Modification of existing techniques in tissue engineering-Ryan
In-Vitro meat: don't have a cow! -Janice
Grow a brain-Cesar

The Essentials of Tissue Engineering

Importance and Impact

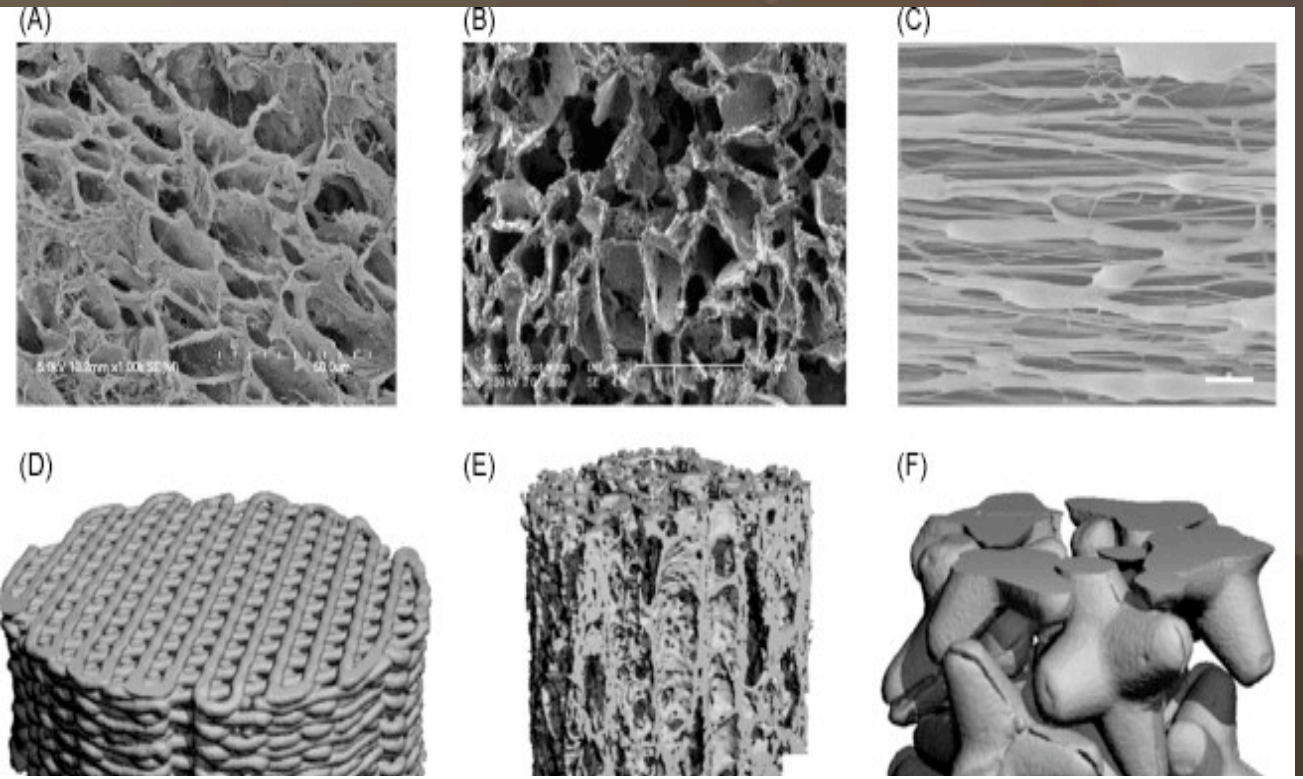
- The focus of tissue engineering is to create three dimensional tissue cultures. These cultures can be used to create functional tissue grafts for transplants derive proteins from tissues, and further studies in the development of tissues and the diseases that affect them. Basically, this is very important and the impact of improving tissue engineering can affect a wide variety of areas.

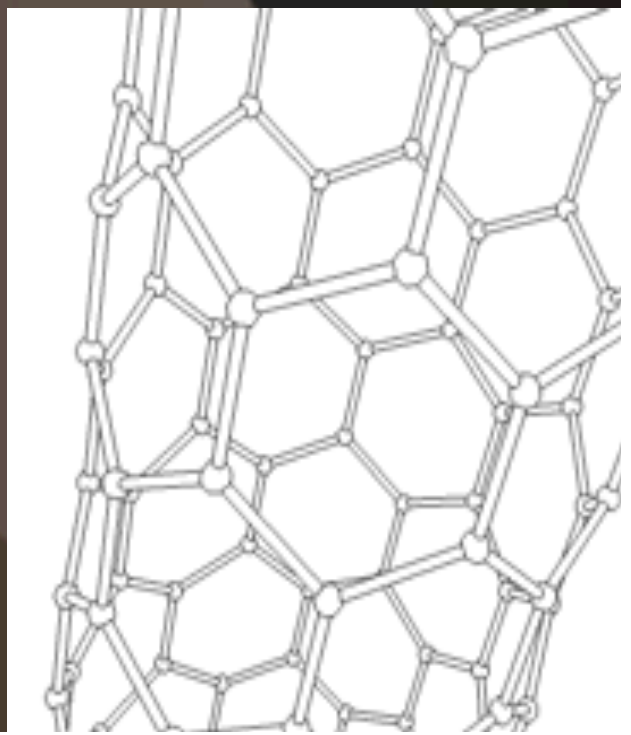
The Essentials of Tissue Engineering

Scaffolds: Informational templates for 3-D cultures

Stem cells and cell seeding

Decellularized tissue vs. Electrospun nanofibers

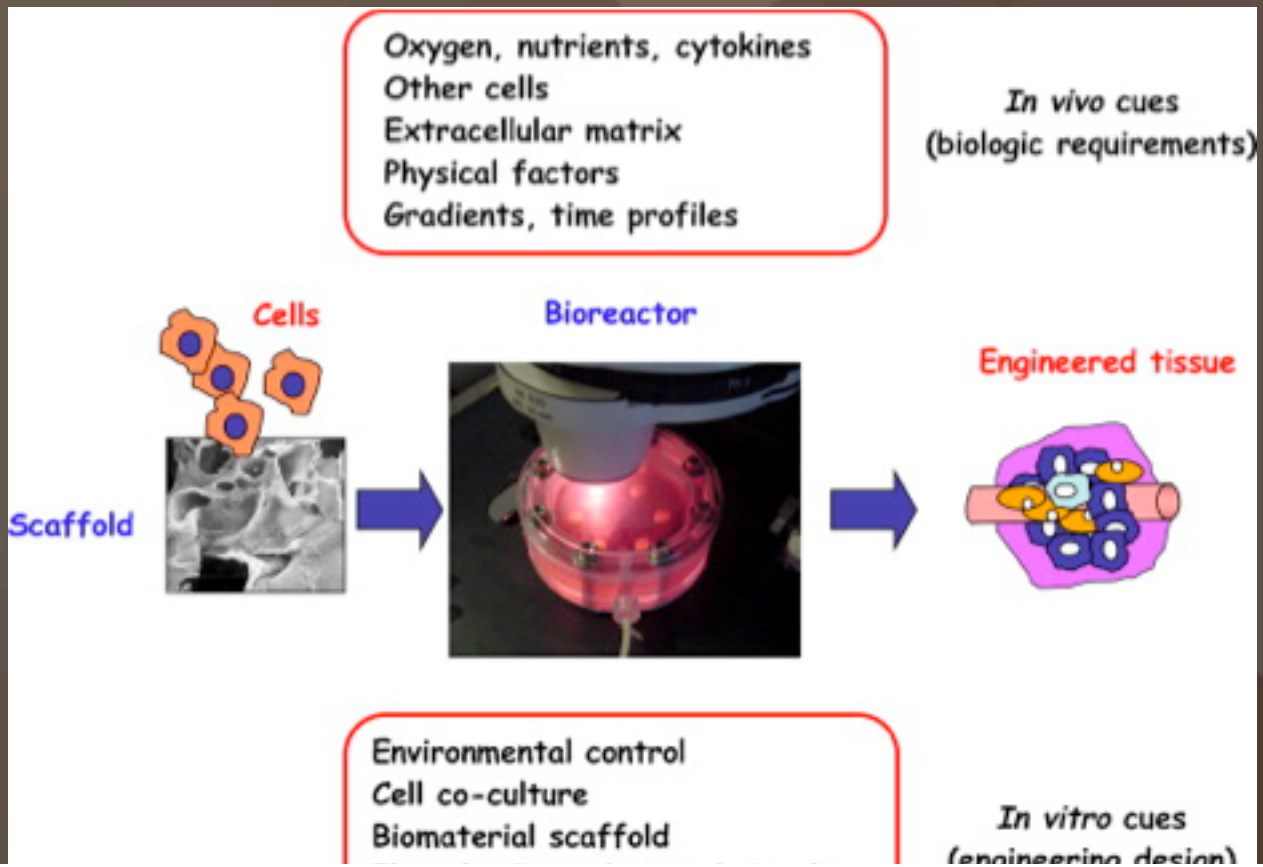




The Essentials of Tissue Engineering cont'd

Biochemical and mechanical stimulation of tissue cultures.

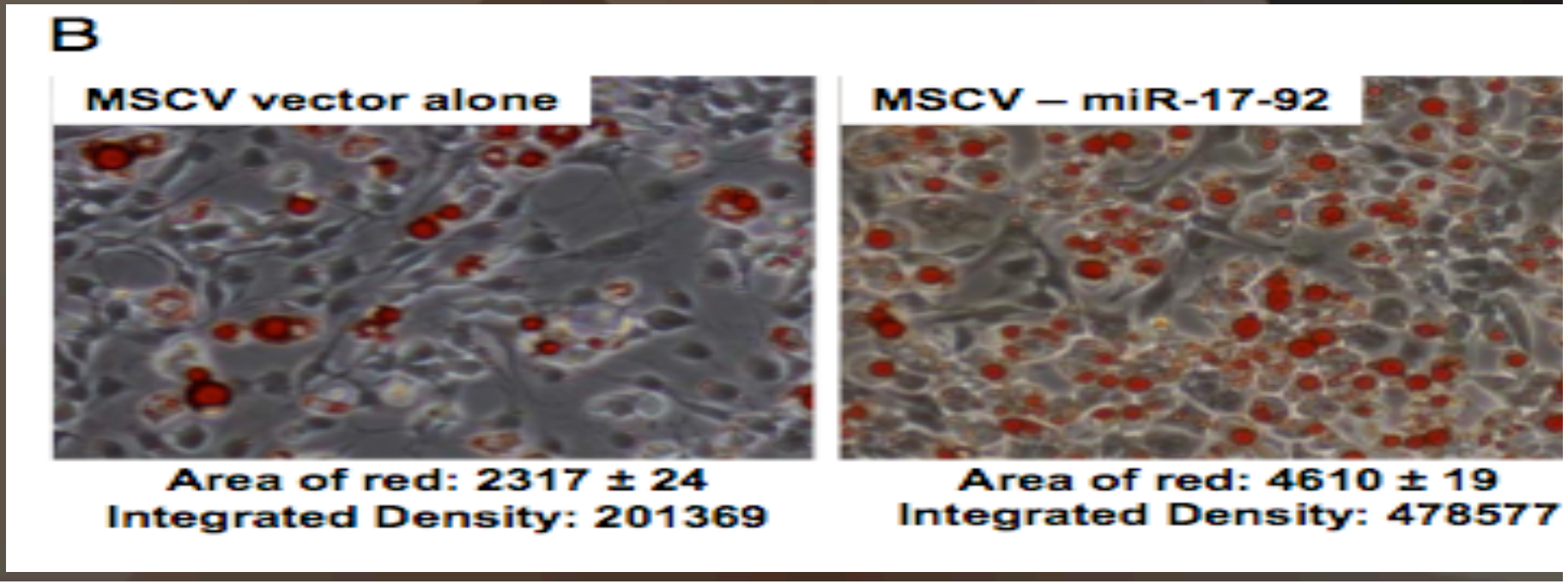
Bioreactors



The Essentials of Tissue Engineering cont'd

Growth factors, microRNA mediated repression

Removal of dead cells: magnetic beads coated with antibodies (existing technology), apoptosis



Knowns and Unknowns

Knowns

- Not dealing with hazardous materials
- MiRNA (especially miRNA mimic) is relatively cheap.
- Trying to improve existing techniques that are already known to be cost effective.

Unknowns

- Don't know how feasible it is to use miRNA mediated repression in 3-D cell cultures.
- Don't know if engineering damaged cells to undergo apoptosis is comparabl to using magnetic

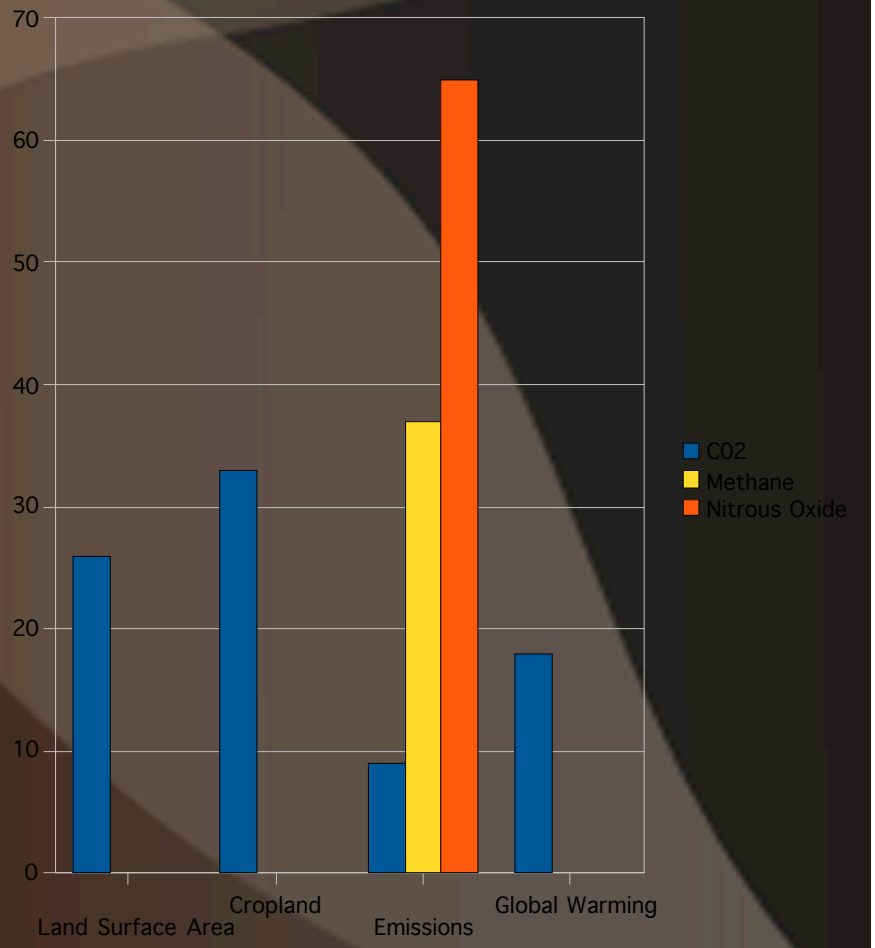
Welcome to the world of meat!

In-Vitro Meat

- The focus of this idea i
  to develop a method fo
  growing meat in a
  laboratory environmen
  using a protein matrix,
  animal muscle cells, an
  a nutrient
  delivery/waste removal
  system.

In-Vitro Meat: Impact and Importanc

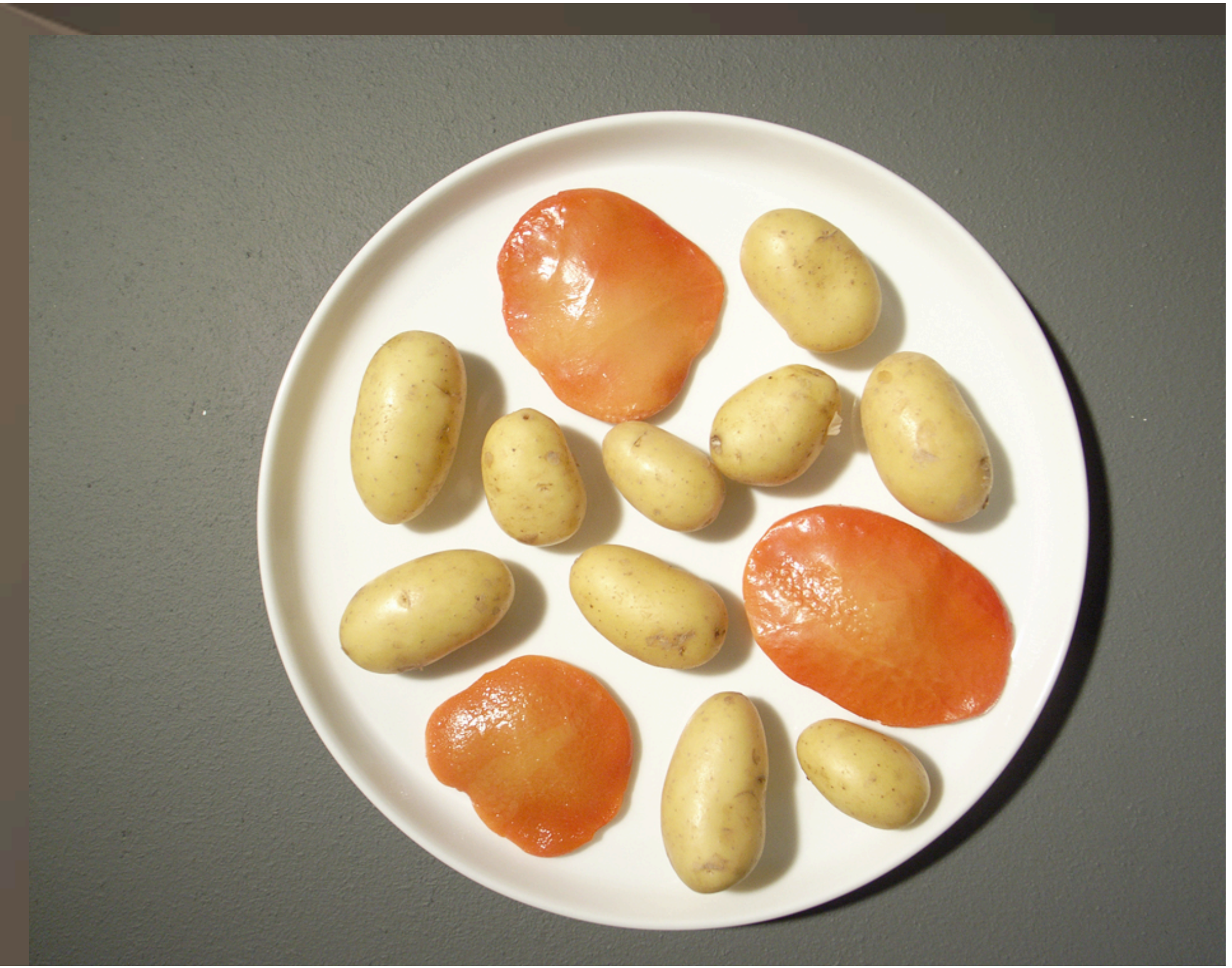
- Economic reasons-1/3 of crops produced become “feed crops”
- Environmental reasons-livestock emissions, deforestation for grazing land
- Ethical Reasons: No butchering
- Cleaner meat: grown in clean environment, no unnecessary antibiotics or growth hormones
- Can be engineered to give certain advantages (built-in barbecue flavor!, extra vitamins, etc.)
- Could offer people a chance to try exotic meats without worrying about poaching or endangered animals.



Competition!

Eddie Lepp/ShutterStock

- potential competitor- "all-nutrition" plants
- competitor-real meat
- Competitor-plant-based protein products (soy)



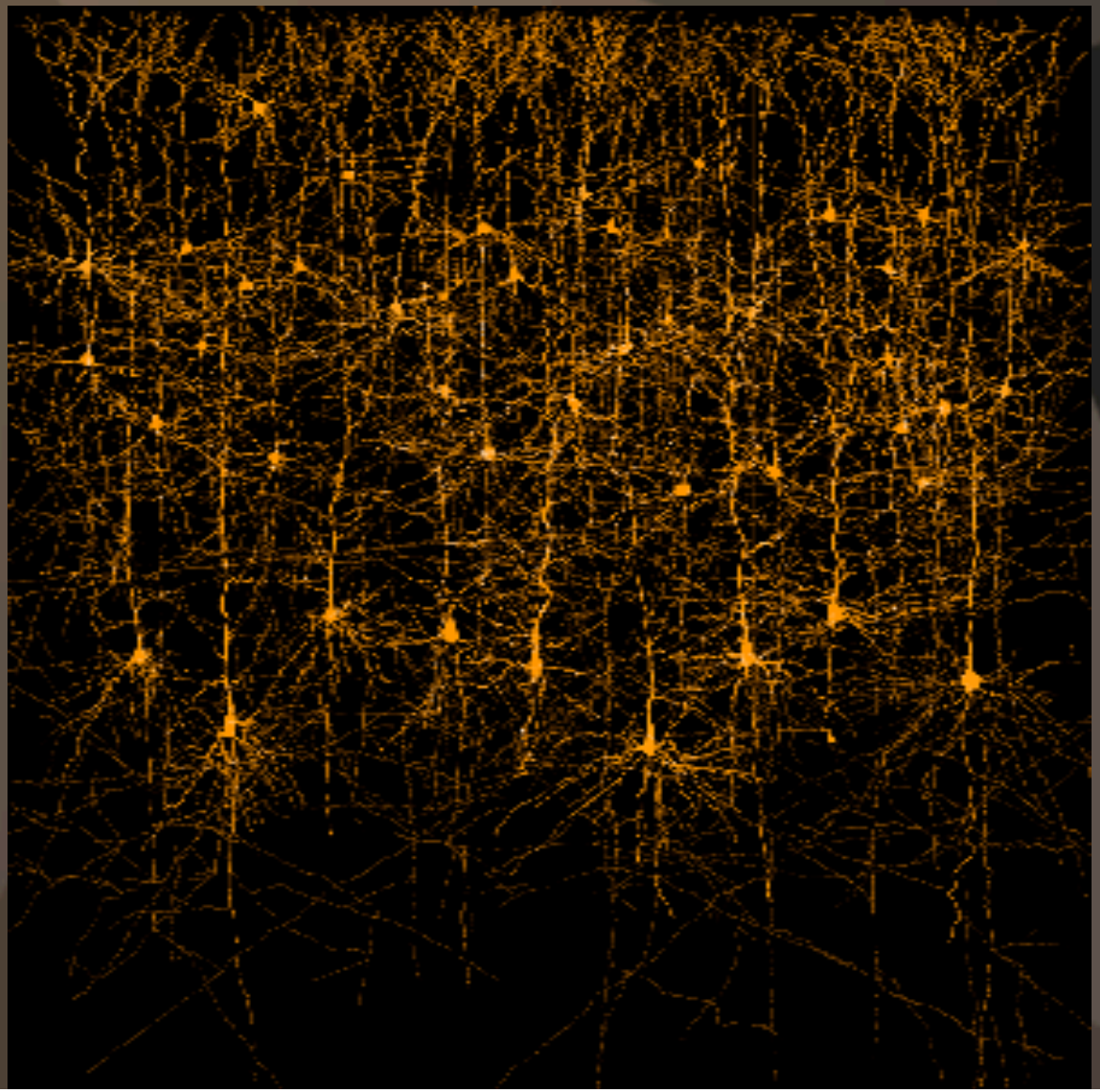
Knowns and Unknowns

- KNOWNS:
- Extremely cost-ineffective compared to current products, but cost could be reduced by use of "bioreactors"
- Need protein matrix to grow it in-collagen

- UNKNOWNS:
- Taste – will it taste as good as real meat (no blood or fat)?
- Consistency – how to grow structured tissue
- Will certain genes need to be "turned on"?

Growing a Brain

Making Neuron Babies



Why?

- Regeneration of damaged neural tissue
- Parkinson's
- Alzheimer's
- Stroke
- Traumatic Brain Injury
- Aging

Impact

QUALITY OVER QUANTITY!

Questions/Unknowns

- How do we induce neural cell division?
- Modification of epigenome after division?
- Configuration for desired connections?
- Best pathway to do this?

What we know

CANCER

- Modifications in cancerous cells lead to uncontrolled cell division

STEM CELLS

- Stem cells undergo controlled cell division

NEUROGENESIS

- Stem cells in the hippocampus can differentiate and integrate themselves

Current Work

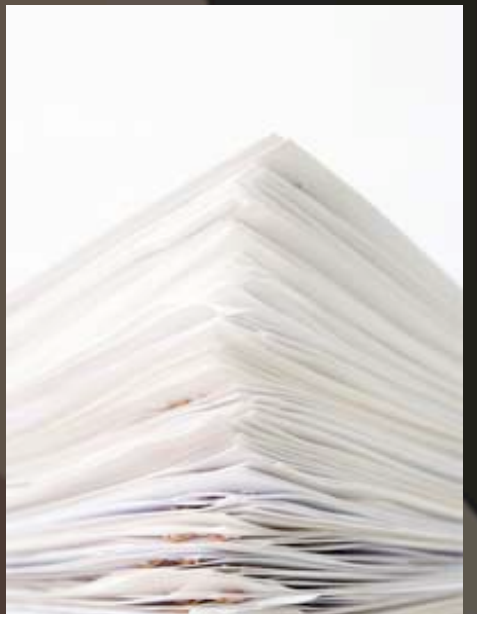
- Skin cells turned into embryonic stem cells Kathryn Plath et. al

First Small Step

Design a simple neural network with neurons that can divide and integrate themselves into the existing network

Start Here and End There

- Look at normal processes that control cell division
- Work backwards: how does it get stopped?
- Look in nature: existing agents that can induc cell division



Summary

- Modifying existing technology and techniques used in tissue engineering.
- Growing unstructured muscle cells in bioreactors using protein matrixes for support.
- Inducing cell division in differentiated neurons