

# Innovation Day 2010

Wednesday 21<sup>st</sup> April

**Creating human muscle in the lab!**

Professor Mark P Lewis – University of Bedfordshire  
Rita Mascia - University of Bedfordshire

# Who are we???

Professor Mark P Lewis

Chair in Exercise Biochemistry and Cell Biology

Head of Department of Sport and Exercise Sciences

Head of Muscle Cellular Physiology Research Group

Institute of Sport and Physical Activity Research, Bedford

Honorary Professor, University College London

# Institute of Sports and Physical Activity Research



- Three main interest groups that our research is allied with:
  - Muscle Cellular and Molecular Physiology
  - Applied Sport and Exercise Physiology
  - Physical Activity and Health
    - Neuromuscular Disease

# Muscle Cellular and Molecular Physiology Research Group



- Current Group Members:
  - Samantha Passey (PDRA)
  - Neil Martin (PGR)
  - Darren Player (PGR)
  - Paul Davies (PGR)
  - James Tuttle (PGR)
  - Alec Smith (PGR)
  - Khalid Al-Qahtani (PGR)
  - Karin Carlqvist (PGR)
  - Ioannis Levisianos (PGR)
  - Rishma Shah (PGR)
  - Andrea Sinanan (PGR)

# Muscle Cellular and Molecular Physiology Research Group



- Main Collaborators:

- Vivek Mudera (IoO, UCL)
- Linda Greensmith (IoN, UCL)
- Ivan Wall (Biochemical Engineering, UCL)
- Nigel Hunt (EDI, UCL)
- Phil Stephens (CITER, Cardiff)
- Alistair Sloan (CITER, Cardiff)
- Paul Castle (ISPAR, UoB)
- Nick Sculthorpe (ISPAR, UoB)
- Emma Spikings (LIRANS, UoB)
- Tiantian Zhang (LIRANS, UoB)
- Geoff Goldspink (Emeritus, UCL)
- Richard Fergurson (School of Sport, Exercise and Health Sciences, Loughborough University)
- Richard Aspinall (Cranfield Health, Cranfield University)

# What is Skeletal Muscle?

## Important Features

- Is: Excitable, Contractile, Extensile and Elastic
- Functions: Motion, Posture, Warmth
- Vary considerably in size, shape, and arrangement of fibers - from extremely tiny strands such as the stapedium muscle of the middle ear to large masses such as the muscles of the thigh
- May be made up of hundreds, or even thousands, of muscle fibers

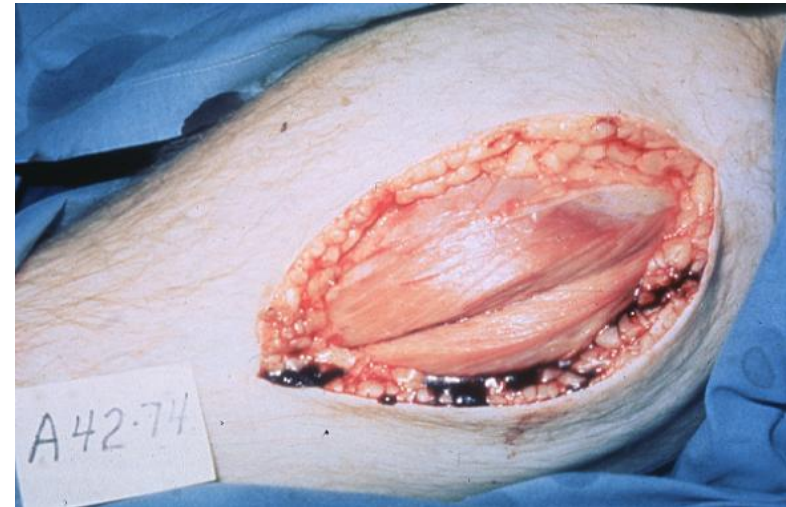
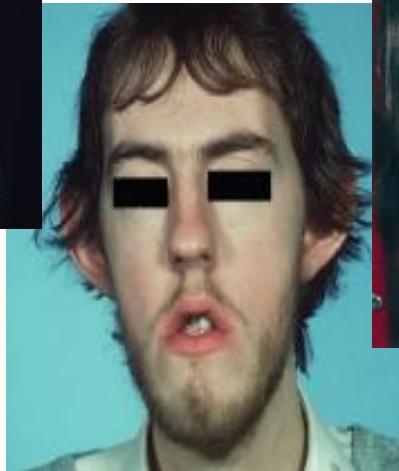
# Skeletal Muscle Adaptation



## When Does Muscle Adaptation Occur?

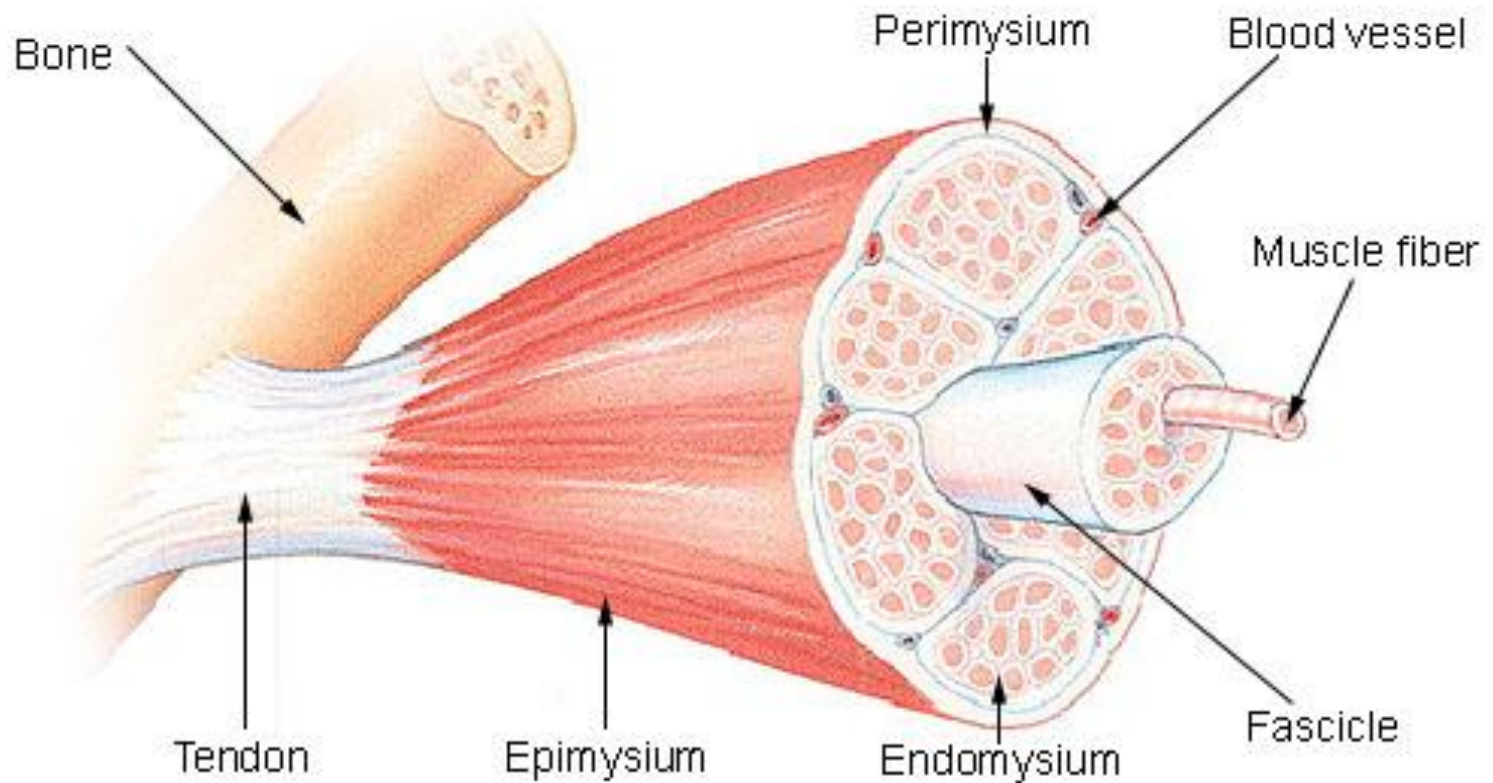
- Due to changes in “normal” or “basal” activity
- Often a mixture of environmental and genetic issues
  - INJURY
  - EXERCISE
  - PATHOLOGY
  - GROWTH

# Skeletal Muscle is ADAPTIVE

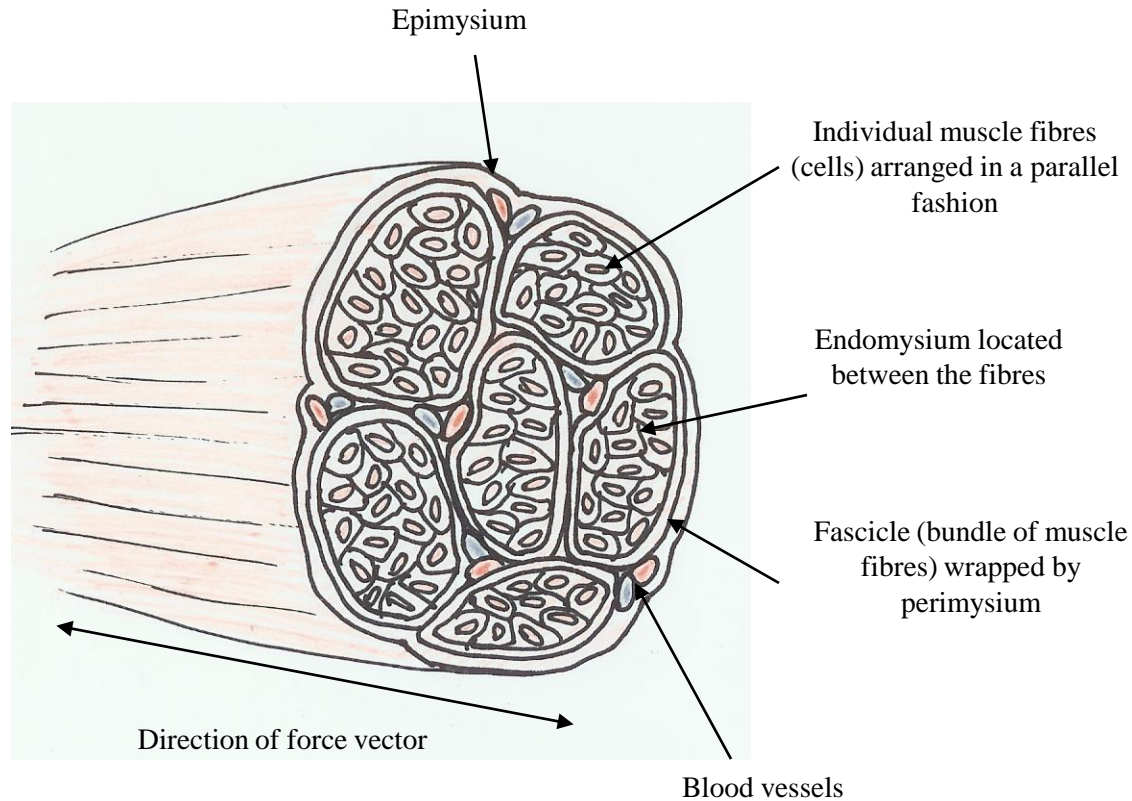


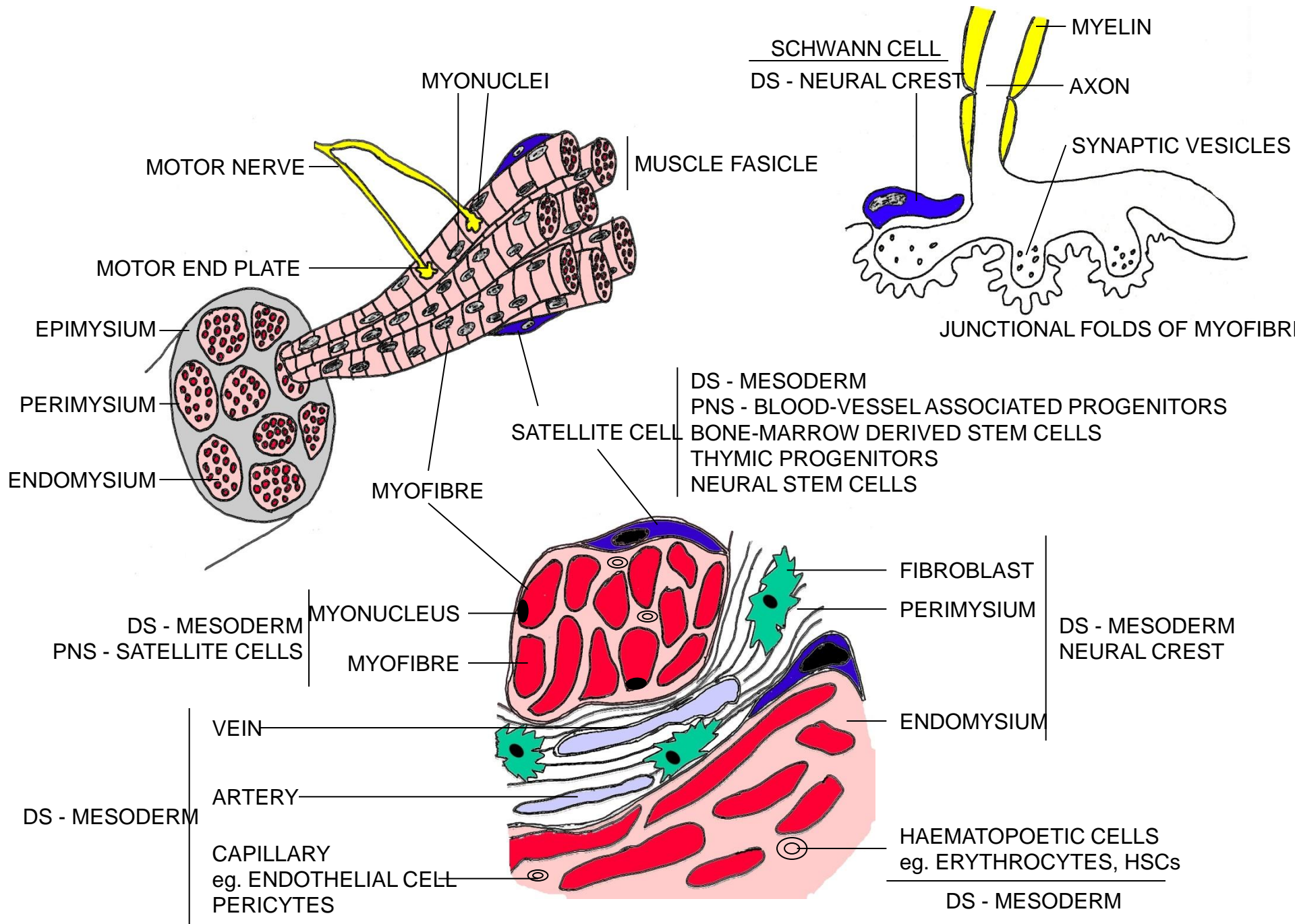
# Skeletal Muscle Structure

## Structure of a Skeletal Muscle



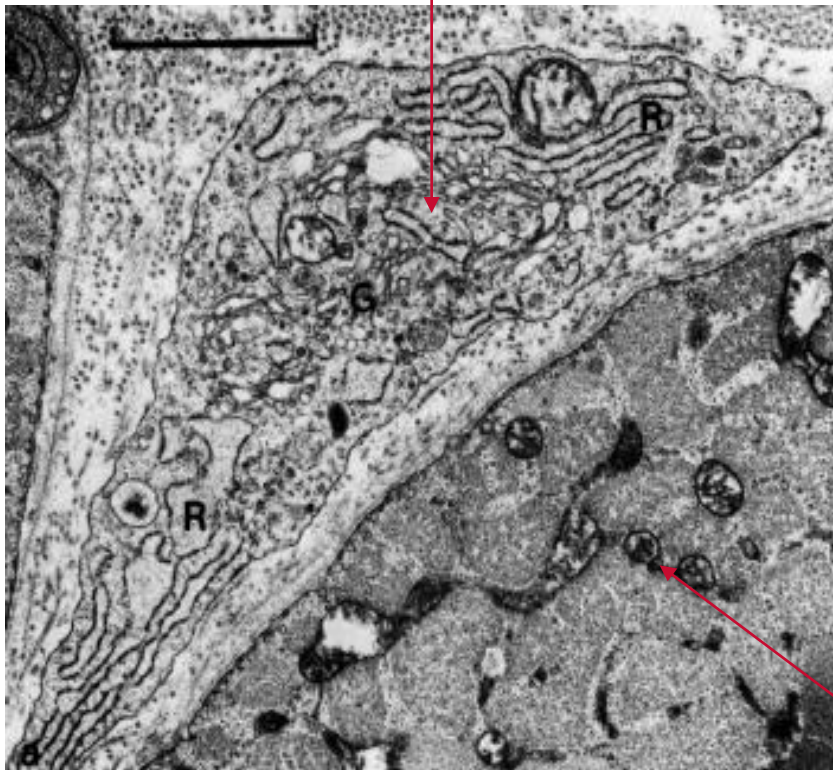
# Skeletal Muscle





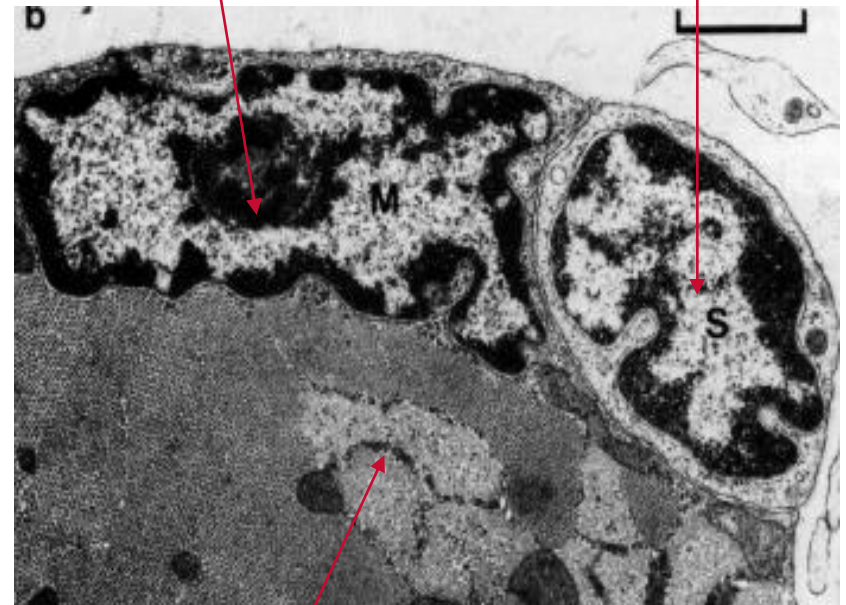
# Skeletal Muscle Cellular Components

Fibroblast



Myonuclei

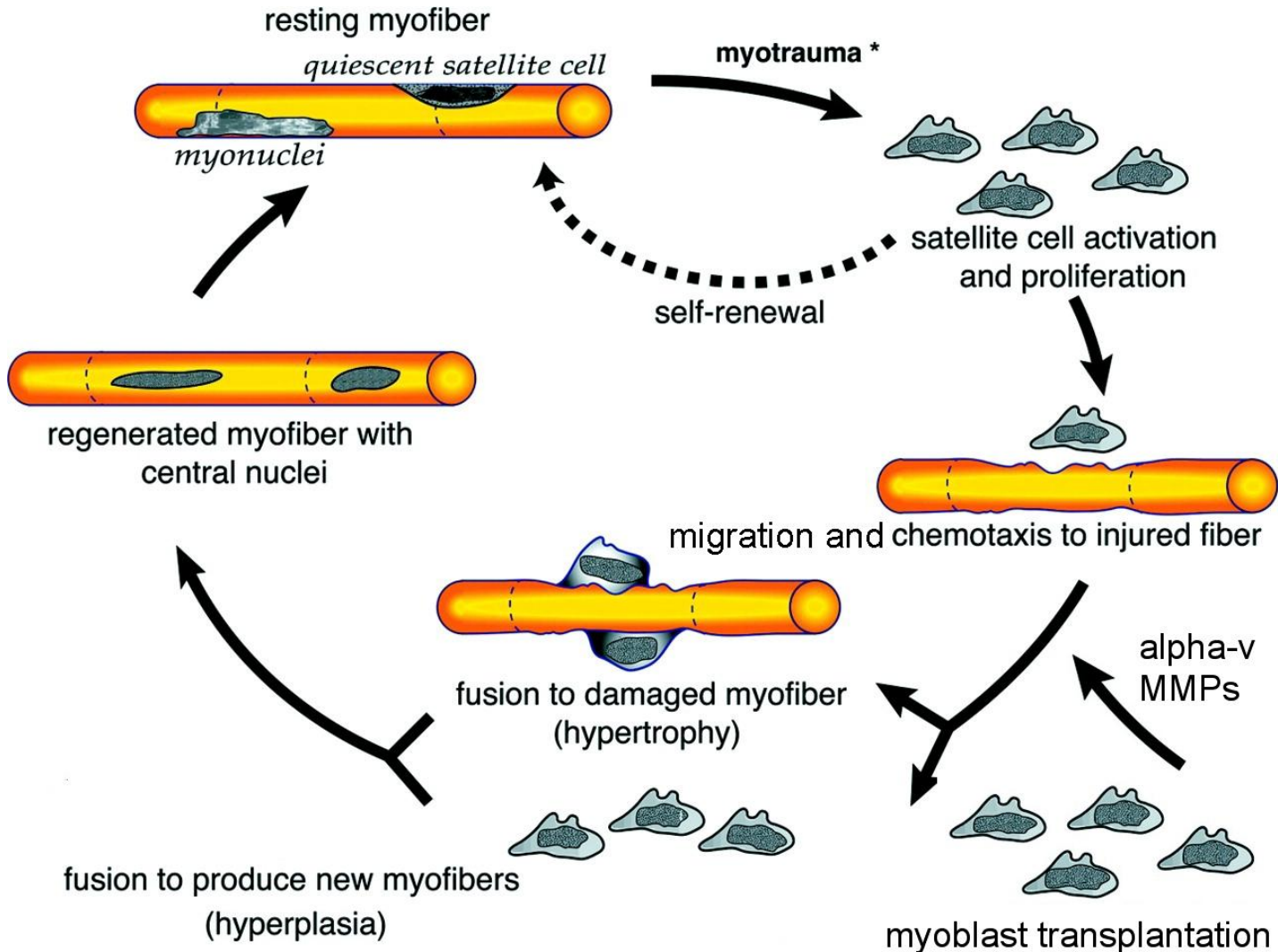
Satellite cell

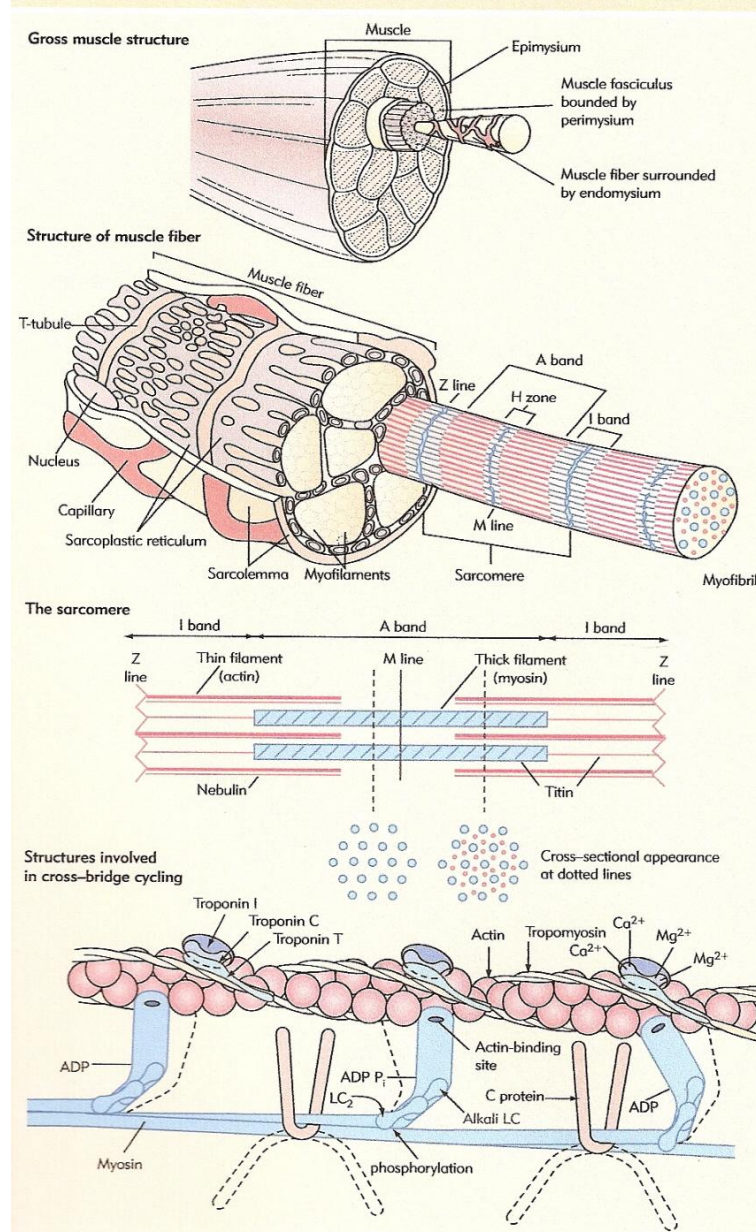


Muscle fibre

# What is Regeneration and Adaptation?

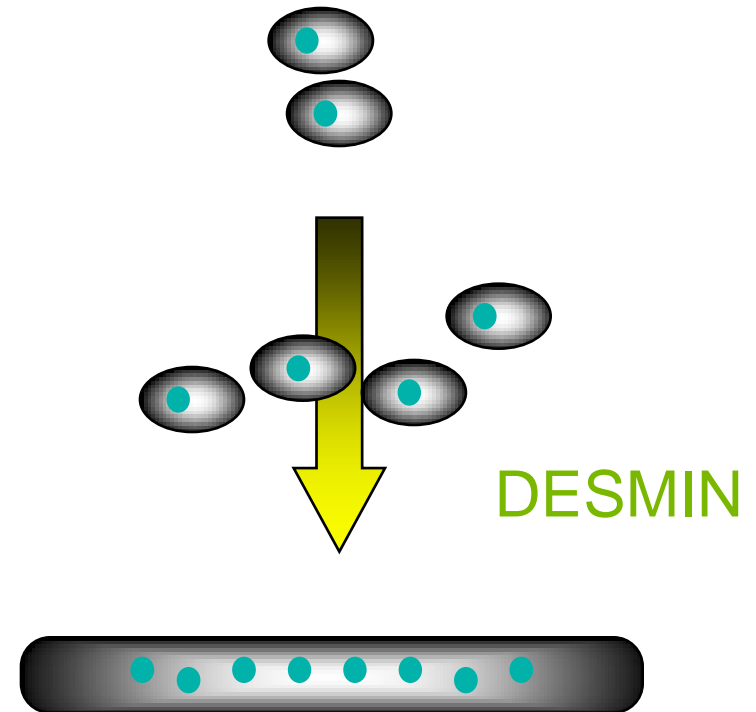
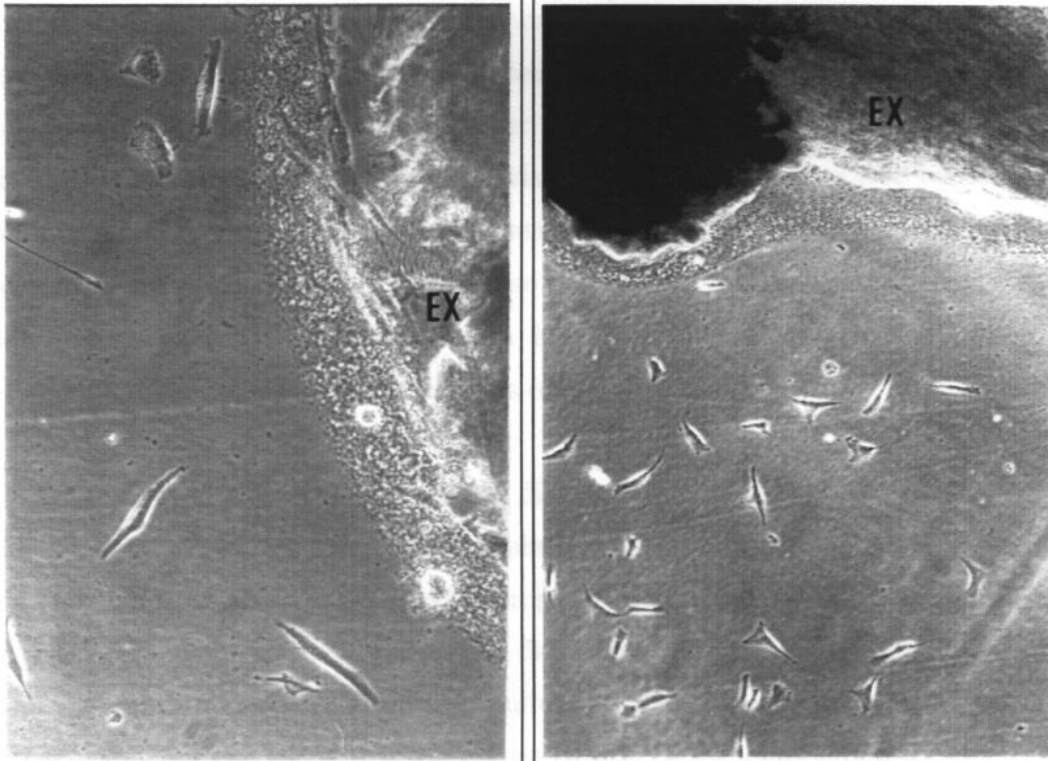
## Regeneration



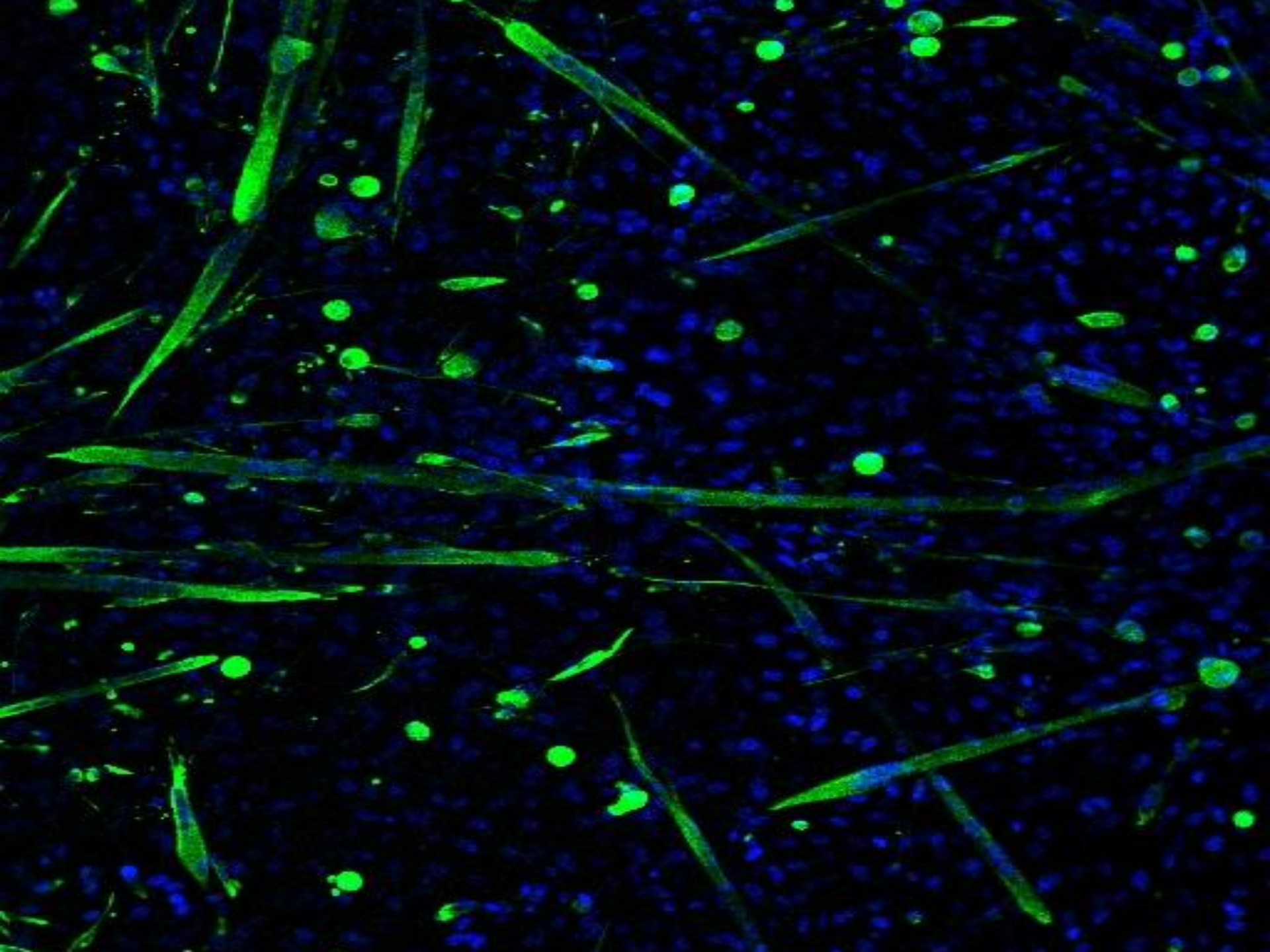


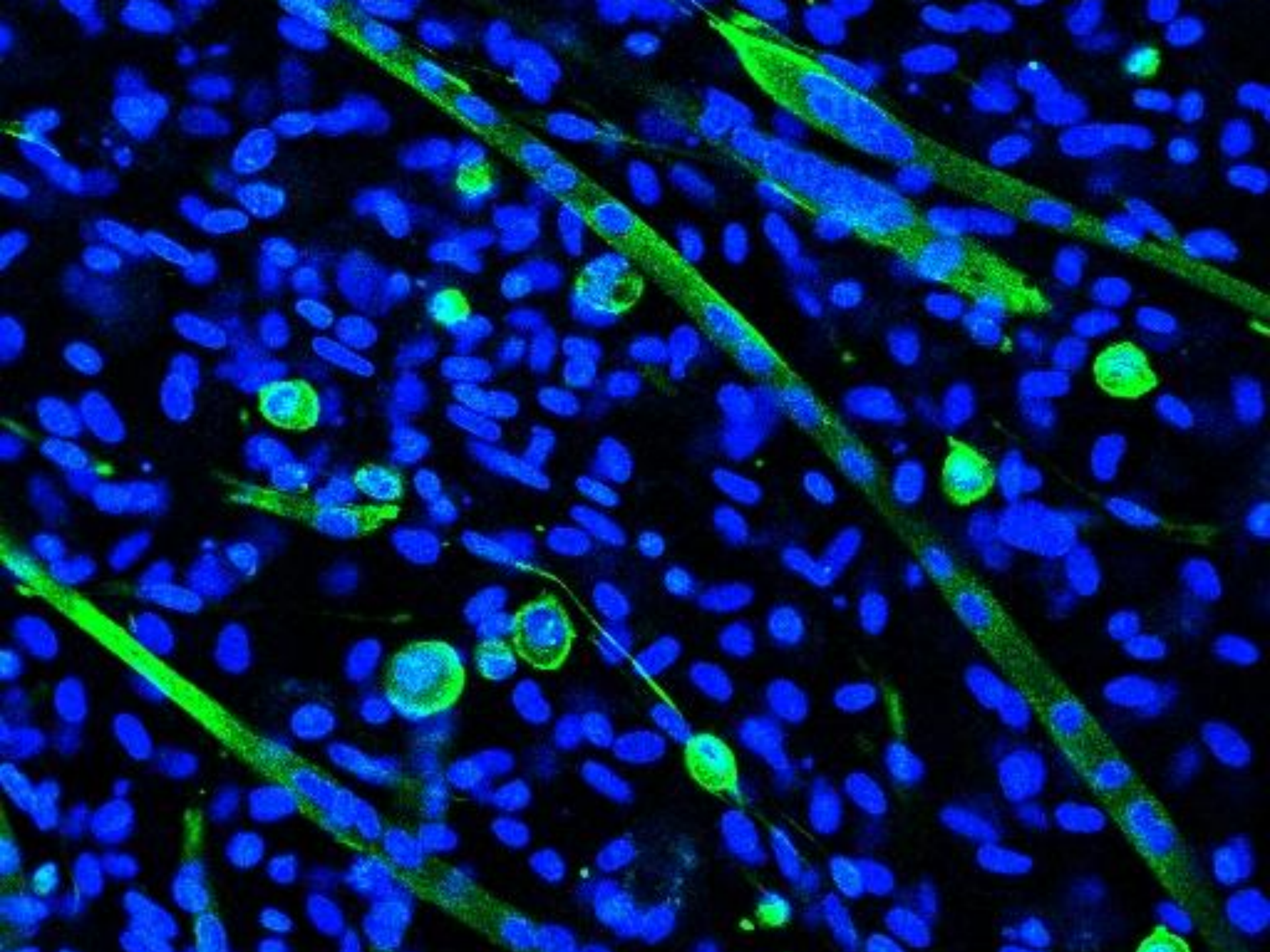
# Skeletal Muscle Cell Culture

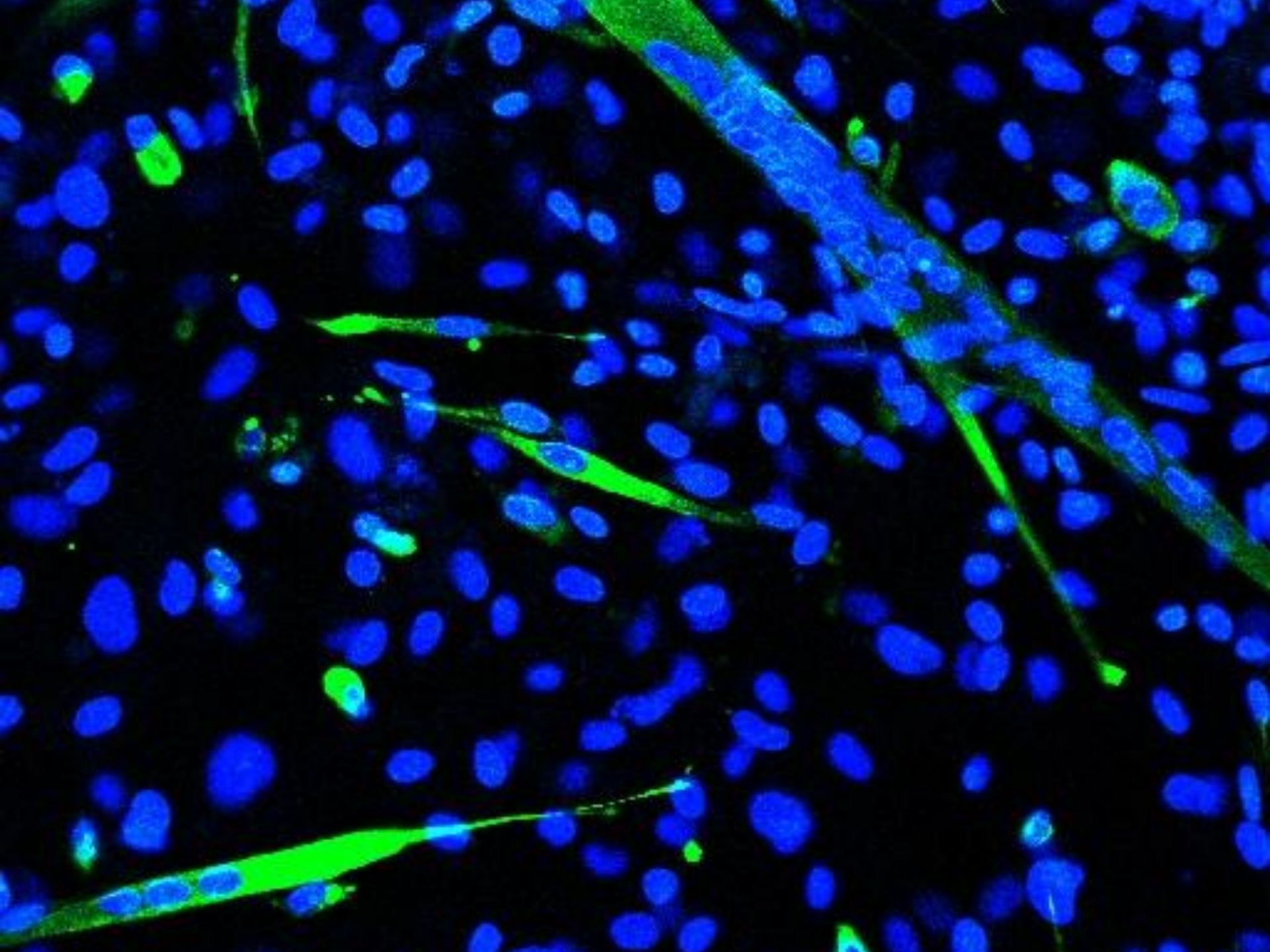
## Muscle Precursor Cells (MPCs)

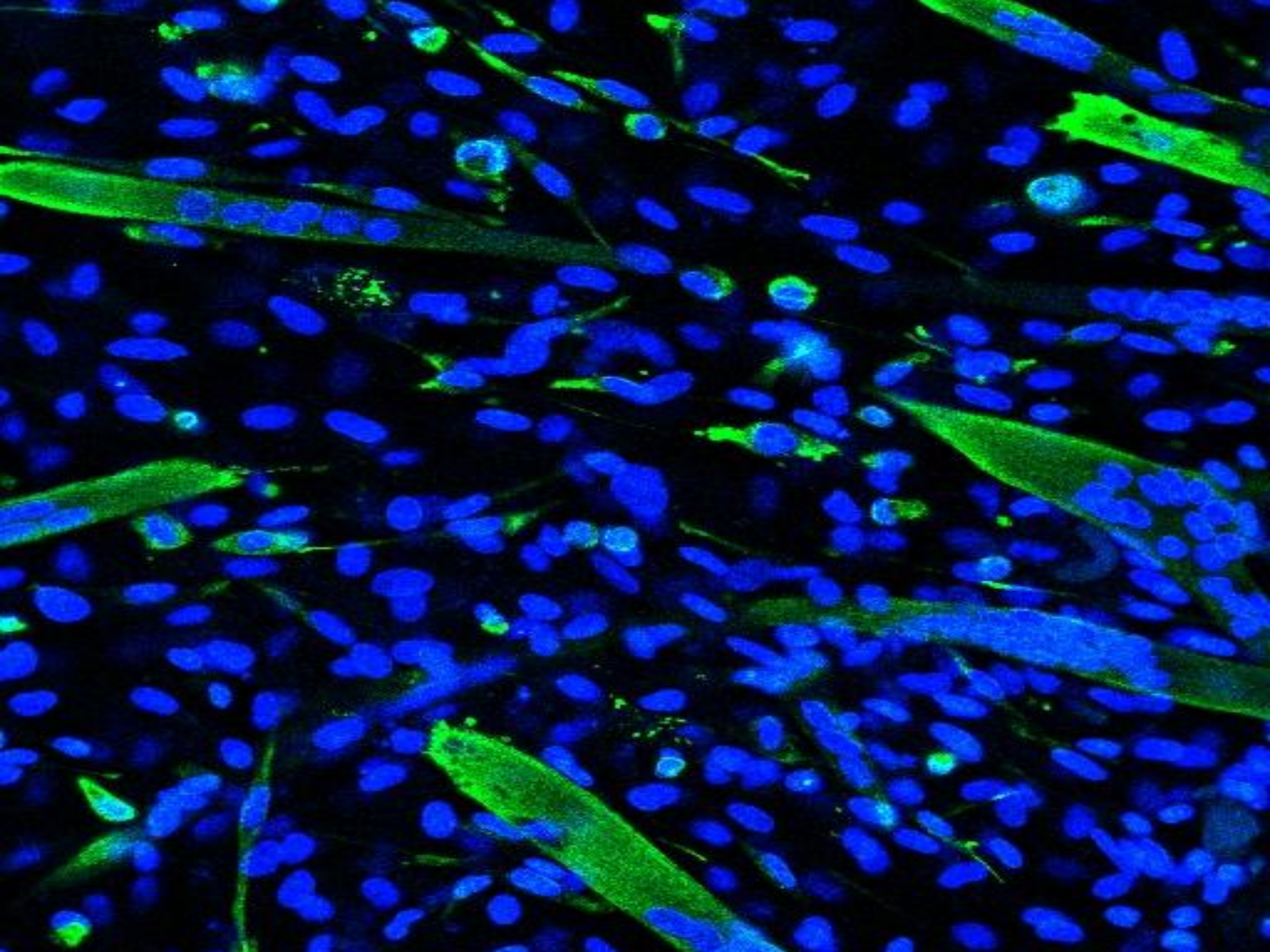


Recapitulates developmental and regenerative/adaptive responses











# Molecular and Cellular Analysis of Skeletal Muscle Adaptation



## Relevant physiological models of skeletal muscle

- Animal studies permit tissue to be studied when required however species specific issues exist as do those of sequential molecular analysis
- Taking living human samples of sufficient quantity for testing is challenging.

THEREFORE

GROW YOUR OWN SKELETAL MUSCLE!!!