Ball State University

Human Performance Laboratory
Human Performance Laboratory Team

50th Anniversary in 2015 (1965 - present)

~500 graduates (MS and PhD degrees)

Students and scientists from around the world
Ball Memorial Hospital

50 year Collaboration with Human Performance Laboratory

Provide medical support for clinical research programs
HPL Graduate Student Office

PhD in Human Bioenergetics
MS in Exercise Physiology
MS in Clinical Exercise Physiology
Metabolic Testing Laboratory
Clinical Testing Laboratory
Clinical Procedures
Exercise Testing and Training Laboratory

Finalizing design to renovate and expand (more than double) this space
HPL Exercise Training Facility

Community Based Fitness Program
Research Training Studies
Indoor 200m Track
(Just out back of HPL)
HPL Workshop

Hardware Support and Fabrication
Custom Software Interface
Single Muscle Fiber Physiology Laboratory

Kiril Minchev
Human Performance Laboratory
Ball State University
Research Program Profile

Whole Body to gene

Aging
Astronauts
Athletes
Are we ready for Mars?
Human Muscle Function with Space Flight

Whole Muscle → Single Fiber

MRI

Human Muscle Fiber Magnified 400 times
Exercise on the International Space Station

Original Exercise Program (2001 - 2010)

Cycling
~2.5 h/wk
Intensity: Moderate

Resistance Exercise
3-6 d/wk
Intensity: Moderate

Treadmill Running
~2.5 h/wk
Intensity: Moderate
Muscle Profile After 6 Months on the International Space Station

2 Crew >20%

Mass  Strength

Trappe et al. J Appl Physiol 2009
Single Muscle Fiber Power with Space Flight
Original ISS Exercise Program (2001-2010)

Change in Single Fiber Power
After 6 months on the ISS

-25
-20
-15
-10
-5
0
Change in Power (μN·FL/s)

- Slow Fibers
- Fast Fibers

J Physiol 588: 3567-92, 2010
Next Generation Exercise Program
New Equipment and High Intensity Program

Exercise Astronauts
Like Athletes
The Aging Athlete: Insights into Slowing the Aging Process

Race Across America Record Holder at 80 y of Age
Muscle Mass and Aging

Young Active (23 y)  Untrained (82 y)  Cyclist (74 y)  Cross Country Skier (91 y)

Strength and Size Gains Very Limited >80y
Aging Athlete Model

Cardiovascular Health
Skeletal Muscle Health

Exercise Genomics
Learning from Elite Athletes

Colin Jackson
World Champion Sprinter

Mostly Fast Fibers
Single Muscle Fiber Power: World Class Sprinter

World Champion Sprinter
- 25% Super Fast

Distance Runners

Recreational Runners

Competitive Swimmers

Resistance Trained

Astronauts (post flight)

$\text{Single Muscle Fiber Power (W} \cdot \text{L}^{-1})$

- MHC I (slow)
- MHC IIa (fast)
- MHC IIx (super fast)

Molecular Transducers of Physical Activity Consortium (MoTrPAC)

$170 million investment by the National Institutes of Health (2017-2023)

**Goal:** Assemble a genetic map of the health benefits of exercise
MoTrPAC Clinical Center Team

UAB

Clinical Center

Ball State

Florida

Human Performance Laboratory
Ball State University
Scott Trappe, PhD
Todd Trappe, PhD

Translational Research Institute
for Metabolism and Diabetes
Florida Hospital • Sanford Burnham Institute
Bret Goodpaster, PhD
Human Performance Lab, Ball State University from 240 miles above.