



2022 NSCA *NATIONAL* CONFERENCE

July 6-9, 2022 | New Orleans & Online
#NSCACon22

› *KNOWLEDGE*
› *ADVANCEMENT*
› *COMMUNITY*

From Marathon to 1 RM

The Study of Elite Sport Performance and How to Get There

Andrew Fry, Ph.D., CSCS*D, FNSCA*E

Jayhawk Athletic Performance Laboratory, University of Kansas

Michael Hahn, Ph.D., CSCS

Bowerman Sport Science Center, University of Oregon



Wu Tsai Human
Performance Alliance

CONFLICT OF INTEREST STATEMENT

We currently have, or we have had in the past 2 years an affiliation or financial interest with Wu Tsai Human Performance Alliance, NSCA Foundation, Dynamic Athlete Research Institute, EliteForm, Strive, Sparta Sport Science, ArmCare, Hewlett-Packard, MondoUSA, Founding Fathers TBT Basketball, Association for the Advancement of Sport Psychology, International Hyperbaric Association around this presentation, including:

- Consulting
- Honoraria
- Research funding
- Corporate laboratory funding
- Collaborations

Andrew Corliss Fry,
PhD, CSCS,*D, FNSCA*E
(Andrew)



Wu Tsai Human Performance Alliance

Digital Athlete &
Wearable Technology



Regenerative Rehabilitation &
Bowerman Sport Science Center

Female Athlete
Health & Performance



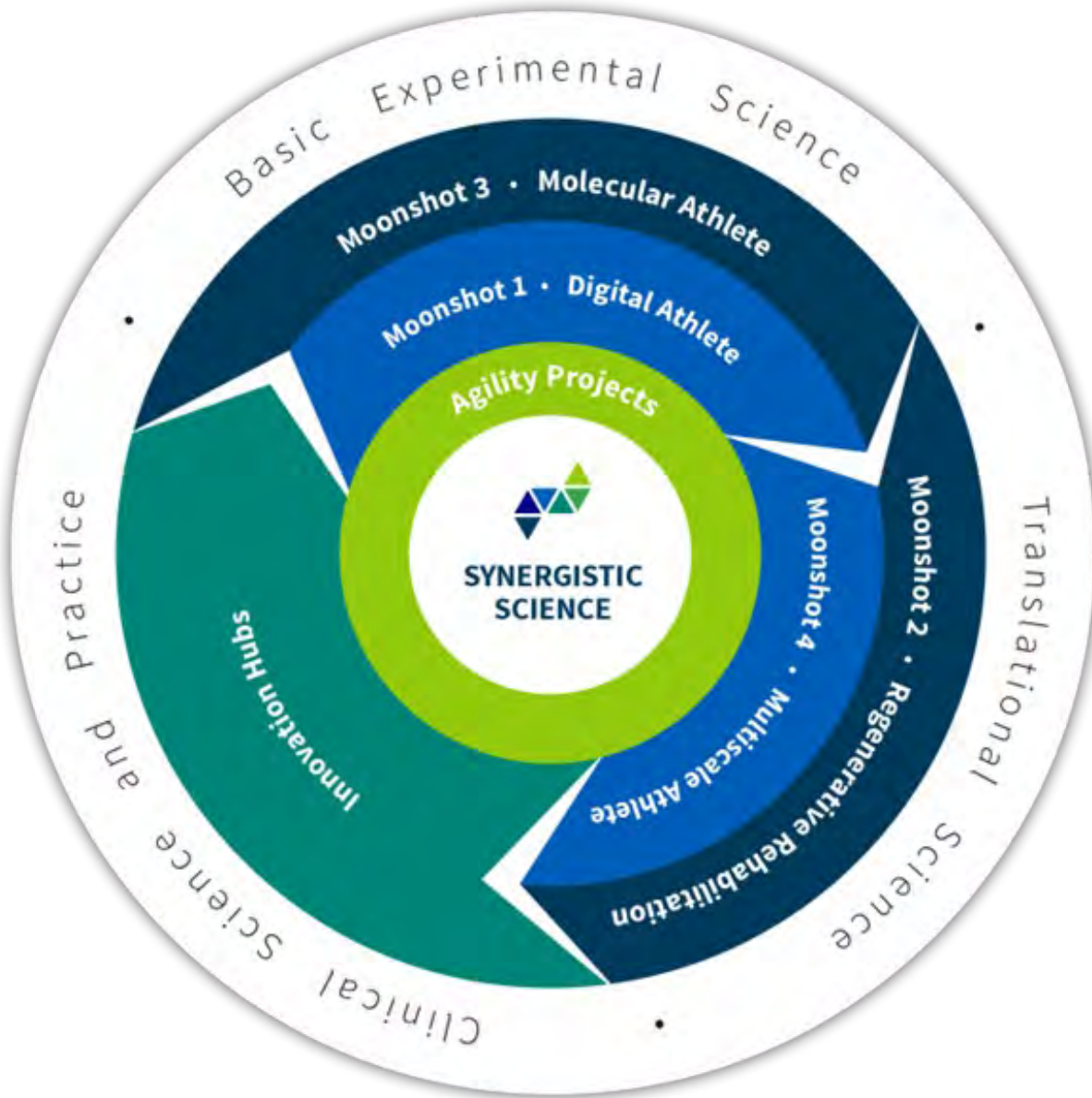
Multi-Scale Athlete
Injury & Recovery

Molecular Athlete



Athletic Performance





Wu Tsai Human
Performance Alliance

Bowerman Sport Science Center



Jayhawk
Athletic
Performance
Laboratory



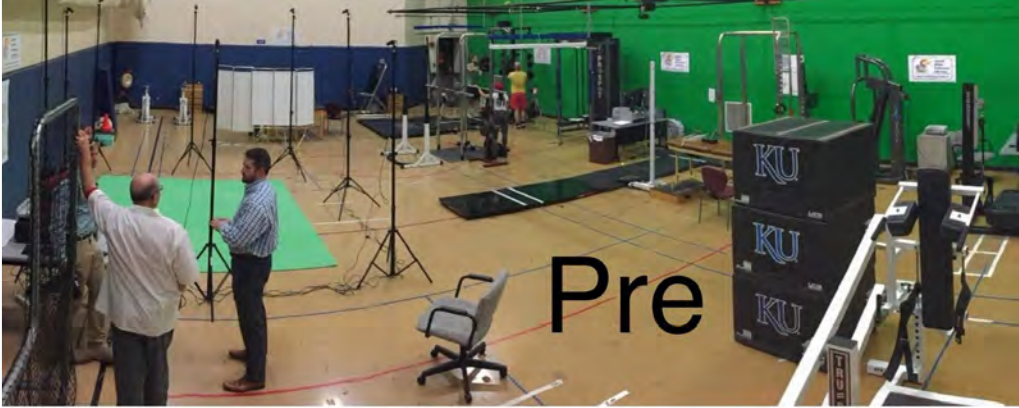
Wu Tsai Human
Performance Alliance
University of Kansas

Missions

- Rapid development and deployment of new approaches for optimizing athletic performance for basketball players and other athletes.
- To better understand the journey to elite athletic performance



Renovations



Our Laboratory Team



Andrew Fry, Ph.D.
Director



Gabe Downey
Director of Operations



Dimitrije Cabarkapa, Ph.D.
Dir. of Basketball Research



Drake Eserhaut, M.S.
Graduate Research Assistant



Nico Philipp, M.S.
Graduate Research Assistant



Damjana Cabarkapa, M.S.
Graduate Research Assistant



Gabe Kavadas, M.S.
Graduate Research Assistant



Daniel Yu, B.S.
Graduate Student
N.Y. Mets



Joe DeLeo, M.S.
Graduate Research Assistant



Jessica Provost, M.S., R.D.
Graduate Research Assistant

Collaborating Labs



Mary Fry, Ph.D.

Director, KU Sport & Exercise
Psychology Laboratory
Formerly member AASP BOD



Jon Miller, Ph.D.

Research Professor
Berkland Lab - KU



Michael Stone, Ph.D.

Ctr. of Excellence in Sports & Coach
Education
East Tennessee State University
Formerly Head of Sports Physiology - USOC



Vincent Wilczynski, Ph.D.

Ctr. for Engineering Innovation & Design
Yale University



Paul Luebbbers, Ph.D.

Dept. Chair, HPER
Emporia State University

Private Sector Partners



Patrick Moodie
CStO/Founder



Skip Cronin
CEO



Nikola Mrvaljevic
CEO/Founder



Ethan Reeve
Director of Strength & Athletic
Performance



Brett Alvar, Ph.D.
President



Michael Massik
Executive
Director



Virginia Meier
Conference
Director



Jason Sonners, DC
HBOT USA



Advisory Board



Andrea Hudy

University of Connecticut
Women's Basketball



Michael Deane

NCAA D1 Basketball Coach
Retired



Bob Alejo

Cal State – Northridge
Asst. Athletic Director
Formerly Oakland A's



John Wagle, Ph.D.

Notre Dame
Director of Player Performance
Formerly KC Royals



Mike Nitka

High School Strength &
Conditioning Coach
Retired
Formerly NSCA BOD



Joe Kenn

NFL Carolina Panthers
Retired



Ramsey Nijem, D.Sc.

University of Kansas
Men's Basketball

THE SCIENCE OF BASKETBALL

Tradition Meets Technology

112.8°

47.6°





Wu Tsai Human
Performance Alliance

MOTIONOMICS

*Transforming Human
Health through the Science
of Peak Performance*

Stanford
University



Boston Children's Hospital
Where the world comes for answers

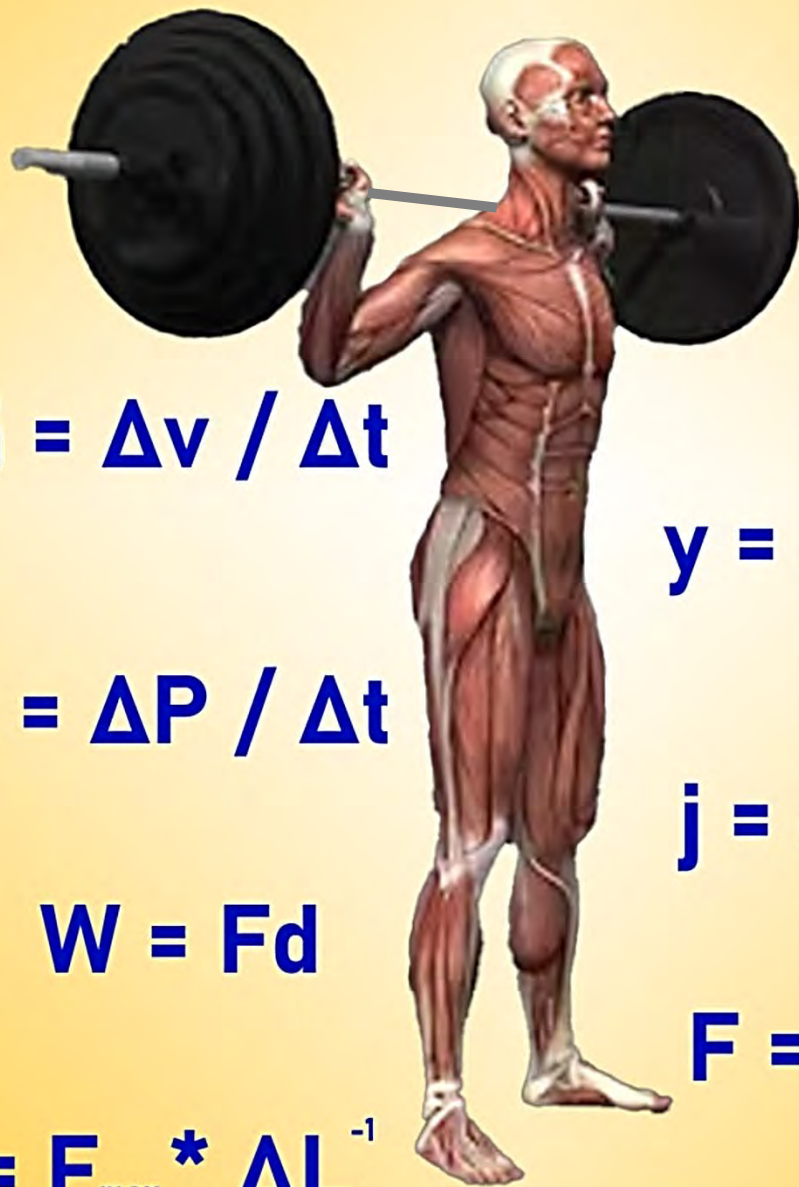


UNIVERSITY OF
OREGON

KU THE UNIVERSITY OF
KANSAS

salk
Where cures begin.

UC San Diego



Modeling Resistance Exercise: Understanding Complexity

$$\bar{a} = \Delta v / \Delta t$$

$$y = d^2(mv) / dt^2$$

$$F = \Delta P / \Delta t$$

$$j = d^3 r / dt^3$$

$$W = Fd$$

$$F = ma$$

$$k = F_{\max} * \Delta L^{-1}$$

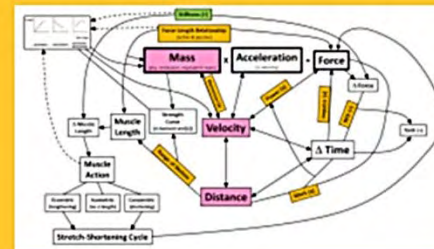
UC San Diego



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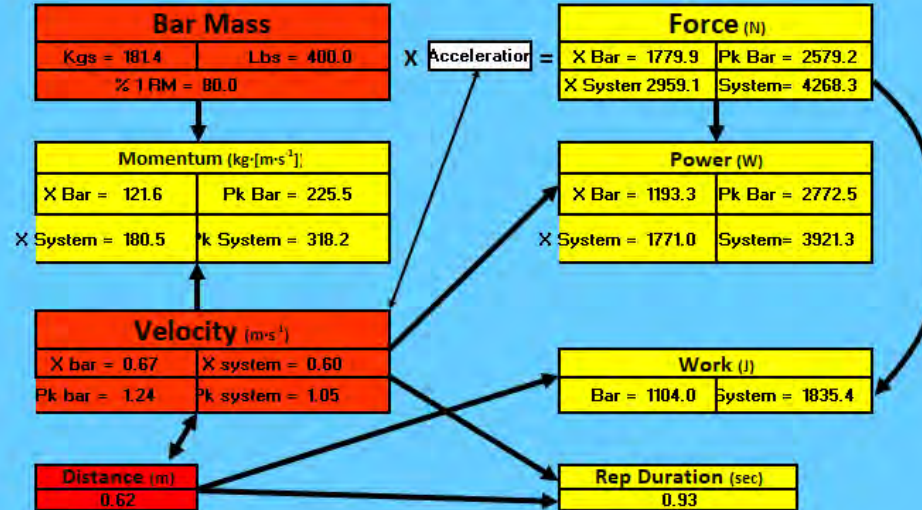
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Performance Alliance



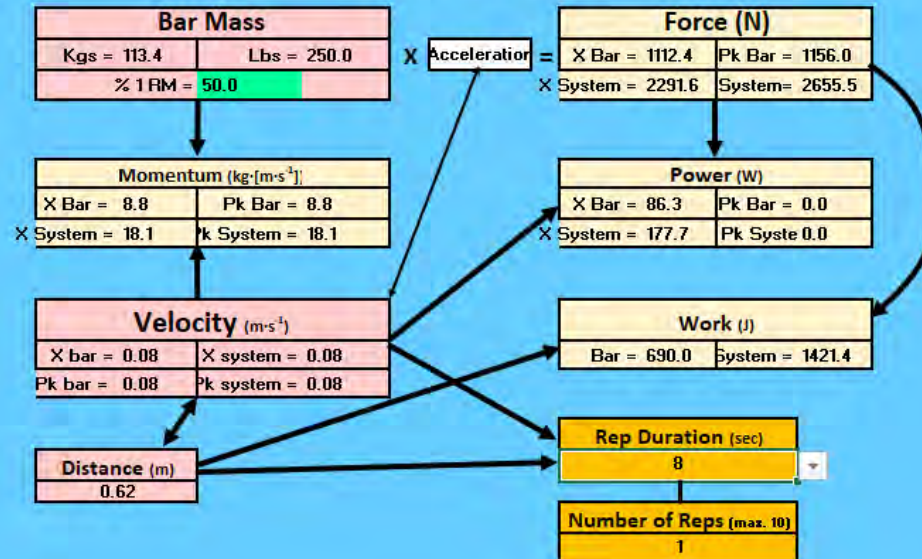
One Repetition Model

Body Weight (lbs)	265.00	Body Weight (kgs)	120.2
Stature (in)	74.0	Stature (m)	1.88
Select Exercise	Squat	Range of Motion	Full
Concentric 1 RM for selected exercise (lbs)	500.0	Concentric 1 RM for selected exercise (kgs)	226.8
Load on Bar (lbs)	400.0	Load on Bar (kgs)	181.4
% 1 RM	80.0	Volitional Tempo (sec)	Not Used
Mean Bar Velocity (m·s ⁻¹)	0.67	Peak Bar Velocity (m·s ⁻¹)	1.24
(m·s ⁻¹)	0.60	(m·s ⁻¹)	1.05
Mean Bar Force (N)	1779.9	Peak Bar Force (N)	2579.2
Mean System Force (N)	2959.1	Peak System Force (N)	4268.3
Mean Bar Power (W)	1193.3	Peak Bar Power (W)	2772.5
Mean System Power (W)	1771.0	Peak System Power (W)	3921.3
Bar Impulse (N·s)	1646.8	System Impulse (N·s)	2737.8
Mean Bar Momentum (m·v)	121.6	Peak Bar Momentum (m·v)	225.5
System Momentum (m·v)	180.5	System Momentum (m·v)	318.2

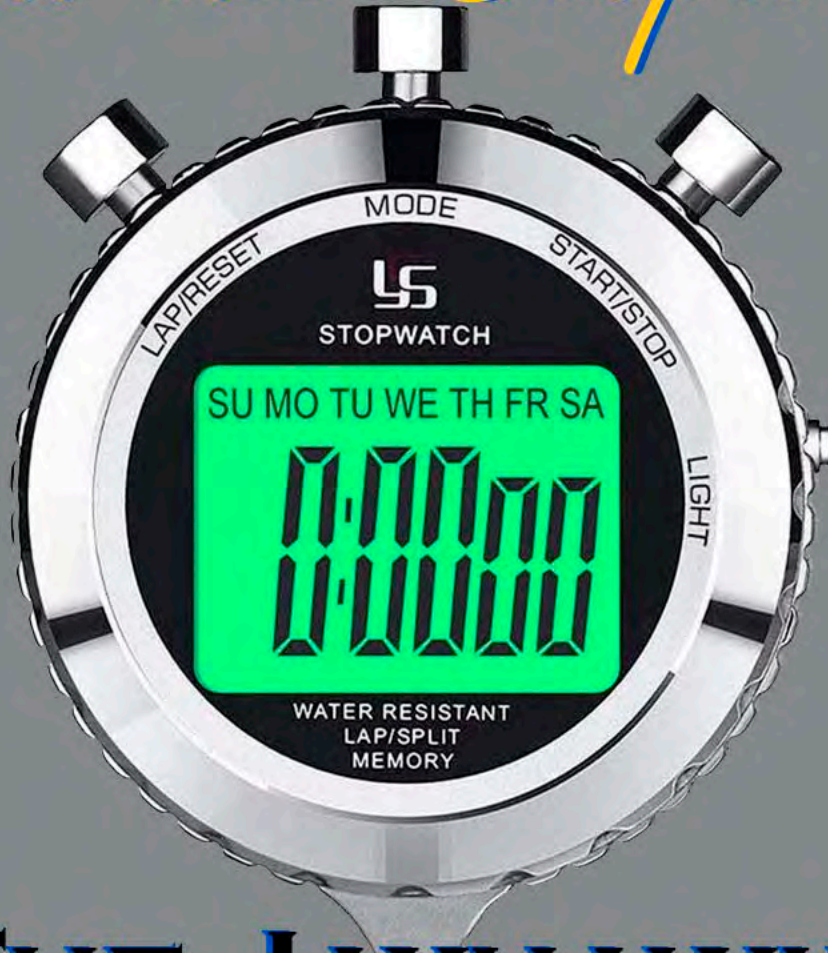
Traditional Resistance Exercise



Intentionally Slow Velocity Resistance Exercise



Beyond the Stopwatch:



**THE JAYHAWK
SPRINT PROJECT**



Drive to Success:



Boston
Children's



Jayhawk
Athletic
Performance
Laboratory

ROWING STRONG

Performing Under Pressure



Psychology Meets Physiology

Types of Research

- Experimental studies
- Generating data bases
- Retrospective studies
- Action research
- Nimble/agile
- **MUST communicate with coaches & athletic staff**
They are collaborators





Plans

- Study elite athletes
- Understand the journey to reach full potential
- EliteForm Visiting Coaches' Program
- Visiting scholars' program (sabbaticals and on-site collaborations)
- **Continue to have fun!**



Jayhawk
Athletic
Performance
Laboratory

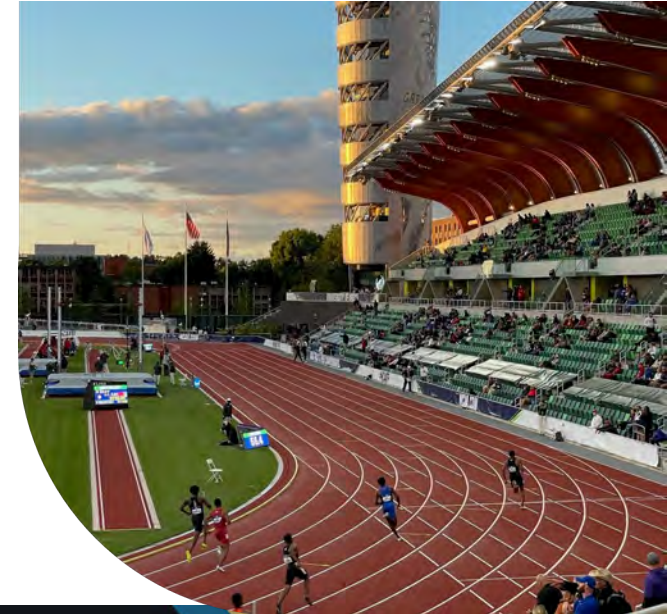


Bowerman Sports
Science Center



Wu Tsai Human
Performance Alliance

Michael Hahn, Ph.D., CSCS





Bowerman Sports Science Center



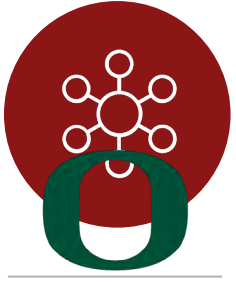
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Performance Alliance
UNIVERSITY OF OREGON



Fry, Andrew & Hahn, Mike
*From Marathon to 1 RM - The Study of Elite Sport Performance and How
to Get There*



Wu Tsai Human
Performance Alliance
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Mission

Developing predictive biomarkers and AI-based algorithms to improve the performance and injury recovery of track and field athletes at the developmental, elite, and masters levels.



Our Team



Mike Hahn

*Associate Professor, Human Physiology
Director, Bowerman Sports
Science Center*



Aida Chebbi

*Research Engineer, Bowerman
Sports Science Center*



Chris Minson

*Kenneth M. and Kenda H. Singer
Endowed Professor, Human
Physiology*



Susan Sokolowski

*Associate Professor and Director,
Sports Product Design Program*



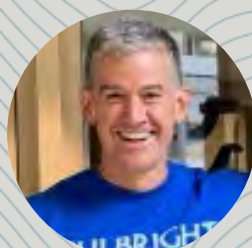
Michelle Marnewek

*Assistant Professor, Human
Physiology*



John Halliwell

*Professor and Department Head,
Human Physiology*



Andrew Lovering

Professor, Human Physiology



Damen Callahan

*Assistant Professor, Human
Physiology*



Jake Searcy

*Assistant Research Professor,
Data Science*

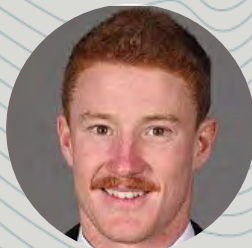
Our Team

Collaborators



Jordan Troester

*Director of Performance and
Sports Science, Athletic
Department*



Ben McKay

*Sports Science Coordinator,
Athletic Department*



Aaron Vaughan

*Sports Medicine Specialist,
Primary Care Sports Medicine*



Grant Wilson

*Associate Athletic
Trainer, Cross Country/Track
& Field*

Trainees



Mike McGeehan

*Postdoctoral Scholar, Ong and
Hahn Labs*



Gabi Lorenzo

*Masters Candidate, Sports
Product Design*



Emily Karolidis

*PhD Student, Human
Physiology*



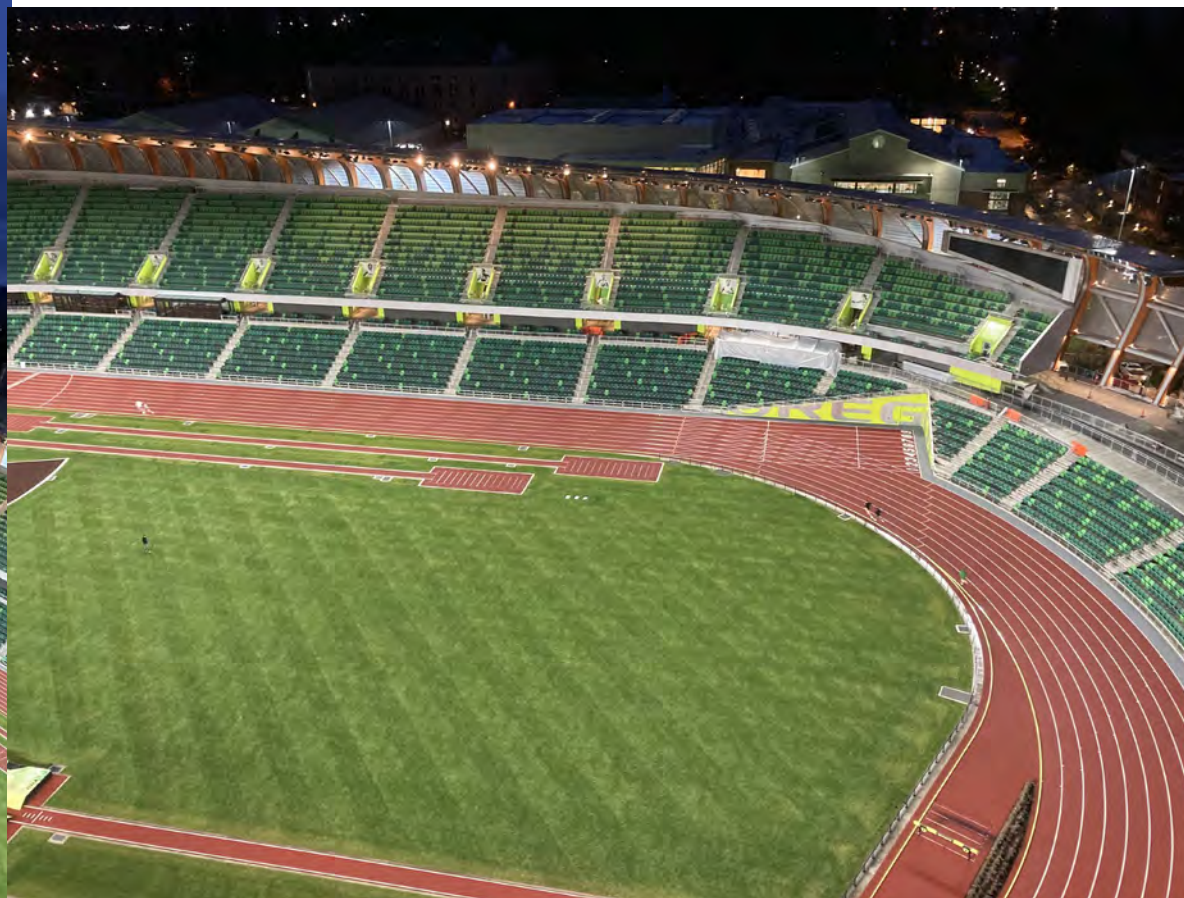
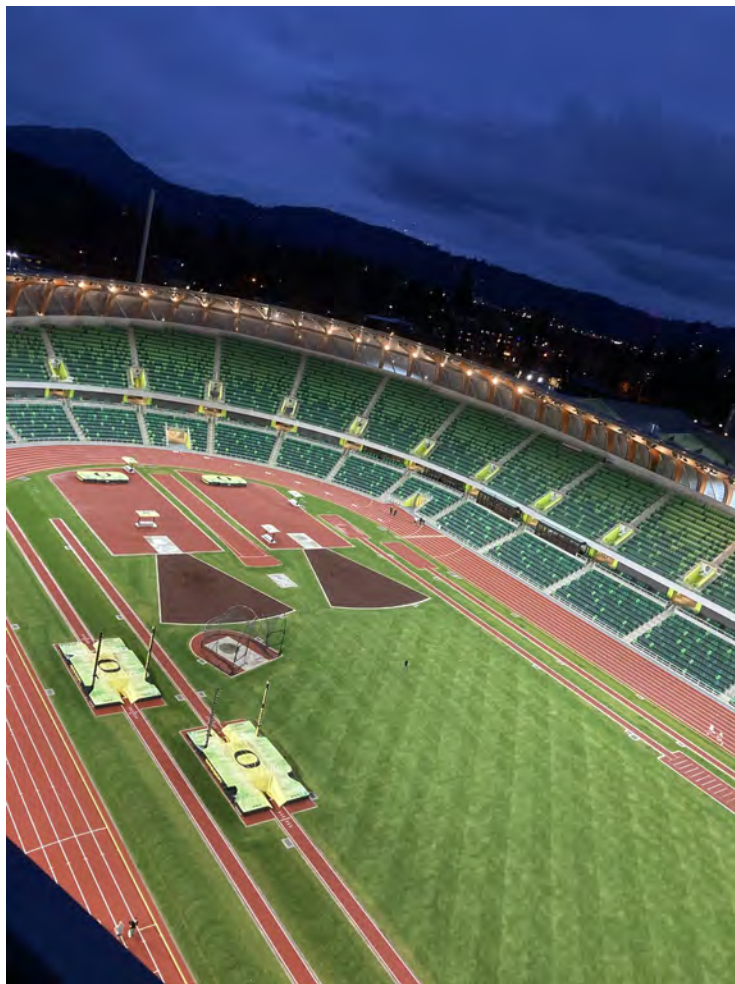
Rachel Robinson

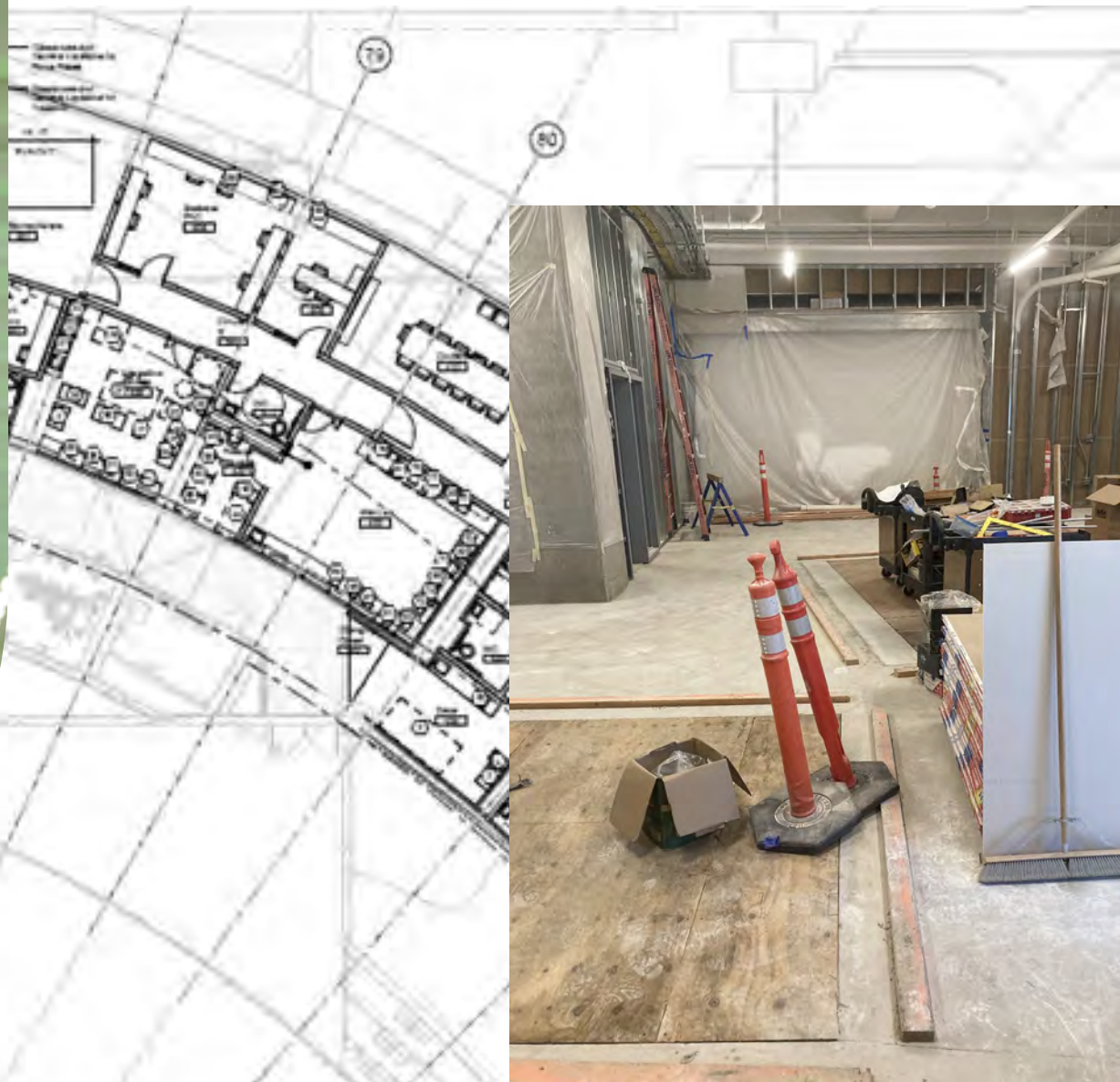
*PhD Student, Human
Physiology*



In preparation for World Athletics Championships (Oregon '22)







BSSC Operating Model

- Service to Athletes



Injury
Prevention

Intervention & Rehabilitation

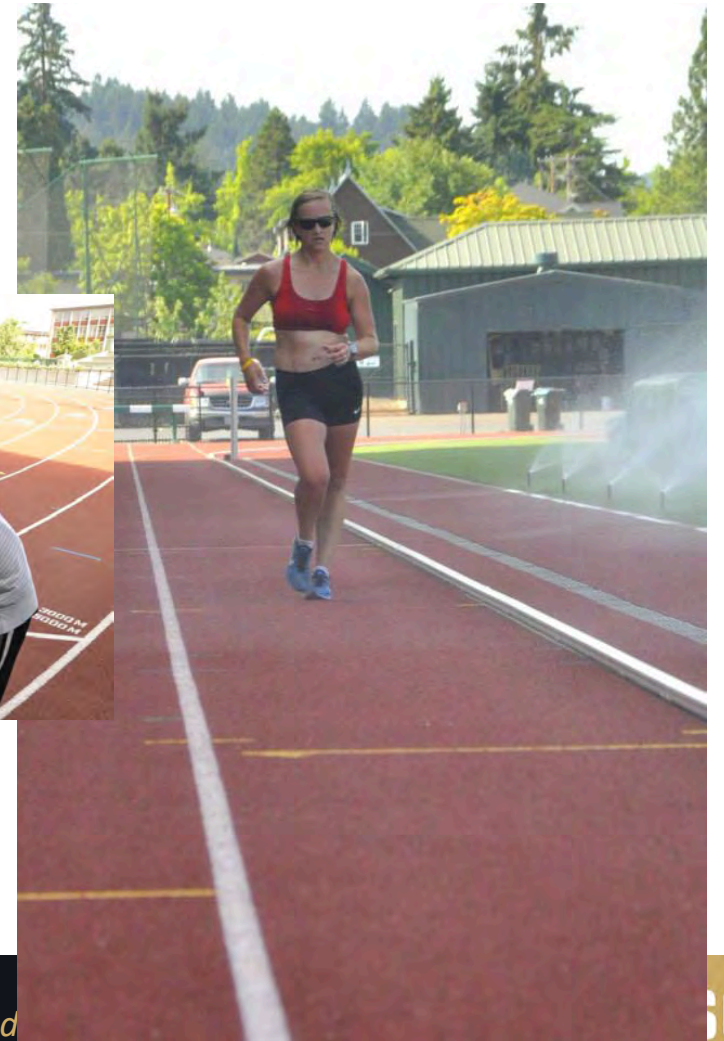
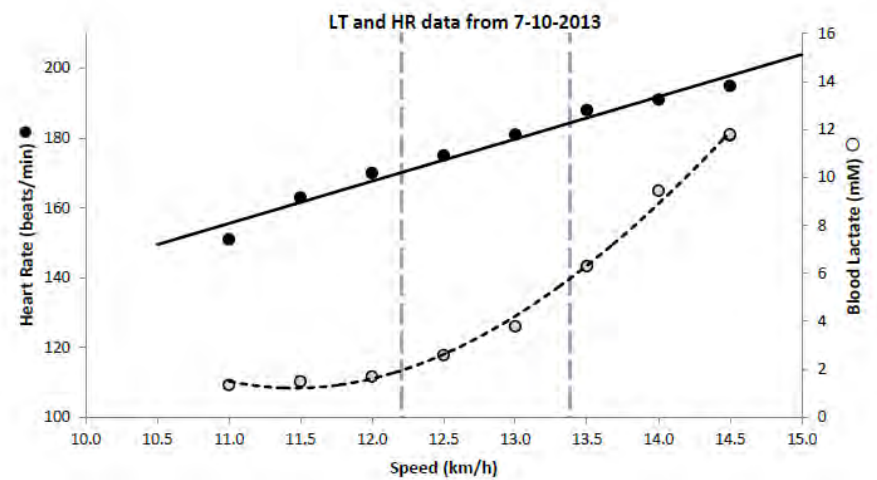
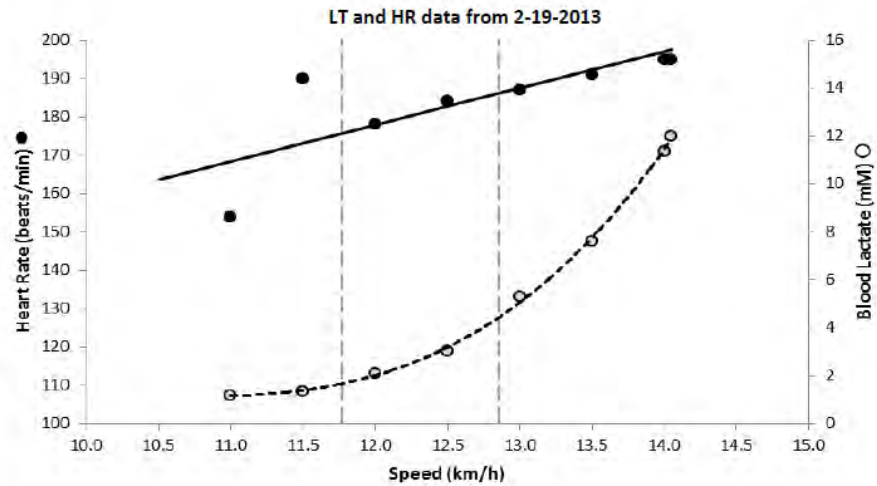
Performance
Enhancement



- Developmental, high school, collegiate, professional
- ... 'avid hobbyists'
- R&D contract-based support
 - Sportswear companies
 - Serial entrepreneurs

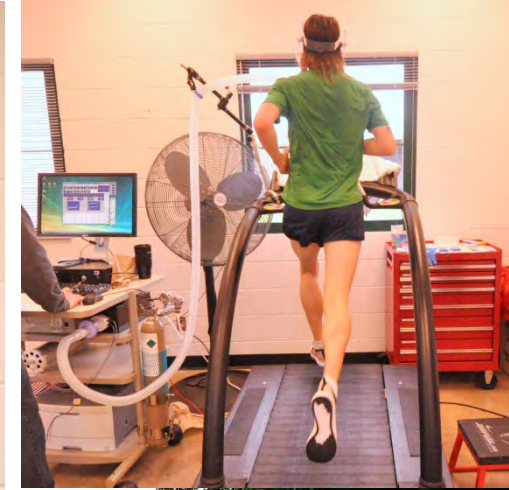






ew & Hahn, Mike
*Study of Elite Sport Performance and
 to Get There*

- Fall intake
 - Lactate Thresholds
 - VO2 Max
 - Field Lactate Validation



- Spring Checkup
 - Field Lactates



200 | | | 16 | 80 | | | 1.3

Your Individualized Training Zones

Zone	Speed	Pace	Heart Rate	% HR max	Description
1	< 15.8	> 6:07	< 175	< 87	Light Aerobic (AKA, Easy, Low-Intensity Aerobic). Recovery workouts or workouts > 3 hours. Performed below LT1.
2	15.8 - 16.9	6:07 - 5:43	175 - 184	87 - 92	Moderate Aerobic (AKA, Steady 1, LSD). Workouts 1-3 hours. Performed in the lower-half of LT1-LT2.
3	16.9 - 17.6	5:43 - 5:29	184 - 189	92 - 94	Heavy Aerobic (AKA, Steady 2, Tempo). Workouts 30-90 minutes. Performed in the upper-half of LT1-LT2.
4	17.6 - 18.4	5:29 - 5:15	189 - 195	94 - 97	Threshold. Workouts 20-60 minutes and Fartleks. Performed at LT2.
5	18.4 - 19.8	5:15 - 4:53	195 - 201	97 - 100	Maximal Aerobic (AKA, VO ₂ max). High-intensity intervals and workouts 2-12 minutes. Performed above LT2.
6	> 19.8	< 4:53			Anaerobic (AKA, Supramaximal). Sprint intervals < 2 minutes. Performed above VO ₂ max.

Respiratory Exchange Ratio



ment
ng





Partnerships

■ Research Collaborations

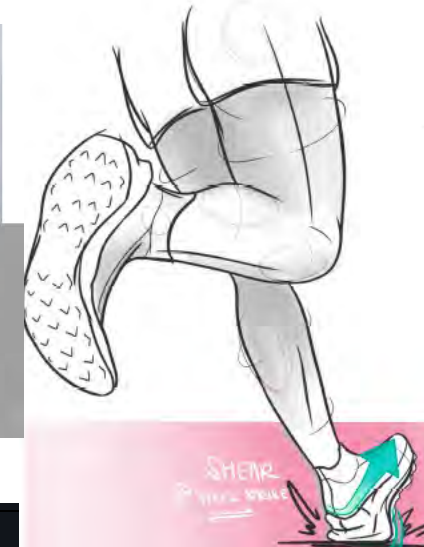
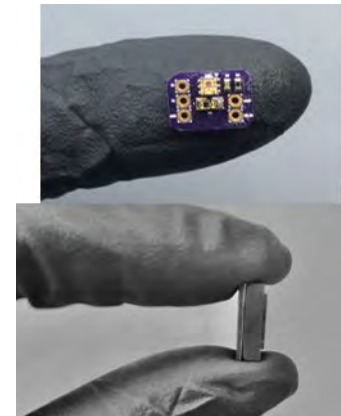
- Shear sensor integration into footwear

■ Education/Outreach and Translation

- UO Athletics (energy deficiency consults)
- Kidsports (nutrition, training, recovery, sleep)

■ Translation

- UO Athletics (heat acclimation)
- Oregon Track Club – Elite (lactate threshold training consultations)



Thank you!!

Mike Hahn

mhahn@uoregon.edu

