



# Exit Presentation

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Prairie View A&M University  
Dr. Millard F. Reschke, Mentor  
Neuroscience Laboratories

# Introduction



Most Outstanding Junior Computer Engineering Student Fall 2013 – Spring 2014  
Graduation date: May 2016

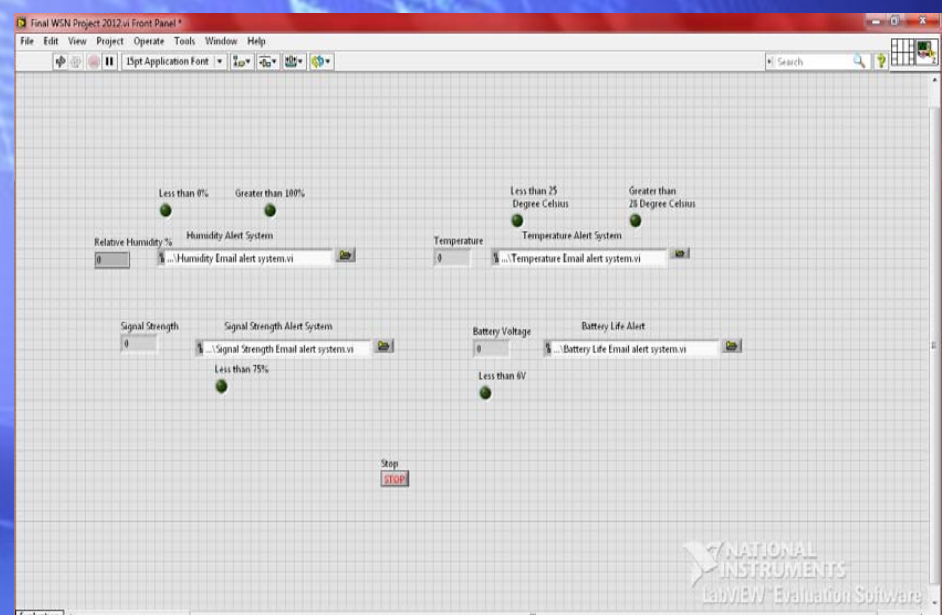
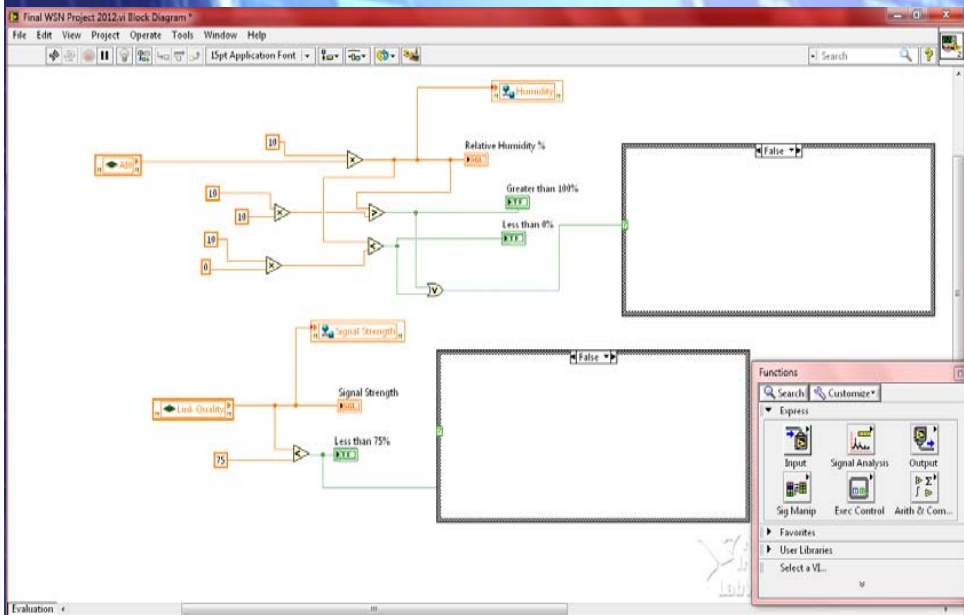
Transferred to Prairie View A&M University, Fall 2013

University of Houston  
2007



# Research at PVAMU

- Wireless Sensor Network for Smart Irrigation  
– Intro to LabVIEW 2012



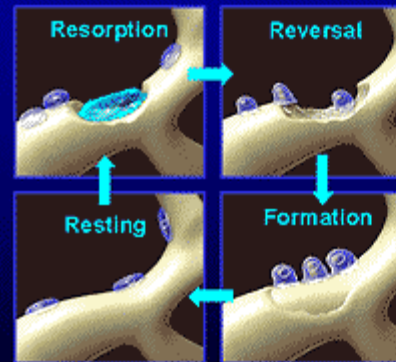
# Research at PVAMU - NSTI

- Development of technologies for elucidation and mitigation of bone loss in microgravity, osteoporosis and inflammatory disease



Mathematical Aspects of Bone Remodeling

## Normal Bone Remodeling



### Resorption

Osteoclasts remove bone mineral and matrix, creating an erosion cavity (3-4 weeks)

### Reversal

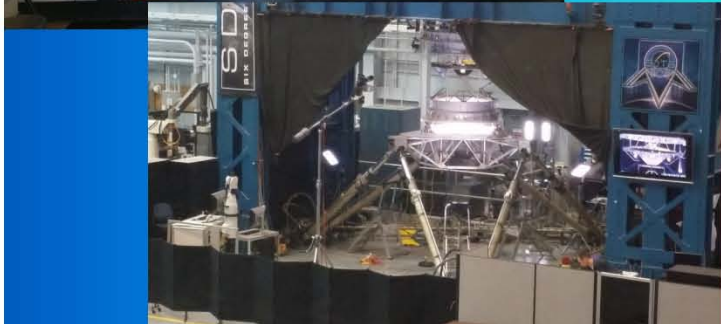
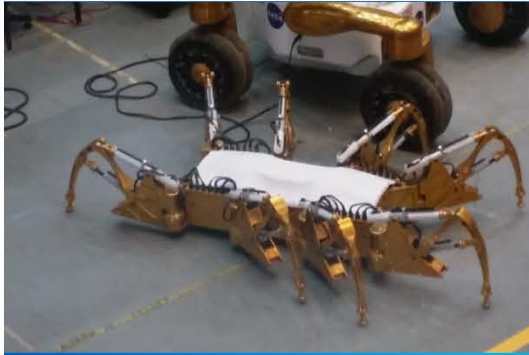
Mononuclear cells prepare bone surface for new osteoblasts to begin building bone

### Formation

Osteoblasts synthesize a matrix to replace resorbed bone with new bone (3-4 months)

### Resting

A prolonged resting period follows until a new remodeling cycle begins



A blue wireframe head with a brain scan overlay and a white waveform.

# Neuroscience Laboratories

## – Research Areas

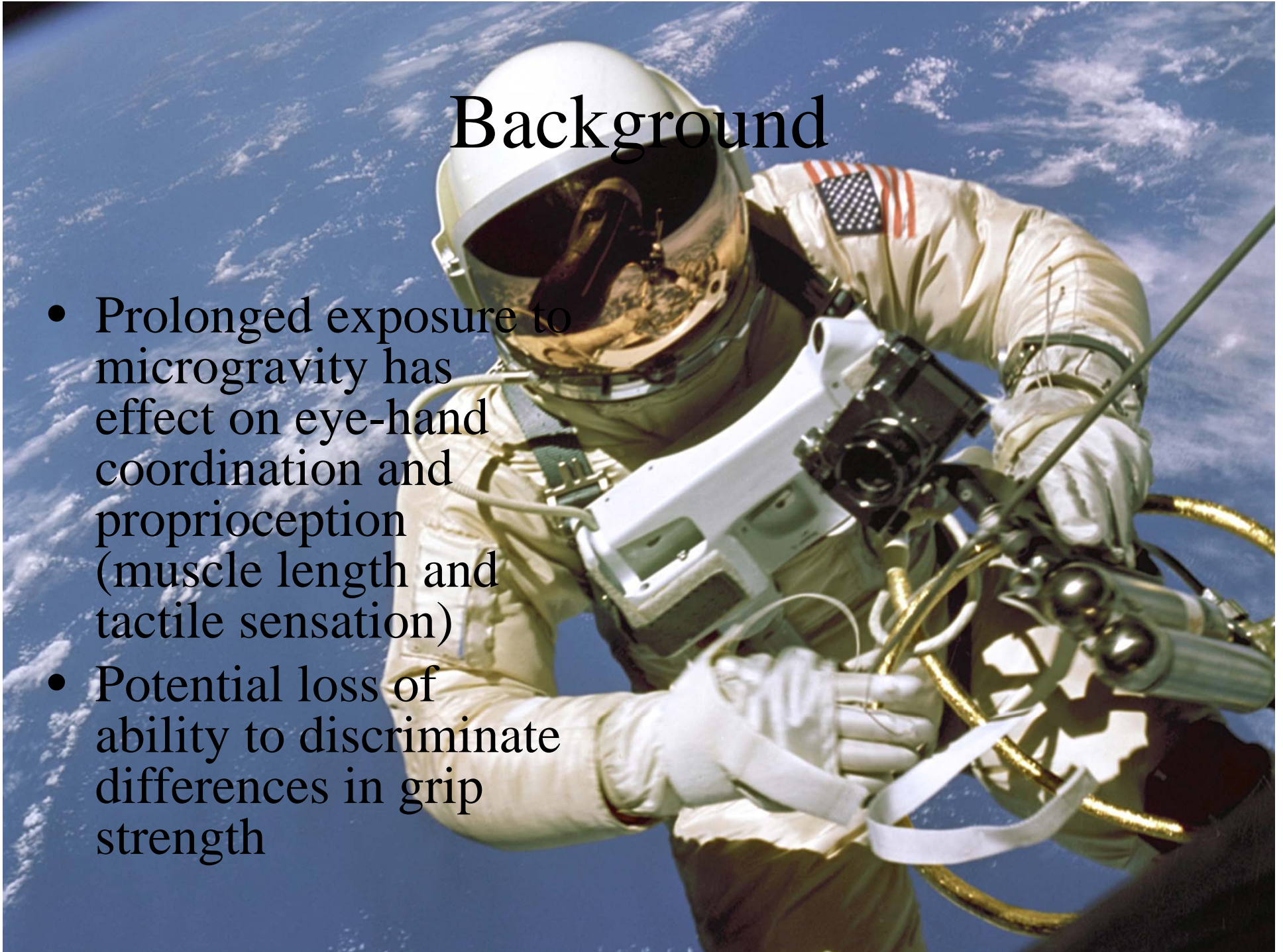
- Motion
- Neuroautonomy
- Off-Vertical Axis Rotator(OVAR)
- Postural Control
- Preflight Adaptation and Virtual Reality Training
- **Sensorimotor**
- Short-Arm Centrifuge
- Visual-Vestibular (Gaze)

# Objectives of Internship

- Recovery of Functional Sensorimotor Performance Following Long Duration Space Flight (Field Test)
  - Validate Force Discrimination and Memory protocol for Field Test
- Effects of Fatigue on Force Discrimination
  - Using fatigue protocol to induce changes in ability to discriminate forces and modify muscle memory

# Background

- Prolonged exposure to microgravity has effect on eye-hand coordination and proprioception (muscle length and tactile sensation)
- Potential loss of ability to discriminate differences in grip strength





# SEAL

Documentation and Approval  
of approval



Medical and safety  
Consent To Be A Researcher  
Study  
Biologics, and Medical Devices  
Hazardous  
Injury, Compensation Information  
Withdrawal and/or Termination  
Record Confidentiality and Authorization to Release  
Protected Health Information (PHI)  
Signatures

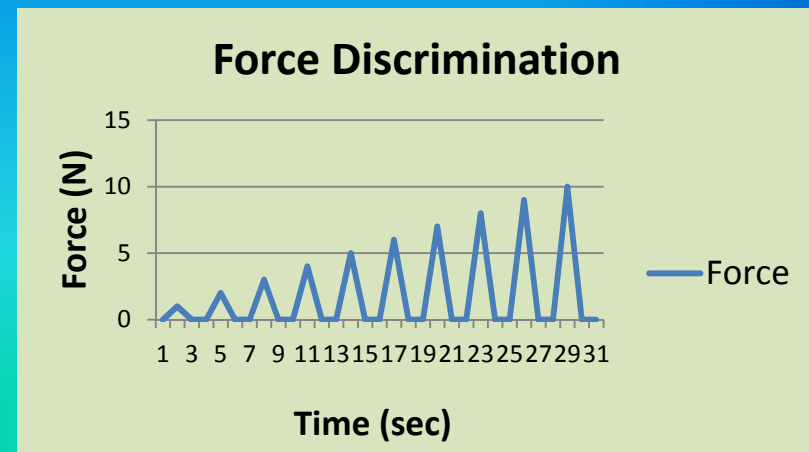


# Recruiting Process

- 24 NASA JSC Interns volunteered as test subjects
  - 12 subjects for Force Discrimination and Memory
  - 12 subjects for Effects of Fatigue on Force Discrimination
  - Each subject received a Layman's summary of project background and procedures

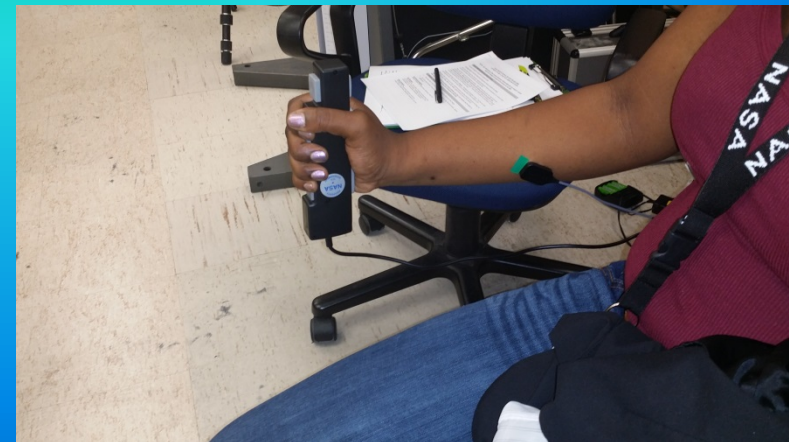
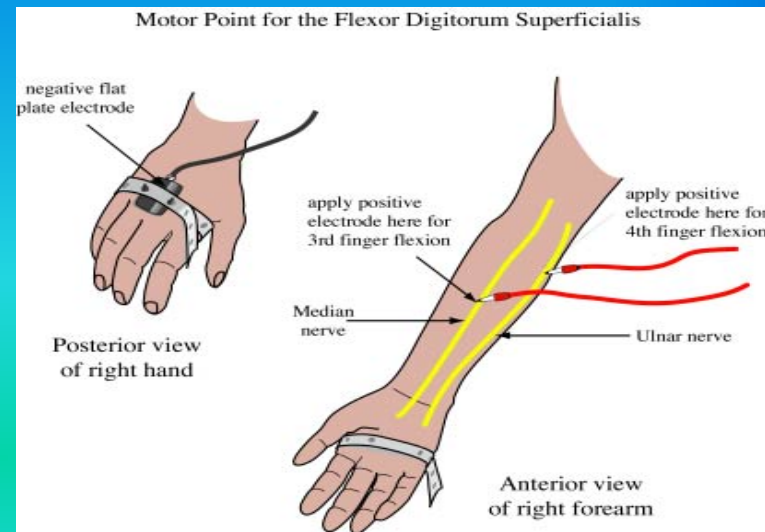
# Experimental Protocol

- Force Discrimination and Memory
  - Force discrimination tasks
  - Dominant hand 30% maximal voluntary contractions (MVC) to target
    - 30s contraction eyes open
    - 5 contractions eyes open
    - 5 contractions eyes closed
    - 5 contractions eyes open
  - Non-dominant hand 30% MVC
    - 5 contractions eyes closed

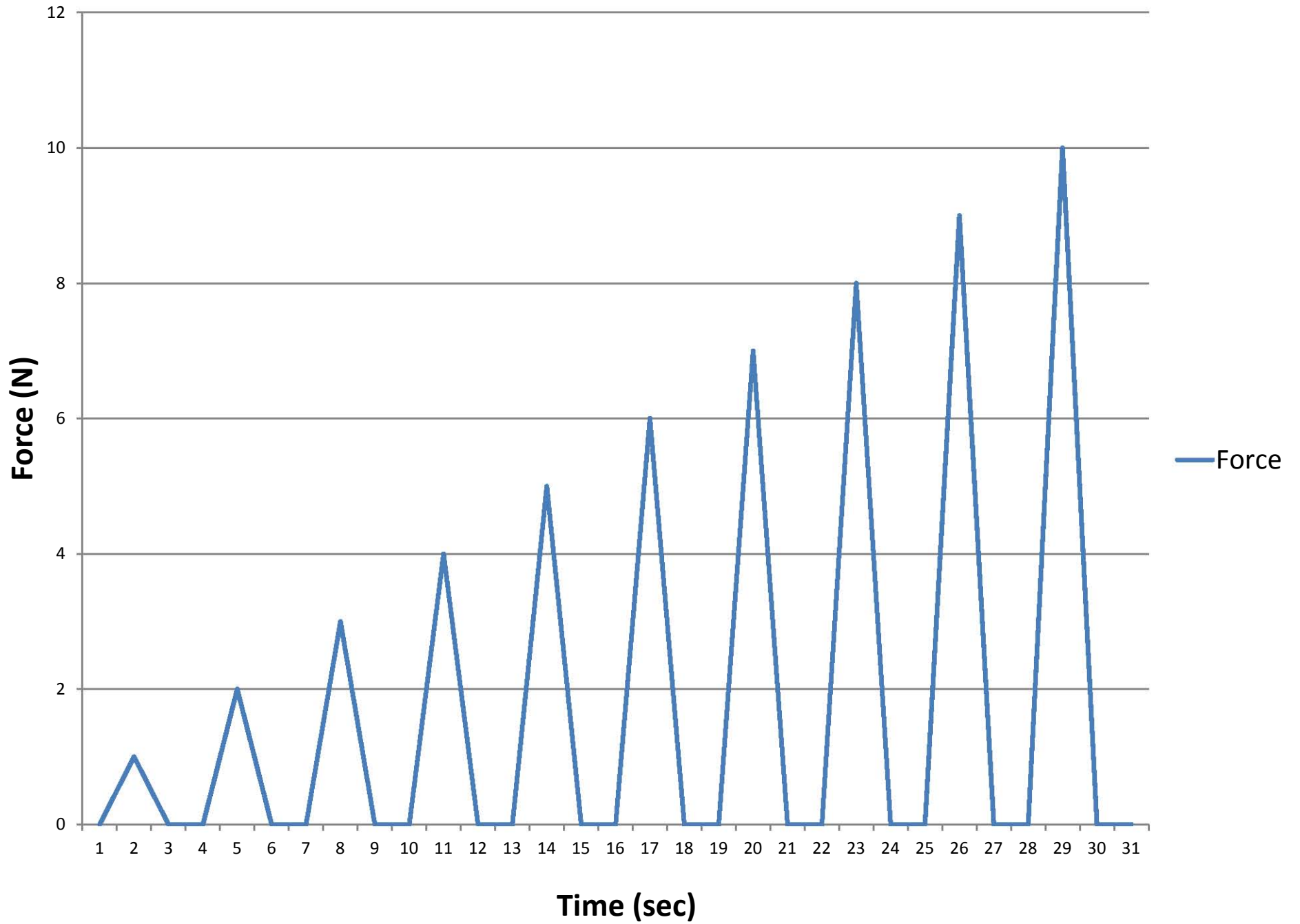


# Experimental Protocol

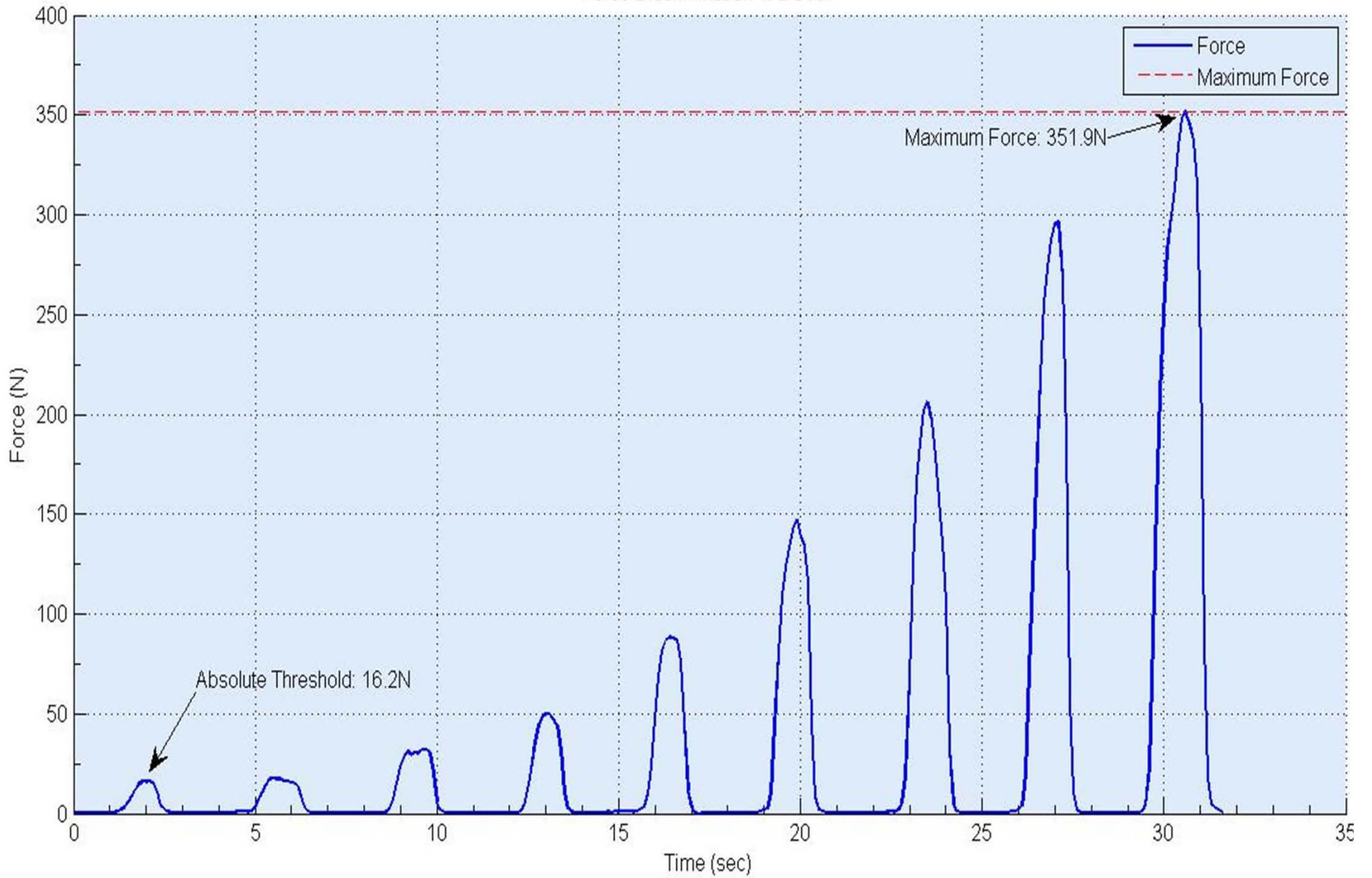
- Effects of Fatigue on Force Discrimination
  - Force discrimination tasks
  - Fatigue task grip for 2s MVC, 2s rest for 30 contractions
  - Force discrimination tasks at 1 min intervals with 5 minutes rest between tasks



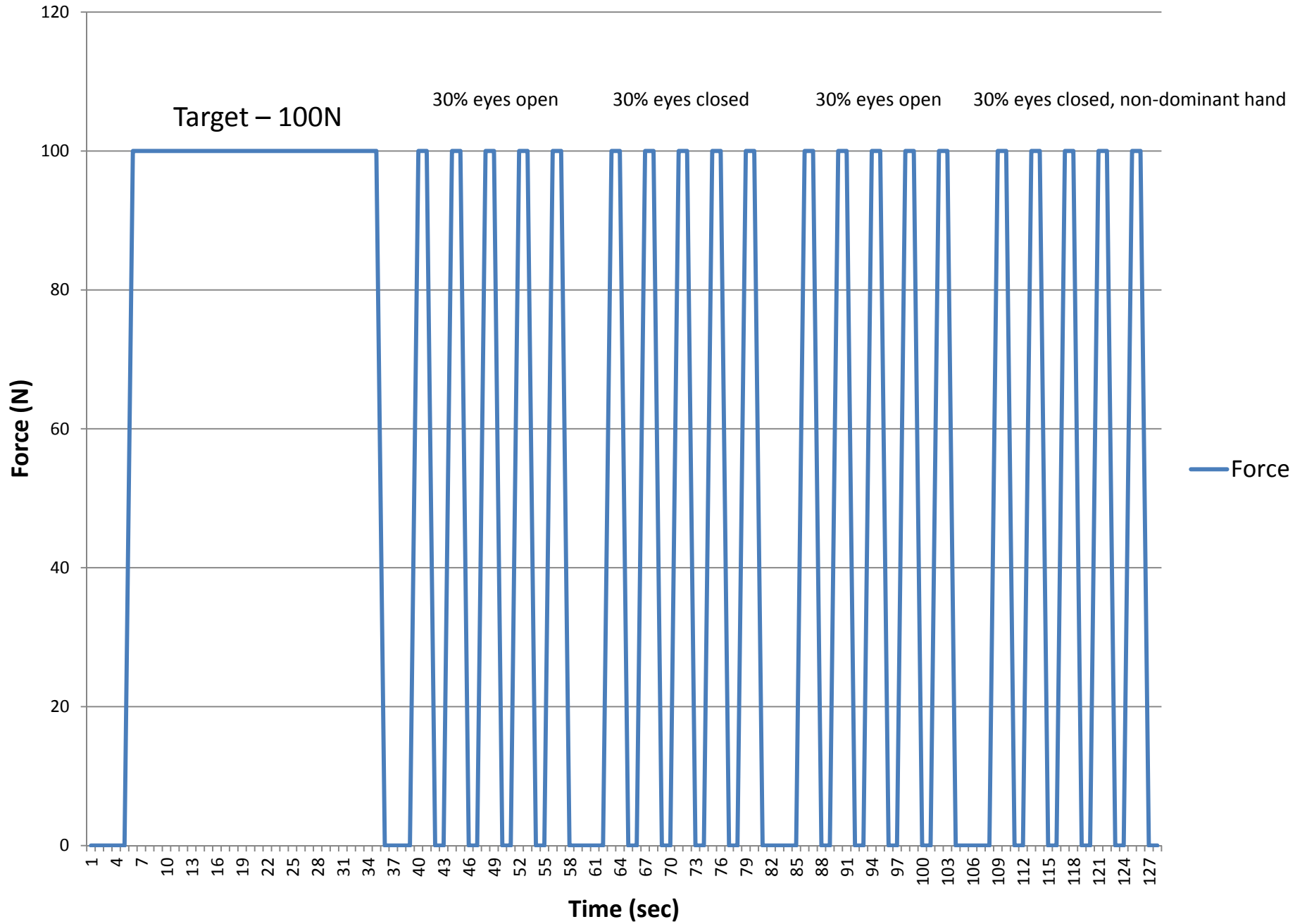
# Force Discrimination

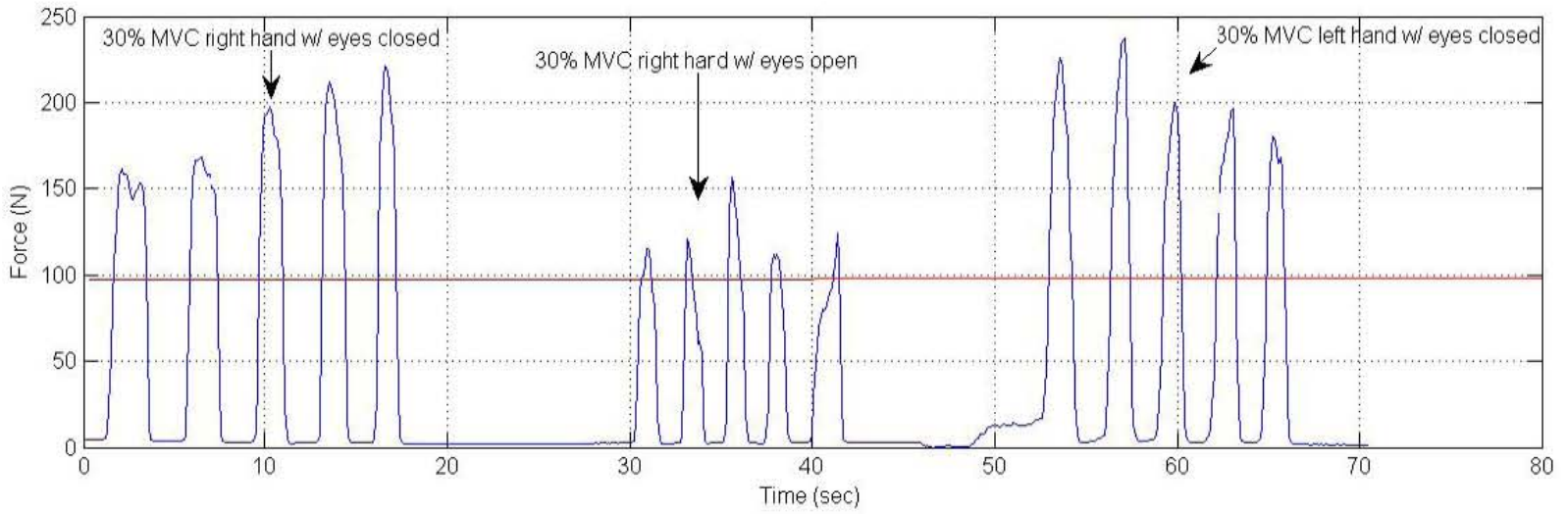
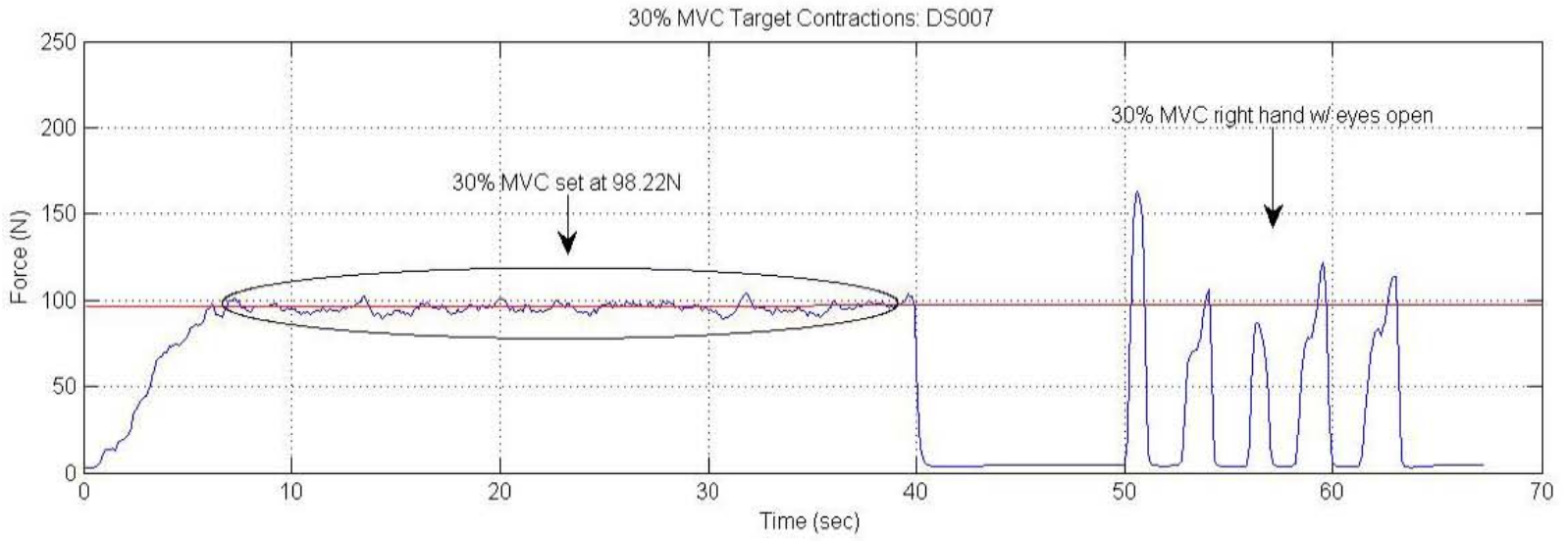


Force Discrimination 1: DS007



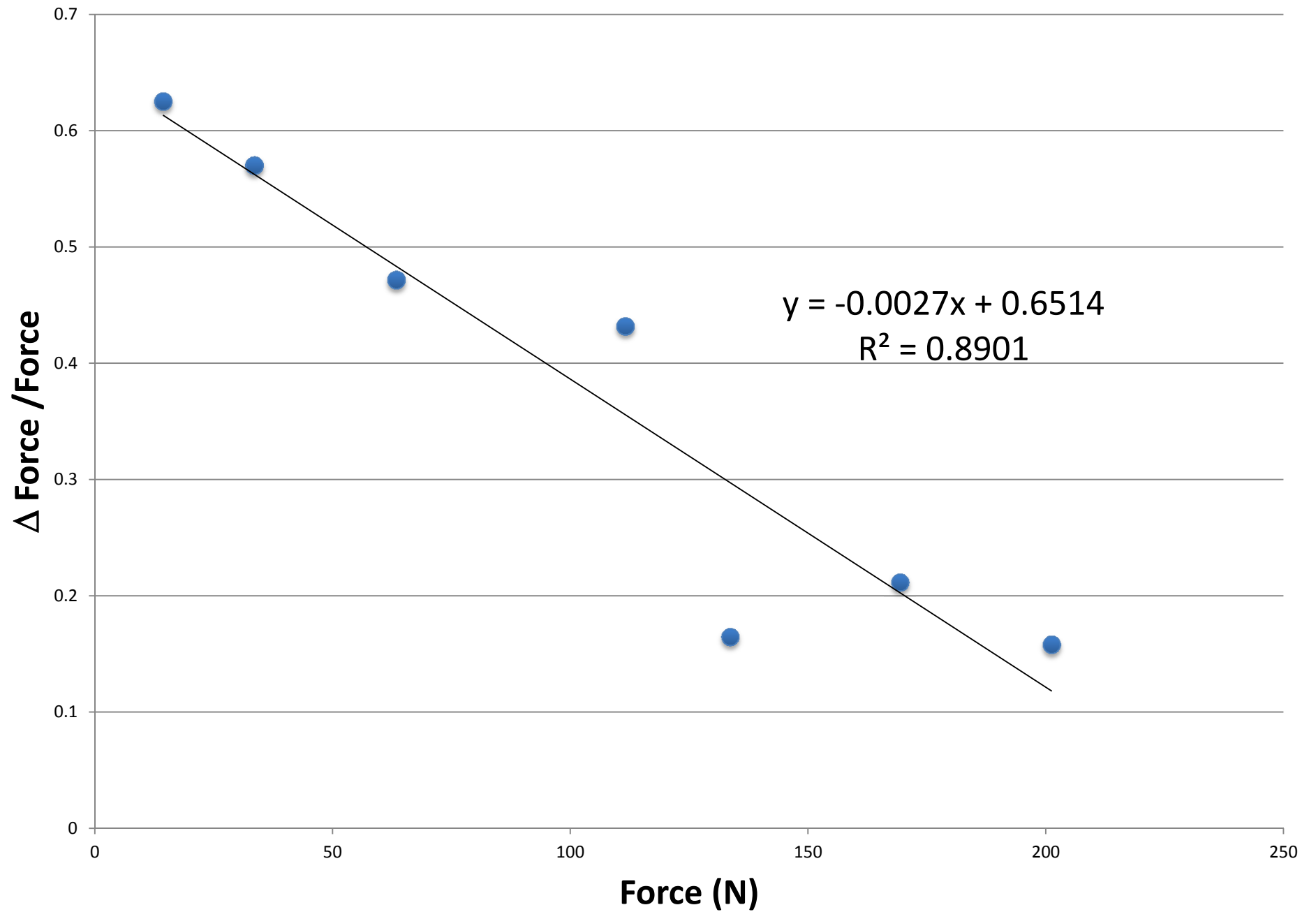
# 30% Maximal Voluntary Contraction (MVC) - MVC = 333.3N



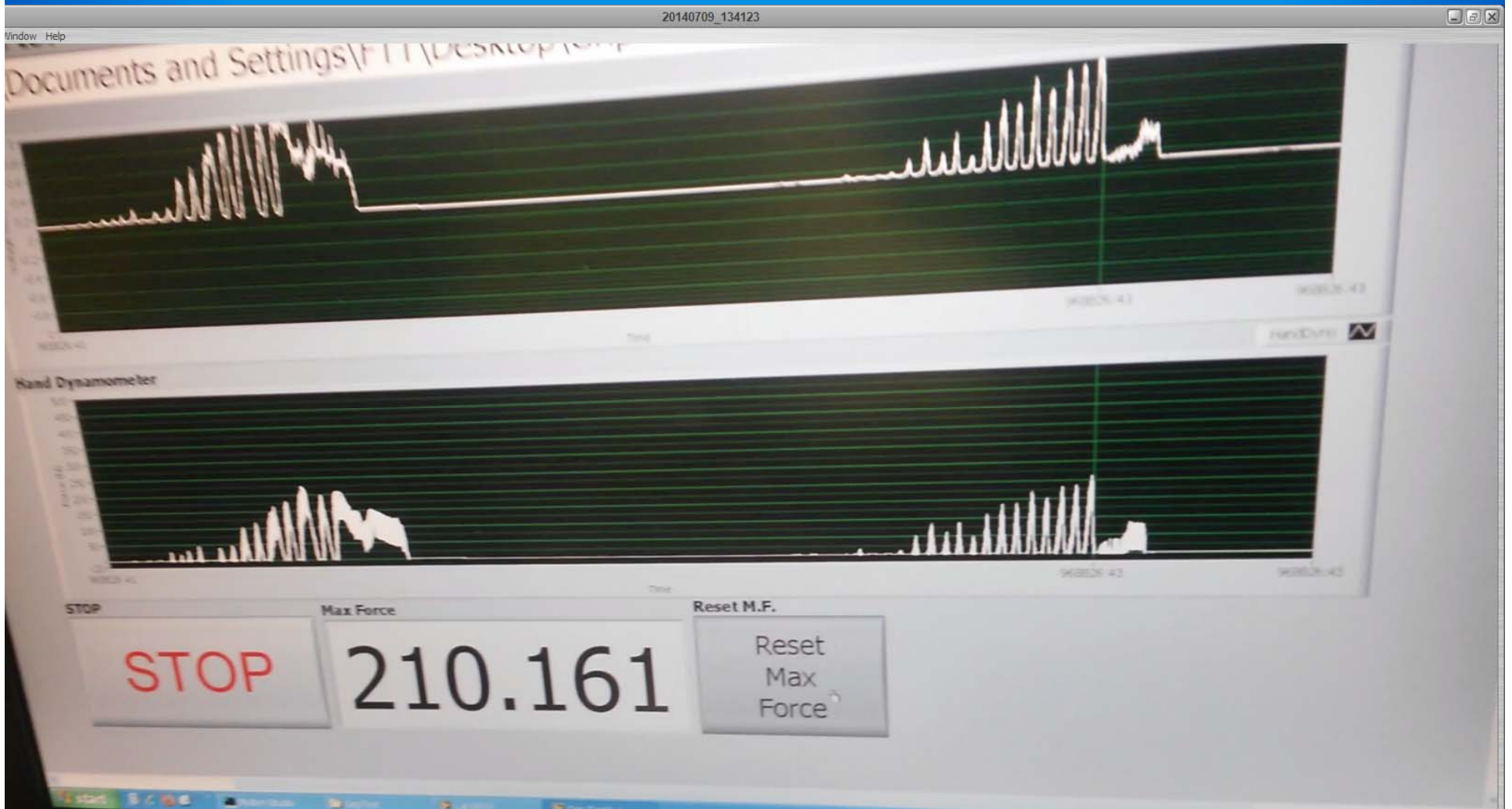




## Weber's Ratio - Just Noticeable Difference



# EMG Data



# Conclusion

Psychophysical technology to determine force discrimination

Fatigue effects force discrimination

Muscle memory depends on vision

# Acknowledgements

- **Alix Dudley**
- **Dr Millard Reschke**
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- **Jan Cook**
- **Elisa Allen**
- **Testing Volunteers**
- **Neuroscience Lab**

