

# Biomechanics and Human Factors Research

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# Main Issues

- Biomechanics and Human Factors are distinct but overlapping disciplines.
- Each has multiple and substantial research agendas in the fields of injury, safety and risk management.
- In short, biomechanics examines the effects of physical loads on the body. Human factors examines the effects of psycho-social (and physical) loads on behaviour. Injury, human error, unsafe systems etc can be examined using these disciplines.

# Examples of Current/Recent Projects

## Biomechanics

- Rollover study
- Pedal and motorcycle helmet study
- Jockey helmet study
- Injury surveillance in rugby
- Injury causation in the tackle in rugby
- Biomechanics of concussion
- Human movement & pathological movement

# Human factors (organised by domain)

- Work:
  - relative risk perception of OHS hazards
  - Psychological hazards (e.g, workplace bullying)
- Risk management:
  - risk communication in biosecurity risk analyses
- Transport:
  - Rail Safety and Reliability ARC LP
  - Road: instrumented car – fatigue, behavioural adaptation
- Sport
  - Risk compensation ARC DP 2009

# Capacity

- Expertise and experience
- Data sets on human movement, anthropometry, human impact tolerance and product performance etc
- Simulation packages, eg. MADYMO, and models
- Biomechanics and HF analysis software
- Biomechanics and Gait Laboratory
  - 3D Motion Analysis system, force platforms, EMG
  - Low fidelity simulator area
  - Impact biomechanics lab with headforms, transducers, data acquisition system etc.
- Injury data sets in rugby union football (with limited linked match video)
- Instrumented vehicle

# Funding Received from:

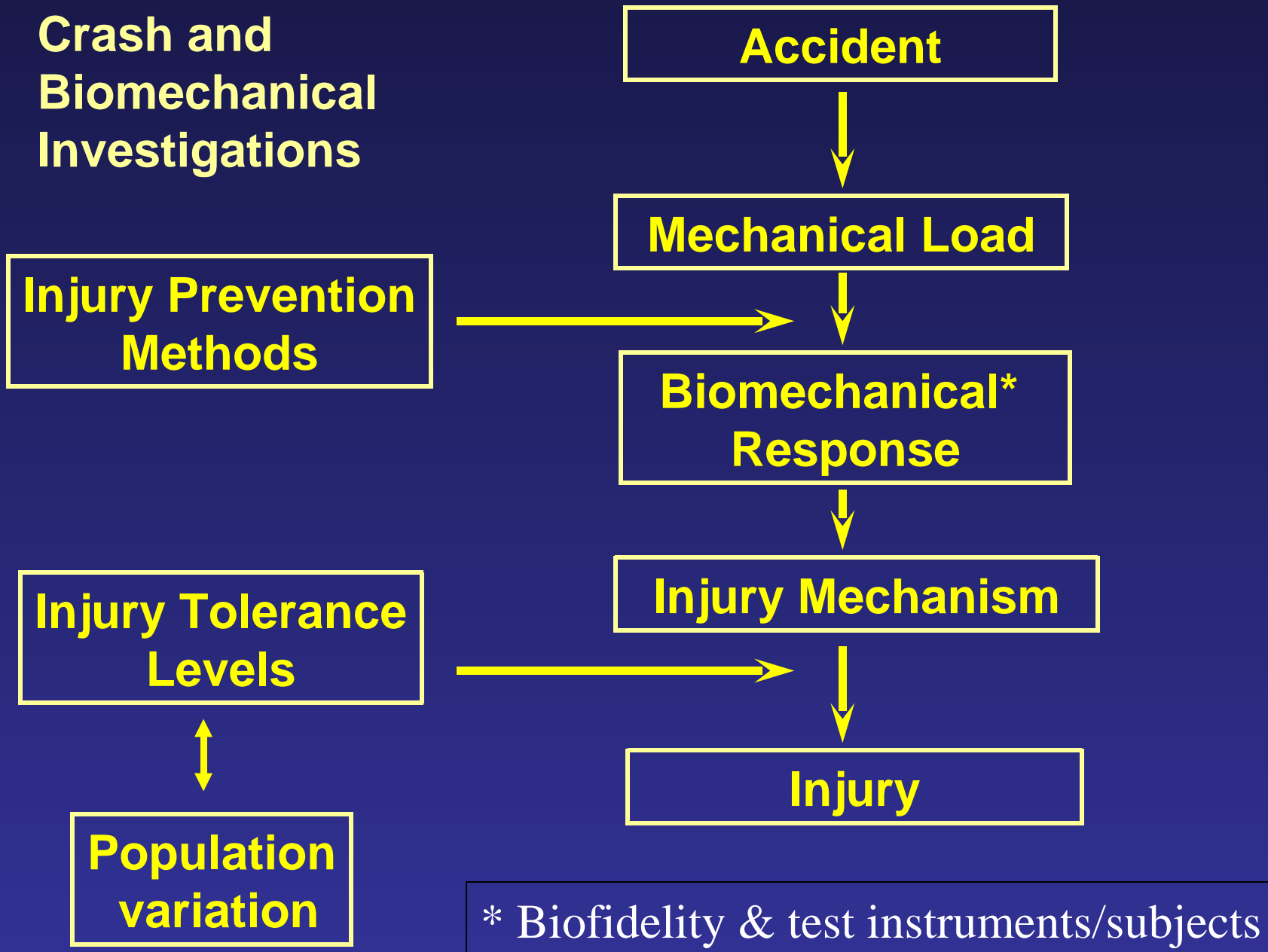
- ARC
  - DP
  - LP
- NIH (USA)
- Govt and Industry
  - ARU, IRB
  - ATSB, RTA, VicRoads, NRMA, DVE, NRMA-ACT Road Safety Trust
  - Racing NSW
  - ITSRR, Railcorp, DOI (Vic)
  - DSTO
  - VACERA (Australian Centre for Excellence in Risk Analysis)

# Pedal and Motor Cycle Helmet Study

- How do current range of helmets perform in crashes?
- Do current standards lead to optimal head protection?
- What would be the effects of changes to the standard?
  - would we increase the proportion of mild to moderate severity injuries, while reducing fatalities or accept fatalities to reduce the 'burden' ?



# Crash and Biomechanical Investigations



\* Biofidelity & test instruments/subjects

# Injury Risk Management in Rugby

- Study of injury causation in the tackle 2006-08
  - Development of qualitative video analysis methods
  - Linkage of injury data prospectively collected with video
  - Novel study design (but time consuming)

# Cohort Analysis

- Main findings were
  - 6618 tackle assessed in 77 game halves
  - Average tackles per hour = 145
  - Tackle injury (observed on video) rate = 12 per 1000 tackles or 1.78 per hour
  - Significantly lower risks of tackle injury in U15 compared to other levels (OR=0.28m p=0.04)
  - No association with tackle technique
  - Significant increased risk of injury with number of tacklers and timing of body contact.

# Rail Safety and Reliability Study

- Focussing on factors that contribute to train operation safety and reliability – especially in the driver's cab
  - Development of HF assessment tools for the rail industry
  - Examination of automation and monotony on driving performance
  - Examination of ergonomics of cab

# Future Projects/Initiatives

- New Grants Awarded
  - LIEF grant for impact biomechanics/crashworthiness infrastructure
  - ARC DP on risk compensation in sport
  - Injury risk factors in rugby pathways
- Under Consideration
  - Biomechanics of Concussion
  - Sports injury multifactorial study
  - Vision zero (multi-disciplinary study of cost:benefit of road safety interventions)
  - Rollover phase II
  - Cycling