Computational Biology Department of Computer Science

Computational Physiology

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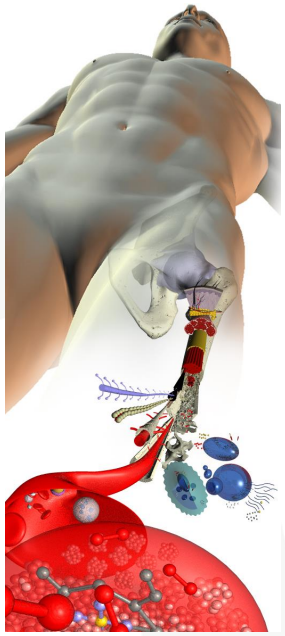
Virtual Physiological Human



Behaviour and Evolutionary Theory Lab

Prof James Marshall

Virtual Physiological Human

Vision :Your own **digital avatar**

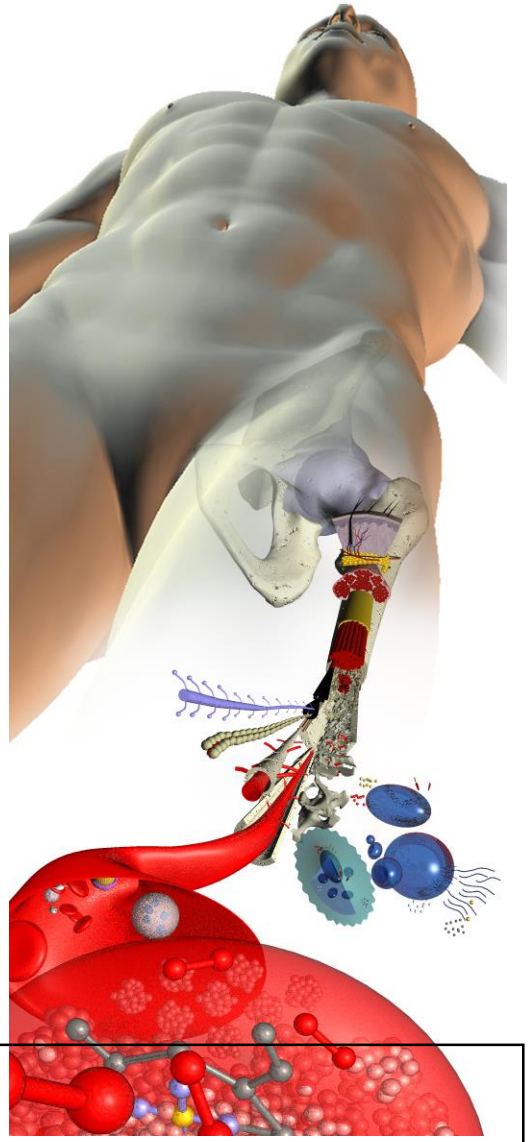
A virtual replica of your anatomy and physiology

Predict disease progression

Test out clinical interventions (surgery) and your response

Test efficacy of medicines in relation to unique physiology

Optimise Health – Personalised exercise plans

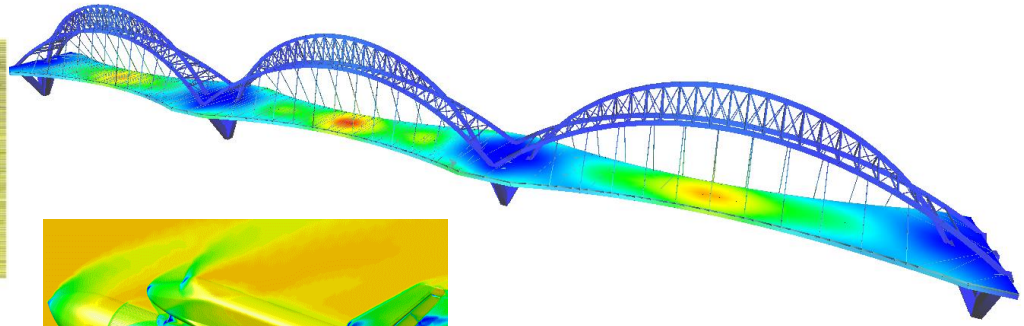


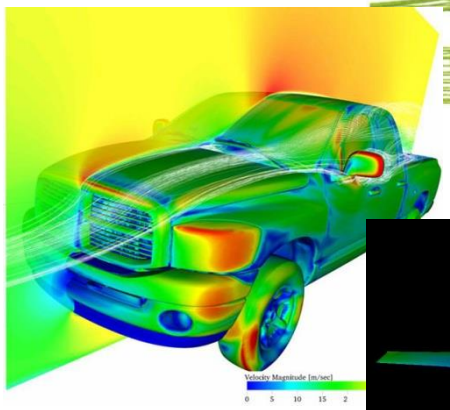
Personalised healthcare

Optimised healthcare (limited financial resources)

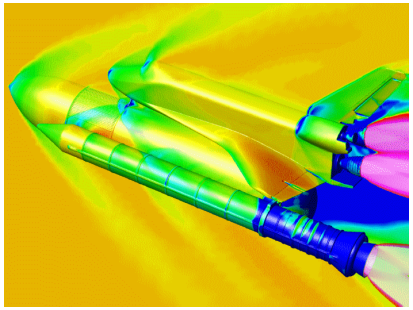
Whats the role for industry ?

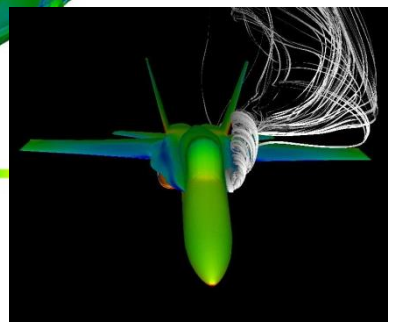
Computational Multi-physics Modelling:
Highly successful…





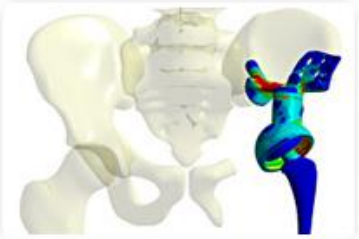
CD ADAPCO

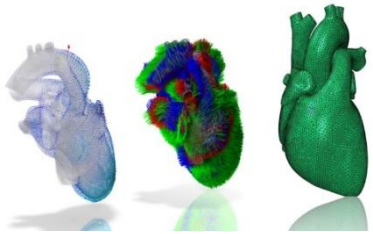




EXA PowerFlow

Growth Area:
Health-care Technology Industries





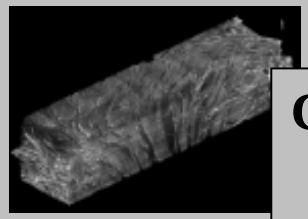
Virtual Physiological Human:
the challenge...

Organism

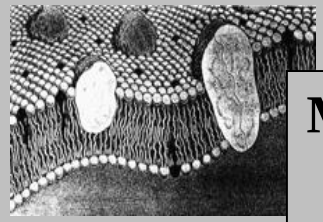
Organ System

Organ

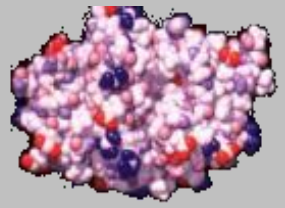
Tissue



Cell



Molecule

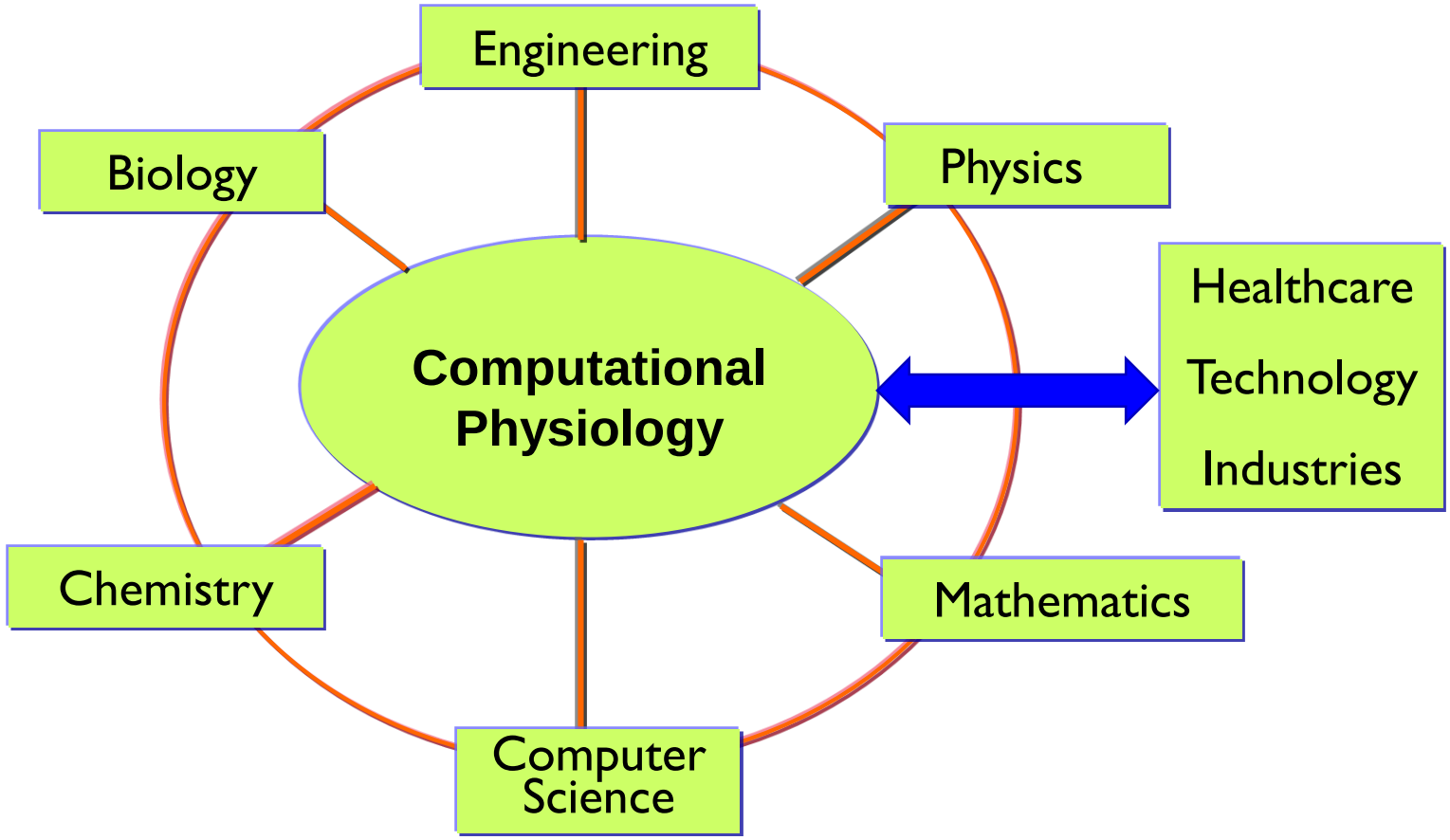


Research:

- **Multi-scale**
- **Multi-physics**
- **Biology**
- **Multi-disciplinary**

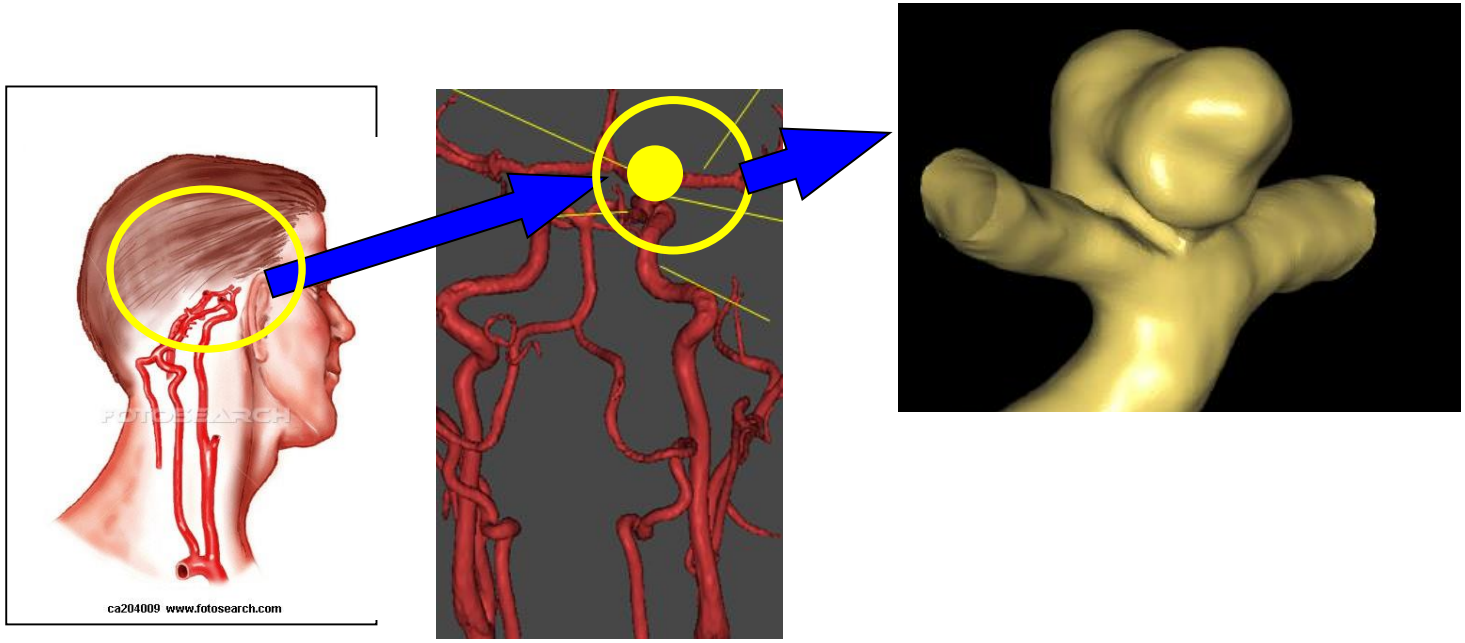
To succeed…

Collaborative interdisciplinary research is essential



Current areas of Computational Physiology Group research: Heart disease, vascular disease, asthma, cancer, bladder disease, neuroscience, in-silico animal models for health technology industry

Example: Cerebral Aneurysms



OCCURRENCE: 3-5% of population.

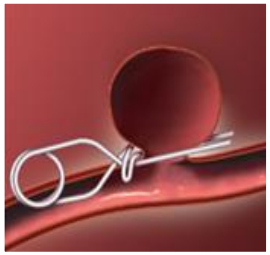
DETECTION: increasingly diagnosed (improved imaging).

RUPTURE: LOW risk <1% per year.

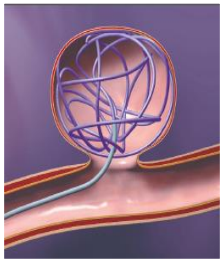
RUPTURE OUTCOME: 30%-40% fatality.

What is the best treatment ?

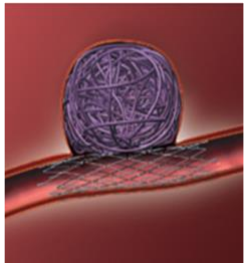
1. Clip



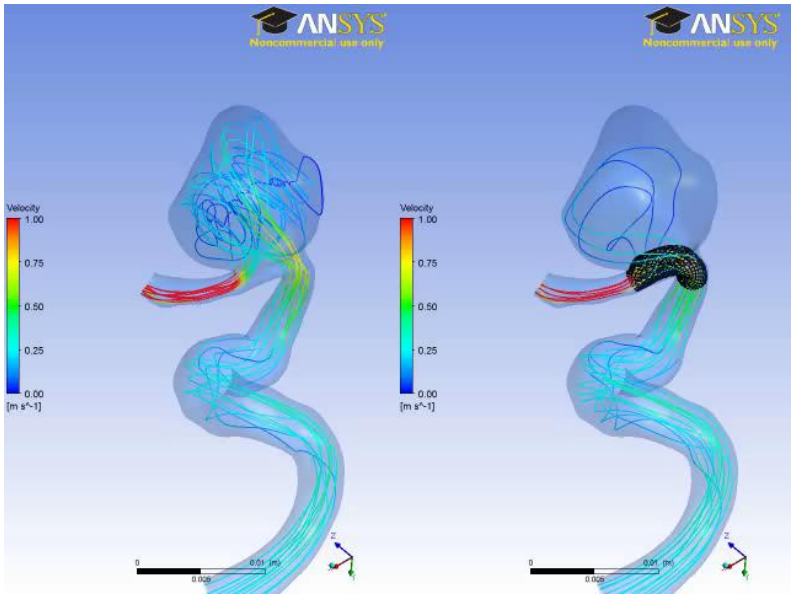
2. Coil



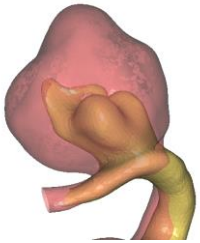
3. Coil & Stent



4. Blood Flow divertors

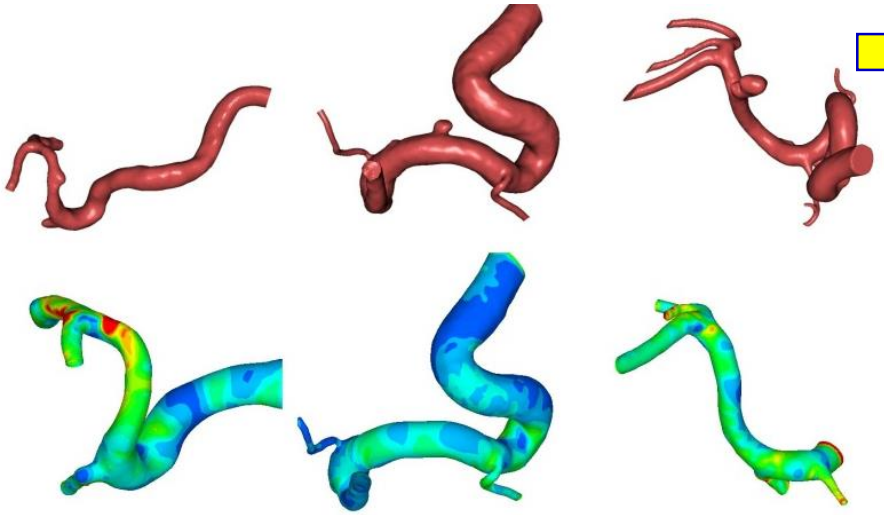


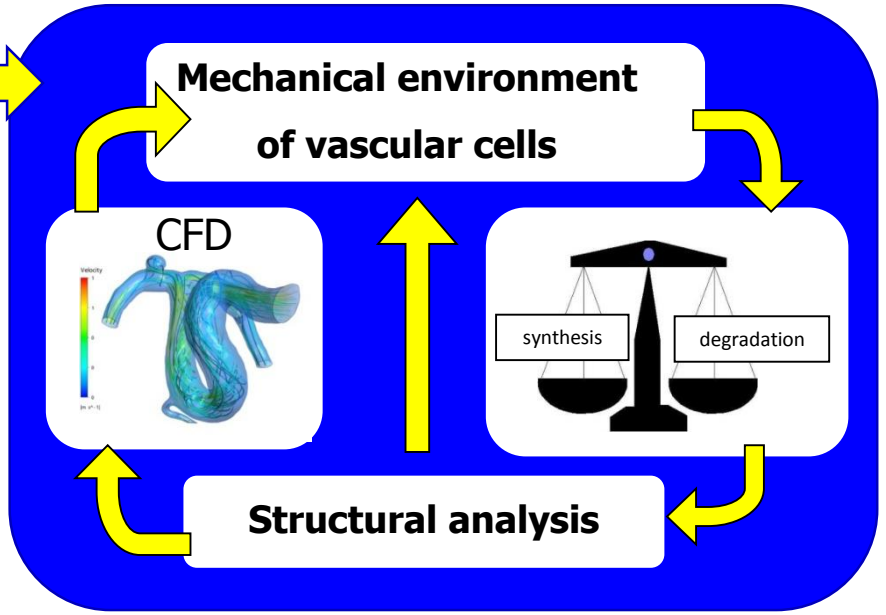
6 months

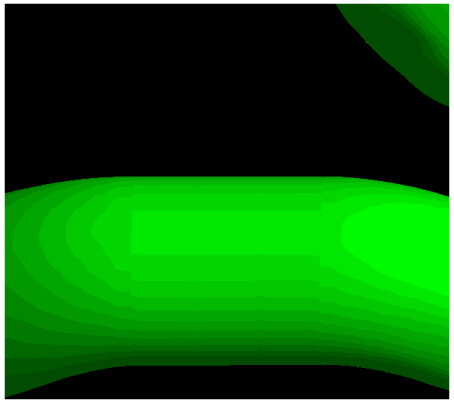


- Computational modelling: **treatment strategies**
  - Intervention: risky (1-7% morbidity) and expensive (£30 000)
  - Low rupture risk (0.1%). ➔ Do Nothing ?

Predictive Modelling of Aneurysm Growth







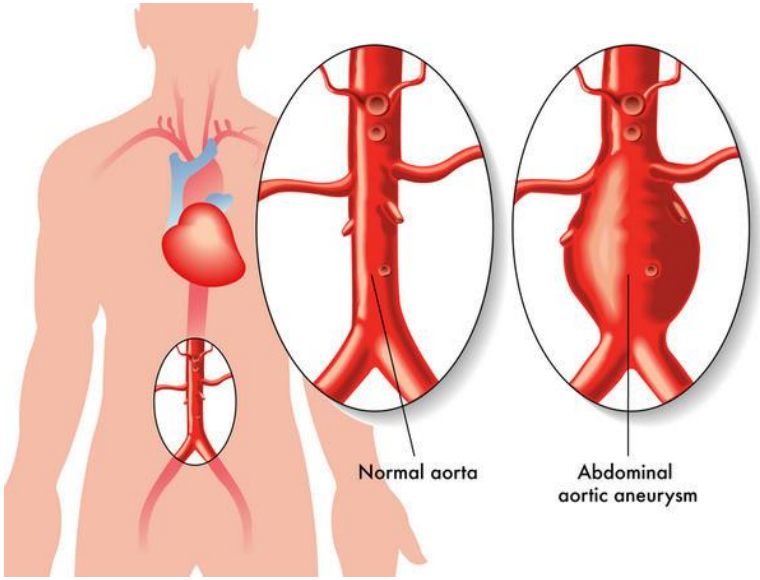
- **CLINICAL CASE**
- **PREDICT GROWTH**
- **PREDICT STABILISATION**

Strategic partnership: Watton and ANSYS Ltd (2010-)

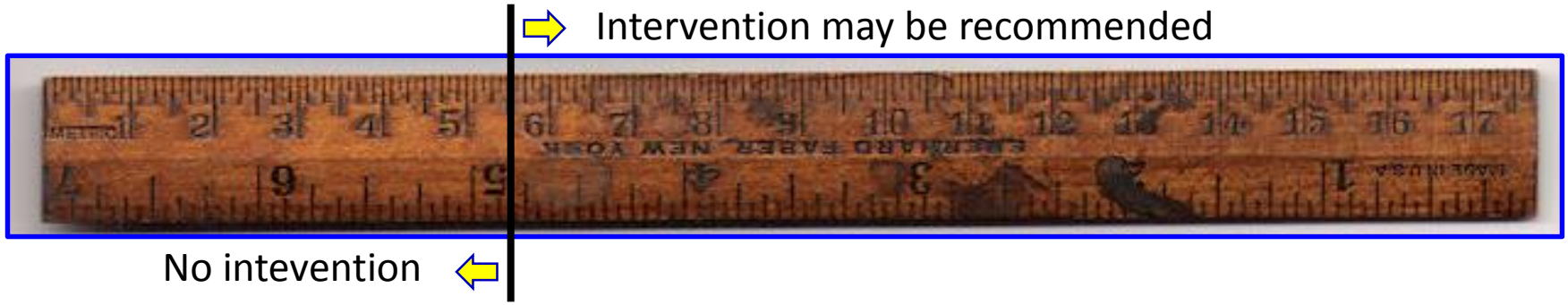
ANSYS employs about 2,600 professionals,

More than 40,000 customers around the world use ANSYS software. These include 96 of the top 100 industrial companies on the *FORTUNE* 500 list.

How sophisticated do the models need to be to achieve IMPACT on clinical management ?



- **5-10% of adults over 60.**
- **Screening – more detected.**
- **Cost-effective management**
- **Decision on whether to operate based on aneurysm diameter**



Need: Improved computational models to aid clinical decisions!!!

economic savings and health benefits

Thank You!

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