Modelling Skills

What is a model?

PROJECTS

- Project 1 - Pumping a Swing
- Project 2 - Spread of Infectious Disease
- Project 3 - Cell Transport
- Project 4 - Melting and Freezing

TIMETABLE

- WK 1 M 10-11 Project 1
- Wk 1 Fr 9-11 Project 1
- Wk 2 M 10-11 Project 1
- Wk 2 Fr 9-11 Project 2
- Wk 3 M 10-11 Project 2
- Wk 3 Fr 9-11 Project 2 + Presentation prep
- Wk 4 M 10-11 Presentation prep
- Wk 4 Fr 9-11 Presentations

TIMETABLE (cont'd)

- WK 5 M 10-11 Project 3
- Wk 5 Fr 9-11 Project 3
- Wk 6 M 10-11 Project 3
- Wk 6 Fr 9-11 Project 4
- Wk 7 M 10-11 Project 4
- Wk 7 Fr 9-11 Project 4 + Presentation prep
- Wk 8 M 10-11 Presentation prep
- Wk 8 Fr 9-11 Presentations

ASSESSMENT

- There is no assessment – but next term you will do case studies and this will be assessed on a presentation

- “This model will be a **simplification** and an **idealization**, and consequently a **falsification**. It is to be **hoped** that the features retained for discussion are those of **greatest importance** in the present state of knowledge.” Turing, 1952

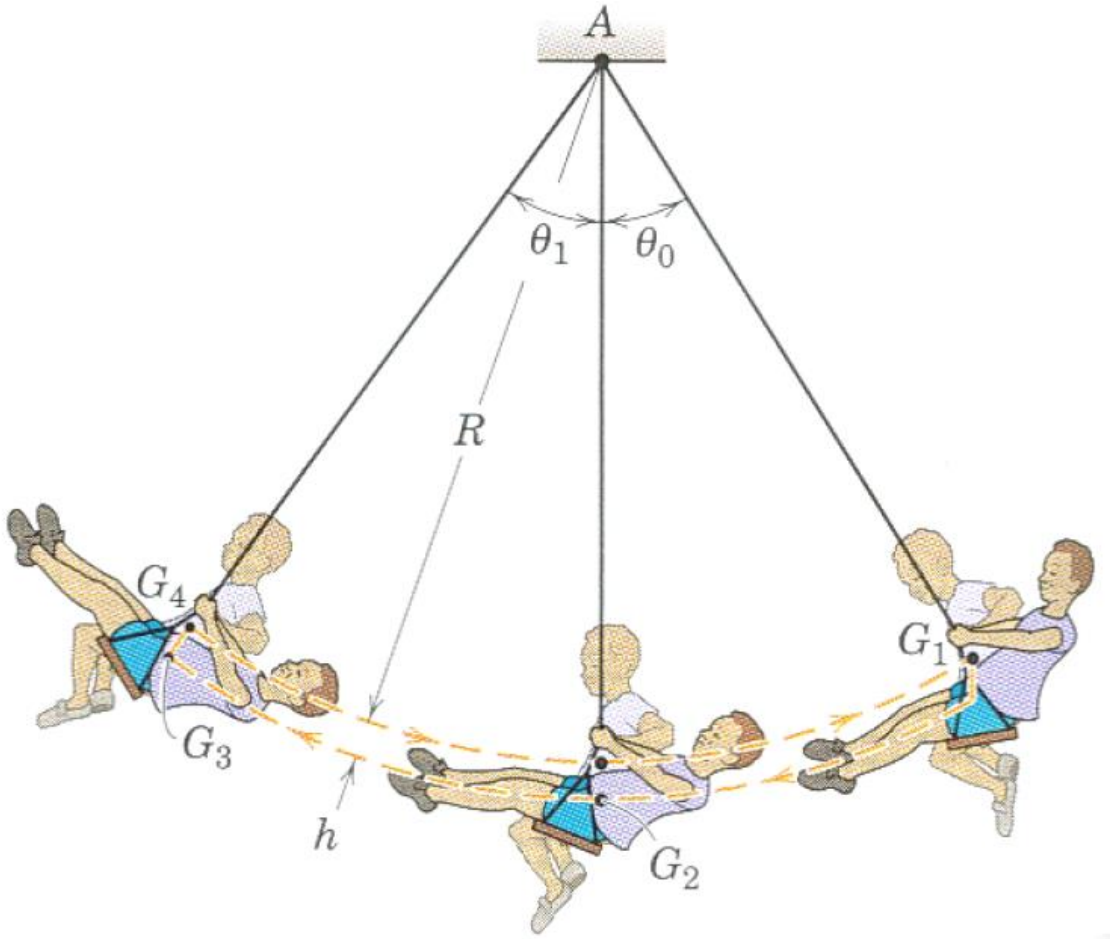
A.M. Turing, The chemical basis of morphogenesis, Phil. Trans. R. Soc. B, 237, 37-72 (1952)

Why Model?

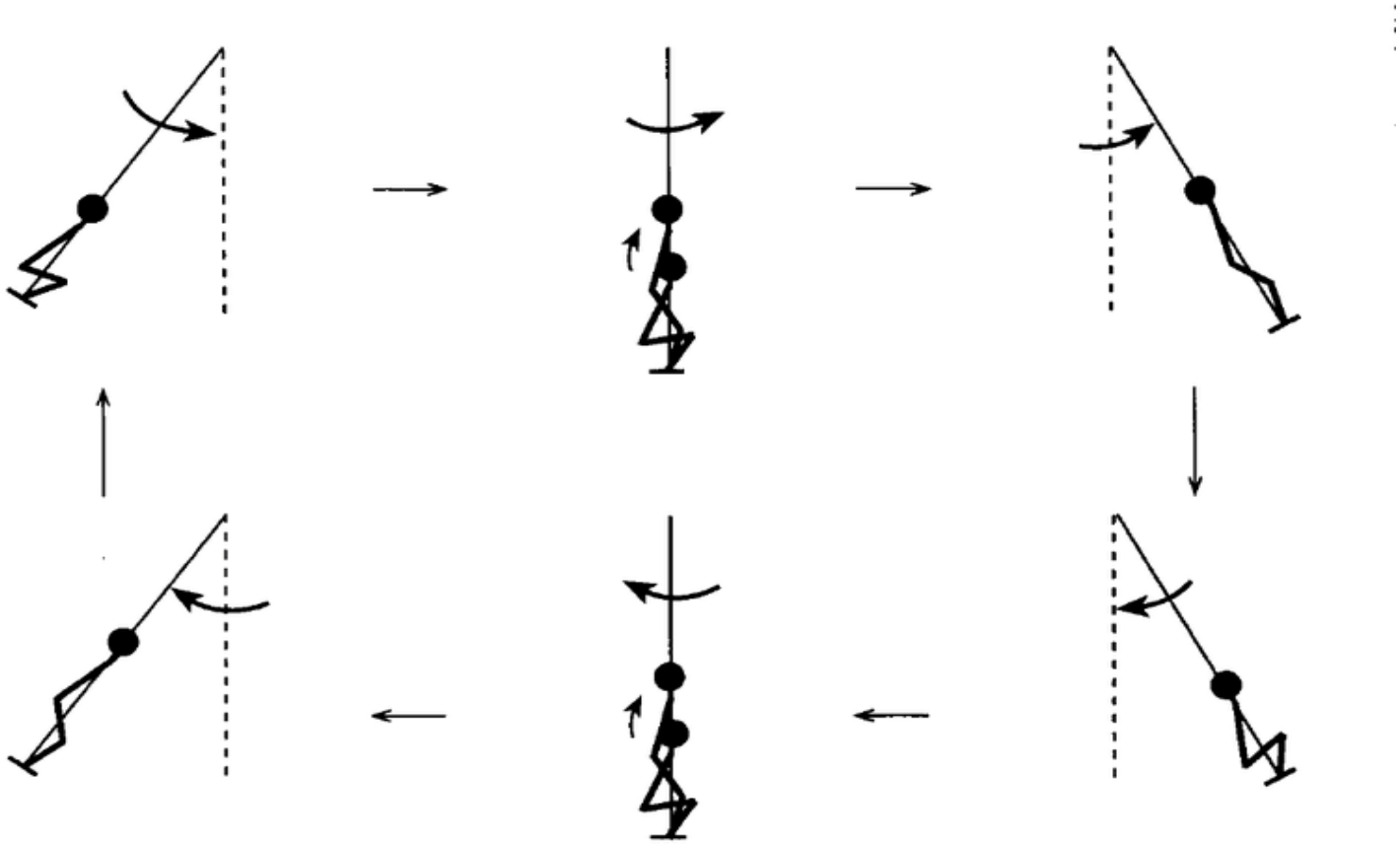
- What question are you trying to answer?
- Why use a mathematical model (why not just do experiments?) Hypothesis testing/generating
- How will you test your model – it must give results consistent with observations but that is only a start!
- Validation

SWING

“Pumping a Swing”



Standing



Strategy for Pumping a Swing while Standing

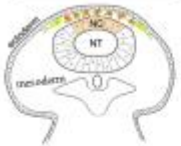
Aim and Questions

- The aim is to model the motion of a rider on a swing to answer the following questions:

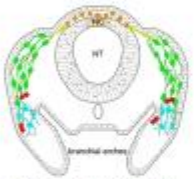
1. How can motion be generated and sustained by the action of the rider?
2. What is the quickest way to build up, or slow down, the amplitude of motion?
3. Is sitting or standing more effective?

NEURAL CREST

hree stages of neural crest cell migration
(Transverse section)



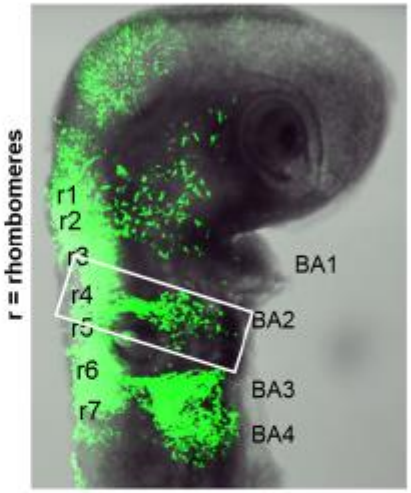
Phase 1:Initial emergence from neural tube (HH9)



Phase 2: Homing to the branchial arch (HH13)

Phase 3: Colonization of the branchial arch (HH15)

Kulesa et al., 2010



Side view of a chicken embryo, Stage HH15 Kulesa et al., 2010

Why Study This?

- Cranial NC cell population is crucial for proper development of face and neck

- Very similar in behaviour to the highly aggressive cancers, melanoma and neuroblastoma

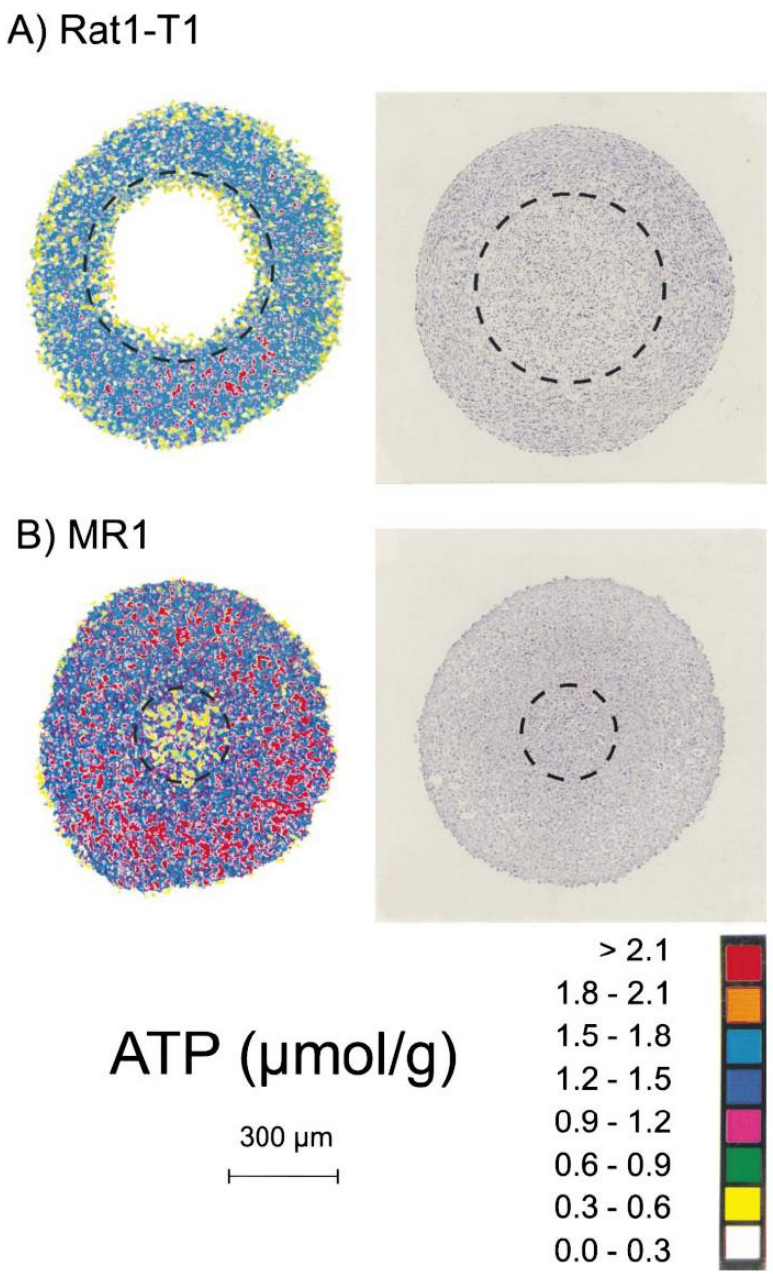


Figure 2 Images of regional ATP distributions and H&E-stained histology in median cryosections of spheroids from REFs transformed to different extents. (**A**) Subclone Rat1-T1 (diameter 920 µm); (**B**) Subclone MR1 (diameter 930 µm). Dashed lines outline the non-viable central area of the spheroids. The ATP distributions are color-coded, i.e., a defined concentration range corresponds to a certain color.

Could an elephant survive by diffusion alone?