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Teaching scientific method and experimental design

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How did you learn yours?

- **By trial and error** - do the experiment, process the data, realise a problem and swear! Learn for next time.
- **Is that appropriate today?** - not enough time; students get discouraged; waste of lab space, consumables and demonstrator time.
- **Essential skill** -for laboratory work **AND** for understanding bioscience

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So, what's to do?

Explicit Teaching

What is the scientific method?

- Hypothesis - prediction - experimental test - result

- Not rocket science - e.g. Unknown drug is agonist; therefore should produce response - not enough, no receptors, tissue dead.

What are critical design features?

- Some are discipline specific but many are generic

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Critical design features

- Achievable - (technology, time, skill, resource)
- Controlled - eliminate bias
- Randomization/sampling
- Data processing
- Unambiguous result
- No unnecessary animal use (ethical)
- Appropriate species/cell/conditions
- Reproducible methods - consistent results
- Part of a series/sequence -pilot experiments
- How done before in literature

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How to provide experience?

- Simulations - allow learn by trial and error methods
- Real data and scenarios - CONTEXT
- Critique of published design (refereed so difficult)
- Invent specific scenario
- Your own research experience - unpick one of your own studies - failures as well as successes!
- Pre-prepared design scenario - students to solve in groups - debrief in lecture

Teach when skill is required and will be exercised

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Take home message

Teaching experimental design:

- Explicit - not by osmosis
- Appropriately timed
- Needs practical application
- Essential bioscience skill which can be taught
- NOT just for students doing practical jobs