

Task III Discussion

Complex Traits and G-to-P Modelling

- Project Objective
 - “Strengthen modelling capacity in Generation Challenge Program by combining different scale and theoretical approaches and open way to new generation models to interpret gene to phenotype effects”
- Context – Cooper
 - “Greater trait complexity provides increased opportunity for molecular enhanced breeding but this generates a corresponding increase in stringency required in g-to-p knowledge and model development to enable reliable predictions for selection”

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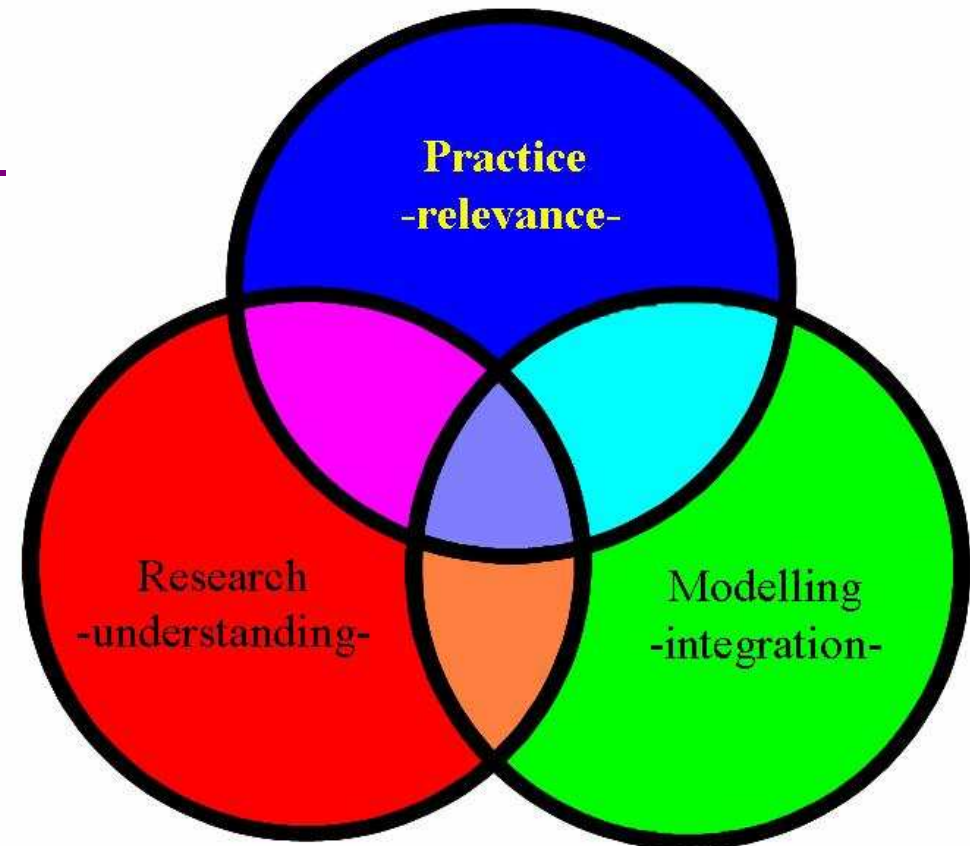
Complex Traits and G-to-P Modelling

- Modelling, serious play, and testable predictions
- Levels of approach - where are the boundaries?
- Making connections – which model for what?

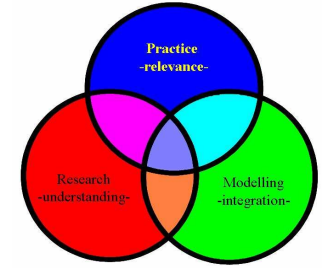
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I Modelling, Serious Play, & Testable Predictions

- Serious play with prototypes to generate dialogue and co-learning (Schrage, 2000)
- Integrating design with dialogue
- Discussion driver to help in decision-making → identify testable hypotheses



Rec – The practitioner (plant breeder) is a key player IN the process and must be actively engaged



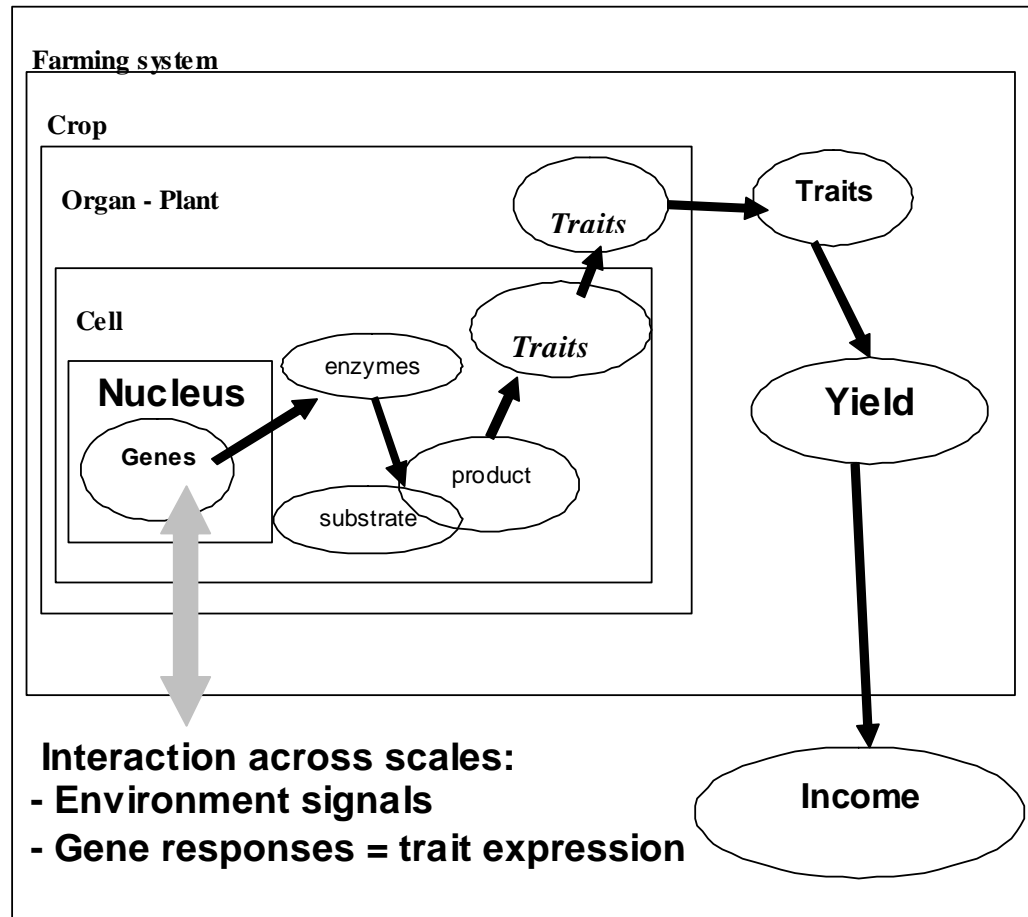
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I Modelling, Serious Play, & Testable Predictions

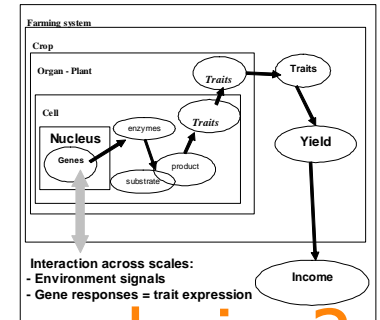
- Serious play with models for what?
 - Environment characterisation
 - Complex trait dissection – can a model-based understanding of a complex trait enhance phenotyping and selection decisions?
 - Complex trait evaluation – can a simulated value of an underpinning complex trait mechanism enhance selection decisions?
 - Selection strategies
- Define questions and generate testable predictions

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II Levels of Approach – Where are the Boundaries?



- Levels of biological and system organisation are interdependent
- Is crossing too many levels treacherous!
- Rec? – Focus at crop and lower levels within contextual awareness of broader system but without being limited by it

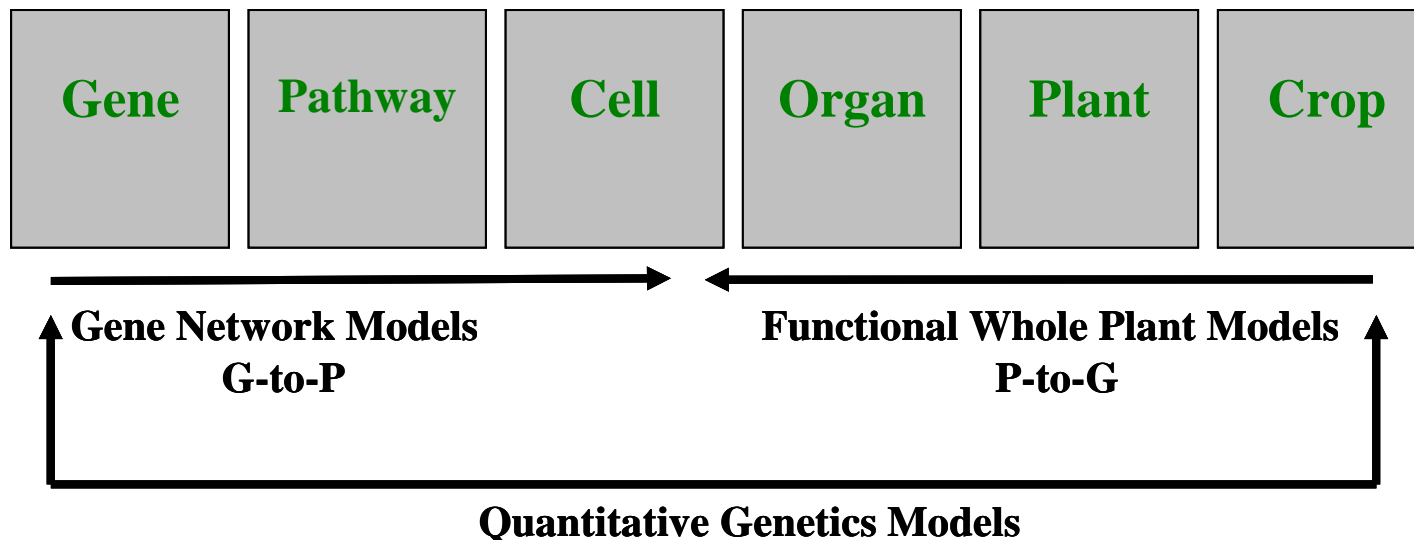


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II Levels of Approach – Where are the Boundaries?

How do we make effective gene-to-phenotype connections?

Roaming the genome or walking the plant?

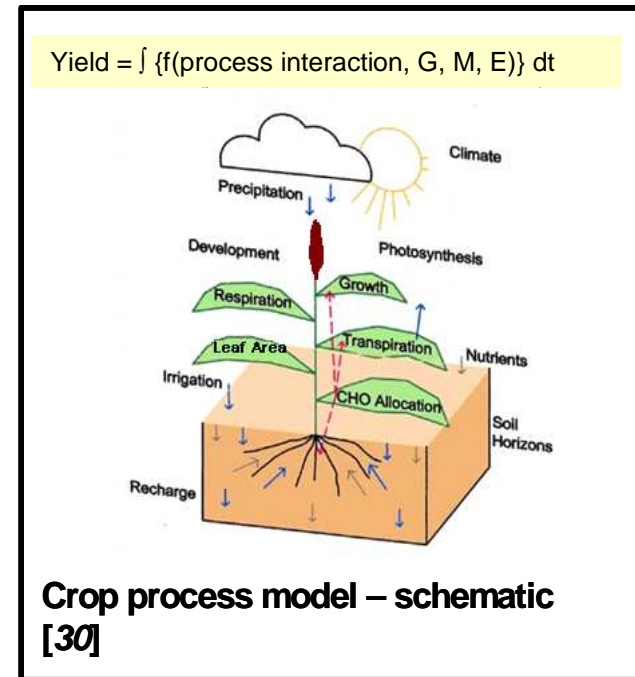


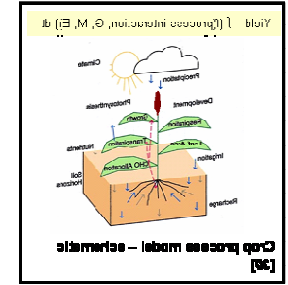
Is it really either/or?

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III Making Connections – Which Model for What?

- Objective – strengthen modelling capacity; combine different scale and theoretical approaches; interpret g-to-p effects
- Crop models used do not differ greatly conceptually
- Attention to science in models operating at process level not model level
- So what are the key issues?

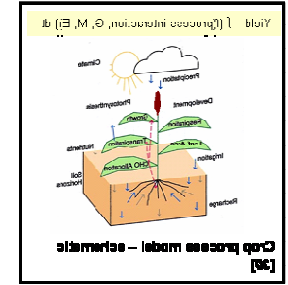




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III Making Connections – Which Model for What?

- Issues
 - model as hypothesis testing vehicle or hypothesis development vehicle for g-to-p link? (good to visit the hypothesis graveyard!)
 - is nesting of models at various levels of detail needed for effective g-to-p link? Informing vs hard-wiring?
 - is it more effective to phenotype to link model coefficients directly to QTLs or to use models more heuristically to guide more integrated phenotyping and search strategies?
 - how can we use models based on incomplete knowledge in a “learn-as-you-go” mode via hypotheticals and minimise the “crap model” risk?
 - can we make better use of cryptotypes?



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III Making Connections – Which Model for What?

Cryptotype – a virtual genotype expressing an unobservable phenotype in an artificial simulation (*dictionary of GCP-WPM*)

- Rec? - If GCP want to get serious about this approach, then we should suggest a focus on one/two really good integrated case studies.
- If not then we develop a project for cryptotype improvement!