Session 5 - Curriculum Structure Models

Three teams were asked to create curriculum models - one based on the Organizing Principles, another built on the existing structure, and a third unconstrained.

Group A - Curriculum Model Using the Organizing Principles

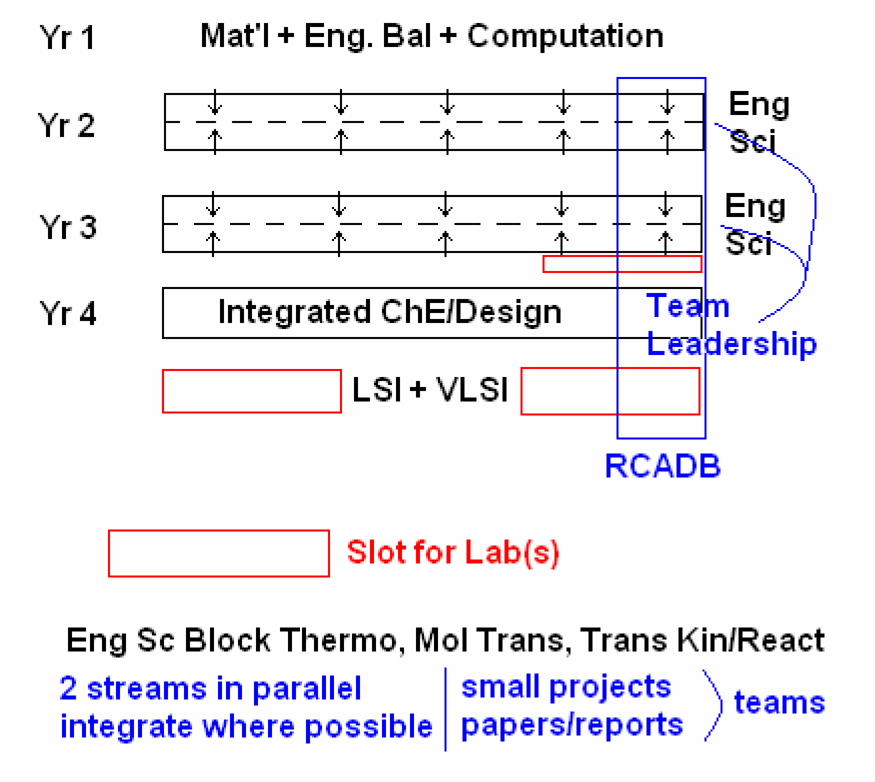
Year 1	Year 2	Year 3	Year 4
Molecular Transformations	Empirical Kinetics	Engineering PChem [Molecular Theory Fundamental Kinetics Molecular Transport Mol. Sept. Principles]	(tech electives)
Multiscale (continuum) ← Dim. Analysis ← Intro to Separation	Colloidal & Interfacial "Existing" (classical) Thermodynamics	Separations Existing Transport (Momentum/Energy/Mass, etc.)	Cumulative Model-building & Solution
Systems ← Intro to Problem ID and Solving (& $) [i.e. Analysis & Design] ← Intro to Control → Integrative I	Mass Balances/ Problem Solving Integrative II - case study theme	Heat Exchangers & Flow Equipment Reactor Dynamics Reacting Systems Integrative III	"Existing" Dynamics & Control Integrative IV - Cumulative Design
Foundation *Real and Virtual Lab Experiences* *Communications & Other Professional Skills*			*Cumulative Lab Experience/ Project*

Group B - Curriculum Model based on Current Practice

- What do you mean by "radical curriculum change"?
- We already have changed the curriculum since ~1960
- We cover – systems, multiscale (though not explicitly)
- Improve depth in molecular transformations
- What new fundamentals./knowledge for Bio
    - Electrochemical transport
    - Aqueous-phase reactions
    - Membranes
- Inclusion of Bio is not driving force (?)
- Can we use existing core to get philosophy across?
- What in or out?
- Hypothesis – we can do this (good place to start!)

1. Material & Energy Balances is renamed "Intro to Chem & <u>Bio</u> Systems"
    a. Dynamic system – "draining tank"
    b. Molecular/chemical properties and reactions
    c. Multiscale (?)
    d. Need <u>bio</u> examples (+)
    e. New visual/ graphical solution methods
2. CheE Thermo
    a. Physical Chemical (Biochem) Equilibrium
    b. QSPR (+)
    c. Electrolytes (+)
3. Heat and Mass Transfer
    a. Brownian motion (motivate mass/ heat transfer coef) (+)
    b. Molecular origin of phenomena. (+)
    c. More room for mass transfer. (+)
    d. Heat transfer emphasis decreased (↓)
    e. Radiation (?) (-)
4. Reaction Engineering
    a. Provide info about molecules in reaction
    b. Bio example of kinetics (+)
    c. Reaction in aqueous systems, ref state (+)
    d. Coupled reactions
    e. Case study – simulation/video (need tool)
    f. ex. EO prod (cat surface → CFD → plant) → multiscales
5. Other
    a. need mass transfer emphasized (teach by "rows")
    b. separations include mass transfer and bio
    c. use partial semester courses
    d. distribute process control in other courses

Group C - Freestyle Curriculum Model



Pedagogical Principles -- Soft Skills

1. Teach in context by doing
2. Bring in many places, repeatedly in Curriculum
3. Active learning
   a. Involvement
   b. Projects, reports in teams
4. Wherever possible
   a. Open-ended problems
   b. Judgment of what is important
   c. Handling missing data

Year 2 – Thermo, Kinetics
Conduction/Diffusion/Reaction Engineering + Fluids
Year 3 – Reaction Engineering
Convective Heat and Mass Transfer + Separations

- Timing Issues: Supporting Science and Math
- Motivation – need structure to promote
  - Integration of content
  - Soft skills in context

Discussion following the Presentations

- Like the idea of the year-end multi-year project in the Freestyle structure
- Could have varying levels of credit hours for different years (for example, seniors would receive more credit; they could “outsource” work to sophomores)
- Group A had to force themselves away from Group B
- Practical considerations of schedule could not be sufficiently addressed, and they are significant
- If we change the curriculum, let’s really do it thoroughly - everything what we want to achieve in a curriculum.
- Group A is the basis for jumping off - further curriculum development.