Medical Education @
Duke-NUS Graduate Medical School

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Immunology made simple: Introductory contextual maps for basic science instruction in medical education
Immunology instruction in Medical School

- Foreign to many students- first time seeing it
- Large number of terms
- Large number of concepts
- Both basic and applied issues under the same roof
- Team taught/specialist taught/easy to get carried away in the details
- Of the basic sciences- it has one of the smallest component in the USMLE- thus less motivation to learn it well/reduced priority
Complete lack of interest

Empty classroom
I am confused....arggghhhhh
Yikes, way too much to memorize! Information overload!!!
Complex terminology/new language

Wordle diagram of immunology terms

CHEMOKINES

INTERLEUKINS

CYTOKINES

HLA/MHC

Self created: using application on www.wordle.net
So how do we as instructors of a complex subject try to make things more enjoyable to the learner?
Goal of this mini project

• Develop a tool to assist medical immunology students to
  – Partition information that they get into themes
  – Visualize the entire course
  – Categorize terms into various domains so to make them easier to remember
  – Provide them with a bird’s eye view of the subject before giving them all of the details
  – Provide a color coded system to help them ‘place’ the information into certain domains/areas
Immunology

Language ‘barrier’

• HLA/MHC
• CD designations
• Receptors
• Cytokines
  – Interferons
  – Interleukins
  – Others
• Chemokines
  – CXC XYZ
  – CRC XYZ

Functional ‘barriers’

• What does the immune system do?
• What are you looking at?
  Autoimmunity/anti viral-bacterial-parasitic defense,
  hypersensitivity, anticancer, inability to respond, etc.
• Complex interactions- not always clear cut

Note: Like medicine some of immunology is still phenomenology- which slowly being proven or disproven by research (evidence-based immunology)
Classification (part 1)

• Players
  – Cells
  – Tissues
  – Anatomical
    • Systemic- lymphatic
    • Local- Skin, etc.
    • Gut
  – Proteins
    • e.g. interleukins
    • e.g. anaphylatoxins
  – Chemical mediators

• Processes
  – Autoimmunity
  – Defense (against invaders)
  – Anti cancer
  – Asthma/allergies
  – Hypersensitivities
    • Type 1-4
  – Immunosuppression
    • Genetic
    • Transplant
Classification (part 2)

• Mechanisms
  – Innate immunity
  – Adaptive immunity
  – Interaction of Innate and adaptive
  – Tolerance
  – Recombination/diversity
  – Effector function
  – Signaling for activation
  – Antibodies/TCR

• Regulation
  – Dampening responses
    • Regulatory cells
    • Regulatory proteins
  – Development
    • Blood system
    • T cell/B cell
    • APC
  – Signals
    • T cell/B cell
Tools/Mixed

- **Tools**
  - Immunodiagnostics
    - Flow cytometry
    - ELISA
  - Animal models
    - Mice/Rats
    - Hag fish (evolution)
    - Pigs/dogs (transplants)
  - Antibody isolation
    - Monoclonal antibody production
  - Complement fixation
  - T cell/B cell/DC isolation
  - Effector cell assays
  - Transgenic animals and gene targeting

- **Interdisciplinary**
  - Childhood Vaccinology
  - Transplant and rejection
  - Medical immunology
  - Gut immunity
  - Immunotherapy to cancer
Medical Immunology

• Transplant - hematology, oncology and surgery
• Vaccination - Tropical medicine - travelers clinic - Pediatrics
• Asthma/Allergy - Respiratory medicine
• Immunodeficiencies - Infectious disease clinic, neonatology, hematology, pediatrics

• Arthritis/Grave’s/other autoimmune disorders - Immunology and Rheumatology, OB/GYN, endocrinology
• Infections/colds - family clinics, ID clinics, general practitioners, STD clinics
• Cancer immunity - oncology, ENT, surgery, etc.

Research labs + medical practice = successful immunology/ translational research
Concept driven Instruction

As we move away from didactic teacher-centric learning towards a more student-centric team and problem-based learning approach:

• Consider using concept-driven instruction
• Each lesson might have a fixed set of core concepts
• Instead of directly providing the students with a list each time...
• What are they and how to get the students to articulate them
• Ask students to cluster concepts
• Can we also get students to functionally map these concepts or link them to previous concepts, etc.
Immunology Core Concept list

• Figure omitted….work in progress
Pulmonary Physiology

QUANTITATIVE CONCEPT MAPPING IN PULMONARY PHYSIOLOGY: COMPARISON OF STUDENT AND FACULTY KNOWLEDGE STRUCTURES
William C. McGaghie, Donald R. McCrimmon, Gordon Mitchell, Jason A. Thompson and Michael M. Ravitch

Concept maps and their usefulness

- 12 terms
- Can measure connectivity/proximity of each term
- 3 major nodes
- This came from an expert teaching in the field
Comparison of faculty and student

FIG. 1.
Pathfinder concept maps from the Northwestern medical course. A: professor’s concept map; B: postinstruction student’s similar concept map; C: postinstruction student’s dissimilar concept map.
Summary

Concept driven instruction may help to make Immunology more fun to teach, more manageable and perhaps even more enjoyable for the learner. It might even lead to a deeper understanding and better retention of the subject.
Thank you!

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