

## Use of Curriculum Mapping Tools to Identify Learning Opportunities and Deficiencies II: KnowledgeMap

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## The Flexner Report

- Medical education in the United States and Canada, 1910
- Set the foundation for modern medical education
- Current pressures challenge this model:
  - “publish or perish” (researcher)
  - Demand on throughput (clinician)



## Part #1: Assessing Curricula

LIASON COMMITTEE ON MEDICAL EDUCATION



- LCME and ACGME require increasing documentation of **curriculum objectives, coverage, and student patient experiences**
- Accreditation standards specific content, competencies, amount of training, etc. for periodic reviews
- ED-2:

*“The institution that offers a medical education program is required to establish a system to specify the types of patients or clinical conditions that medical students must encounter and to monitor and verify the medical students' experiences with patients so as to remedy any identified gaps.”*

## Traditional Medical Education Model



## Guiding questions

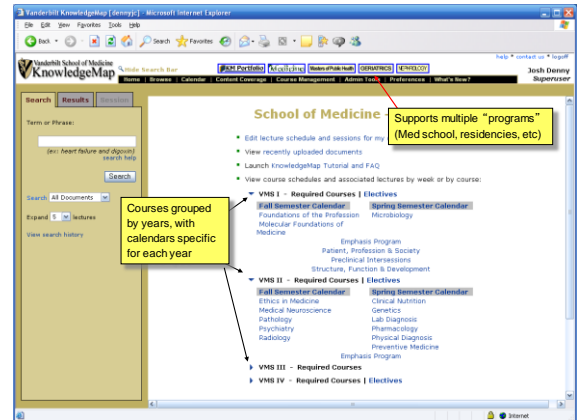
- **Faculty:** “I am teaching about congestive heart disease – what have students already learned about this?”
- **Students:** Studying immunoglobulins, need to find relevant prior concepts like splicing
- **Administrators:** Where do we cover large concepts, like geriatrics?

## Traditional Solutions

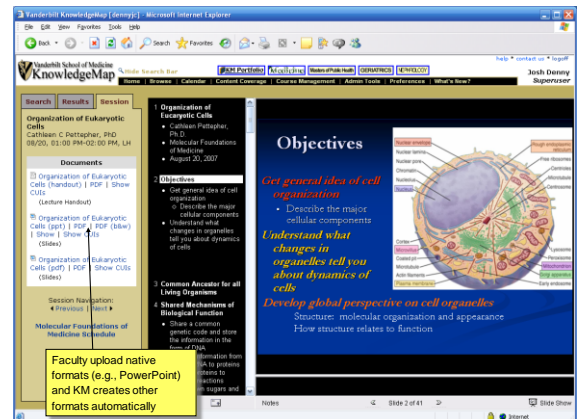
- Web pages for courses
- Course management software (Blackboard, WebCT)
- Finding what is taught where:
  - Curriculum committee meetings
  - Emails
  - Manual logs
  - External, manually maintained curricular databases such as CurrMIT

## An Informatics Model

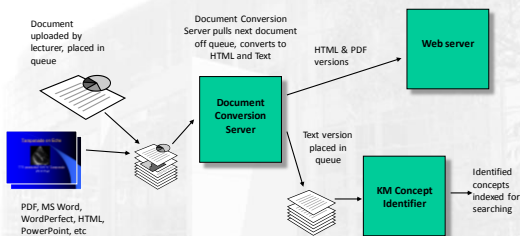
- Let learners access work at their own rate (finding old and new data)
- Use multiple methods to delivery content
- Faculty are busy – focus on easing content capture, and create tools to accurately capture
- Provide robust searching tools across the entire curriculum



Date	Time	Location	Title	Lecturer	Document(s)
10/25	08:30 AM - 09:30 AM	UH 202	Introduction	Arthur F. Dallas	
10/25	09:30 AM - 10:30 AM	UH 202	Introduction to Anatomical Orientation Program and In-Lab Memorial vnc. Intro to Gross Anatomy Lab, Safety, and Technique	Arthur F. Dallas	
10/25	10:30 AM - 12:00 PM	UH 202	Layered & Segmented Structure of Body, Intro to Nerves & Nerve Classification, Simple Spinal n.	Arthur F. Dallas	
10/25	02:00 PM - 02:00 PM	UH 202	(Embryos) Neuroanatomical Development 1	Ullian B. Ramsey	
10/25	02:00 PM - 02:00 PM	UH 202	(SA Lab) Removal of Skin and Subcutaneous Tissue of Back; Superficial Muscles of the Back and Cervical Nerve V3	Arthur F. Dallas	
10/26	08:00 AM - 09:00 AM	UH 202	(Embryos) Neuroanatomical Development 2	Ullian B. Ramsey	
10/26	09:00 AM - 10:00 AM	UH 202	Types of Muscle Action and Movement; Freshly Movable Joints	John E. Halle	
10/26	10:00 AM - 12:00 PM	UH 202	SA Lab: Scapular Region	Arthur F. Dallas	
10/29	08:00 AM - 09:00 AM	UH 202	Vertebral Column; Postural Muscles; Spinal Cord and Its Environment	Arthur F. Dallas	
10/29	09:00 AM - 10:00 AM	UH 202	Neuroanatomical Phis # 3: Membrane Transport; Fluid Compartments; Osmosis	Al George	
10/29	10:00 PM - 02:00 PM	UH 202	SA Lab: Deep Back (Perform Laminectomy)	Arthur F. Dallas	
10/30	08:00 AM - 09:00 AM	UH 202	Overview of Lymphatic System; Principles of Collateral Circulation	Ullian B. Ramsey	
10/30	09:00 AM - 11:00 AM	UH 202	SA Lab: Complex Dissection of Deep Back; Pedicular Region, Including Removal of Skin from Arm (Excluding Female Breast)	Arthur F. Dallas	



## Document Processing



## Concept vs. Text indexing

- **Text indexing**
  - Indexing by words of document
  - "Hepatolenticular degeneration" ≠ "Wilson's Disease"
- **Concept indexing / Natural language processing**
  - Recognizes words in document to a controlled vocabulary
    - Unified Medical Language System, contains >100 vocabularies, >2 million concepts mapped to >8 million English synonyms
  - "Hepatolenticular degeneration" = "Wilson's disease"
  - Figures out ambiguous concepts:
    - "CHF" – "Congestive Heart Failure" or "Congenital Hepatic Fibrosis"?
    - "BSE" – "Bovine spongiform encephalopathy" or "Breast self exam"
  - Interprets phrases
    - "The aortic valve was stenosed" = "aortic stenosis"
    - "gram negative infection" = "gram-negative bacterial infection"

**Search Results for "urinary incontinence" (23 documents)**

Term or Phrase: urinary incontinence  
 (See: Heart failure and dyspnea) search help

Search: All Documents

Expand: 5 lectures

**Searching for "urinary incontinence"**  
 Analysis of first ~60,000 searches showed that 85% were medical concepts

**Welcome to KnowledgeMap**

- Edit lecture schedule and sessions for your course
- View recently updated documents
- Launch KnowledgeMap Tutorial and FAQ
- View course schedules and associated lectures by week or by course:

**VNS I - Required Courses | Electives**

**1st Semester Calendar**

- Anatomy (Histology)
- Biochemistry
- Adv. Biochemistry
- Mind and Medicine
- Ecology of Health Care
- Intro to Patient Clinical Professionalism
- Emphasis Program

**2nd Semester Calendar**

- Histology
- Physiology
- Microbiology
- Lab Diagnosis
- Genetics
- Physical Diagnosis
- Pharmacology
- Preventive Medicine
- Clinical Nutrition

**VNS II - Required Courses | Electives**

**1st Semester Calendar**

- Pathology
- Medical Neuroscience
- Pathology
- Psychiatry
- Ethics in Medicine

**2nd Semester Calendar**

- Lab Diagnosis
- Genetics
- Physical Diagnosis
- Pharmacology
- Preventive Medicine
- Clinical Nutrition

**VNS III**

- Medicine
- Surgery
- Pediatrics
- Gynecology and Gynecology
- Neurology
- Psychiatry

**VNS IV - Required Courses | Electives**

**Search Results for "urinary incontinence" (23 documents)**

Term or Phrase: urinary incontinence  
 (See: Heart failure and dyspnea) search help

Search: All Documents

Expand: 5 lectures

**VNS I**

- Biochemistry (1 document)
- Genes and Genes (1 document)
- Microbiology (1 document)

**VNS II**

- Lab Diagnosis (3 documents)
- Medical Neuroscience (2 documents)
- Normal Pressure Hydrocephalus [See Me] 4 hits
- 1 more...

**VNS III**

- Pathology (1 document)
- Pharmacology (4 documents)
- Physical Diagnosis (1 document)

**VNS IV**

- Pediatrics (1 document)
- Psychiatry (1 document)
- Surgery (3 documents)
- Urology: PSA, scrotal pain; urinary complaints [See Me] Harriette Scarpore 3 hits
- Emergency Medicine (2 documents)
- Neurologic Emergencies [See Me] Susan Marlow 2 hits
- 1 more...

**Documents containing the concept "urinary incontinence"**

**Search Results for "urinary incontinence" (23 documents)**

Term or Phrase: urinary incontinence  
 (See: Heart failure and dyspnea) search help

Search: All Documents

Expand: 5 lectures

**Document-specific Tools:**

- Get Original Document
- Get Original as PDF
- Similar Published Articles
- Find Similar Documents

**Slide #92 "Urinary Incontinence"**

**KM shows one of lectures that mention "urinary incontinence"**

Stress incontinence  
 Urge incontinence  
 Mixed incontinence

**Slide #93 "Incontinence"**

The involuntary loss of urine

Stress incontinence (STI), occurs with increases in intra-abdominal pressure

Urge incontinence (UTI), leakage that is preceded by an intense uncontrollable urge to void

Mixed incontinence: both UTI and STI

**Slide #94 "Components of a Thorough Evaluation"**

Detailed history\*

Questionnaire\*

Physical examination\*

Other testing: UA, voiding diary\*, pad test\*, voiding, postvoid residual (PVR), urodynamic\*

\*Recommended minimal standards for pre-eval by AUA

**Search Results for "congestive heart failure" (23 documents)**

Term or Phrase: congestive heart failure  
 (See: Heart failure and dyspnea) search help

Search: All Documents

Expand: 5 lectures

**Document-specific Tools:**

- Get Original Document
- Get Original as PDF
- Similar Published Articles
- Find Similar Documents

**Definitions for "CHF"**

**KnowledgeMap Definitions:**

- Congestive heart failure** [Approx. 6 documents in KM]: no definition
- Congestive heart failure** [Approx. 281 documents in KM]: Weakness of the heart muscle that leads to a buildup of fluid in body tissues.
- Hemorrhagic Fever, Crimean** [no documents]: A severe, often fatal disease in humans caused by the Crimean-Congo hemorrhagic fever virus (HEMORRHAGIC FEVER VIRUS, CRIMEAN-CONGO).

**Three definitions for "CHF" – the system disambiguates each occurrence of "CHF" into one of these three matches when in documents**

**Search Results for "congestive heart failure" (23 documents)**

Term or Phrase: congestive heart failure  
 (See: Heart failure and dyspnea) search help

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**Document-specific Tools:**

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**CONGESTIVE HEART FAILURE**

Heart failure exists when the heart does not pump the state causes congestion of the tissues, leading to an accumulation of extracellular fluid in the tissues. This is responsible for the failure of the heart to pump at a rate commensurate with the requirements of metabolizing tissues. CHF is encountered frequently by the clinician, it accounts for 27 of all hospital admissions and carries a 5-year survival rate of <50%.

**CAUSES OF CONGESTIVE HEART FAILURE**

**A. Myocardial Disease (pump defect)**

- Coronary heart disease – myocardium is impaired by ischemia
- Cardiomyopathy – intrinsic myocardial defect
- Infiltrative diseases: amyloidosis, sarcoidosis, myocarditis

**B. Excessive Workload due to:**

- Increased resistance to ejection which can be due to pressure overload, hypertension, aortic or pulmonary stenosis, or hypertrophic cardiomyopathy
- Increased stroke volume, volume overload which can be due to aortic, mitral or tricuspid insufficiency or congenital left-to-right shunt
- Increased body demands (high output failure), can occur with thyrotoxicosis, anemia, pregnancy, or arteriovenous fistula (shunt) shunt between an artery and vein, which increases venous return and decreases oxygen to shunted area

**A document matching "Congestive heart failure"; the system finds both "congestive heart failure" and "CHF"**

**Search Results for "congestive heart failure" (23 documents)**

Term or Phrase: congestive heart failure  
 (See: Heart failure and dyspnea) search help

Search: All Documents

Expand: 5 lectures

**Document-specific Tools:**

- Get Original Document
- Get Original as PDF
- Similar Published Articles
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**Infantile Polycystic Kidney Disease (Autosomal Recessive Polycystic Kidney Disease, ARPKD)**

**I. General and clinical features:**

A. Incidence and relationship to **congestive heart failure**: Infantile polycystic kidney disease is closely associated with **congestive heart failure** (CHF). CHF is an important cause of perinatal hypotension in children and adolescents. In general, as patients who present at neonates and infants, the clinical picture is dominated by renal failure. Patients who present later tend to have liver problems as the major clinical feature. Although at one time thought to represent distinct disorders, diffuse affected members in the same family may present at different ages with either predominant renal or liver abnormalities, suggesting the underlying genetic relationship of these diseases.

Infantile polycystic kidney disease is inherited in an autosomal recessive manner (i.e., parents are not affected), with the reported incidence varying from 1:6000 to 1:40,000.

B. Clinical presentation: Can present at or shortly after birth.

Can be suspected during prenatal ultrasonography associated oligohydramnios.

Presentation shortly after birth can be:

Presentation later in infancy can be due to:

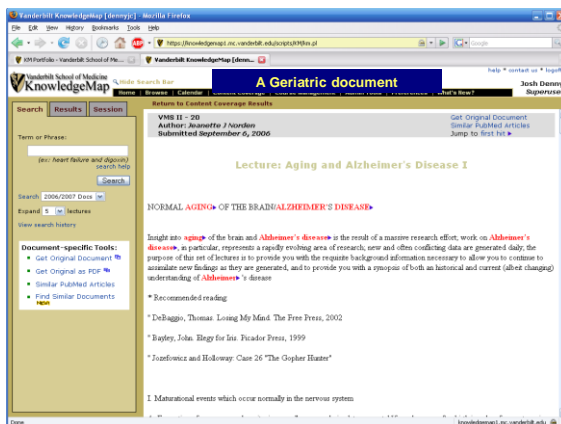
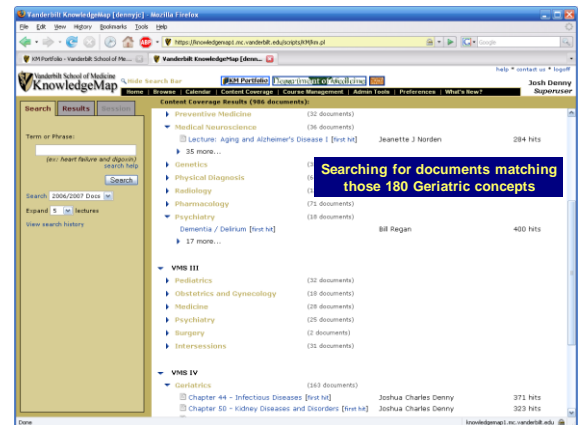
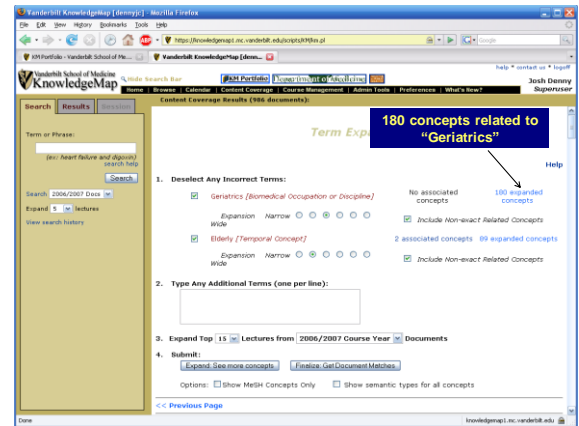
polyuria and dehydration (especially during intercurrent sepsis).

The kidneys may be sufficiently enlarged to result in a palpable mass. Deteriorating renal function is inevitable, and patients may present later with renal failure/azotemia/hypertension.

As implied above, patients presenting in later childhood and early adulthood usually present with signs of liver involvement, particularly portal hypertension, which may result in hepatomegaly and bleeding esophageal varices.

**A document matching "congestive heart failure"; these instances of "CHF" are interpreted as "congestive heart failure" instead of "congestive heart failure"**

How do we find broad concepts like “geriatrics” or “women’s health”?



## How well does KM find metaconcepts?

- Identified gold standard set of 380 documents as containing high, medium or low relevance to each topic
- Used KM to generate a variable number of subconcepts for each broad concept and calculated a relevance score for each document.

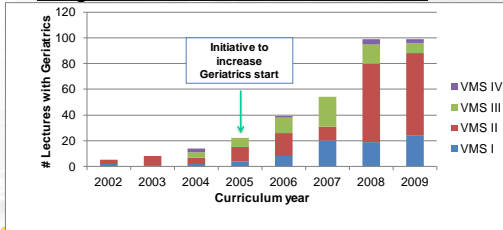
Topic	ROC area
Genetics	0.98
Women's Health	0.93
Dermatology	0.95
Radiology	0.97

Denny, Smithers, Armstrong, Spickard, JGIM, Oct, 2005

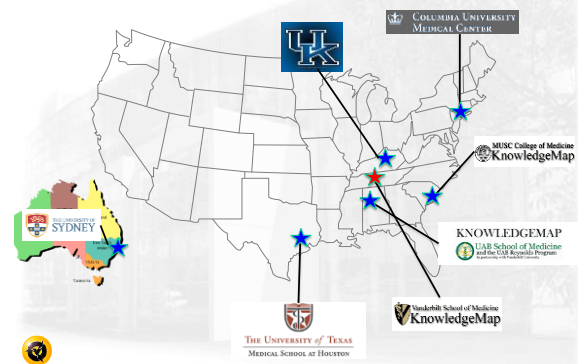
## Finding broad curricular topics

- Used for LCME, creating/rearranging courses, revising curriculum

### Using to infuse Geriatrics in the curriculum:



## KM has been adopted by others



## POGOe.org, a free geriatrics site based on KM

- Funded by ADGAP and Reynolds Foundation
- >10,000 users in 174 countries
- 875 published products (free)
- Video, image libraries
- Quizzes
- EBM content

## Part #2: Assessment in Clinical Years

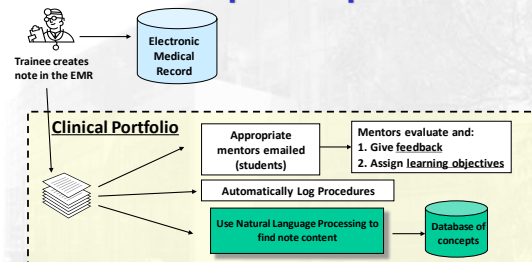
- Testing based: USMLE, NCLEX, Residency Board Exams
- Experience Based:
  - ACGME and RRC
  - Nursing requirements
- Both current methods tend to aggregate at high levels
- Experience is an important part of competency

## Components of "Learning Portfolio"

- Clinical notes
- Mentor feedback on notes and other documents
- Logs of procedures/patients
- Reflections
- Tests/academic work
- Essays and other documents

We will focus on these

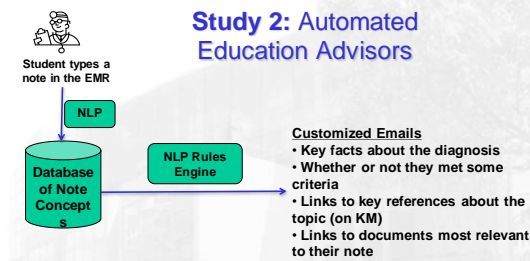
## Learning Portfolio – leveraging EMR to capture experience











• Current Email Advisors:

- Advanced directives (pts > 65, if they don't mention them)
- Altered mental status (must say AMS concept in key section of note)

**Step 1. Student sees a patients, writes a note**

CHIEF COMPLAINT: confusion, weakness, and lethargy  
 HISTORY OF PRESENT ILLNESS: Mrs. X is a 70 year old female with metastatic undifferentiated carcinoma, likely lung in origin, who was recently discharged from the hospital s/p left femoral fracture and biopsy due to a fracture who now presents with increasing confusion, weakness, and lethargy.  
 ...  
 PHYSICAL EXAMINATION: General: waxing and waning alertness,  
 ...  
 SUMMARY: This is a 72 year old female with metastatic lung carcinoma admitted for delirium most likely secondary to hypercalcemia.  
 ...  
 ASSESSMENT AND PLAN:  
 1. Hypercalcemia Hyperparathyroidism.. malignancy..  
 6. Disp -Will keep hospitalized until altered mental status improves...

**Step 2. Portfolio finds AMS concepts found in note**

CHIEF COMPLAINT: **confusion, weakness, and lethargy**  
 HISTORY OF PRESENT ILLNESS: Mrs. X is a 70 year old female with **metastatic undifferentiated carcinoma**, likely lung in origin, who was recently discharged from the hospital s/p left femoral fracture and biopsy due to a fracture who now presents with increasing **confusion, weakness, and lethargy**.  
 ...  
 PHYSICAL EXAMINATION: General: **waxing and waning alertness**,  
 ...  
 SUMMARY: This is a 72 year old female with metastatic lung carcinoma admitted for **delirium** most likely secondary to **hypercalcemia**.  
 ...  
 ASSESSMENT AND PLAN:  
 1. **Hypercalcemia Hyperparathyroidism.. malignancy..**  
 6. Disp -Will keep hospitalized until **altered mental status** improves...

**Step 3. Portfolio finds related curriculum documents and emails the student**

CHIEF COMPLAINT: **confusion, weakness, and lethargy**  
 HISTORY OF PRESENT ILLNESS: Mrs. X is a 70 year old female with **metastatic undifferentiated carcinoma**, likely lung in origin, who was recently discharged from the hospital s/p left femoral fracture and biopsy due to a fracture who now presents with increasing **confusion, weakness, and lethargy**.  
 ...  
 PHYSICAL EXAMINATION: General: **waxing and waning alertness**,  
 ...  
 SUMMARY: This is a 72 year old female with metastatic lung carcinoma admitted for **delirium** most likely secondary to **hypercalcemia**.  
 ...  
 ASSESSMENT AND PLAN:  
 1. **Hypercalcemia Hyperparathyroidism.. malignancy..**  
 6. Disp -Will keep hospitalized until **altered mental status** improves...

You are getting this email as part of a project to improve your understanding of **altered mental status**. This email is generated based on your note: [Medical Student Admission History and Physical, written on 2011-01-15 19:42:15](#).

**Key facts about Altered Mental Status:**

- The differential diagnosis of altered mental status is extensive including dementia, delirium, substance induced, drug side effects, infection, intracranial lesions or strokes, trauma, and metabolic entities such as liver disease or hypoglycemia.
- Alzheimer's disease, vascular dementia, and dementia with Lewy bodies are the most common forms of degenerative dementias seen in late life.

**KM documents most like yours:**

- Typical Laboratory Results in the Differential Diagnosis of Hypercalcemia | Joshua Charles Denny | Geriatrics Review Syllabus (Geriatrics)
- Hypercalcemia | Natasha Janelle Schneider | Outpatient Medicine Curriculum (Core Lecture Series)
- Fluid Management for Students | Kyle Bertram Brothers | Pediatrics (VMS III)
- Pharmacological Concepts | Joseph A Awad | Pharmacology (VMS III)

**Other searches that may be relevant to this patient:**

- Differential diagnosis of metabolic (liver ds, electrolytes, glucose abnormalities) as causes of AMS. (4 overlapping concepts)
- Differential diagnosis of delirium as a cause of AMS. (2 overlapping concepts)
- Signs and symptoms of AMS (2 overlapping concepts)
- Evaluation of AMS (1 overlapping concepts)

## Acknowledgements

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- Lisa Bastarache, MS

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- National Board of Medical Examiners

## Questions?