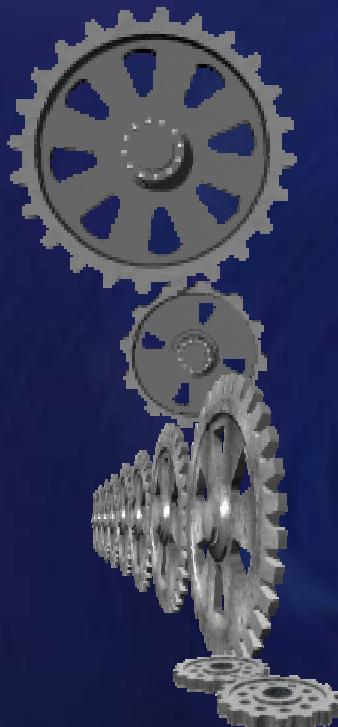


Standard terminology in pathology reporting, storage and retrieval

**Next-generation systems
at Duke University**

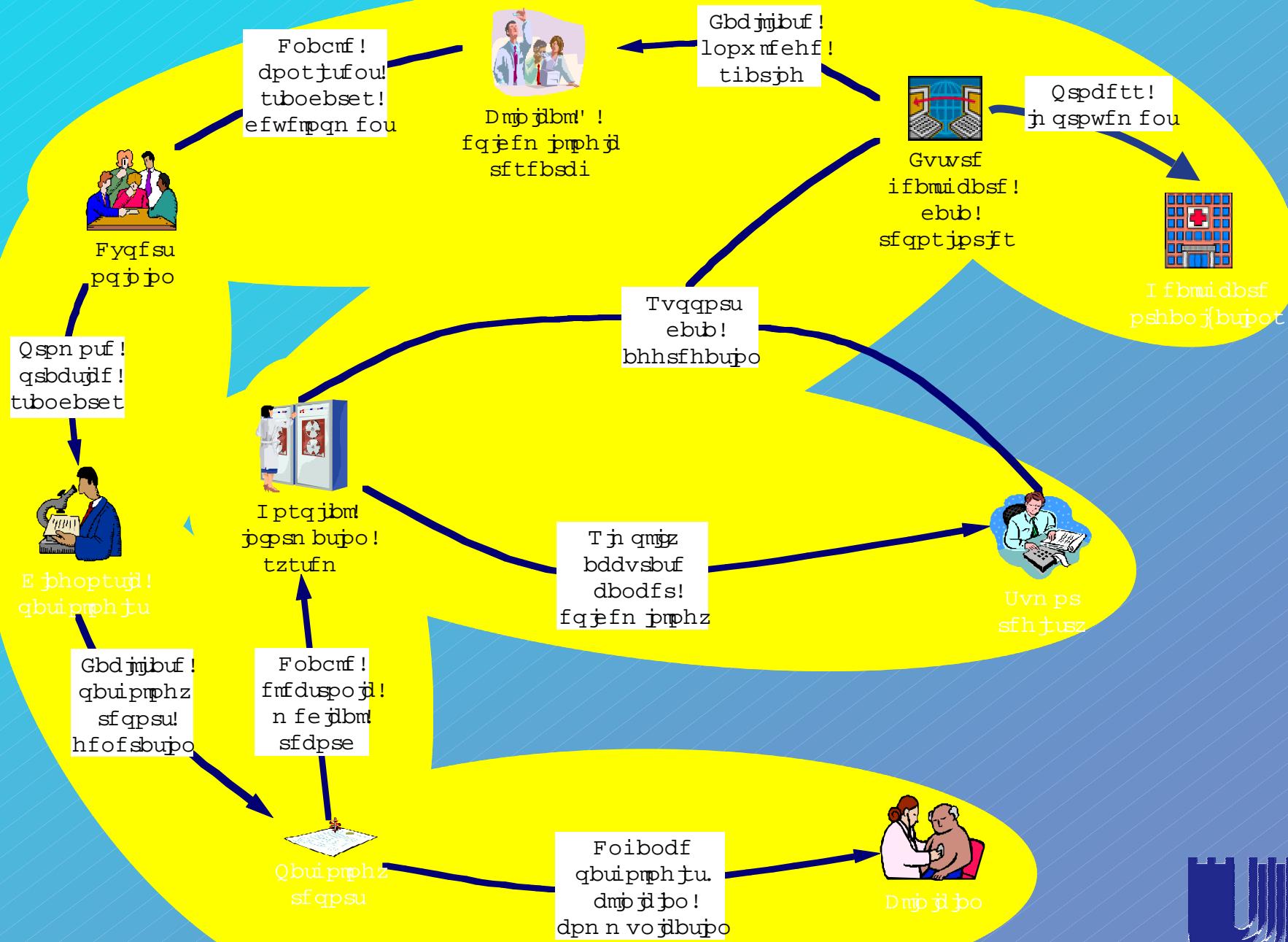


Anatomic pathology reporting: a complex process



- Reporting standards
- Customizability
- Many data consumers with varied requirements
- Retrievability





Next generation systems at Duke University

- “Medical Assistant on the World Wide Web” (MAW3™)
- Standardized Cancer Reporting System



Medical Assistant on the World Wide Web (MAW3™)



- Prototype for a centralized, multi-institutional medical database
- Addresses need for a centralized electronic medical record (EMR)

Currently serves as Autopsy IS at Duke

- Security is critical
- SNOMED CT encodes all data elements



MAW3 Key Components

- Data entry
- Data storage
- Data reporting
- Very flexible: multiple data paradigms
- Underlying unifying factor: **SNOMED CT**

Common terminology in which all data is encoded, stored, and referenced

The screenshot shows the homepage of the "Medical Assistant on the World Wide Web" website. The title is displayed prominently at the top in a stylized font. Below the title, there is a photograph of two medical professionals in a laboratory setting. To the right of the photo, there is descriptive text about the site's purpose and development. At the bottom of the page, there are several security and authentication logos, including THAWTE, AMD, and Secured by SSL.

Medical Assistant on the World Wide Web

Welcome to a revolutionary new web-based multi-institutional medical information system hosted by the Department of Pathology at Duke University Medical Center!

[Enter the Site](#)

This site is continually under active development and improvement. To find out more about Medical Assistant on the World Wide Web, you may e-mail the web site administrator who can describe the ultimate goals that will hopefully be achieved with the final version of this web site.

Please contact a system administrator by clicking below if you are interested in having your medical institution utilize this web-based medical information system.

THAWTE AUTHENTIC SITE CLICK TO VERIFY Secured by SSL

AMD

If you experience difficulties, please contact a system administrator by clicking here.

All programs, tools and/or designs are ©2000 Ray C. Davis, Alan D. Rose, MD, PhD, Department of Pathology, Duke University Medical Center. All supplied medical data is considered confidential property of the supplying institution and their patients.

Current User: Raj Dash (Attending, Administrator, Director) at Duke University Medical Center, Durham, NC

Connection: web server prancer, data s

Current Topic: ATEST-11-01 · Autopsy Report · Cardiovascular System · Heart

Autopsy

Coronary artery

Normal

Gross Description

External Findings

Upon external examination, the epicardium is smooth, glistening and unremarkable. There is a moderate amount of epicardial fat present. The aorta, pulmonary artery,

Right Coronary Artery

The coronary artery has no atherosclerosis. There are no occlusive thrombi.

Left Main Coronary Artery

The coronary artery has no atherosclerosis. There are no occlusive thrombi or abnormalities. A normal distribution of red and white pulp is present. No calcification is noted.

Circumflex Branch

The coronary artery has no atherosclerosis. There are no occlusive thrombi or abnormalities.

Encoding Free Text using SNOMED CT

- Link from source text to encoded representation
- Natural language processor
- Related term browser

Medical Assistant on the World Wide Web - Encode Text -- Web Page Dialog

Free Text Encoder Encode

Representative sections of the heart demonstrate no evidence of fibrosis or hemorrhage. There is no evidence of ischemia or inflammation. No lesions are

Find Related Change

Code Details and Related Concepts

- alternative_suggestions
 - "Ischemia"
 - code = 87658016
 - "Retinal ischemia"
 - "Subendocardial ischemia"
 - "Transient ischemia"
 - "Asymptomatic ischemia"
 - "Arterial ischemia"
 - "Peripheral ischemia"
 - "Flap ischemia"
 - "Ischemia score"
 - "Cerebral ischemia"
 - "Choroidal ischemia"
 - "Myocardial ischemia"
 - Cardiac ischemia"
 - code = 493076016

52674009

OK Cancel

Encoded Sentence

- "Representative sections of the heart demonstrate
- "There is no evidence of ischemia or inflammation"
- phrases
 - "ischemia"
 - phrase = ischemia
 - sentenceldx = 1
 - phraseldx = 0
 - charldx = 0
 - charLen = 35
 - absoluteOffset = 89
 - isNegatory = true
 - certainty = 1
 - leftContext = there is no evidence
 - rightContext = or
 - keyword_forms
 - "Ischemia"
 - conceptID = 52674009
 - descriptionID = 87658016
 - "inflammation"
 - "No lesions are identified"

Enter free text into the window at the top left, then press the ENCODE button - review the returned codes, and press OK to continue, or Cancel to abort

Encoding Free Text using SNOMED CT

- Identify SNOMED CT code meaning
- Browse Hierarchy
- View canonical forms

Medical Assistant on the World Wide Web - Encode Text -- Web Page Dialog

Free Text Encoder Encode

Representative sections of the heart demonstrate no evidence of fibrosis or hemorrhage. There is no evidence of ischemia or inflammation. No lesions are

Find Related Change >

Code Details and Related Concepts

- code_details
 - descriptionID = [no value]
 - conceptID = 52674009
 - conceptStatus = 0
 - fullySpecifiedName = Ischemia (disorder)
 - snomedID = F-39340
 - ctv3ID = X79pz
 - isPrimitive = true
- parent_concepts
- sibling_concepts
- children_concepts
- literal_canonical_form
 - short_canonical_form
 - long_canonical_form

Encoded Sentences

- "Representative sections of the heart demonstrate
- "There is no evidence of ischemia or inflammation"
- phrases
 - "ischemia"
 - phrase = ischemia
 - sentenceldx = 1
 - phraseldx = 0
 - charIdx = 0
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- "No lesions are identified"

OK Cancel

52674009

Enter free text into the window at the top left, then press the ENCODE button - review the returned codes, and press OK to continue, or Cancel to abort

College of American Pathologists Cancer Reporting Protocols



- Specifies of required data elements in cancer reports
- ≥90% compliance for ACoS Cancer Center accreditation (begins 2004)
- Over 30 site-specific protocols with complex, cascading requirements
- SNOMED CT encodings developed in cooperation with CAP Cancer Committee



Colon and rectum

CAP.COLO

CARCINOMA OF COLON/RECTUM (SPECIFY):

Histologic type TYPE□co	<p>[1] <input type="radio"/> Adenocarcinoma [2] <input type="radio"/> Mucinous adenocarcinoma [3] <input type="radio"/> Signet ring cell carcinoma [4] <input type="radio"/> Undifferentiated carcinoma [S] <input type="radio"/> Other (specify: _____) [X] <input type="radio"/> Cannot be determined</p>
Histologic grade GRADE□co	<p>[1] <input type="radio"/> Low grade [2] <input type="radio"/> High grade [X] <input type="radio"/> Cannot be determined</p>
Extent of invasion INVA□co	<p>[S] <input type="radio"/> Intramucosal carcinoma [SA] <input type="radio"/> Lamina propria invasion only [SB] <input type="radio"/> Into (not through) muscularis mucosae only [1] <input type="radio"/> Submucosa [2] <input type="radio"/> Into (not through) muscularis propria [3] <input type="radio"/> Through muscularis propria into subserosa/pericolic tissue [3A] <input type="radio"/> ≤ 5 mm into subserosa/pericolic tissue [3B] <input type="radio"/> > 5 mm into subserosa/pericolic tissue [4] <input type="radio"/> Invades other structures or peritoneal cavity [4A] <input type="radio"/> Directly invades extracolic organs/structures (specify) [4B] <input type="radio"/> Perforates visceral peritoneum</p>
Margin	
Proximal:	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Indeterminate
Distal:	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Indeterminate
Radial (deep):	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Indeterminate
Closest margin:	_____ , _____ CM

Vascular (small vessel) invasion: Negative Positive Indeterminate

Vascular (large venous) invasion: Negative Positive Indeterminate

Perineural invasion: Negative Positive Indeterminate

Tumor border configuration: Pushing (smooth) Infiltrating (ragged)

Peritumoral lymphocytic response: None
[1] Mild to moderate
[2] Marked ("Crohn's-like response")

Associated adenoma(s) : Absent Present (specify: _____)

Appendix: No pathologic diagnosis Other (specify: _____)

Regional lymph nodes Negative for carcinoma, _____ lymph nodes examined
 Metastatic malignancy in _____ of _____ lymph nodes
(For solitary metastatic focus ≤ 2 mm, include explanatory note)
NODES□co Lymph nodes reported separately
[X] No lymph nodes recovered

Additional findings: _____

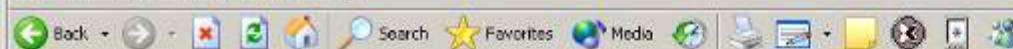


Cancer Reporting System

Software layers

- Data entry module
 - Web server pages
- Relational database backend
 - SNOMED CT encoding
 - Item logic
- Visual template construction environment





CAP Cancer Protocol Checklists

Select template

- Abdominoperineal resection
- Other

Length **Histologic type**

- Adenocarcinoma
- Mucinous adenocarcinoma
- Signet ring cell carcinoma
- Undifferentiated carcinoma
- Other
- Cannot be determined

Breast

Histologic grade

- Low grade
- High grade greater than or equal to 50% gland formation
- Cannot be determined
- Not applicable

Colon/Rectum

Lung

Pancreas

Test

Extent of invasion

- Intramucosal carcinoma
- Submucosa
- Into (not through) muscularis propria
- Through muscularis propria into subserosa/pericolic tissue
- Invades other structures or peritoneal cavity

Margins

Cancer Reporting System

User Input

- Simple, visual interface
 - Checkboxes, dropdown lists, etc.
 - Error & type checking
 - Context dependent constraints, hide/show, computed outputs
- Hyperlinks to protocols, tooltip help
- Platform independent (web-based)



Coding : Form

Select template Colon/Rectum

Template Colon/Rectum

- SpecimenType (371439000)
 - Right hemicolectomy (122648004)
 - Transverse hemicolectomy (122649007)
 - Left hemicolectomy (122650007)
 - Sigmoidectomy (122651006)
 - Rectal/rectosigmoid resection (122652004)
- HistologicType
- HistologicGrade
- ExtentInvasion
- Margins
- SiteDimensionMax

Select checkboxes: COLON AND RECTUM: Resection

SPECIMEN TYPE

TUMOR SITE

TUMOR CONFIGURATION

TUMOR SIZE

MESORECTUM

HISTOLOGIC TYPE

HISTOLOGIC GRADE

EXTENT OF INVASION

Item specific information (ordinal choices)

SNOMED CT Concepts

CONCEPTID	SNOMEDID
371439000	R-00254

FULLYSPECIFIEDNAME

Specimen type (observable entity)

Response constraints with SNOMED CT ID's

Template items for user display

Synonymy display

SNOMED CT Cancer Subset Browser

SpecimenType (371439000)

Right hemicolectomy (122648004)

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COLON AND RECTUM: Resection

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Specimen type (observable entity)

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SNOMED CT Cancer Subset Browser

Cancer Reporting System

Flexible output



- Same “input” template can have many different output representations
 - TXT, RTF
 - XML, including CDA Level 1 wrapper
 - CDA Level 2 on the way...



XML output with SNOMED CT codes

```
<CAP:Choices>
  <CAP:Choice Name="Cecum" Text="Cecum" Ordinal="1" ChoiceID="1407">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="32713005"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Right (ascending) colon" Text="Right (ascending) colon" Ordinal="2" ChoiceID="1408">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="9040008"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Hepatic flexure" Text="Hepatic flexure" Ordinal="3" ChoiceID="1409">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="48338005"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Transverse colon" Text="Transverse colon" Ordinal="4" ChoiceID="1410">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="485005"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Splenic flexure" Text="Splenic flexure" Ordinal="5" ChoiceID="1411">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="72592005"/>
    </CAP:Codes>
```





Breast cancer diagnostic template

CARCINOMA OF BREAST,

Section

Specimen type

Select...



• Tumor location

<input type="checkbox"/> Upper inner	<input type="checkbox"/> Central	<input type="checkbox"/> Upper outer
<input type="checkbox"/> Lower inner	<input type="checkbox"/> Lower outer	<input type="checkbox"/>

Other

Section

• Size of excision

 x x cm

User

interacts
with form

Section

Section

Histologic type

Select...

Specify...

Section

Histologic grade

Specify...

Data Source

Layout Controls Data Source Views

Work with the data source

SpecimenTypeSection

- SpecimenType string

MarginSection

- MarginInvasiveSection

 - MarginInvasiveExtentSection
 - ClosestMarginSection

 - ClosestMarginInvasive double
 - MarginClosestInvasiveName string

- MarginInvasiveStatus* string

- MarginCISSection

ImageSection

- Image

 - Photo base64Binary: Picture has been set
 - ImageDescription XHTML
 - TypeOfImage String
 - Magnification String
 - Stain String

Show details

Add...

Help with the Data Source

XML Schema defines data structure

Key terminologic synergies

- Standard vocabulary (e.g. SNOMED CT)
 - Rich internal relationships
 - Can constitute new relationships (post-coordinations, compositions)
- Templates (e.g. CAP Cancer Specs)
 - Reusable context to capture stereotypical healthcare scenarios
- Structured documents (e.g HL7 CDA)
 - Allow encodings to address natural-language assertions at high granularity

