

Identifying the Essence of Clinical Findings

Mia Levy

Rush Medical College
Chicago, IL

NIH Clinical Elective in Medical Informatics

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Preceptors

Olivier Bodenreider

Tom Rindflesch

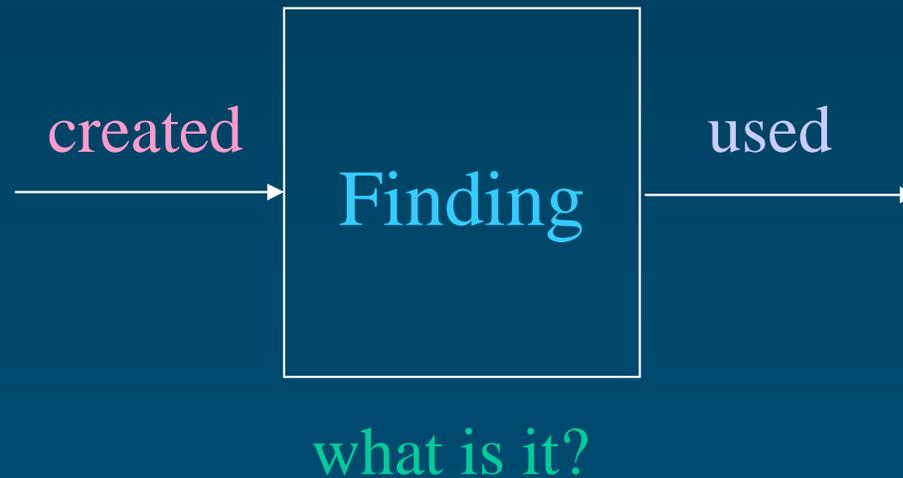
Goals and Methods

- ◆ Project Goal
 - Create an ontology for Clinical Findings
 - Populate with UMLS concepts

- ◆ Two Approaches
 - Top-down approach – principle driven
 - Bottom-up approach – data driven

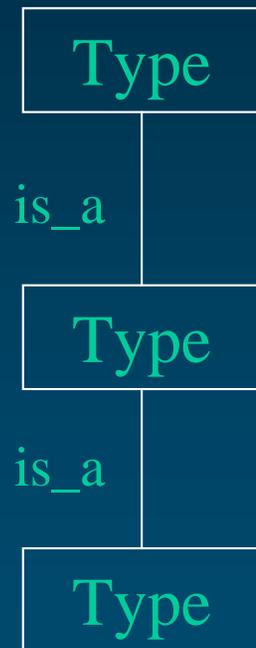
Top-Down Approach

- ◆ Ontology Principles
 - Role vs. Type
- ◆ Formal Definition of Findings

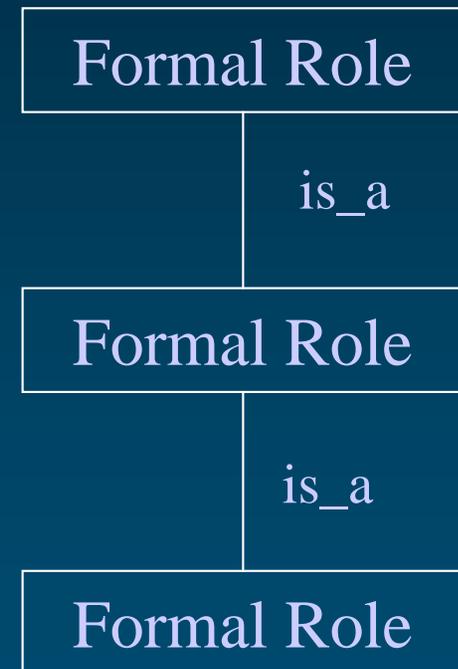


Ontology Principles

Type Taxonomy

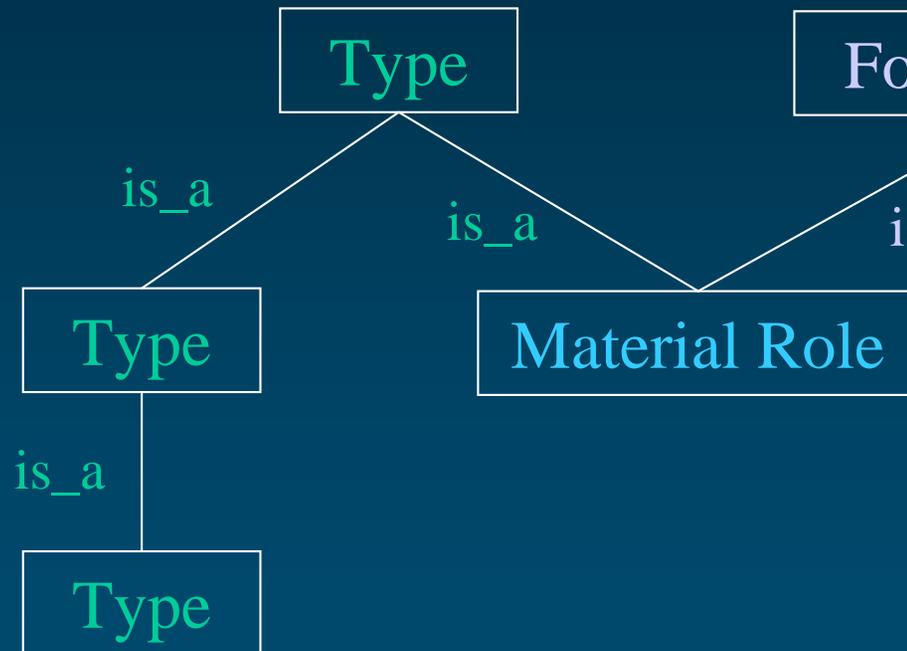


Role Taxonomy

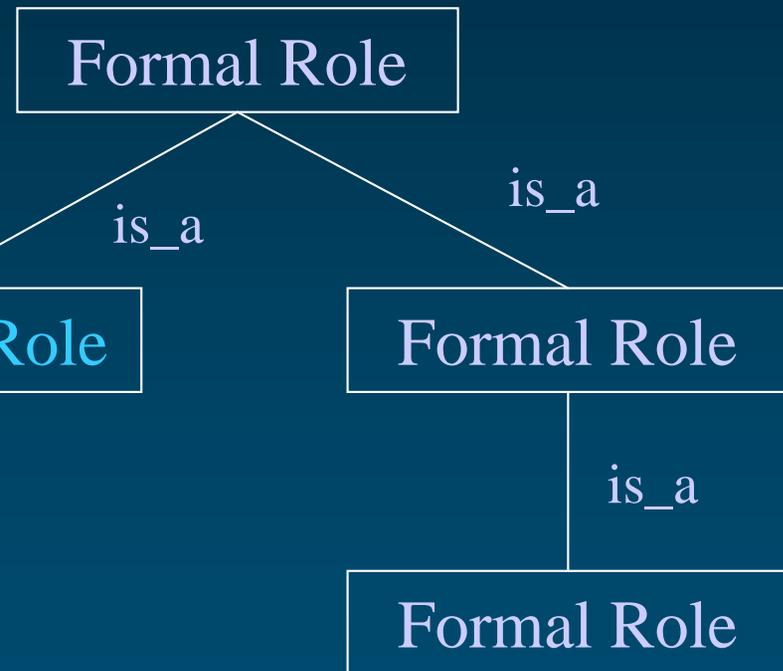


Ontology Principles

Type Taxonomy



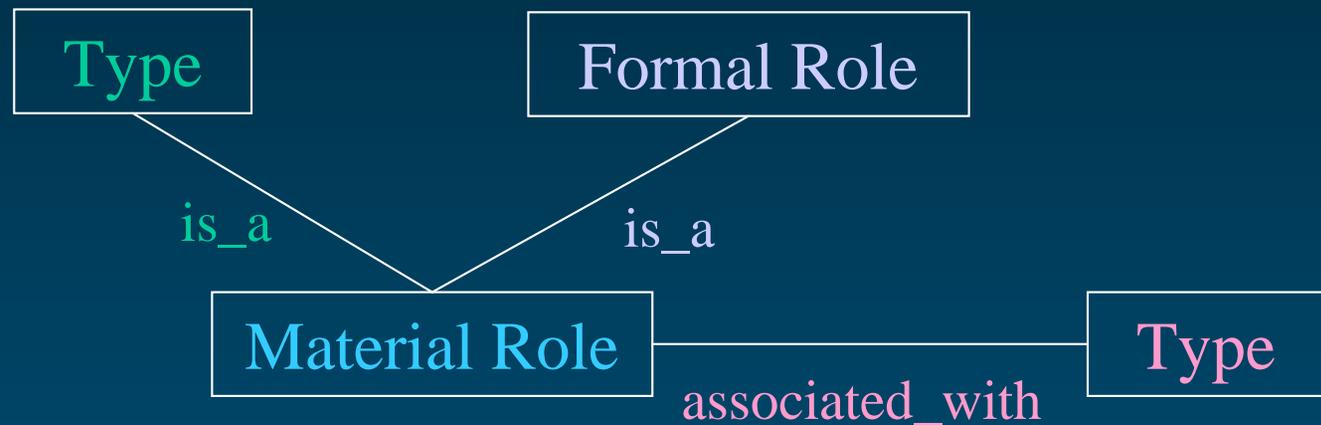
Role Taxonomy



Ontology Principles

Type Taxonomy

Role Taxonomy

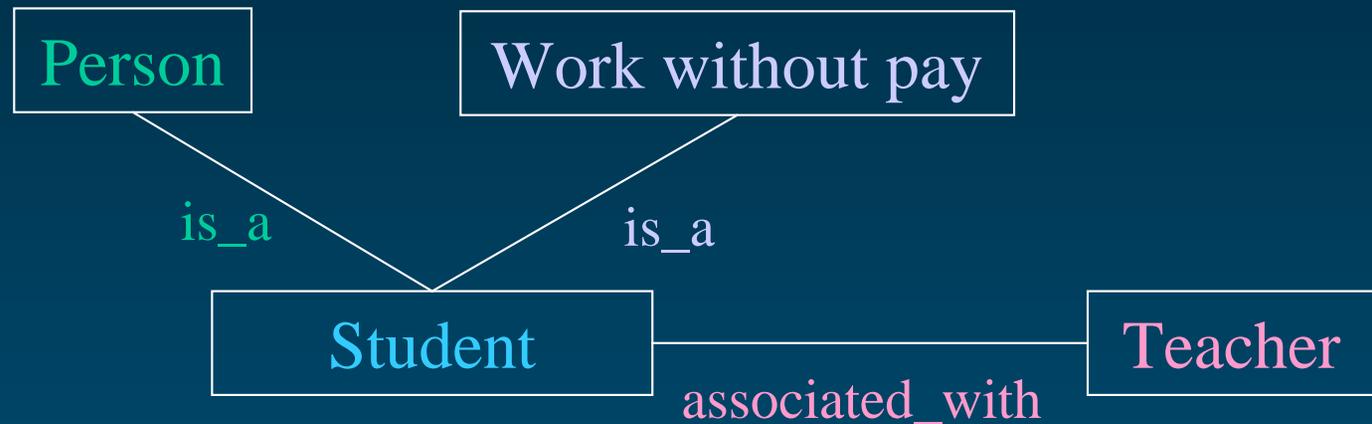


Associative Relationship

Ontology Principles

Type Taxonomy

Role Taxonomy

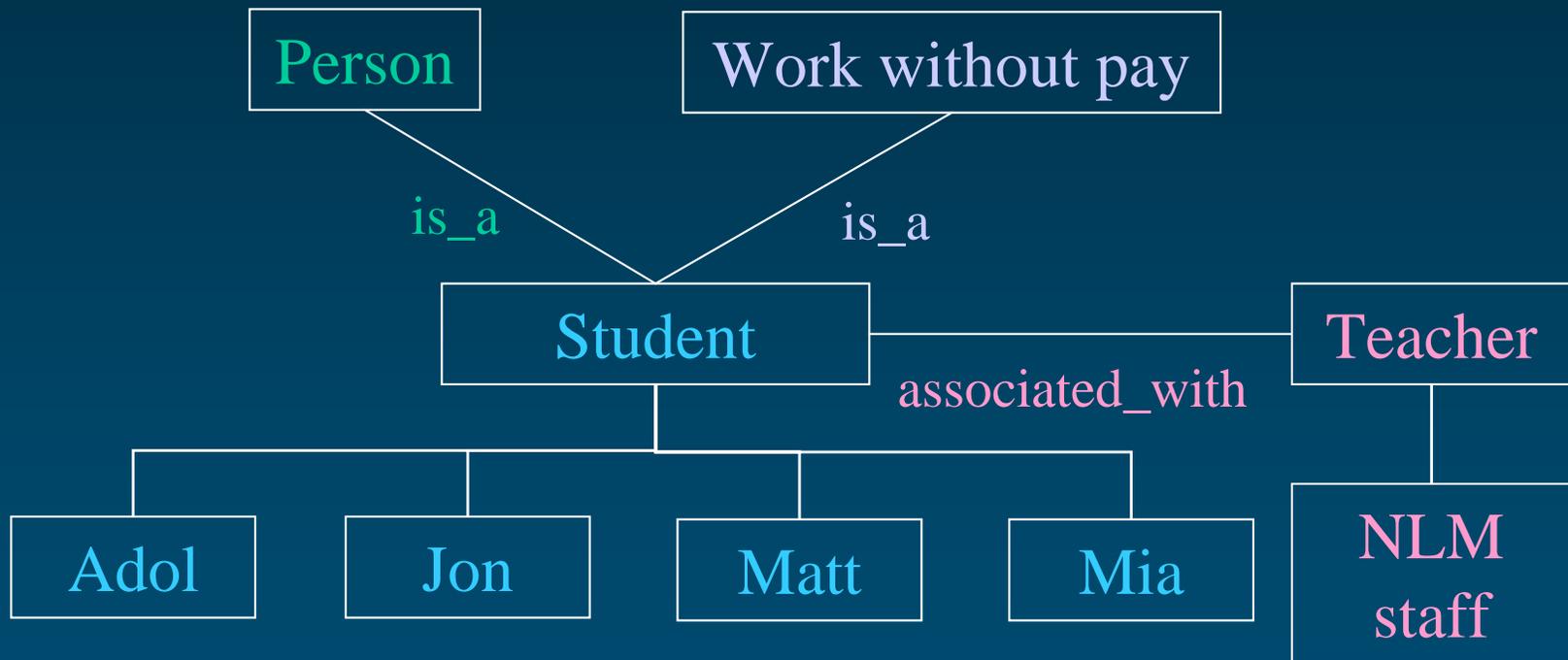


Associative Relationship

Ontology Principles

Type Taxonomy

Role Taxonomy



Associative Relationship

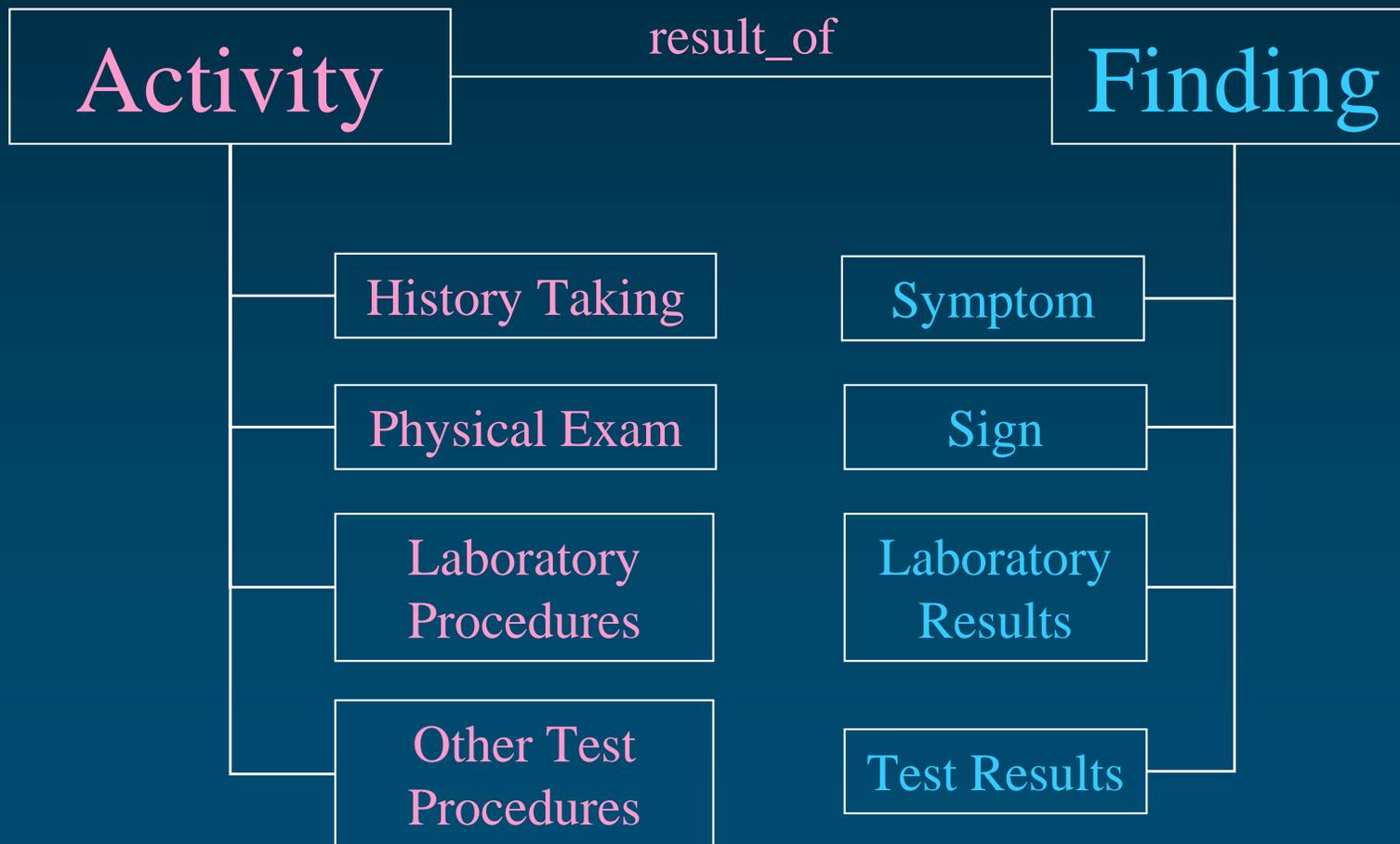
Formal Definition of Findings



what is it?

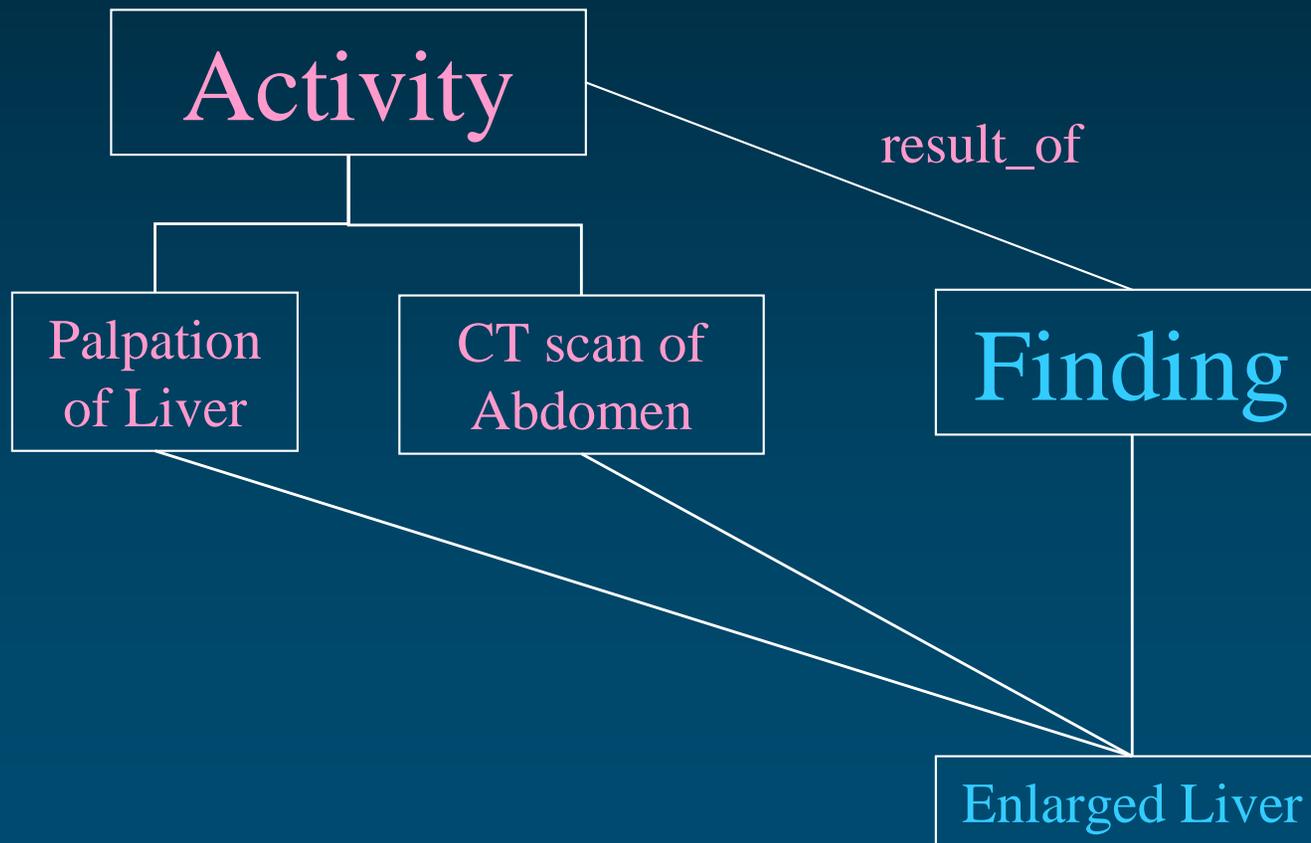
Formal Definition of Findings

- ◆ Finding is the result of a Healthcare Activity



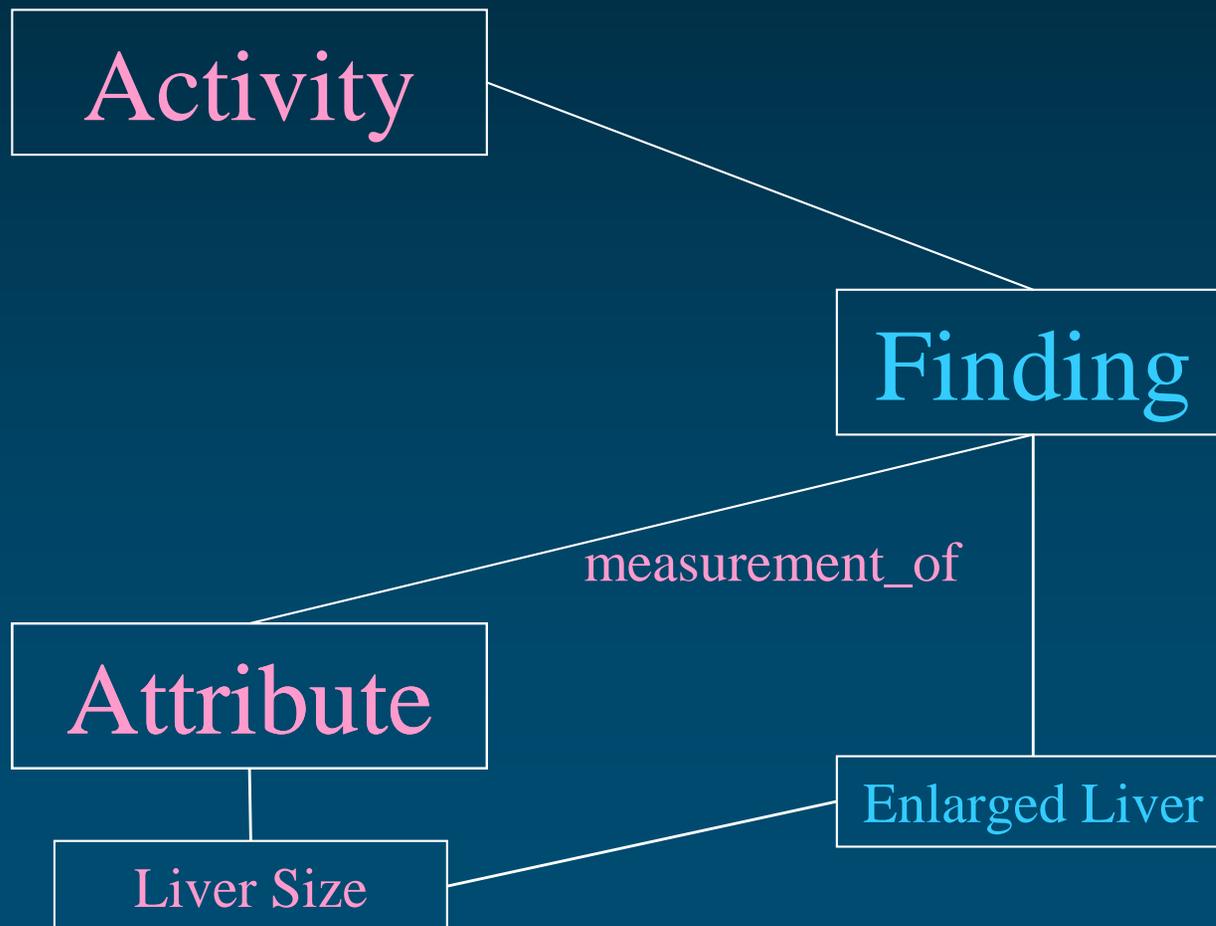
Formal Definition of Findings

- ◆ Finding is the result of a Healthcare Activity



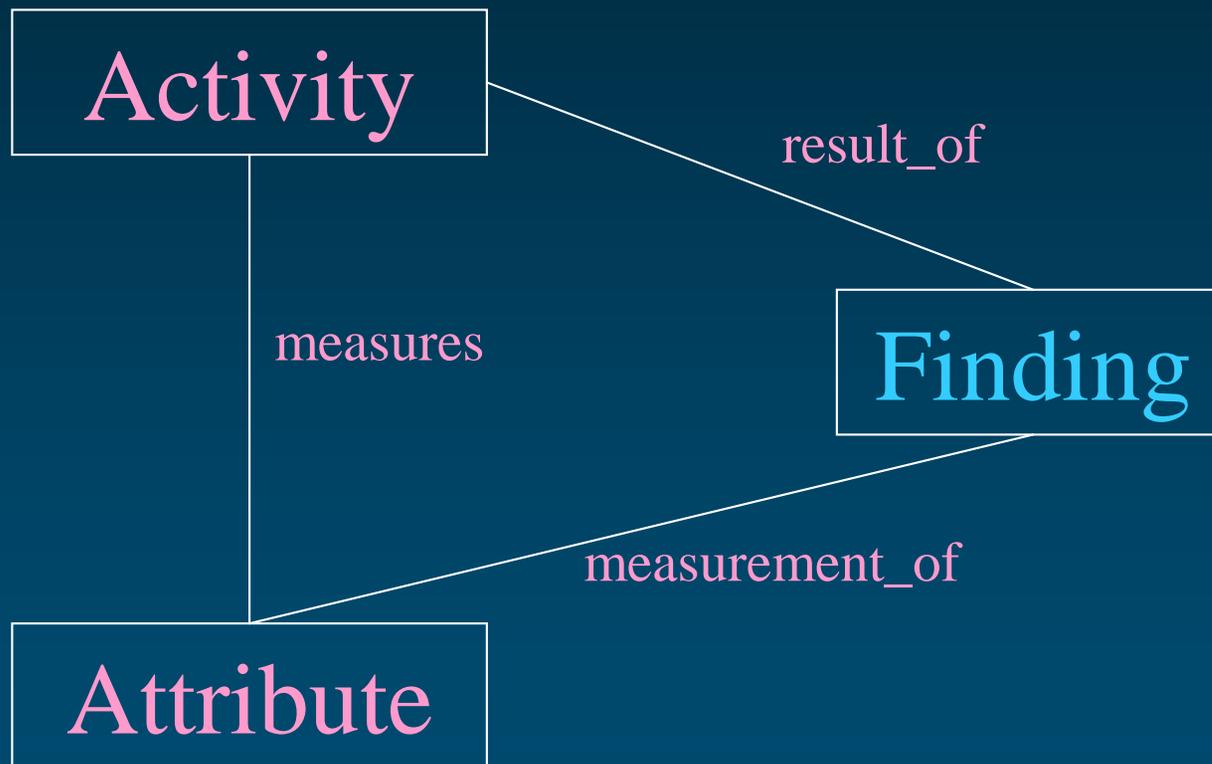
Formal Definition of Findings

- ◆ Finding is a measurement of an Attribute



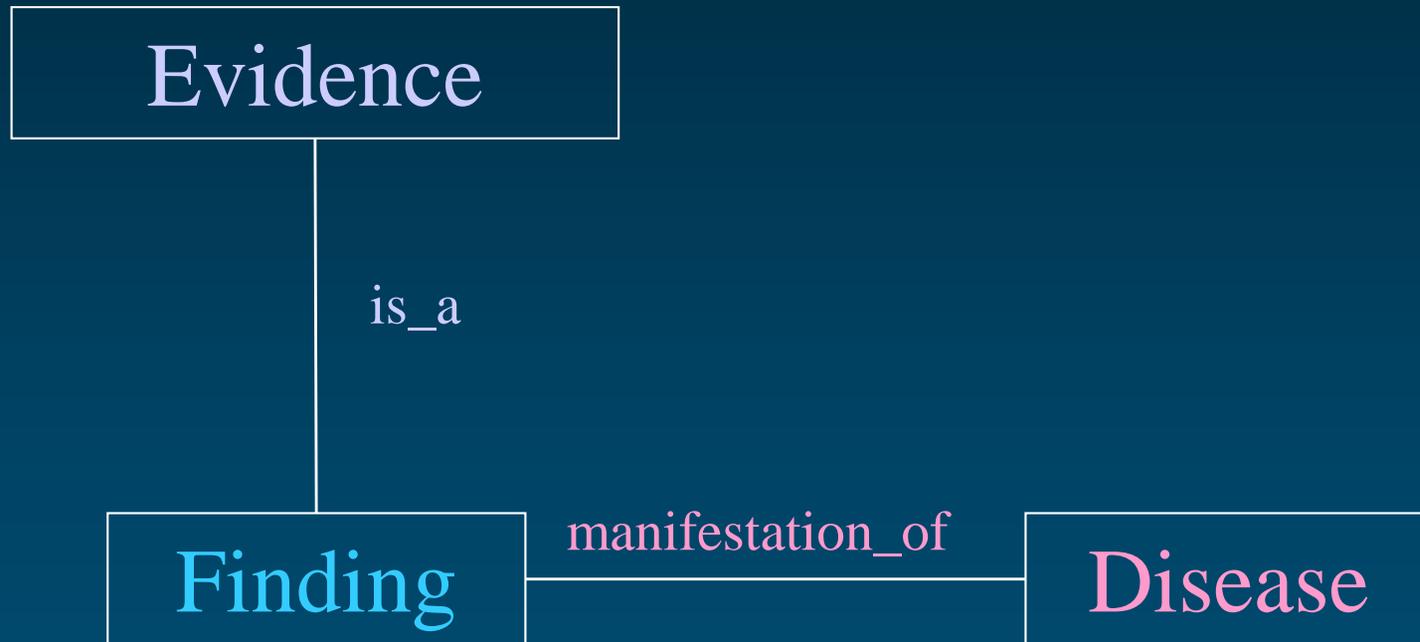
Formal Definition of Findings

- ◆ Finding is the result of an Activity that measures an Attribute



Formal Definition of Findings

- ◆ Finding is a type of Evidence of the manifestation of Disease

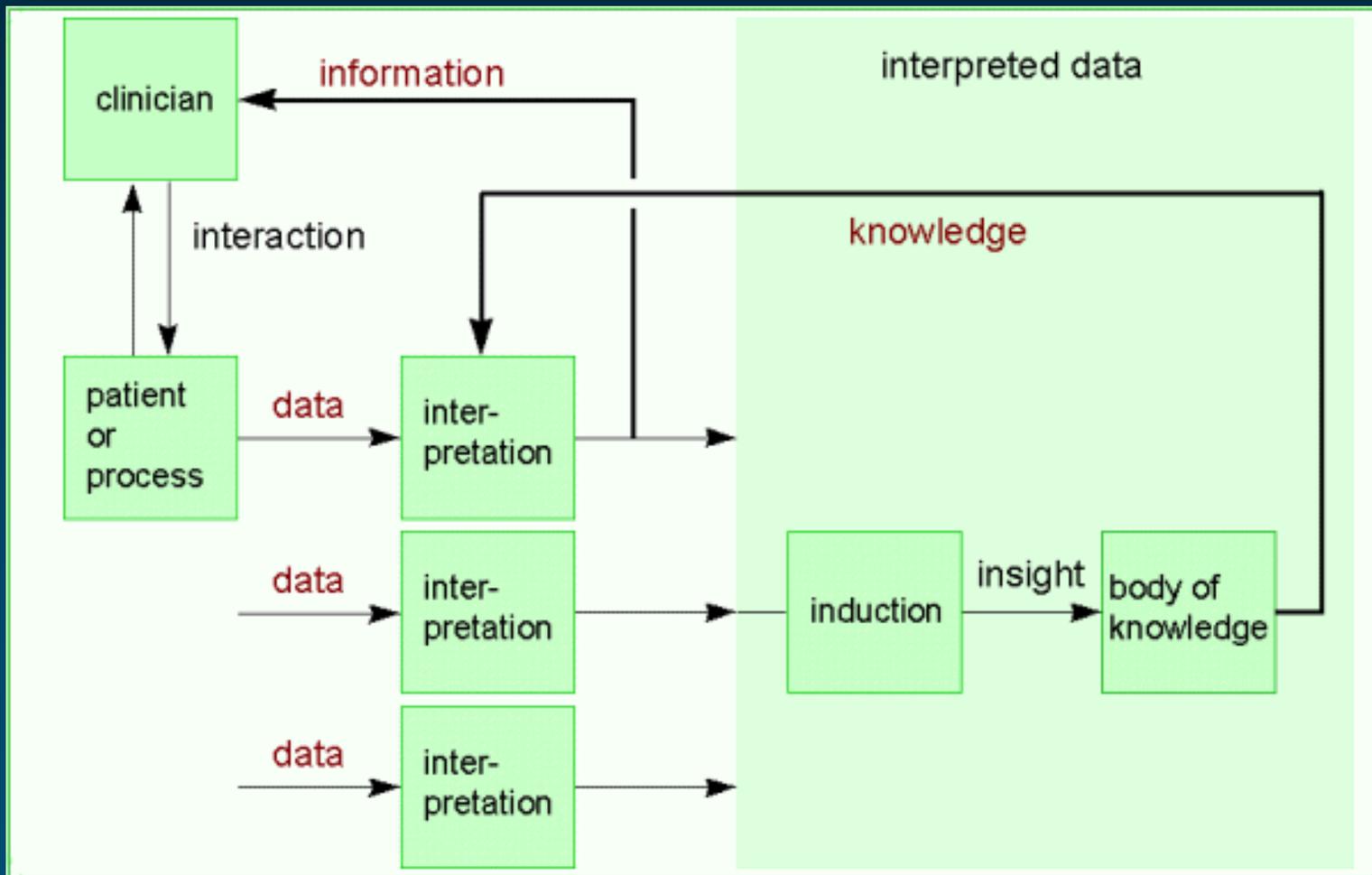


Formal Definition of Findings



what is it?

Data, Information, Knowledge

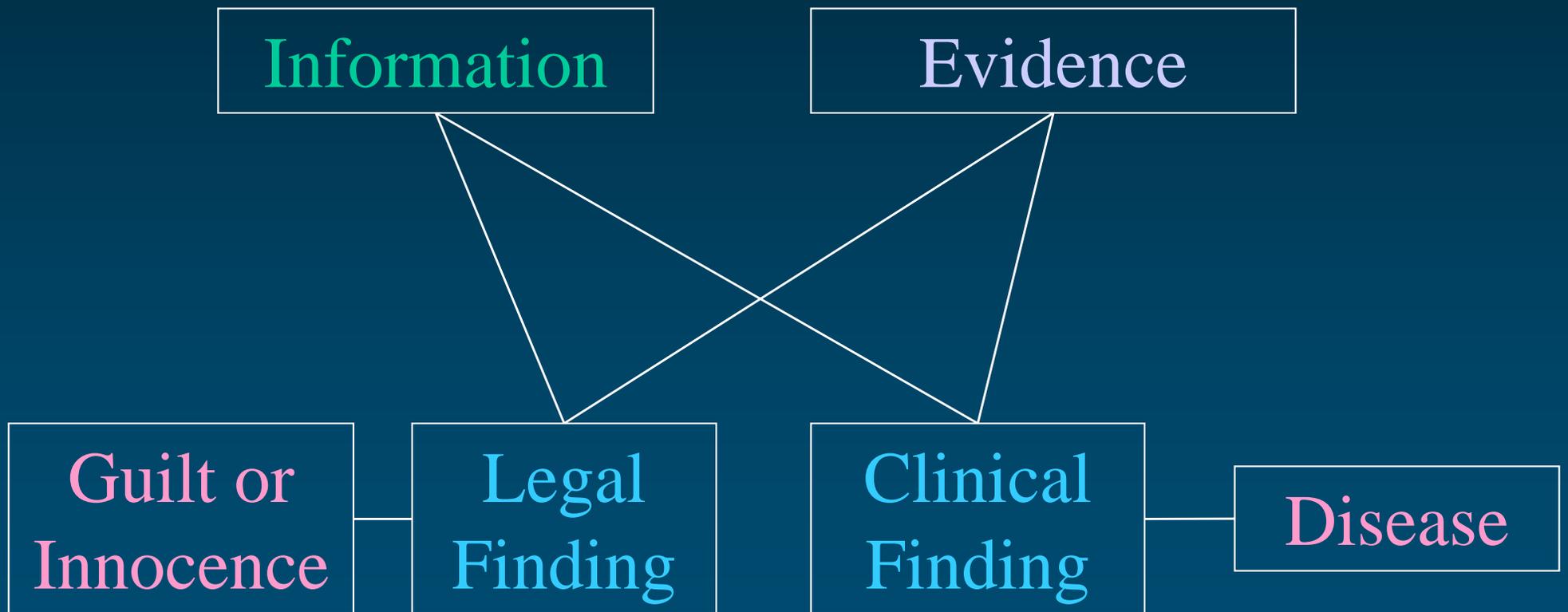


Data, Information, Knowledge

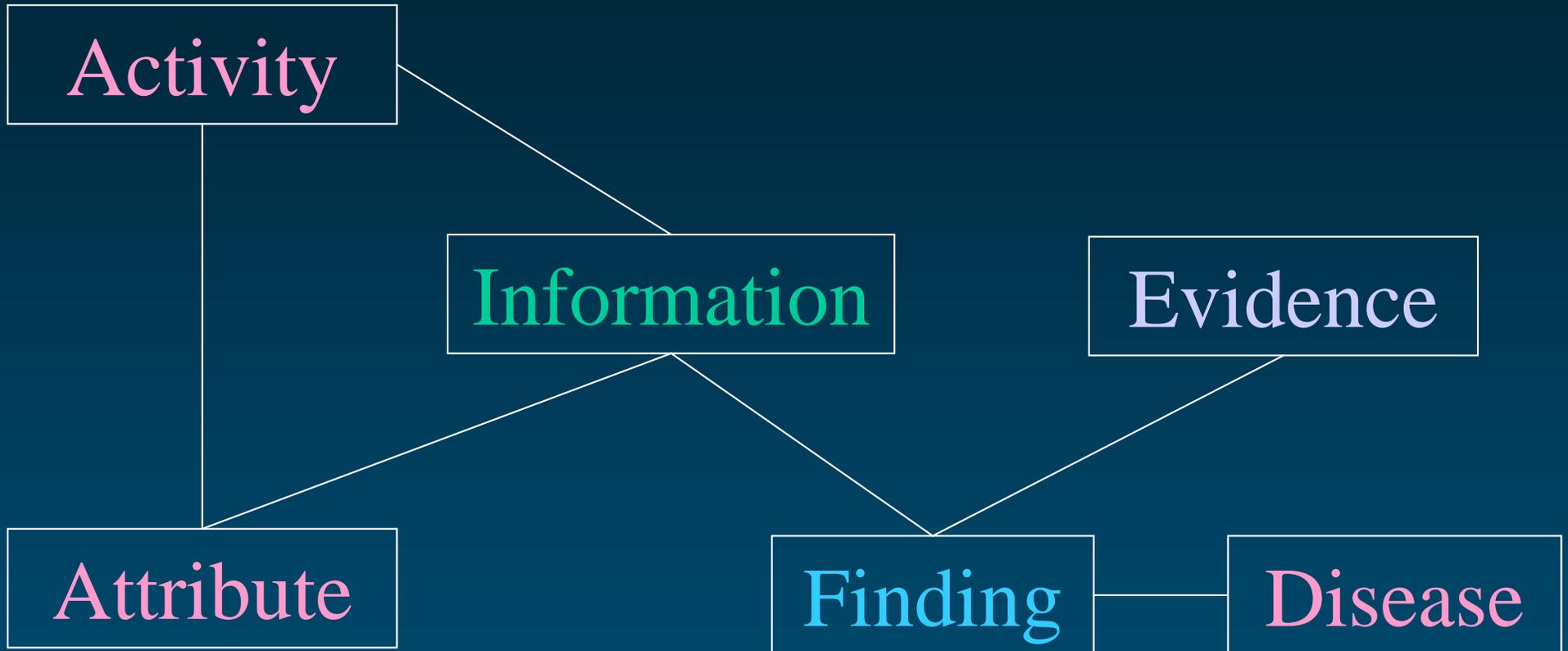
Example - ECG

Formal Definition of Findings

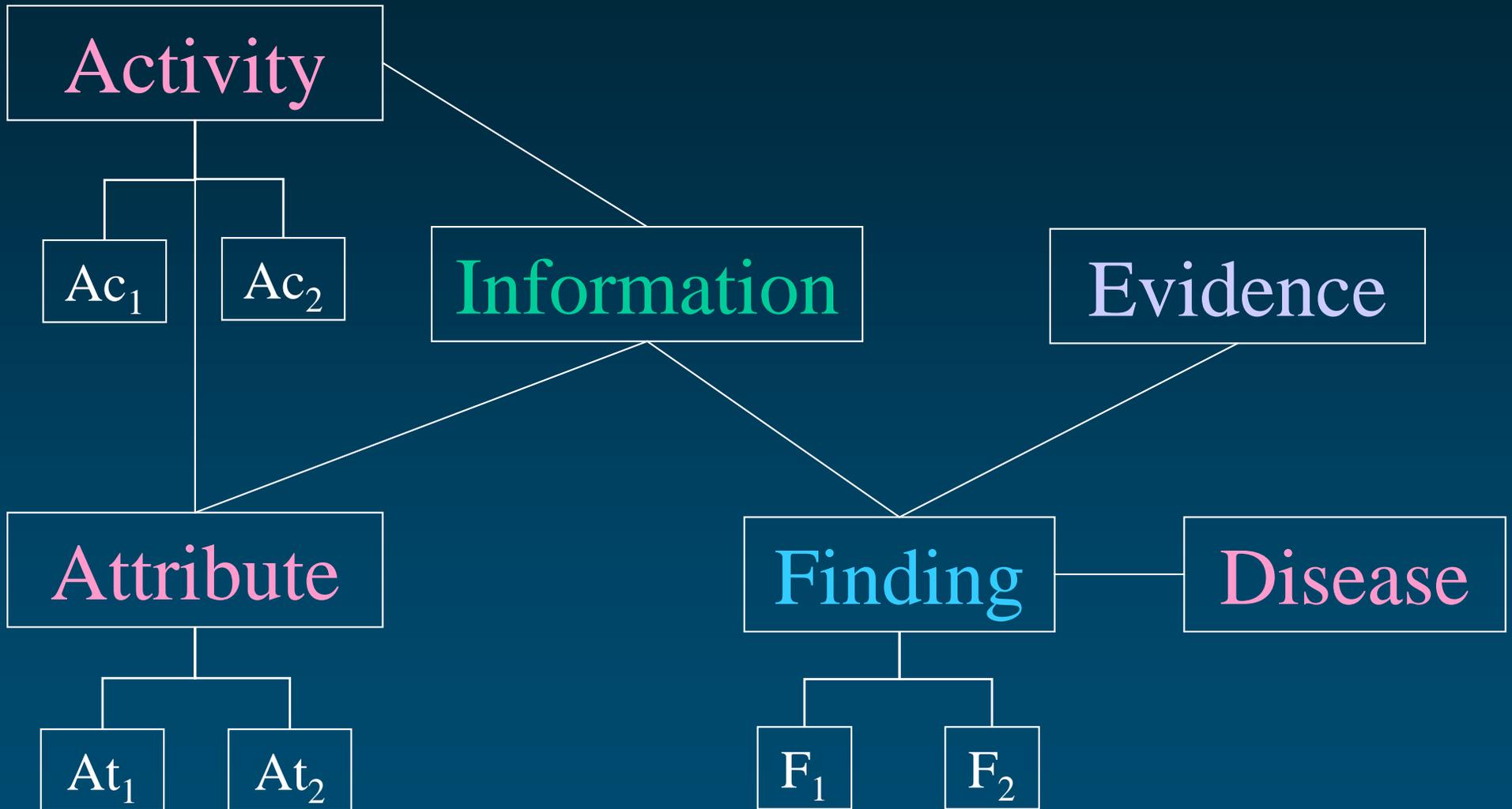
- ◆ Finding is Information used as Evidence of the manifestation of Disease



Ontology for Clinical Findings



Populating the Ontology



Populating the Ontology

Bottom-Up Approach

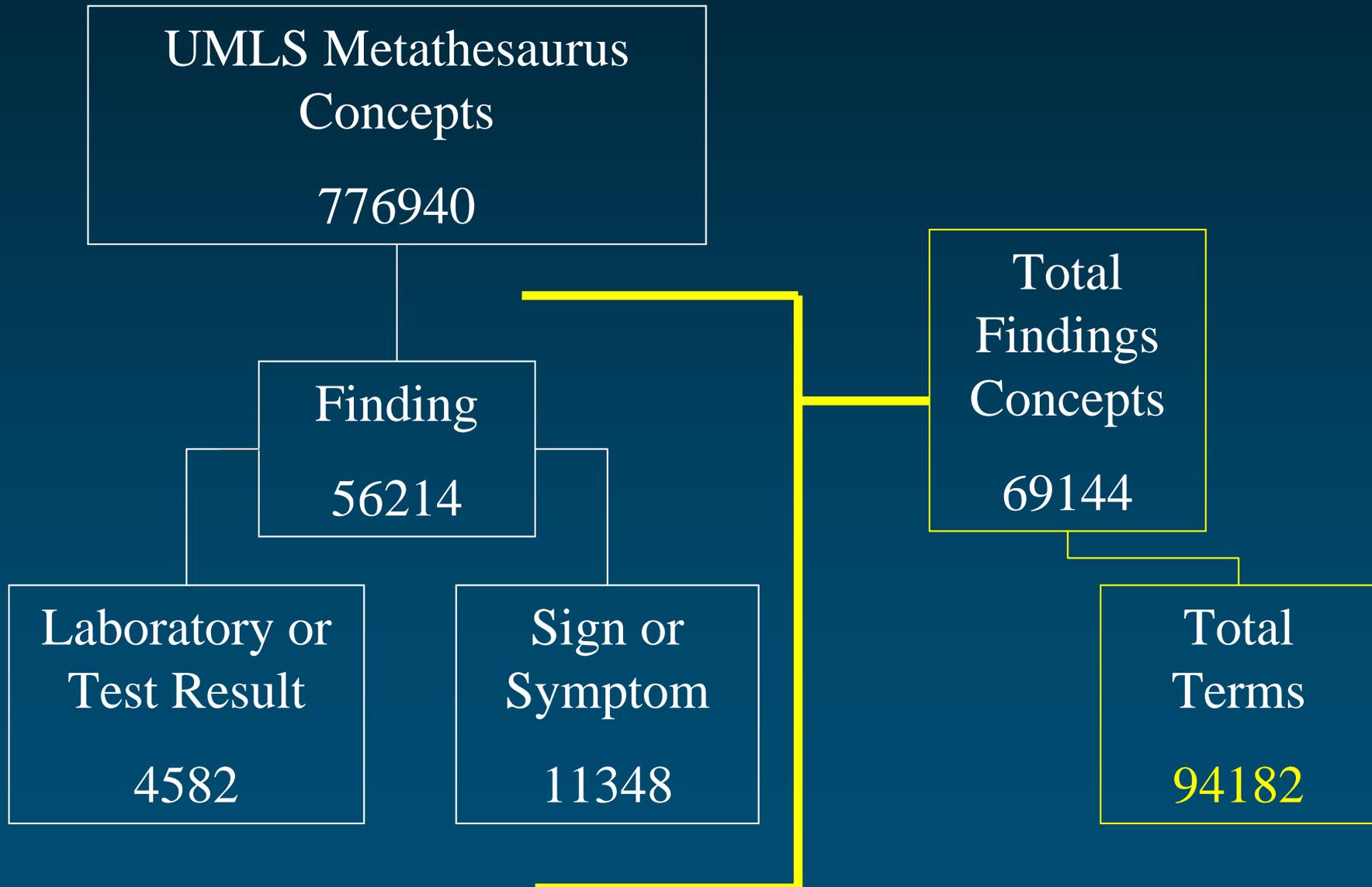
Data Set

UMLS Metathesaurus Concepts

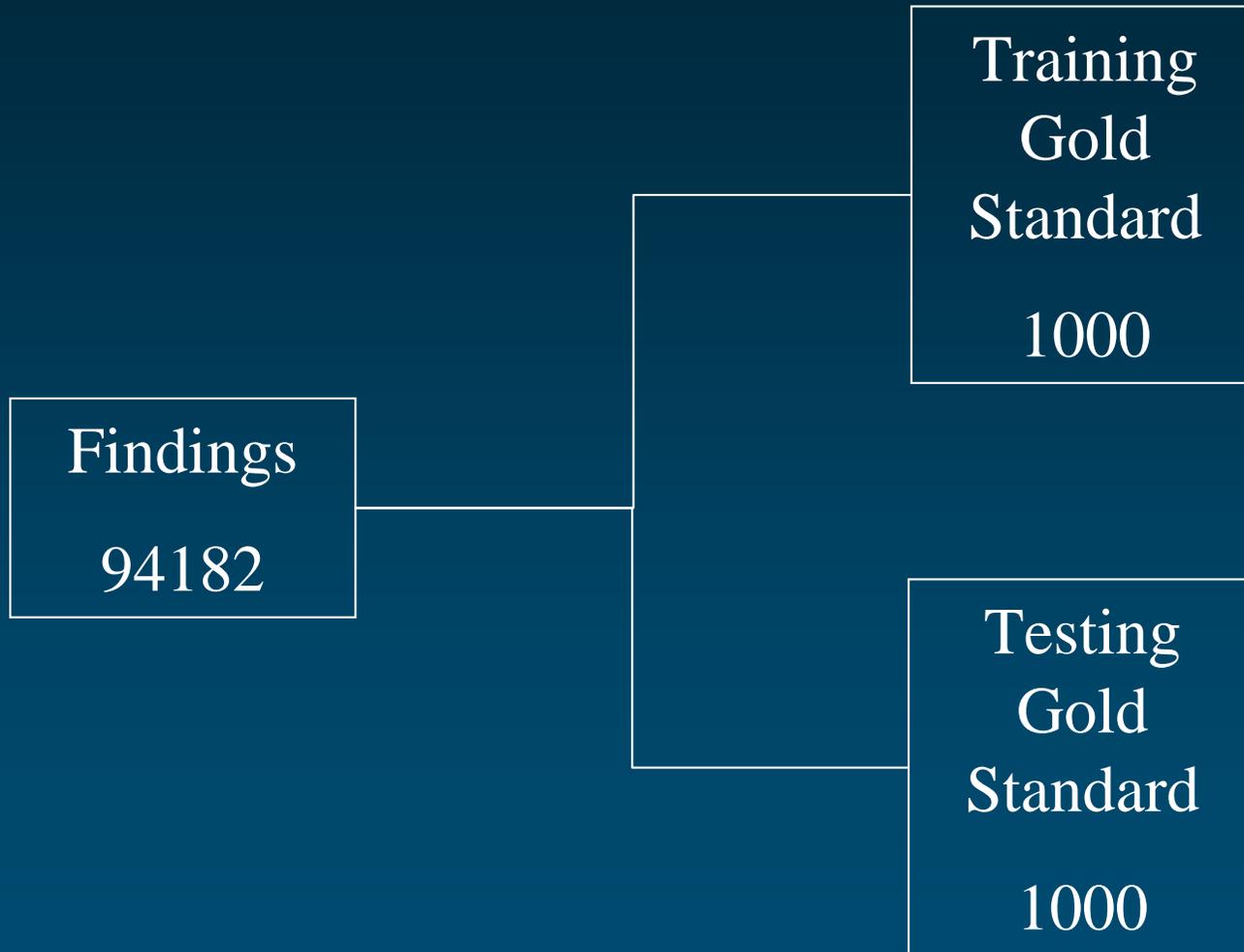
Rules for extracting Findings, Activities, Attributes

Modified version of NLP program FindX

UMLS Metathesaurus Concepts



UMLS Metathesaurus Concepts



Populating the Ontology

◆ FindX

- Rule Structure
 - Attribute – semantic grouping
 - Value
 - numeric value
 - SNOWMED adjective

Populating the Ontology

◆ FindX

- Four Rules
 - Anatomy Rule
 - Physiologic Function Rule
 - Test Result Rule
 - Finding Rule

Populating the Ontology

◆ FindX Mechanics

- Syntactic Analysis
 - Lexical Look-up
 - Xerox Tagger
 - Parser
- MetaMap – Semantic Types
- FindX
 - Semantic Grouping
 - Identify Values
 - Apply Rules

Input

Potassium

Level

Increased

Lexical Look-up

Potassium

noun

Level

noun

verb

adj

adv

Increased

adj

verb

SPECIALIST Lexicon – Identify Parts of Speech

Tagger

Potassium

noun

Level

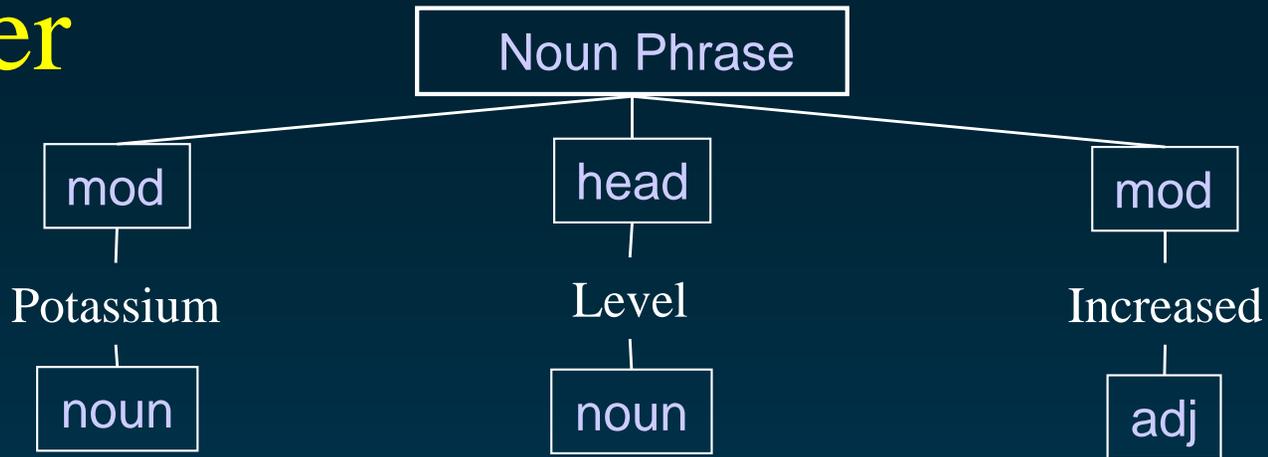
noun

Increased

adj

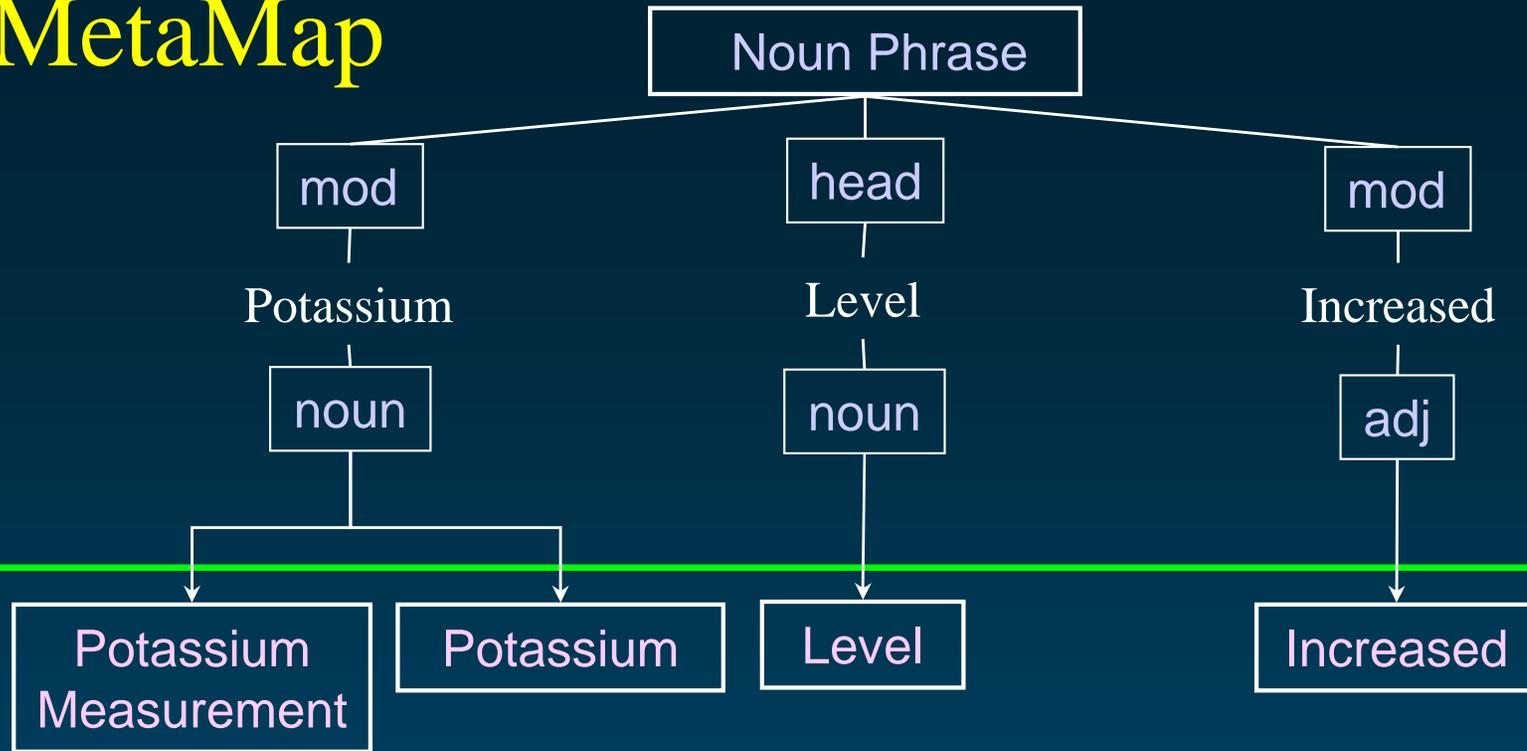
Resolve Parts of Speech

Parser



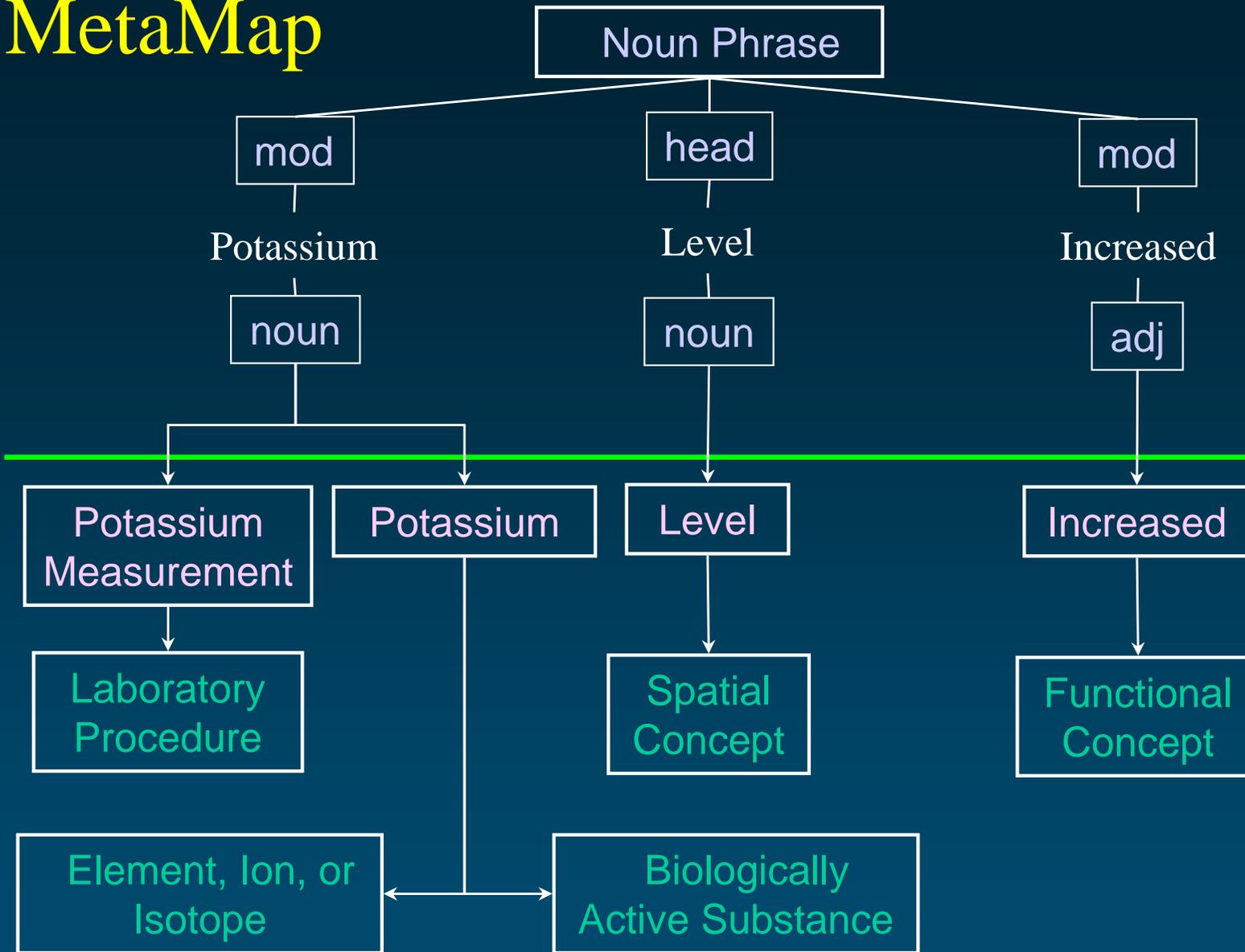
Identify Noun Phrases

MetaMap



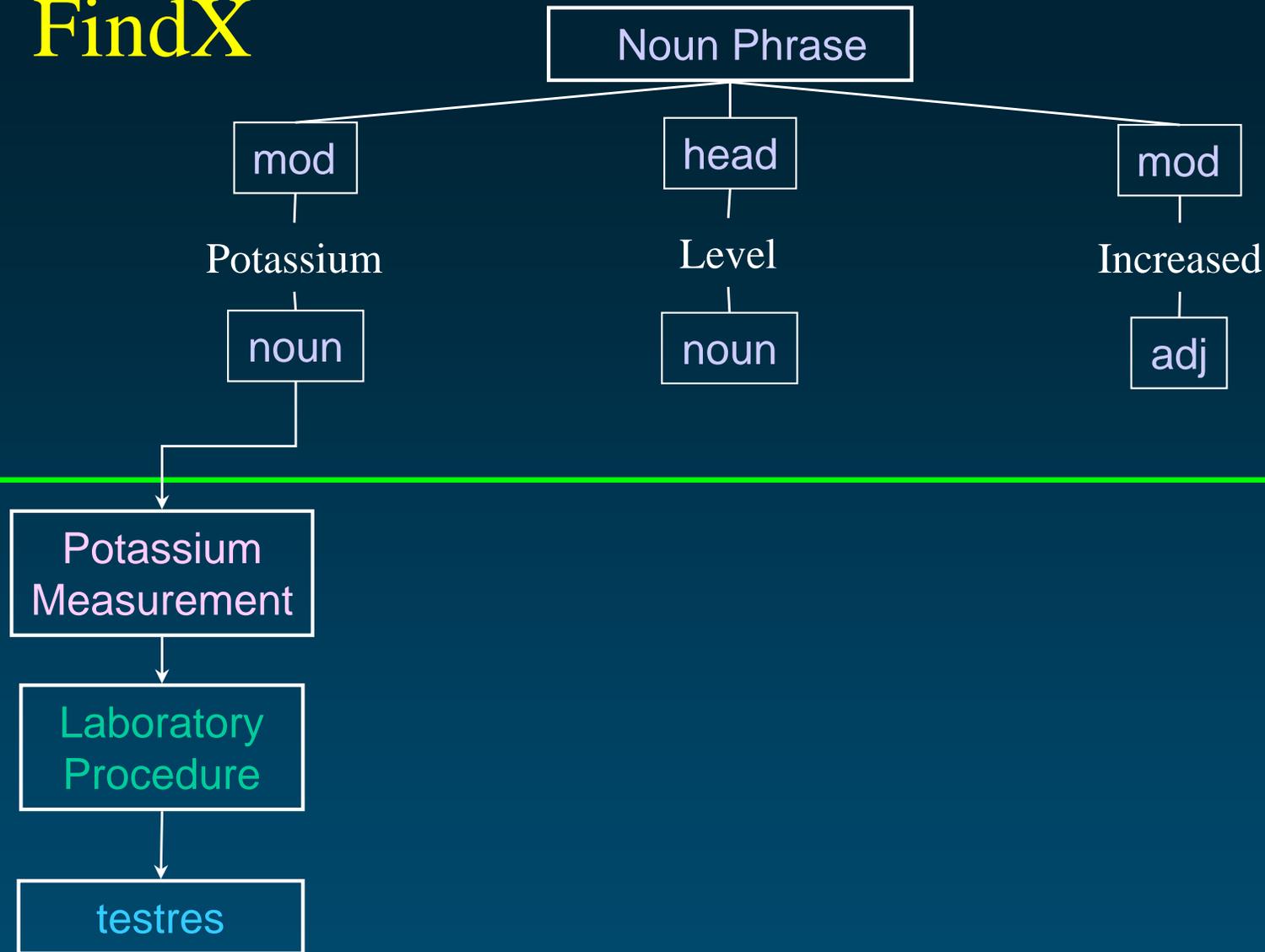
Map to Metathesaurus – Prefer Multiple Concepts

MetaMap



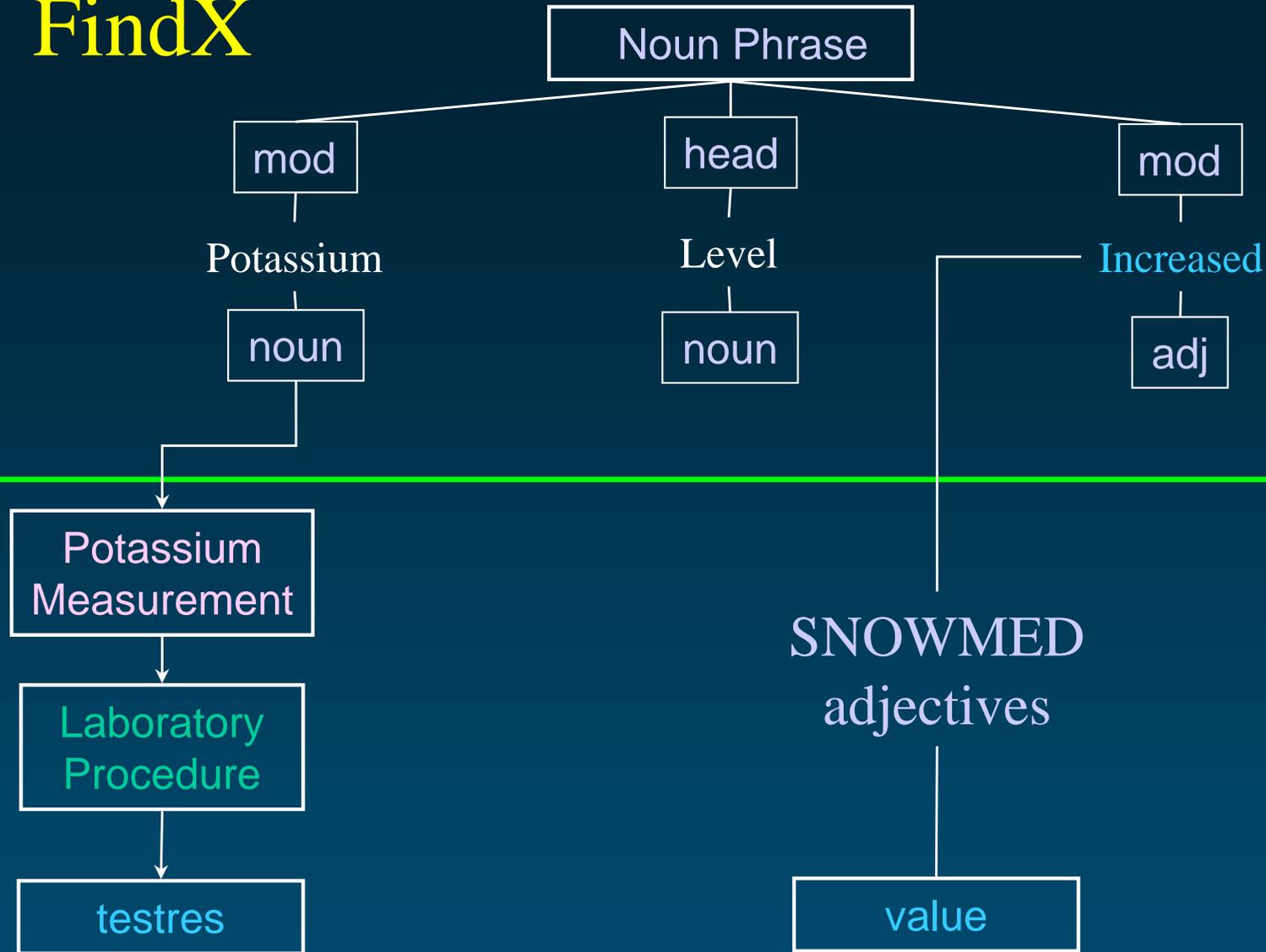
Map to Semantic Network

FindX



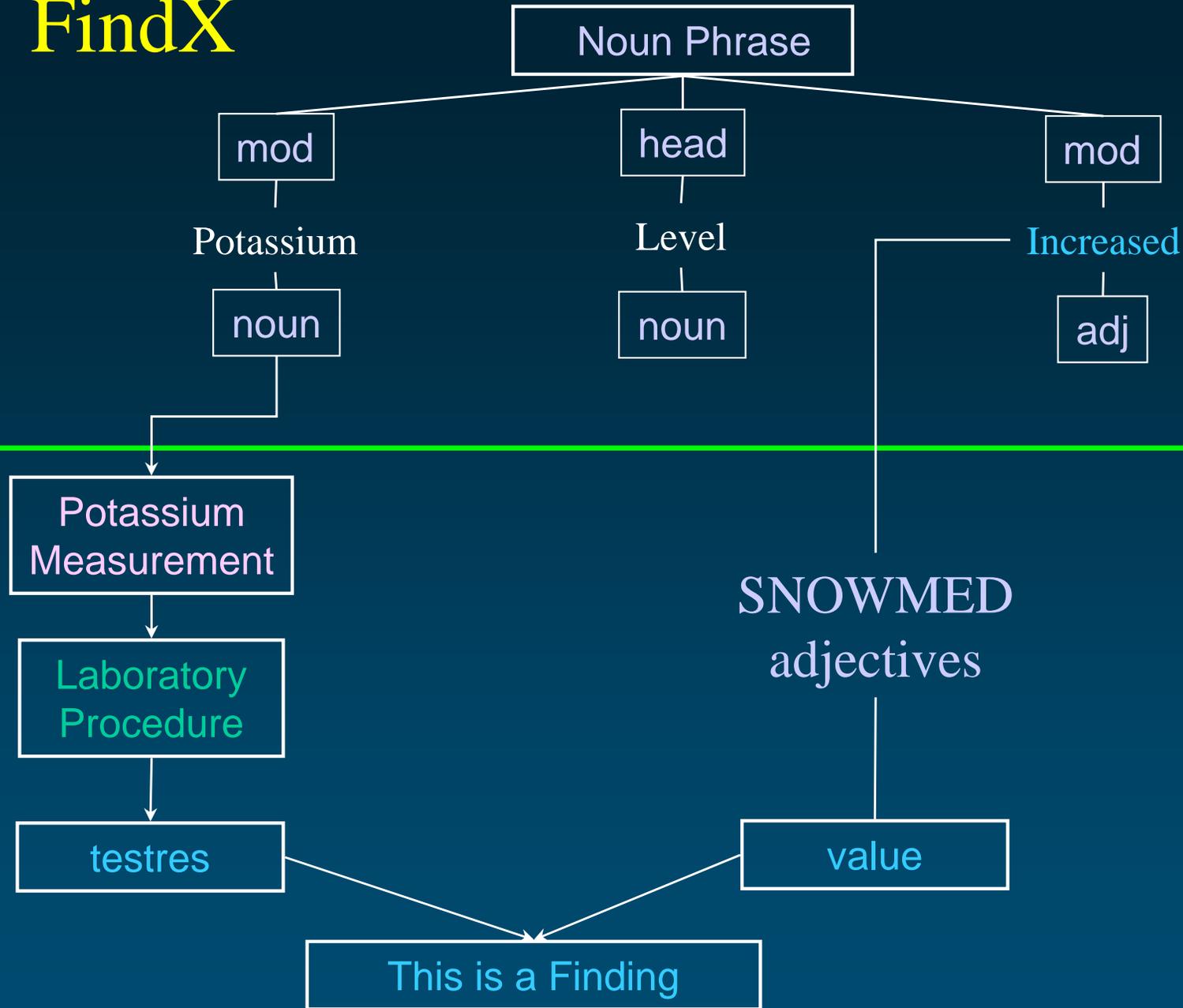
Semantic Grouping

FindX



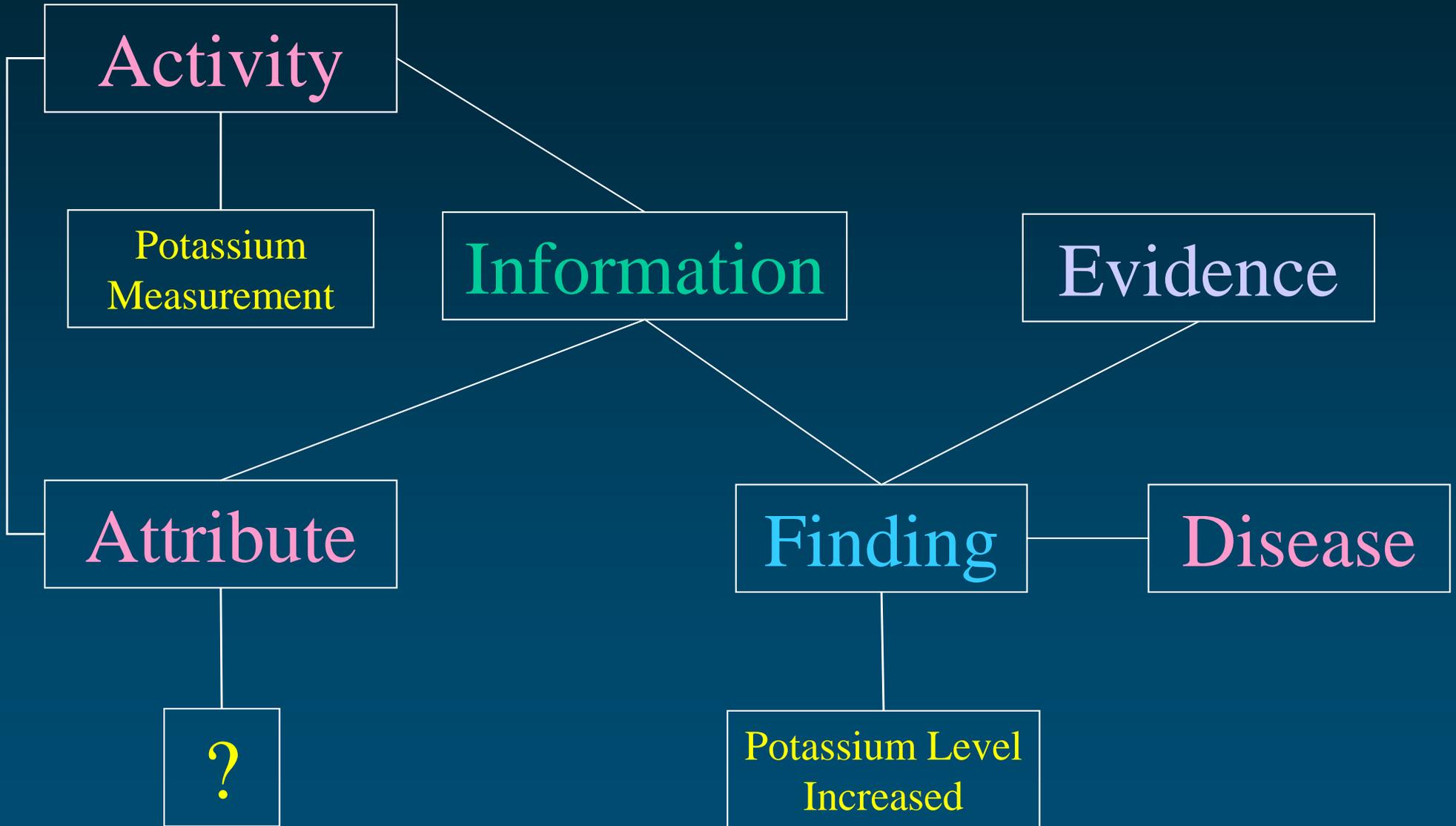
Identify Values

FindX



Apply Rules

Populating the Ontology



FindX

Noun Phrase

mod

Potassium

noun

head

Level

noun

mod

Increased

adj

Potassium
Measurement

Laboratory
Procedure

Potassium

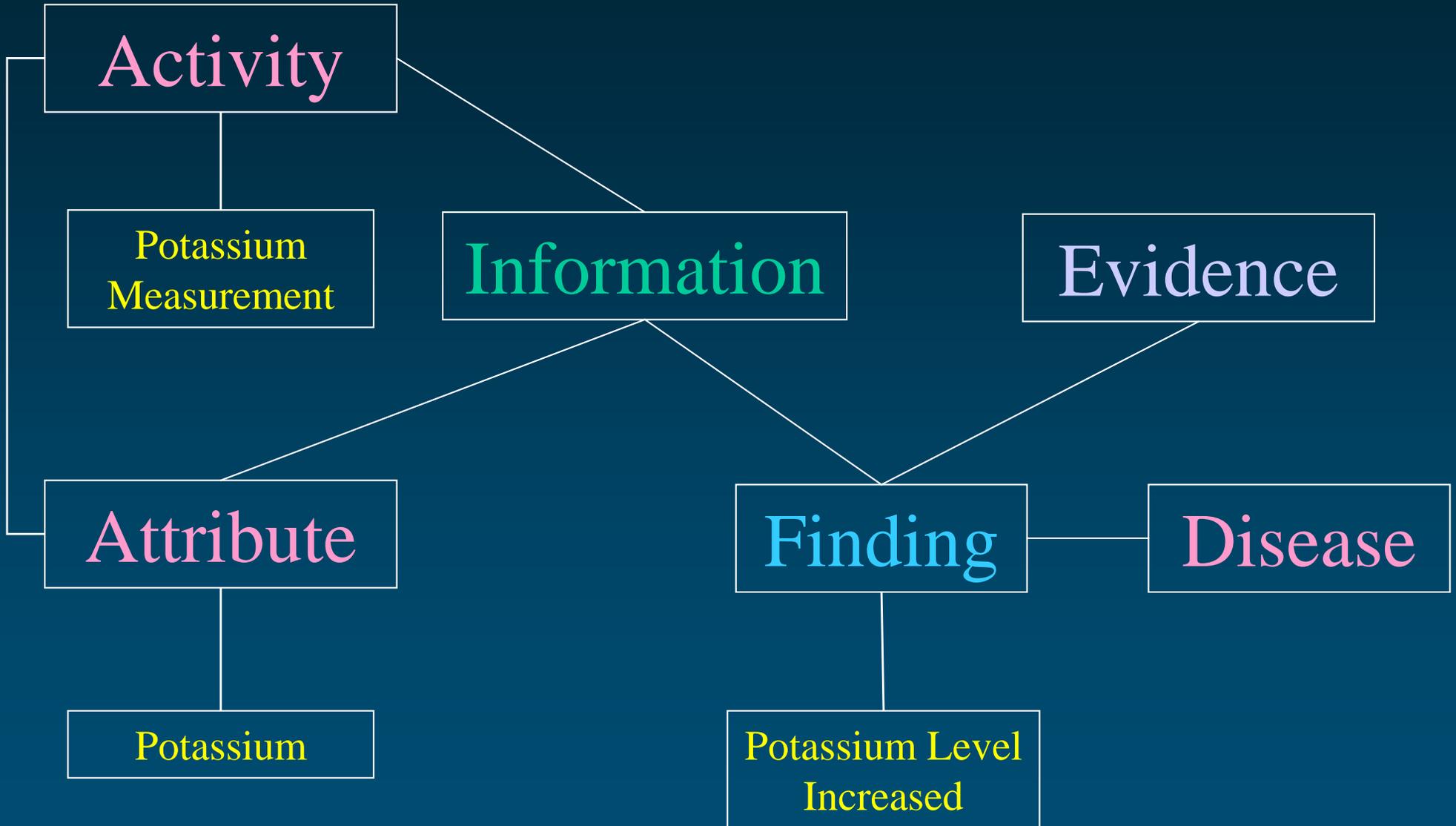
Element, Ion, or
Isotope

Biologically
Active Substance

biosub

Create New Rules

Populating the Ontology



New FindX Rules

- ◆ Biological Substance Rule
- ◆ Pathogen Rule
- ◆ Therapy Rule
- ◆ Abnormality Rule
- ◆ Modified Abnormality Rule
- ◆ Regional Abnormality Rule

Performance

- ◆ Recall and Precision

Special FindX Modifications

- ◆ Clean-up ambiguity designators
 - Arterial Pressure <2>
- ◆ Inflectional variation of SNOWMED adjectives
 - Faeces Discoloured