

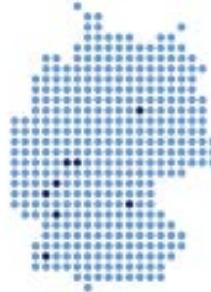


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**MIRACUM Kick-off Symposium  
22nd - 23rd February 2018**

Erlangen



**miracum**

Medical Informatics for Research and Care in University Medicine

**The use of SNOMED CT  
in BMBF MI-I: Opportunities,  
Challenges and Requirements**

# SNOMED CT – An opportunity for MI-I ?

## SNOMED CT The Global Language of Healthcare

© SNOMED International 2018 v1.36.5

SNOMED CT model component	2
Filter results by Refset	
CTV3 simple map	1272
ICD-O simple map reference set	133
Anatomy structure and entire association reference set	89
Anatomy structure and part association reference set	2

Pancreatic divisum	Pancreas divisum (disorder)
Pancreatic abscess	Abscess of pancreas (disorder)
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Pancreatic hormone	Pancreatic hormone (substance)
Pancreatic surgeon	Pancreatic surgeon (occupation)
Pancreatic ascites	Pancreatic ascites (disorder)
Pancreatin capsule	Pancreatin capsule (product)
Pancreatic amylase	Pancreatic amylase (substance)
Pancreatic hormone	Pancreatic hormone (disposition)
Acute pancreatitis	Acute pancreatitis (disorder)
Pancreatic function	Pancreatic function (observable entity)
Groove pancreatitis	Groove pancreatitis (disorder)

Summary Details Diagram Expression Refsets Members References  
Stated Inferred

**Parents**

- Gastrointestinal tract anastomosis - intestine (procedure)
- Repair of pancreas (procedure)

**Pancreas to intestine anastomosis (procedure)**  
SCTID: 43907003  
43907003 | Pancreas to intestine anastomosis (procedure) |  
Pancreas to intestine anastomosis  
Pancreaticoenterostomy  
Drainage of pancreas by anastomosis  
Enteropancreatostomy  
Pancreas to intestine anastomosis (procedure)

Method → Anastomosis - action  
Procedure site - Direct → Pancreatic structure

Method → Anastomosis - action  
Procedure site - Direct → Intestinal structure

**Children (6)**

- Distal subtotal pancreatectomy with pancreaticojejunostomy (procedure)
- Ileopancreatostomy (procedure)
- Pancreaticocystoenterostomy (procedure)
- Pancreaticoduodenostomy (procedure)
- Pancreaticojejunostomy (procedure)
- Pancreaticojejunostomy, side-to-side anastomosis (procedure)

# SNOMED CT – An opportunity for MI-I ?

- Covers all aspects of the EHR, providing metadata ("concepts") for semantic interoperability of clinical data
- ~300k clinical concepts (disorders, findings, procedures, observables, organisms, products, substances, qualities, ...)
- Terms in several languages  
(no official German translation)
- Increasing world-wide acceptance
- Computable and Extensible
- International standard, governed by a non-profit SDO ("SNOMED International", former IHTSDO)

# SNOMED CT – Yet another standard?

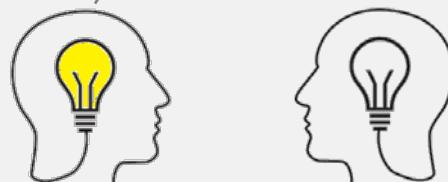
current

There are **n** competing semantic standards

soon

There are **n + 1** competing semantic standards

"**n**? Ridiculous !  
Let's develop one global, universal standard that covers everybody's use cases"



HL7 NCIT ICD LOINC  
IDMP ICPC DICOM HPO  
RxNORM MedDRA ADT  
MeSH OPS Abdamed

HL7 NCIT ICD ICPC HPO  
IDMP DICOM SNOMED CT  
RxNORM MedDRA ADT  
MeSH OPS Abdamed



# Designed to interface with other standards

The screenshot shows the FHIR website's navigation bar with links to Home, Getting Started, Documentation, Resources, Profiles, and Extensions. Below the navigation bar, a breadcrumb trail shows 'Terminology > Code Systems > SNOMED CT'. A red box highlights the 'Using Codes' tab under the 'Code Systems' section. A grey arrow points from this highlighted area towards the center of the slide.

The screenshot shows the LOINC website's navigation bar with links to Learn, Content, Downloads, Community, and Donate. Below the navigation bar, a section titled 'COLLABORATION' features the 'SNOMED International' logo. A grey arrow points from this section towards the center of the slide.

Regenstrief and the SNOMED International are working together to link LOINC and SNOMED CT

## 4.2.1.0 Using SNOMED CT with FHIR

# SNOMED CT



Leading healthcare terminology, worldwide

## 4. Short Term (July 2017, Jan 2018 International Release)

The short term goals of the SNOMED Drug project will include an agile, risk adverse approach in the area of drug products specifically to;

- 4.1. Provide coarse level content internationally, supporting granularity at national level.
- 4.2. Focus on international requirements and regulations, such as initial IDMP alignment to support interoperability defined by the [use cases](#) and remove some barriers of adoption.

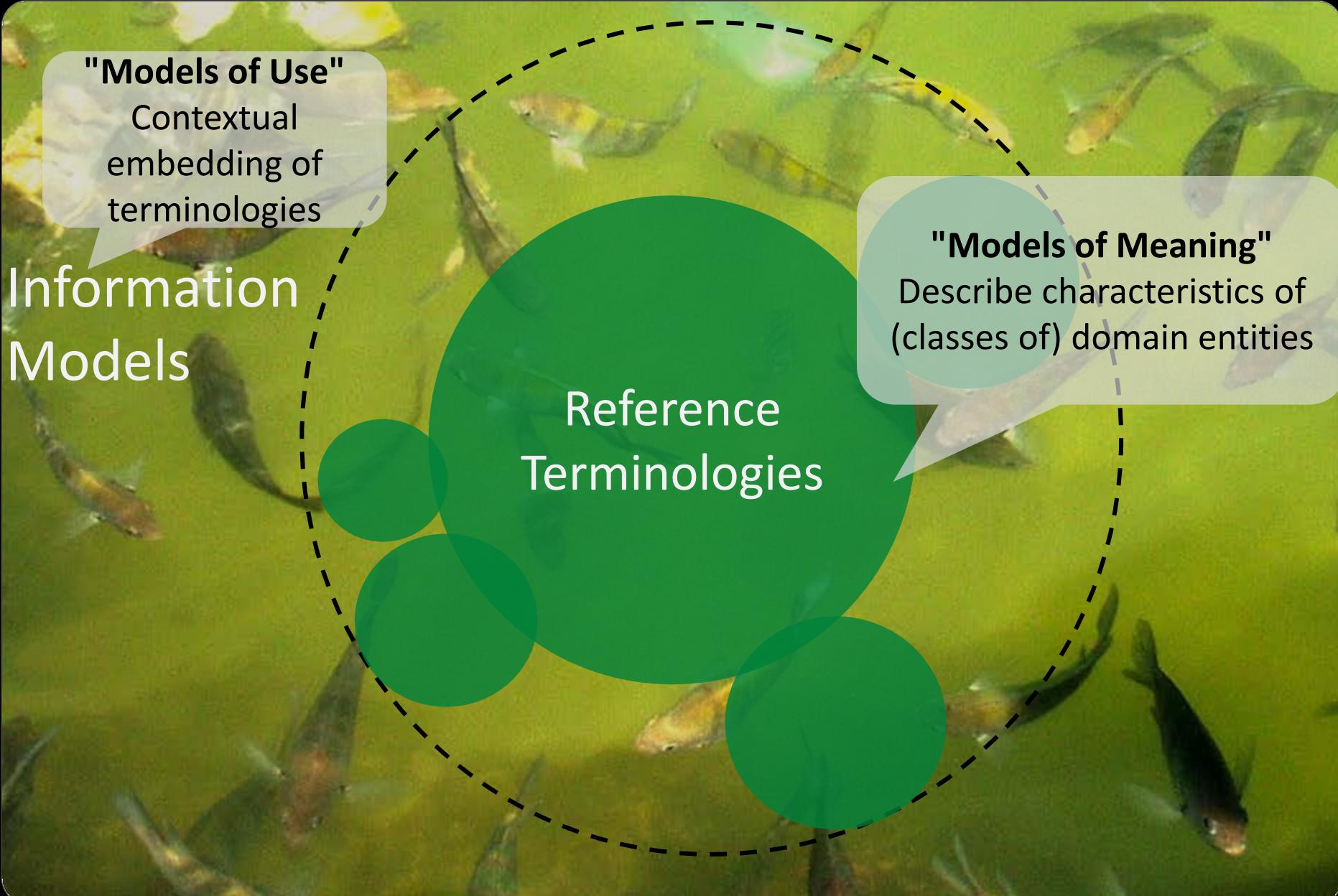


INTERNATIONAL HEALTH TERMINOLOGY STANDARDS DEVELOPMENT ORGANISATION

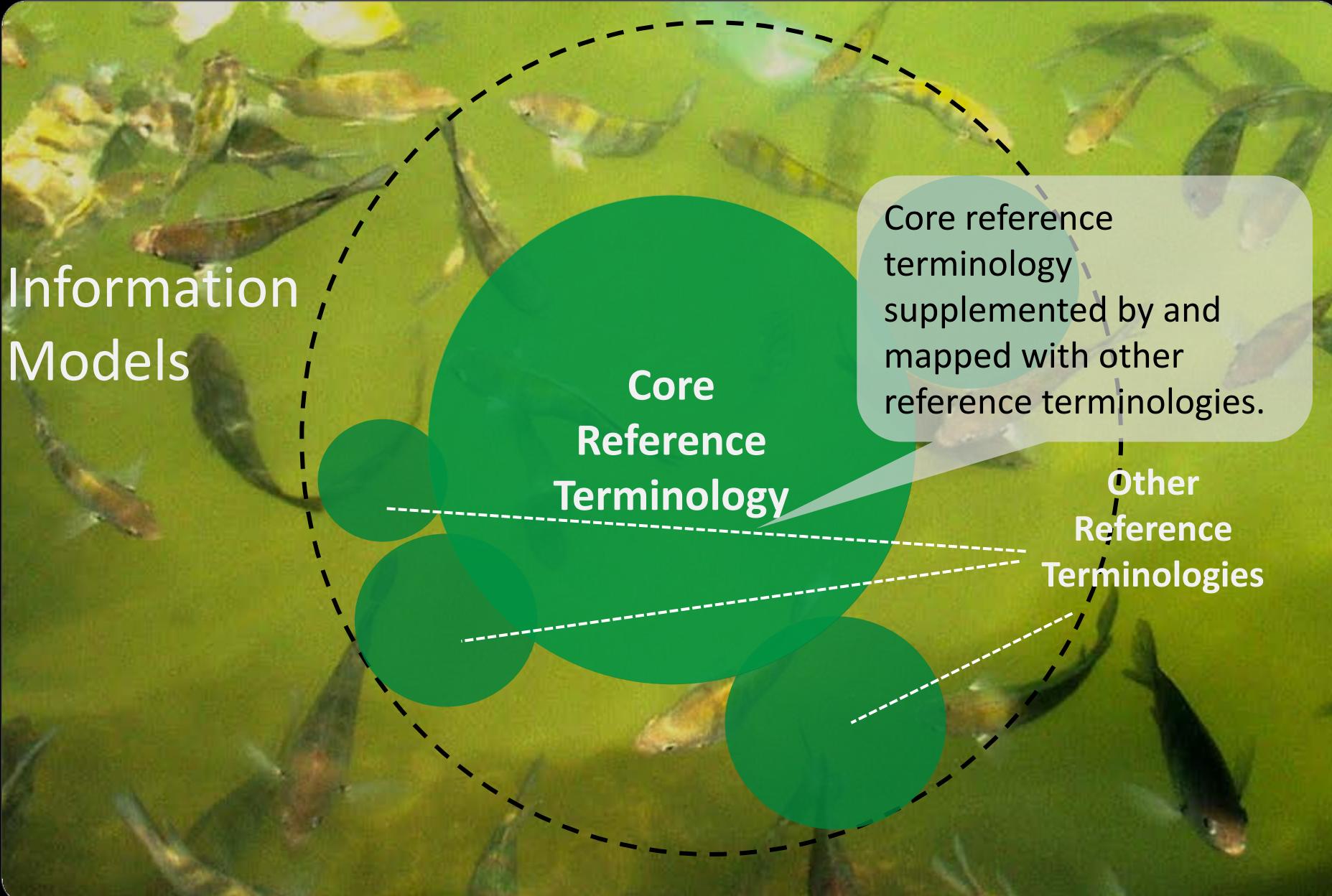


GMDN and IHTSDO sign Cooperation Agreement

# Interoperability ecosystem



# Interoperability ecosystem



# Interoperability ecosystem

Information Models

Core  
Reference  
Terminology

Aggregation  
Terminologies  
(Classifications)

AT<sub>4</sub>

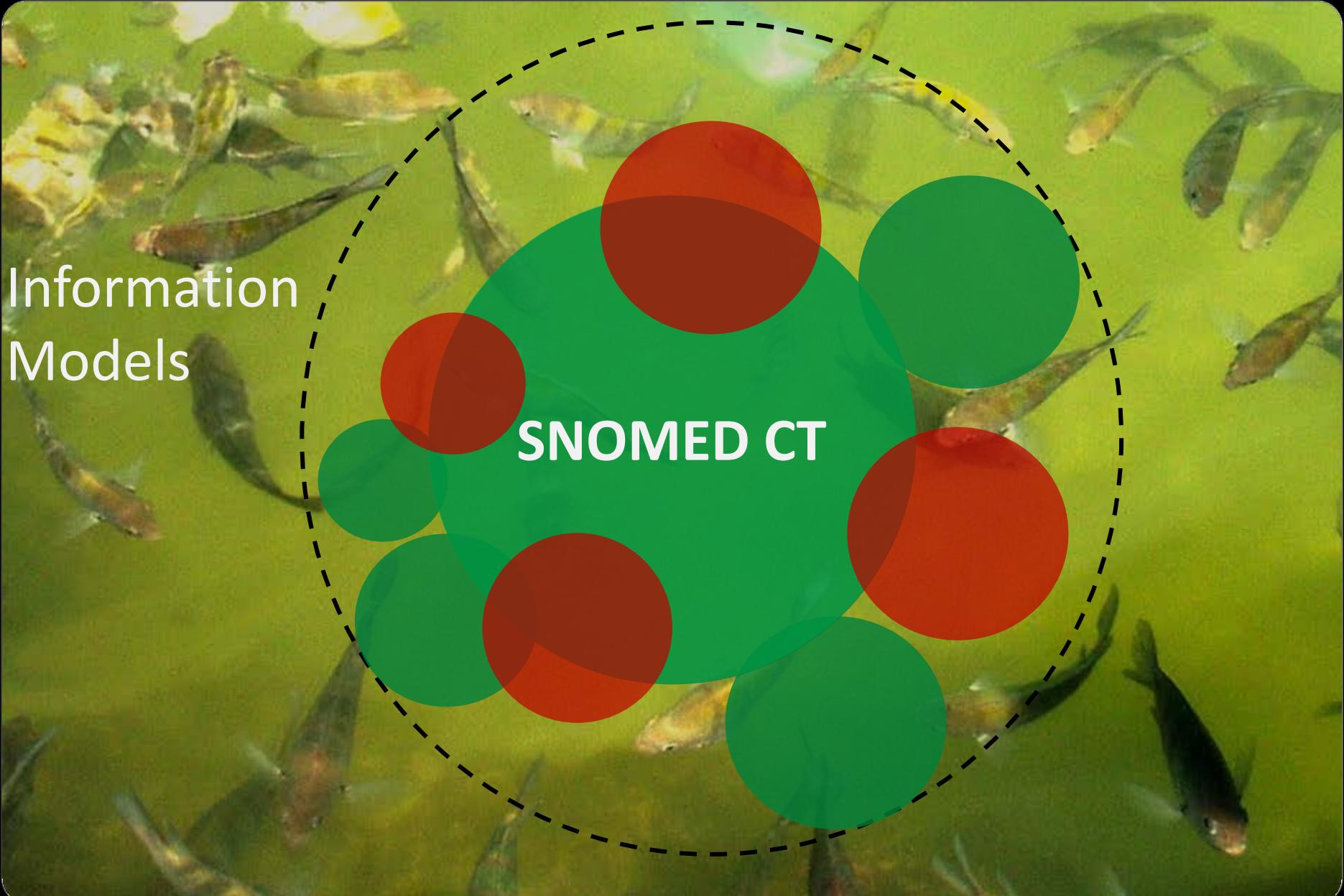
AT<sub>2</sub>

AT<sub>3</sub>

AT<sub>1</sub>

AKA classification systems:  
non-overlapping classes in  
single hierarchies, for data  
aggregation and ordering

# Interoperability ecosystem



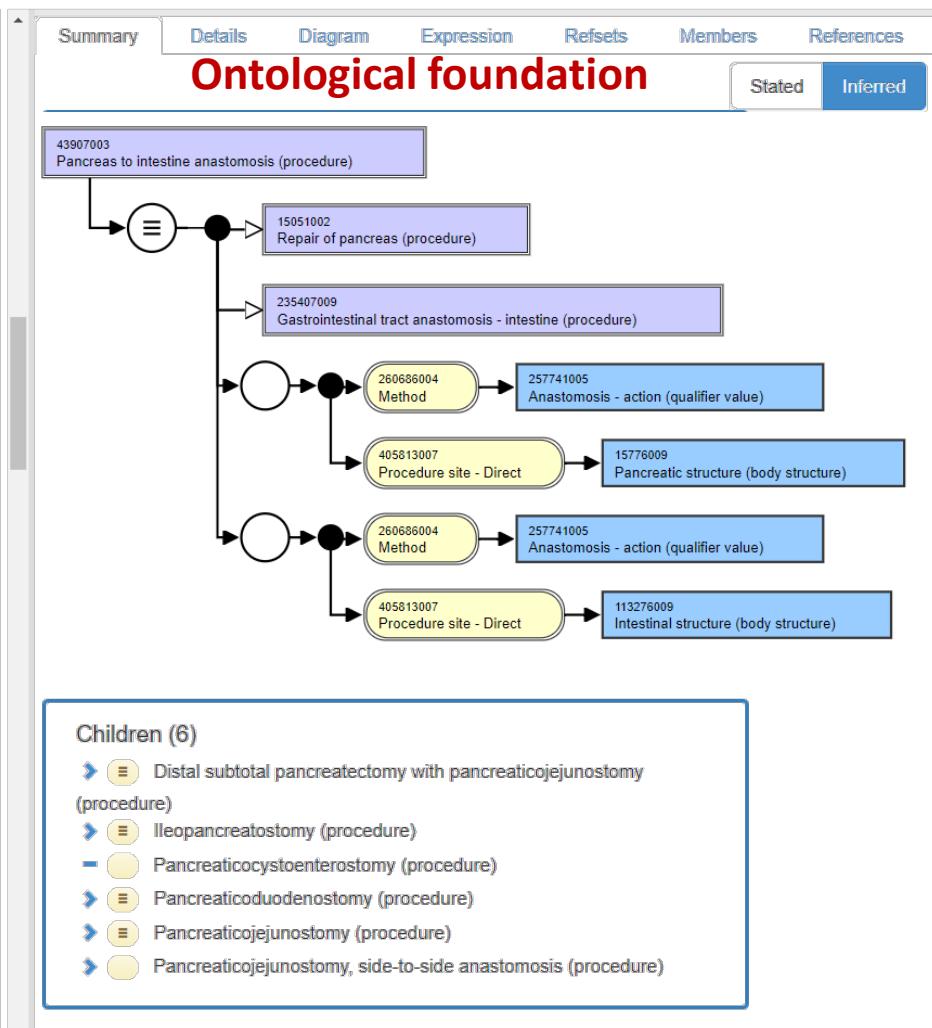
# SNOMED CT: reference terminology

## SNOMED CT The Global Language of Healthcare

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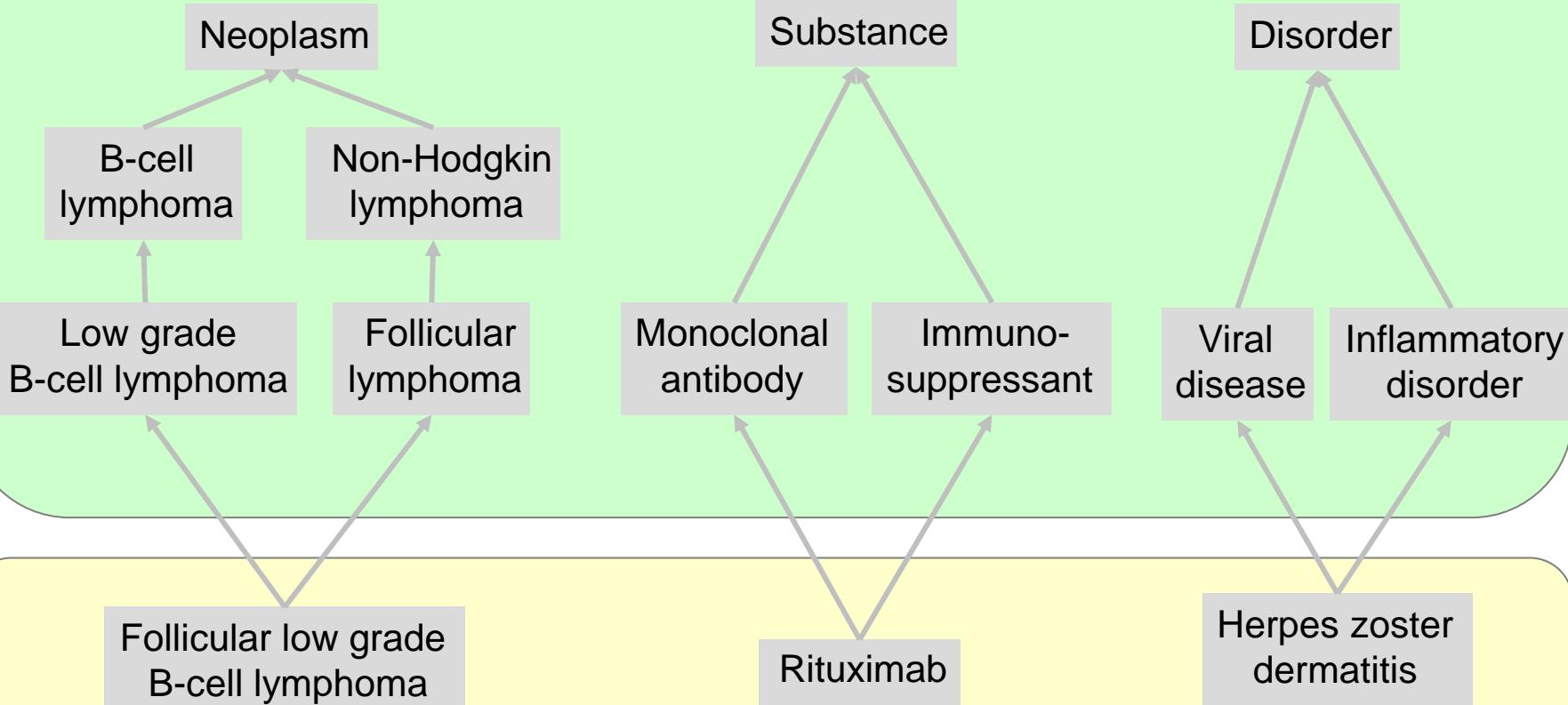
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# SNOMED CT – Structural benefits (I): Polyhierarchies

*aggregated concepts for querying*



*detailed patient-level encoding*

# SNOMED CT – Structural benefits (II): Co-ordination



## Pre-coordination

"Verbrennung 2. Grades eines einzelnen Fingers"

211908006 |Deep partial thickness burn of a single finger (disorder)|

≡

<<< 29673001 |Second degree burn of single finger, not thumb (disorder)| :  
{ 116676008 |Associated morphology| = 262588000 |Deep partial thickness burn  
(morphologic abnormality)| ,363698007 |Finding site| = 56213003 |Skin of  
finger (body structure)| }

## Post-coordination

"Verbrennung 2. Grades der Rückseite des rechten Zeigefingers"

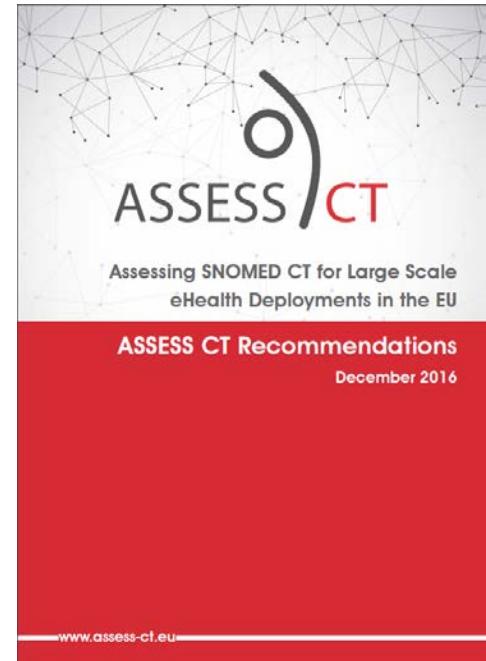
<<< 29673001 |Second degree burn of single finger, not thumb (disorder)| :  
{ 116676008 |Associated morphology| = 262588000 |Deep partial thickness burn  
(morphologic abnormality)| ,363698007 |Finding site| = 37314006 | Skin  
structure of dorsal surface of index finger (body structure) | , 272741003  
|Laterality| = 24028007 |Right (qualifier value)| }

# SNOMED CT – Challenges for MI-I

- Three major scenarios of use
  - SNOMED CT codes linked to (small) value sets for structured data entry
  - SNOMED CT as vocabulary for manual annotation of unstructured text
    - broad coverage of clinical jargon in medical texts
    - dealing with ambiguous expressions
    - known low inter-annotator agreement with large vocabularies (ASSESS-CT)
  - SNOMED CT as a vocabulary for machine annotations of clinical text

# ASSESS CT recommendations

- "SNOMED CT is the best candidate for a core reference terminology for cross-border, national and regional eHealth deployments in Europe."
- SNOMED CT adoption must be part of a wider, strategy for optimising the benefits of semantic interoperability in health data
- The adoption of SNOMED CT should be realised incrementally rather than all at once
- Mechanisms should be established to facilitate and co-ordinate European Member State co-operation on terminology and semantic interoperability
- SNOMED CT should be part of a terminology ecosystem, including international aggregation terminologies and as wells as local user interface terminologies, which address multilingualism in Europe and clinical communication with multidisciplinary professional and lay language



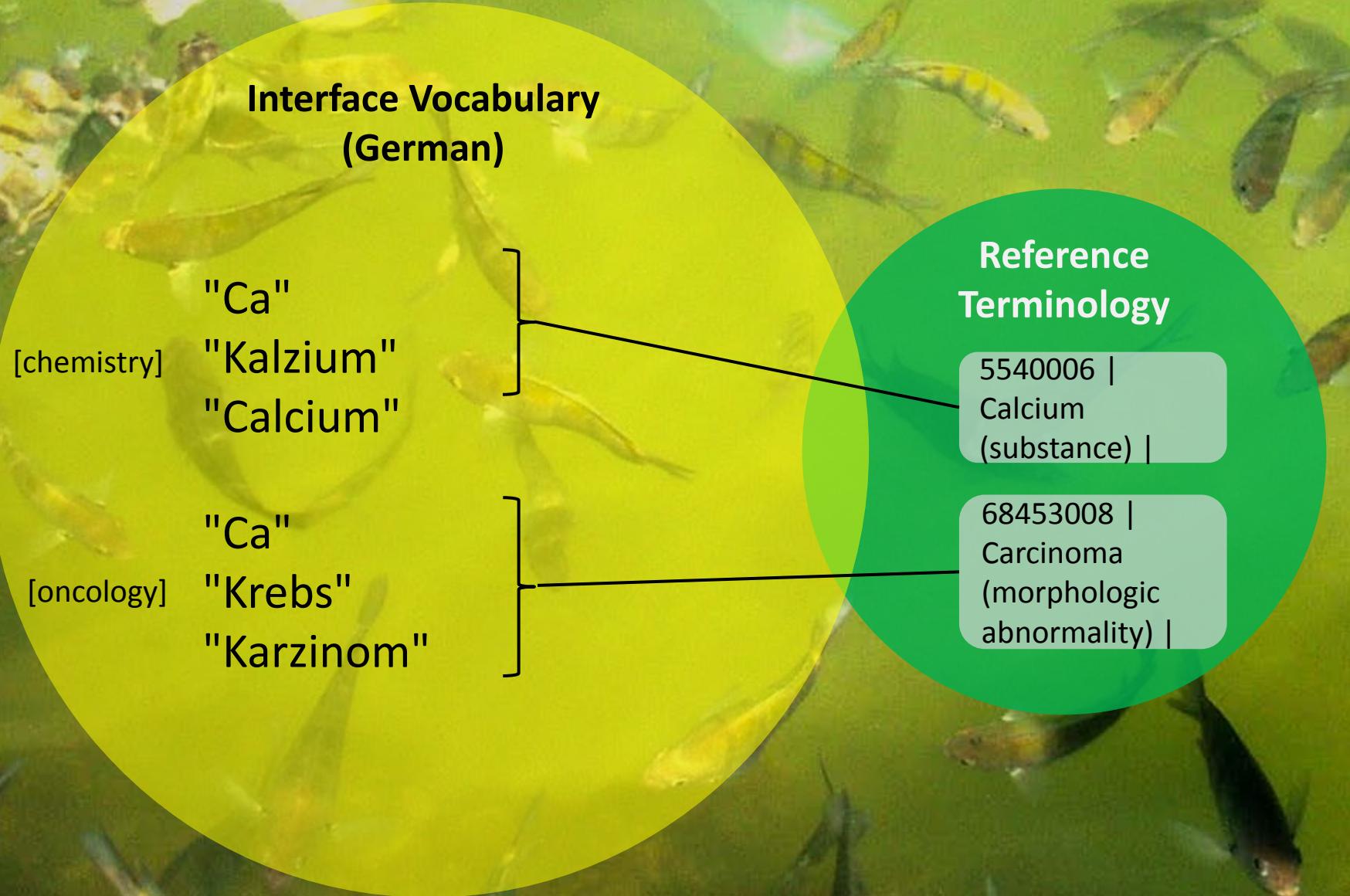
# Interoperability ecosystem

Information  
Models

**User Interface  
Vocabulary  
(language specific)**

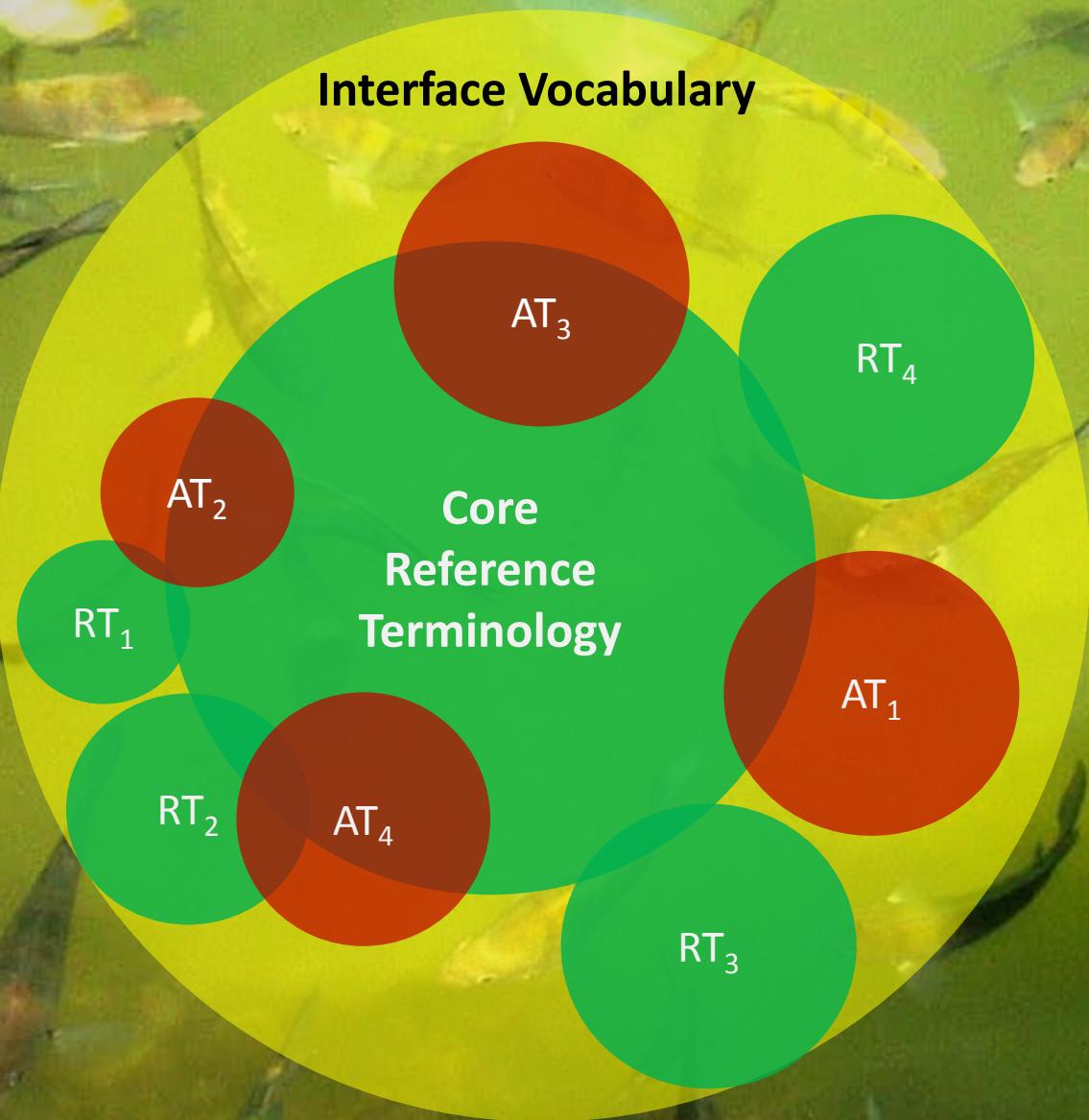
- Collections of terms used by end users.
- Terms often ambiguous.
- Abbreviations frequent
- Language, dialect, user group specific

# Interoperability ecosystem

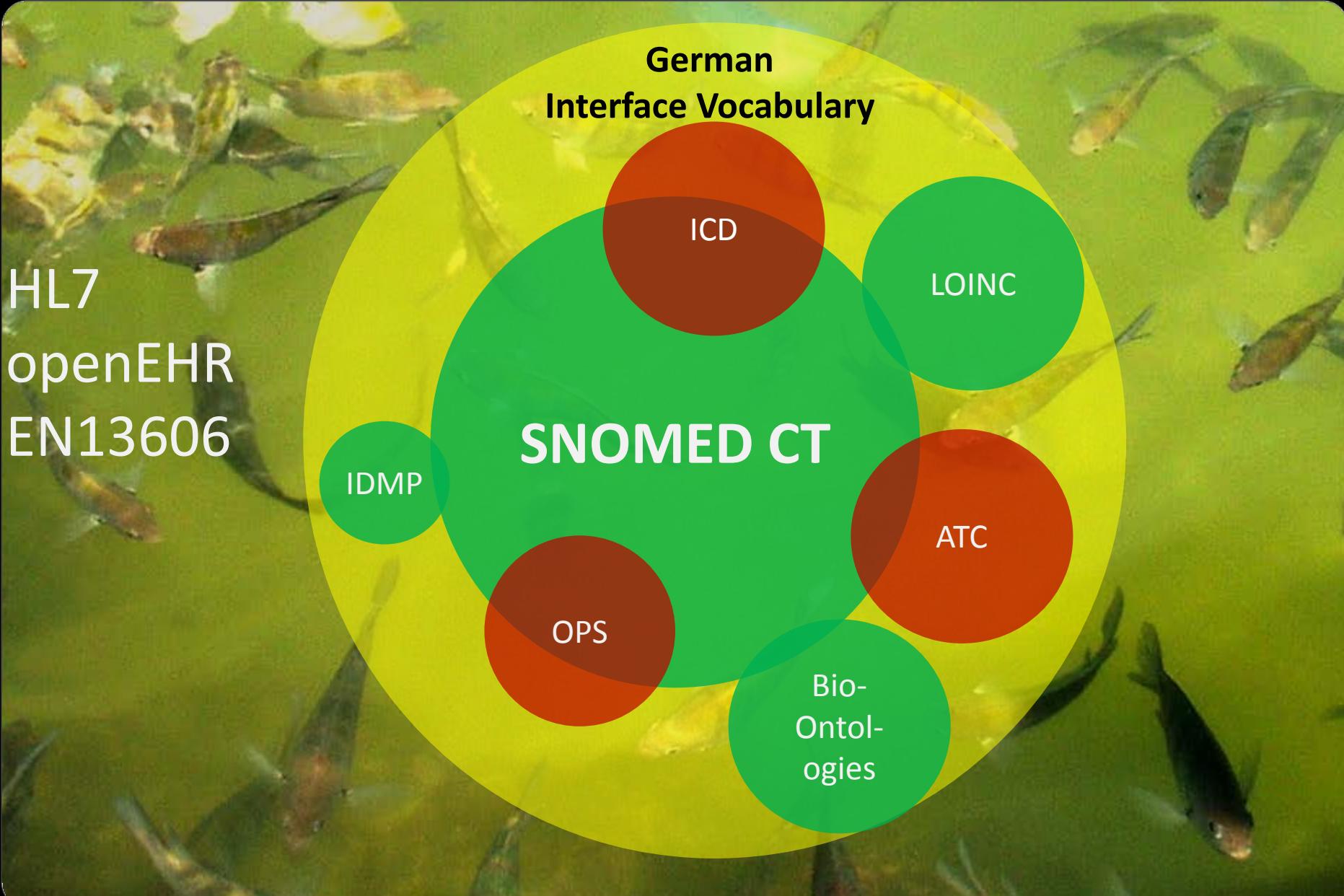


# Interoperability ecosystem

Information  
Models



# Interoperability ecosystem



# SNOMED CT – Requirements for MI-I

- Acquire a SNOMED CT licence
  - Project-specific free research licence
  - Membership of SNOMED International (IHTSDO)
- Build and maintain German-language interface vocabulary
  - Joint effort of MI-I, in cooperation with international partners (Switzerland, Austria)
  - Use case driven
  - Crowdsourcing approach
  - In concert with advanced human language technology
- Experience: SNOMED CT Interface Vocabulary currently created at Medical University of Graz (Austria)

# Preferred terms ≠ Interface terms

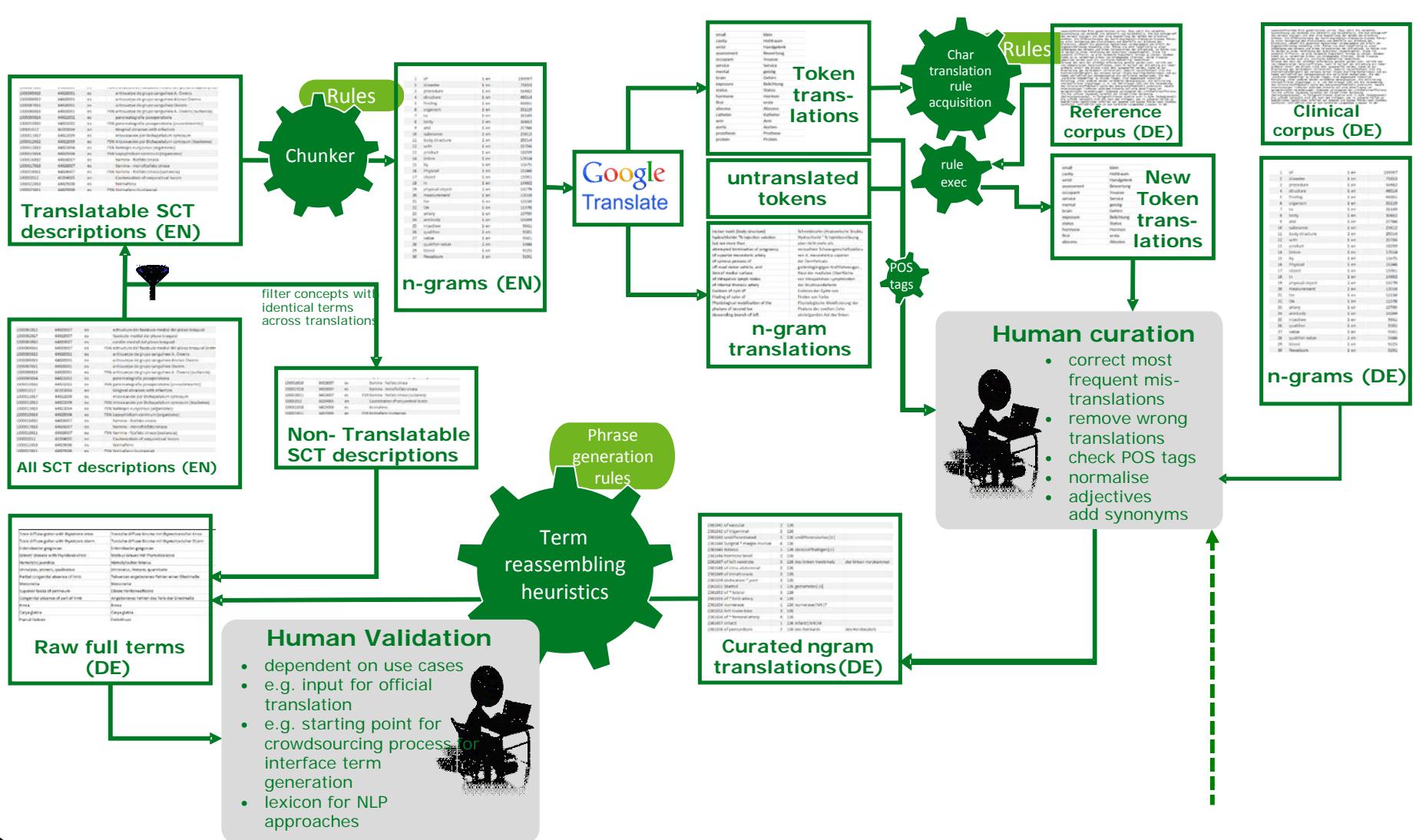
- Term occurrences in corpus of 30k cardiology discharge summaries (Med. Univ. Graz)

Preferred term (ICD, OPS)	Count	Interface term	Count
Aortenklappenstenose	3749	Aortenstenose	3126
Hirninfarkt	7	Schlaganfall	65
Elektrokardiogramm	0	EKG	12208
Koronare Herzerkrankung	331	KHK	18455
Nicht-ST-Hebungsinfarkt	498	NSTEMI	3839
Magnetresonanztomographie	2	NMR	17

# MUG-GIT (Medical University of Graz – German Interface Vocabulary for SNOMED CT)

- Motivation: semantic EHR extracts for biomarker research (CBmed IICCAB\*)
- Approach
  - Split of SNOMED CT terms into word n-grams
  - Manual editing of derived core vocabulary
  - Priority: term frequency and use cases
  - German terms from clinical corpora and terminologies
- Current state
  - Approx. 2 Million machine-generated interface terms, out of 95,000 n-gram translations
  - Core vocabulary maintained by medical students, guideline-driven (e.g. inclusion of word stems, spelling rules, acronyms only in context)

# MUG-GIT: Creation of German Interface Vocabulary for SNOMED CT



# Word ngram – core vocabulary

vaginal	1	1478 vaginales JJ	Scheiden-	
fluoroscopic guidance	2	1477 Durchleuchtungskontrolle NN F		
disc	1	1476 Scheibe NN F		
lower limb	2	1473 unteres JJ Extremität NN F	Bein NN N	
brain	1	1468 Gehirn NN N	Hirn NN N	Encephalon NN N
preparation	1	1464 Zubereitung NN F	Aufbereitung NN F	Präparation NN F
method	1	1463 Verfahren NN N	Methode NN F	
of bone	2	1462 des Knochens	_Knochen_	
Red	1	1455 rotes JJ		
Monitoring	1	1453 Überwachung NN F	Monitoring NN N	
Computed	1	1453 berechnetes JJ	Computer-	
phalanx	1	1449 Phalanx NN F		
subsp.	1	1449		
anastomosis	1	1447 Anastomose NN F	Anastomosierung NN F	
vessel	1	1446 Blutgefäß NN N	Gefäß NN N	
Computed tomography	2	1443 Computertomographie NN F		
uterus	1	1436 Uterus NN M	Gebärmutter NN F	
difficulty	1	1432 Schwierigkeit NN F		
elbow	1	1429 Ellbogen NN M	Cubitus NN M	Ellbogengelenk NN N
high	1	1429 hohes JJ		
food	1	1423 Lebensmittel NN N	Speise NN F	Nahrungsmittel NN N
Observation	1	1423 Beobachtung NN F		
using fluoroscopic	2	1422		
unable	1	1421 unfähiges JJ		
Peripheral	1	1419 peripheres JJ		
unable to	2	1418 unfähig zu		
Vascular	1	1417 vaskuläres JJ	Gefäß-	
using fluoroscopic guidance	3	1416 mit Durchleuchtungskontrolle		
Benign neoplasm	2	1415 gutartiges JJ Neubildung NN F	gutartiges JJ Neoplasie NN F	benignes JJ Neoplasie NN F

# Machine-generated Interface terms

20170315_240011_002	126952004	Neoplasm of brain	Gehirneubildung
20170315_240011_003	126952004	Neoplasm of brain	Neubildung des Hirns
20170315_240011_004	126952004	Neoplasm of brain	Hirnneubildung
20170315_240011_005	126952004	Neoplasm of brain	Neoplasie des Gehirns
20170315_240011_006	126952004	Neoplasm of brain	Gehirnneoplasie
20170315_240011_007	126952004	Neoplasm of brain	Neoplasie des Hirns
20170315_240011_008	126952004	Neoplasm of brain	Hirnneoplasie
20170315_240011_009	126952004	Neoplasm of brain	Neoplasma des Gehirns
20170315_240011_010	126952004	Neoplasm of brain	Gehirnneoplasma
20170315_240011_011	126952004	Neoplasm of brain	Neoplasma des Hirns
20170315_240011_012	126952004	Neoplasm of brain	Hirnneoplasma
20170315_241010_001	126953009	Neoplasm of cerebrum	Neubildung des Großhirns
20170315_241010_002	126953009	Neoplasm of cerebrum	Neoplasie des Großhirns
20170315_241010_003	126953009	Neoplasm of cerebrum	Neoplasma des Großhirns
20170315_242015_001	126954003	Neoplasm of frontal lobe	Neubildung des Frontallappens
20170315_242015_002	126954003	Neoplasm of frontal lobe	Neubildung des Lobus frontalis
20170315_242015_003	126954003	Neoplasm of frontal lobe	Neoplasie des Frontallappens
20170315_242015_004	126954003	Neoplasm of frontal lobe	Neoplasie des Lobus frontalis
20170315_242015_005	126954003	Neoplasm of frontal lobe	Neoplasma des Frontallappens
20170315_242015_006	126954003	Neoplasm of frontal lobe	Neoplasma des Lobus frontalis
20170315_243013_001	126955002	Neoplasm of temporal lobe	Neubildung des Temporallappens
20170315_243013_002	126955002	Neoplasm of temporal lobe	Neubildung des Lobus temporalis
20170315_243013_003	126955002	Neoplasm of temporal lobe	Neoplasie des Temporallappens
20170315_243013_004	126955002	Neoplasm of temporal lobe	Neoplasie des Lobus temporalis
20170315_243013_005	126955002	Neoplasm of temporal lobe	Neoplasma des Temporallappens

# Suggestion: collaborative development of SNOMED CT interface dictionary within MI-I

- Rationale
  - Project on data integration / secondary use / semantic search: MI-I, Austria: ELGA, Switzerland: SNOMED CT introduction
  - Need for local vocabulary / value sets
  - Natural language processing of clinical texts
- Dictionary Crowdsourcing platform
  - Bottom-up development of German language interface terms linked to SNOMED CT
  - Term translations, context of use, example annotations
  - Recommender services, user rating
  - Joint ownership of content

# Take home messages for MI-I projects

- MI-I as a **catalyst for SNOMED CT adoption in DE**
- Consider **SNOMED CT as a central part of a semantic ecosystem**, populated by other interfacing standards, e.g. IDMP, LOINC, ICD, HL7 etc.
- **Build a terminology task force** across all MI-I project and collaborate with other SNOMED CT users / adopters in the D-A-CH countries
- Focus on the **collaborative building of a German clinical interface vocabulary** linked to SNOMED CT, using state-of-the are crowdsourcing technology



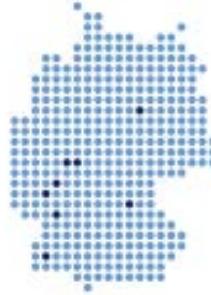
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Erlangen



# miracum

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## Acknowledgements:

