ODLS 2017 Ontologies & Data in Life Sciences

Basics of a drug ontology for annotations of clinical narratives

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Ontologies for Text Annotations

- Manually annotated texts: key resource for model-based information extraction
- Annotation scheme
  - clear-cut criteria
  - high reliability
  - no ambiguity
- Are ontologies good as annotation schemes
- Are their specific requirements / difficulties?

Use case: annotation of drug mentions

- Identification of drugs during a hospital stay crucial for quality assurance, detection of adverse events, retrospective studies, …
- In many hospitals across Europe: No computerised drug prescription, only paper notes
- Mentions of drugs in progress notes, nursing documentation, discharge letters
- Difficulties
  - ambiguities, misspellings, constantly new drugs
  - mention of drugs in many different contexts

Example drug annotations in prescription section

Thrombo	Ass	100mg	0-1-0				
DrugName	DrugName	Strength	Regimen				
Sortis	80mg	0-0-1					
DrugName	Strength	Regimen					
Pantoloc	ret.	47,5mg	1	-	0	-	1
DrugName	DrugName	Strength	Regimen	Regimen	Regimen	Regimen	Regimen
Seloken	DA	2-0-0					
DrugName	DrugName	Regimen					
Oleovit	D3	1x	wöchentlich	(Do)			
DrugName	DrugName	Regimen	Regimen	Regimen			
Thyrex	10 mg	mg	1-0-0				
DrugName	Strength	Strength	Regimen				
Torasemid	1-0-1						
DrugSubstance	Regimen						
Antiflat	5mg	3	x	3	ml	bei	Blähungen
DrugName	Strength	Regimen	Regimen	Regimen	Regimen	Other	Other
Xatral	forte	0-0-0-1					
DrugName	DrugName	Regimen					
Dominal	25mg	1-0-0					
DrugName	Strength	Regimen					
Marcoumar	laut	Pass	bitte	um	Gerinnungskontrolle	beim	HA
DrugName	Other	Other	Other	Other	Other	Other	Other
Laevolac	3x2EL						
DrugName	Regimen						
Hypren	Kapseln	3x1					
DrugName	DoseForm	Regimen					
Bioflorin	500mg	p.	o.	1-0-0			
DrugName	Strength	Route	Route	Regimen			
Tavanic	40mg	s.c.	1x1	abends			
DrugName	Strength	Route	Regimen	Regimen			
Urosin	300	mg	dzt.	pausiert			
DrugName	Strength	Strength	Other	Other			

Typical Drug-related information in other document sections

- *Past history*:
  - "History of amphetamine abuse"
- *Allergies:*
  - "No known Penicillin allergy"
- *Evolution*
  - "after antibiotic treatment"
  - "Beta blockers suspended"
- *Lab findings*
  - "Carbamazepine serum level 5 µg/ml"

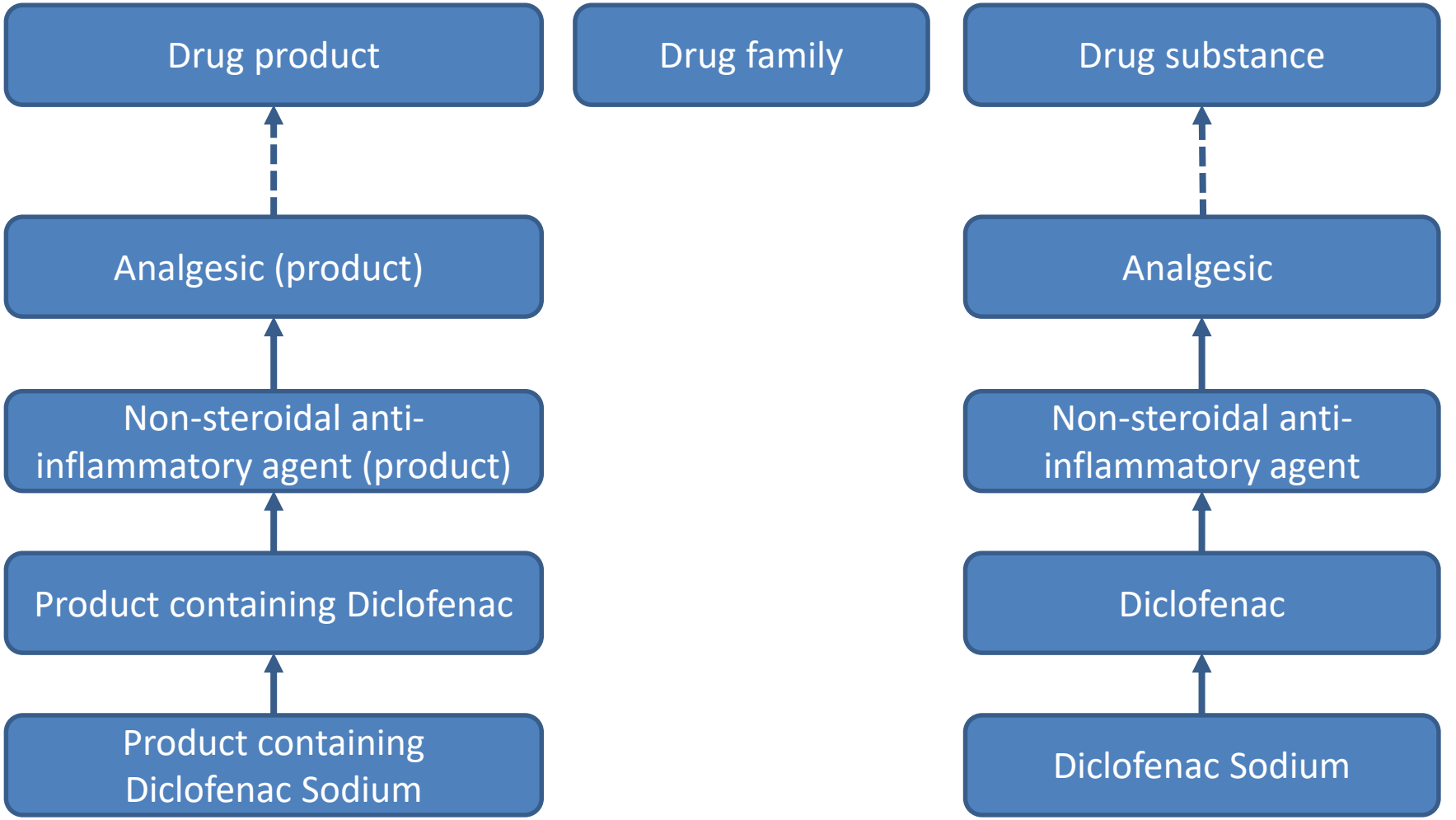
Dimensions of annotation

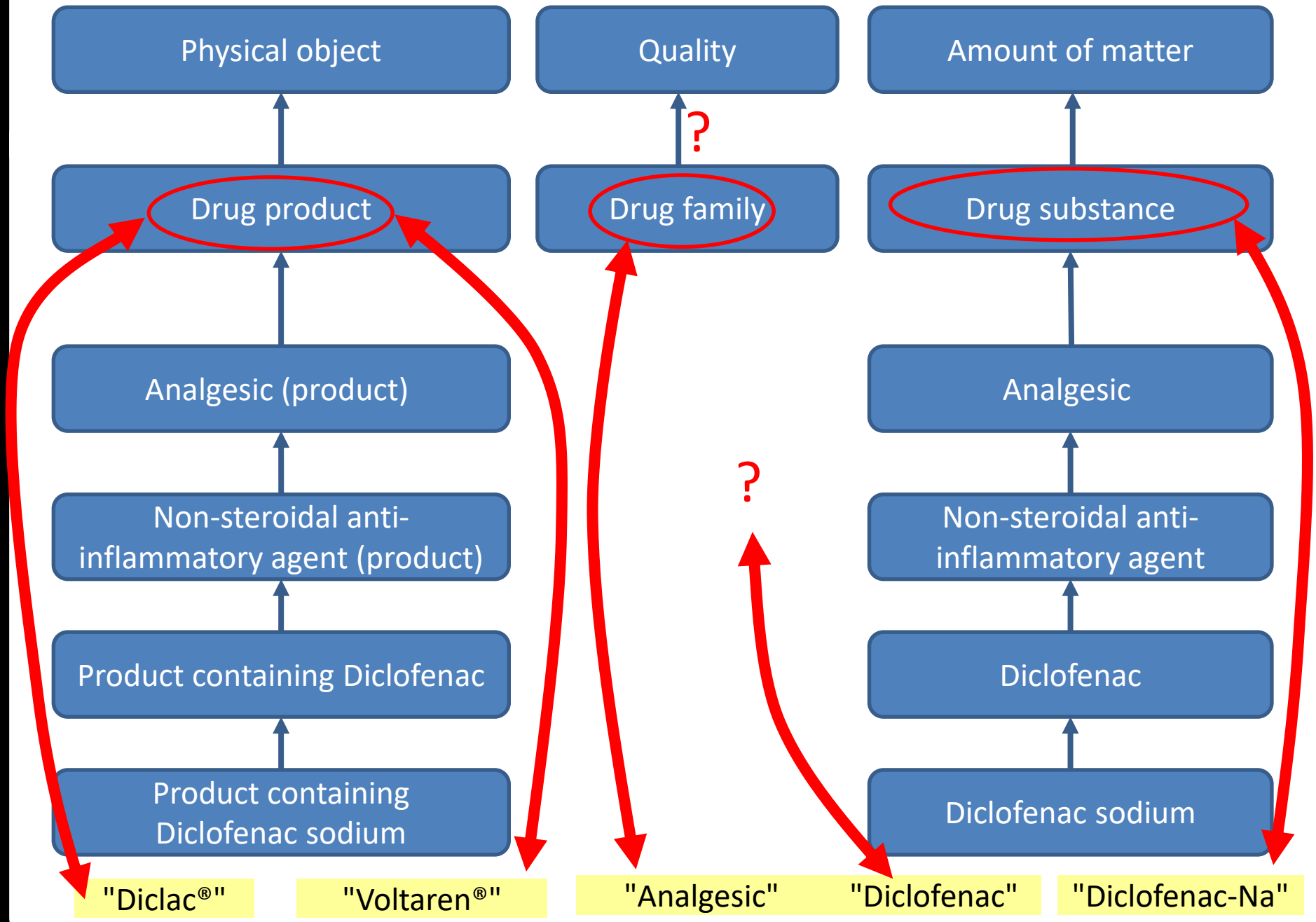
- Drug:
  - Drug substance, drug product, drug family, strength, dose form
- Administration:
  - Route ("oral"), regimen ("bd", "1-0-1"), other instructions ("before meal"), trigger conditions ("rectal temperature > 39°C)
- Context
  - current vs. past
  - prescribed, administered, suspended, changed
  - drug related risks, dispositions

Ontological issues: Drug

- Drug substance:
  - Amount of matter, mostly chemically defined, e.g. Diclofenac
- Drug product:
  - mostly industrially manufactured and registered, Brand name, e.g. Voltaren®
  - Drug products have drug substances as active ingredients
- Drug family
  - Non-terminal class in drug substance or drug product tree
  - Boundary issues

Example


Drug product
Drug family
Drug substance
Analgesic (product)
Analgesic
Non-steroidal anti-inflammatory agent (product)
Non-steroidal anti-inflammatory agent
Product containing Diclofenac
Diclofenac
Product containing Diclofenac Sodium
Diclofenac Sodium
"Diclac®"
"Voltaren®"
"Analgesic"
"Diclofenac"
"Diclofenac-Na"

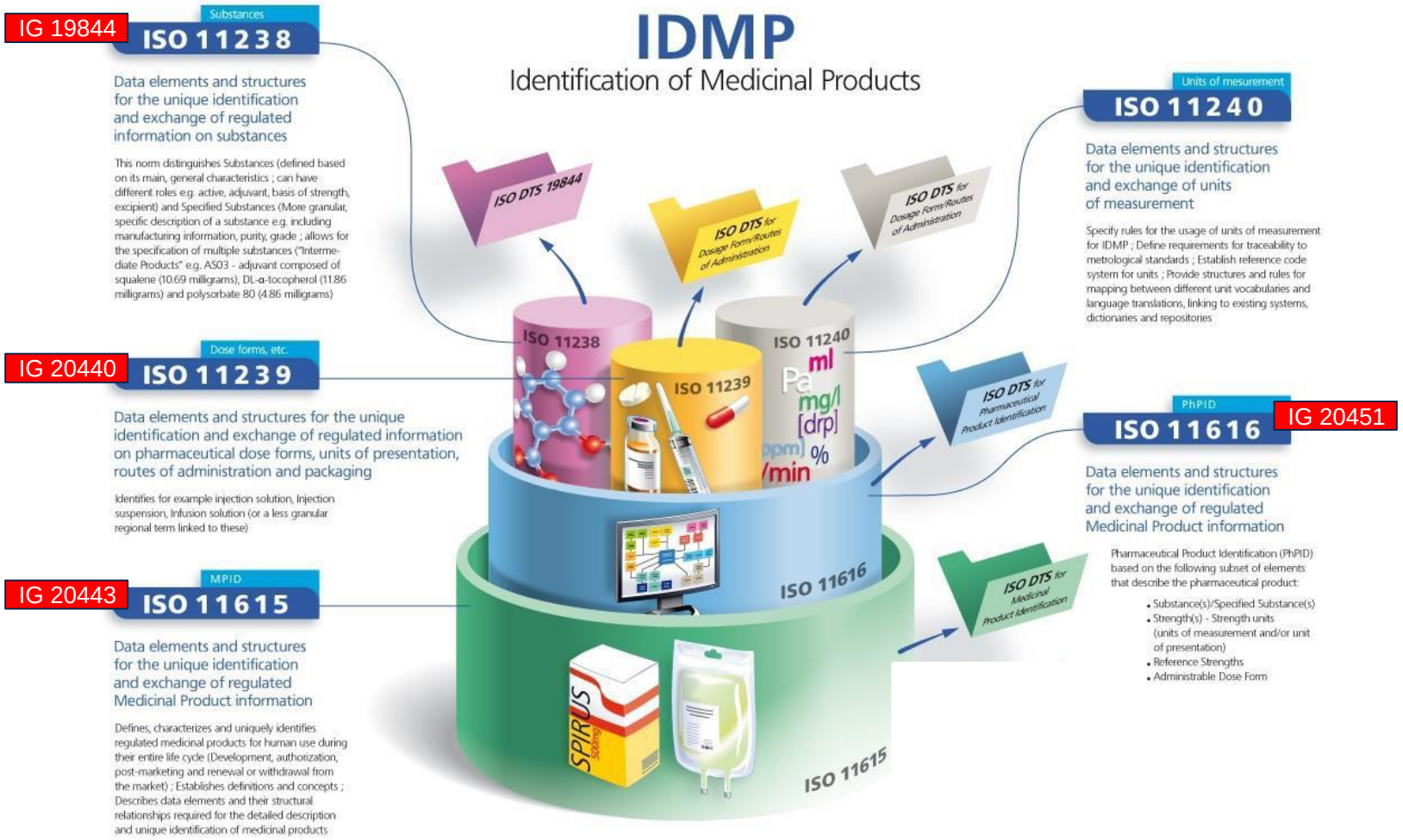

Physical object
Quality
Amount of matter
?
Drug product
Drug family
Drug substance
Analgesic (product)
Analgesic
?
Non-steroidal anti-inflammatory agent (product)
Non-steroidal anti-inflammatory agent
Product containing Diclofenac
Diclofenac
Product containing Diclofenac sodium
Diclofenac sodium
"Diclac®"
"Voltaren®"
"Analgesic"
"Diclofenac"
"Diclofenac-Na"

Denotation

- Link between text sequence ("entity") and classes (concept) or logical expressions
  - Drugs, dose forms, regimen
- Context expressed by processual entity involved
  - administrating, prescribing etc.
- Epistemic status of denotation
  - e.g. if prescribed at discharge high likelihood that it has been given during hospital stay
  - drug allergy reported by patient vs.
  - drug allergy incident documented in EHR.

Denotation

- Type (*DenotingEntity* and
  btl2:represents only
  (*MedicationPrescription*
  and **btl2:hasOutcome** some *DrugX*
  and **btl2:hasOutcome** some *DoseFormX*
  and **btl2:hasOutcome** some RegimenX
  and **…**))
- Type (*DenotingEntity* and **btl2:hasPart** some *HighLikelyhood* and **btl2:represents** only
  (*MedicationPrescription*
  and **btl2:hasOutcome** some *DrugX* and …))
- Type (*DenotingEntity* and
  btl2:represents only
  (*D* and **btl2:isIncludedIn** some *BloodSample*) and
  btl2:isbearerof some (*Concentration* and …)



Source: ISO, 2012