Food-Drug Interaction Evidence Ontology (FIDEO)

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September 2020

Motivation

- Certain foods contain chemical substances that may interact with drugs
- Unexpected consequences
  - Increasing or reducing the effect of a drug
  - Treatment failure
  - Toxicity
  - Higher risk of side-effects
- Similar to drug interactions but there is limited research on extracting and representing these interactions

Food-Drug Interaction Examples

- Altered absorption of drugs by **fatty, high protein and fiber diets**
- **Grapefruit juice** drug interactions - inhibition of CYP3A enzymes
- **Milk products** with antibiotics
- Food containing **tyramine** (matured cheese, red vine, ripped bananas, yogurt, shrimp paste and salami) with Monoamine Oxidase Inhibitors
- Vegetables high in **vitamin K** (broccoli, Brussels sprouts, kale, parsley, spinach) with warfarin

Materials

- Stockley's Drug Interactions
- Thériaque database
- POMELO 2017
  - Limited coverage of food-drug interactions
  - Annotations done by one expert
  - No annotation guide
- 20 articles selected by hand
  - Corpus annotated by two groups of experts
  - Annotation guide
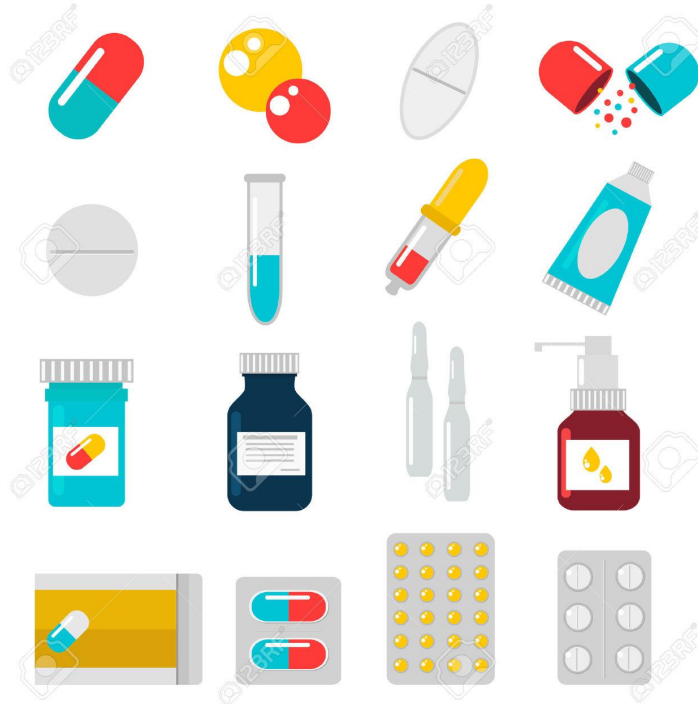 - Consensus established

METHONTOLOGY Methodology

- Specification
- Knowledge acquisition
- Conceptualisation
- Integration
- Implementation
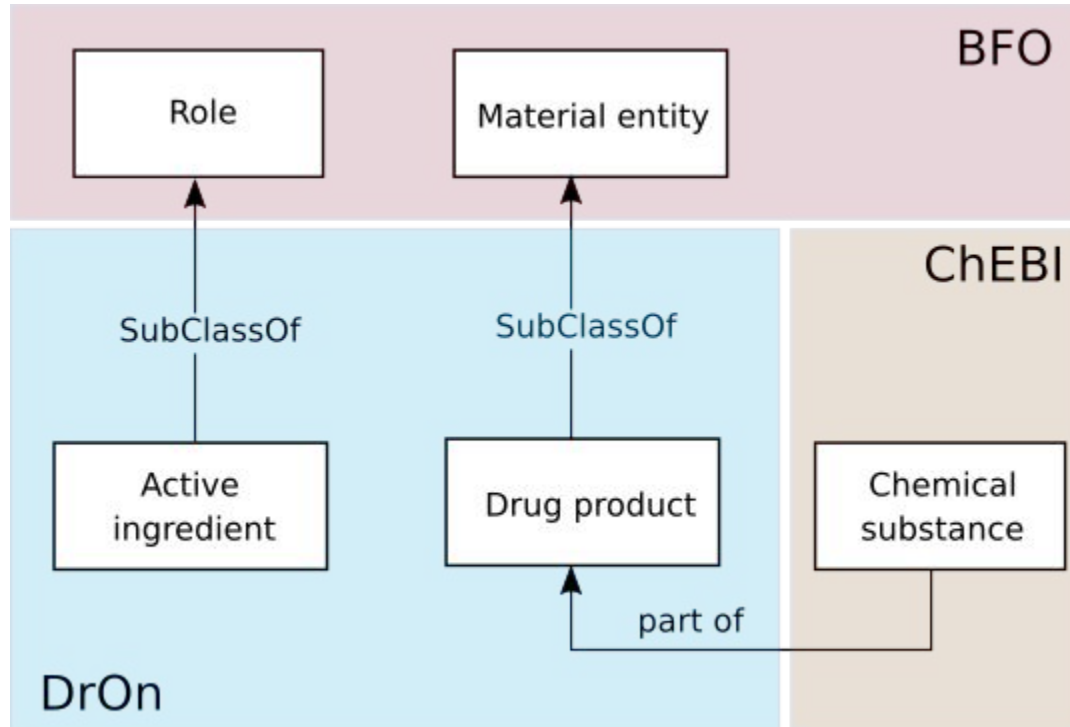- Evaluation

FIDEO Ontology: Core concepts

Upper ontology: Basic Formal Ontology (BFO)

- Object Drug
- Precipitant Food
- Food-Drug Interaction
- Interaction mechanism
- Related Evidence
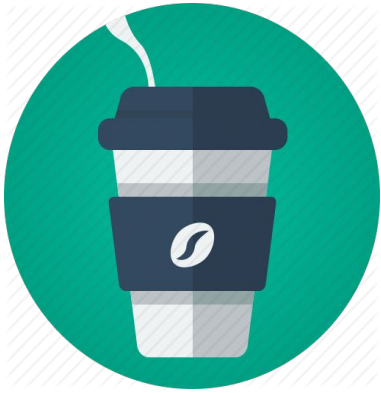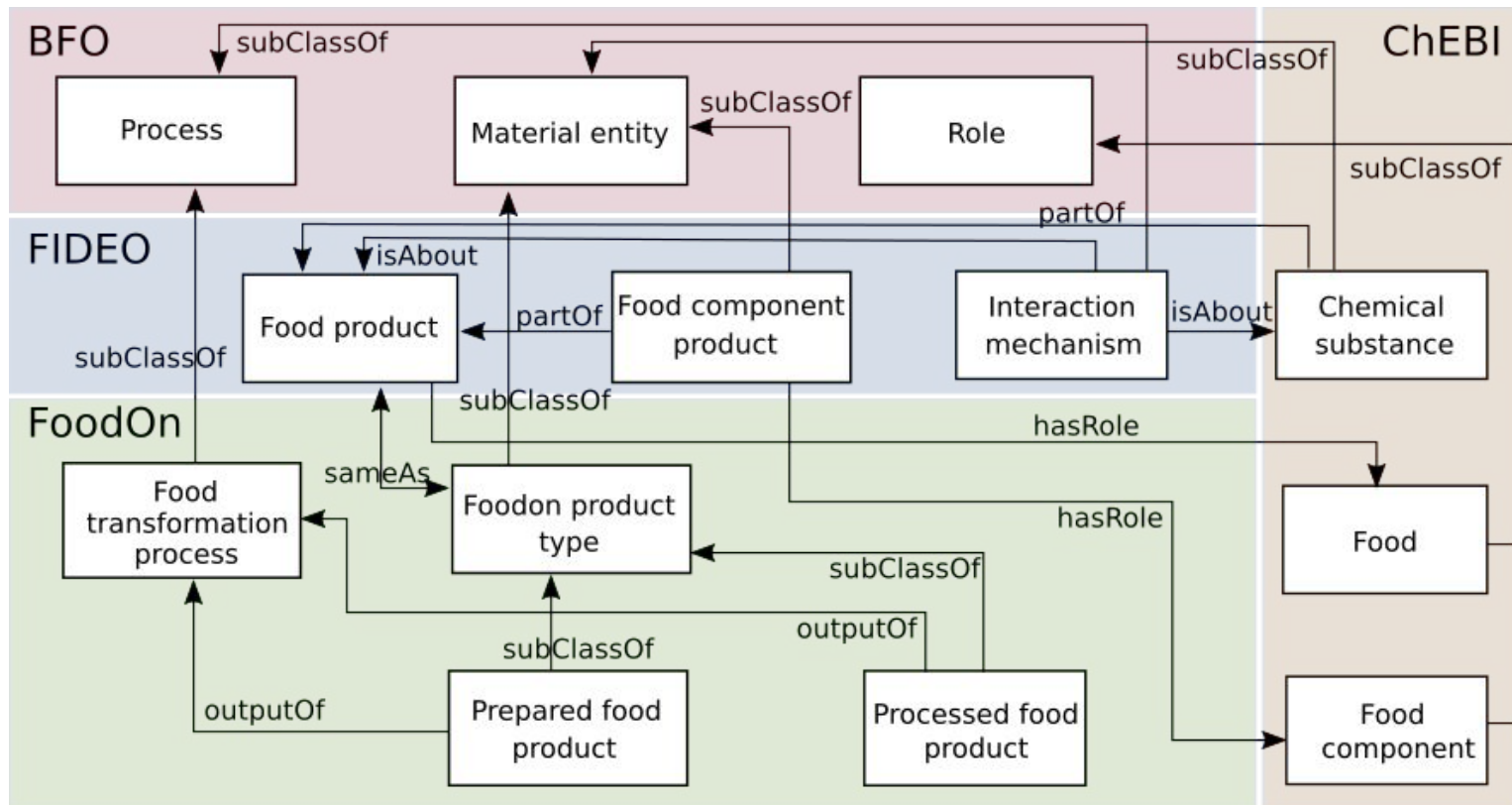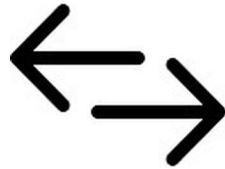
Modeling the Drugs Domain

Drug Ontology (DrOn)

Modeling the Food Domain

Grounding food concepts on BFO

Modeling Food-Drug Interactions (FDIs)

Drug-Drug Interaction Ontologies

DIDEO (Drug Interaction and Evidence Ontology)
- Potential Drug-Drug Interaction
  - DIDEO:'potential drug-drug interaction' SubClassOf **IAO:'information content entity'**
- Drug-Drug Interaction
  - DIDEO:'drug-drug interaction' SubClassOf
  - **GO:'biological process'**
- Evidence
  - DIDEO:'evidence information content entity' SubClassOf **IAO:'information content entity'**

Evaluation

- 82% of drugs and 90% of drug classes found in ChEBI
- 62% of foods and 76% of food components found in FoodOn

Drugs	Drug classes	Foods	Food categories	Interactions	Interaction mechanisms
134	4	76	2	569	18

Conclusions

- **Ontology design**
  FIDEO extends drug interaction ontologies for food-drug interactions by modeling foods using FOODON
- **Entity Linking**
  Incomplete coverage of foods involved in food-drug interactions
- **Future work**
  Interaction mechanisms represented using the Interaction Network Ontology (INO)

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