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Representing Foods Potentially Involved in Food-Drug Interactions using FoodOn

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Motivation Convenience, safety and reduced costs are some of the reasons that make the oral route a preferred method for drug administration in clinical practice. But a main limitation of this route of administration is related to the way drugs move through the digestive tract because of their likely association with other drugs and foods, which may affect how much and how fast a drug is absorbed. To prevent undesired interactions, clinical trials are required prior to drug marketing to systematically analyse the absorption of a drug with respect to standard meals. Furthermore, chemical substances and compounds contained in specific foods may occasionally interact with drugs, dramatically increasing or reducing the effect of a drug. Grapefruit for example contains bioactive furocoumarins and flavonoids that activate or deactivate many drugs in ways that can be life-threatening [5]. Evidence-based approaches and information about interaction mechanisms provide clinicians with the necessary context to make an informed decision about the appropriate management strategy for a specific patient. With a rapid increase in the number of biomedical publications that report food-drug interactions [3], there is a growing need for systems that automatically process scientific literature and for formal models to represent this information.

Background The Food Interactions with Drugs Evidence Ontology, namely FIDEO[2], is created in the frame of the French ANR MIAM (Maladies, Interactions Alimentation-Médicaments, 2017-2020) project[3] aiming to automatically extract interactions between foods and drugs and to represent them in an ontology. More precisely, the objectives of this research project are: (i) to automatically identify mentions of food-drug interactions in scientific articles using text analysis, (ii) to represent these interactions in a formal way, and (iii) to make them accessible to healthcare professionals within the Thériaque® database[4], which contains exhaustive information related to drugs marketed in France [7]. This widely used national database, curated by pharmacists, is independent from pharmaceutical companies and the national healthcare insurance fund, gathering information from official sources and from reference books. FIDEO addresses the second objective of the project and is based on the Basic Formal Ontology (BFO) and is

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[2] FIDEO Git: `https://gitub.u-bordeaux.fr/erias/fideo.git`
[3] MIAM project: `https://miam.limsi.fr/`
[4] Thériaque database: `http://www.theriaque.org/`

compliant with the OBO Foundry principles. To address the first objective of the project, food-drug interaction discovery is defined as a relation extraction task [8].

Representing foods The FIDEO ontology builds on one side on large scale efforts modelling the foods domain, namely the FoodOn ontology [6], and on another side on recent work in building evidence-driven ontologies for potential drug-drug interactions, that is the DIDEO ontology [4]. Entity extraction and linking are prerequisite tasks for relation extraction but while high-coverage, structured resources about drugs are readily available, the field of foods is more challenging. Hierarchical relations between foods are important in this application context because they can be used to infer relations between food categories such as *green vegetables* that are rich in vitamin K, and specific food items such as *kale*, *spinach*, and *beet greens*. Similarly, interactions can be inferred between *dairy products*, such as *milk*, *yoghurt*, and *cheese*, that are susceptible to cause interactions with tetracyclines because of their high content of calcium. Occasionally, the interaction only occurs due to cooking processes such as grilling meat, therefore food transformation processes have to be represented as well. Another challenge when representing food-drug interactions is that management recommendations vary considerably between drug information sources, and even between different editions of the same compendium. Take for example the Stockley compendium [1], a comparison between the 2008 edition and the 2016 edition shows that 26% interactions were not considered to be of interest anymore and 42% new interactions were added. Overall, 18 food items were not mentioned in the latter edition (e.g., *avocado*, *cabbage*, *kiwi fruits*) and three new food items were added (i.e., *purple grape juice*, *soya milk*, *soya oil*).

In this talk, we will discuss the FoodOn coverage of food items potentially responsible for food-drug interactions. Additionally, we will report our recent work on using the Wikipedia category structure to identify other food categories [2].

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