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NEGLECTED TROPICAL DISEASES -
A CHALLENGE TO BIOMEDICAL ONTOLOGY ENGINEERING
SUMMARY

- Domain description
  - Diseases, actions, institutions involved
- Use cases envisaged
- Ontologies and their connections
- Challenges
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NEGLECTED TROPICAL DISEASES (NTDs)

- They have been hardly heard of in richer countries ...
- ... but cause severe disability in the world's poorest regions in over 1 billion people [WHO]

- Lymphatic filariasis,
- Onchocerciasis,
- Schistosomiasis,
- Leishmaniasis
- Chagas disease (American trypanosomiasis)
- Trachoma
- Dengue
- Malaria
- ...
COMMON FEATURES OF THESE DISEASES

- In most (if not all) of them, biological organisms play these different roles:
  - Pathogens: complicated organisms with different relevant lifecycles that cause disabilities in humans
  - Vectors: transmit the pathogens if their habitat is comfortable for them to reproduce
  - Hosts: are also a means of transmission (e.g. dogs)

- Each of them possess their own set of:
  - manifestations,
  - symptoms,
  - phases,
  - prophylactic, detection and treatment actions
AN EXAMPLE: SCHISTOSOMIASIS

**Esquistossomose**

Esporocistos multiplicam-se em gerações sucessivas de caracóis

1. Na água os ovos chocam em miracídeos
2. Miracídeos invadem tecidos do caracol
3. Cércaias abandonam o caracol e nadam livres na água
4. Esporocistos em gerações sucessivas de caracóis
5. Penetram a pele intacta
6. Após penetração transformam-se em schistosumulas
7. Disseminam-se pelo sangue
8. Atingem o fígado onde se maturam as formas adultas
9. Os adultos emparelham e migram para:
   - Plexo venoso mesentérico do Intestino
   - Ovos são expulsos com as fezes.
   - Ou
   - Plexo venoso da Bexiga
   - Ovos são levados pela urina
ACTIONS AGAINST NTDs IN BRAZIL

- Prophylactic: To prevent their transmission
  + Improvement of basic sanitation (long term)
  + Educational programs
  + Field operations
    - In the environment, by avoiding a comfortable habitat for the organisms
      - E.g. cover river parts with small polystyrene balls
    - Against vectors, to reduce their population
      - E.g., a chemical smoke to kill dengue’s mosquitoes

- Detection: To check individuals’ and populations’ prevalence

- Treatments
INVOLVED INSTITUTIONS

- Municipalities
  + Actions, treatment, registration

- States
  + Inter-municipality action coordination, policy and guidelines definitions, database analysis

- Federal Government
  + State coordination of the actions, policy and guidelines definitions, database analysis

- Oswaldo Cruz Foundation’s instances
  + Study, research on the disease as well as its actions, campaign planning and creation of treatment and diagnosis new methods
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INTENDED USE CASES FOR THE ONTOLOGIES

- Decision support systems (DSS) for neglected diseases
  - Stakeholders: governments on the 3 levels
  - Phase 1: ontology-based information integration that allows querying heterogeneous neglected diseases-related databases from different governmental sources (county, state and country).
    - Integration with OTICSSS [], an emerging health information integration initiative in Brazil.
  - Phase 2: Diagnoses of the situation
  - Phase 3: Assessment of actions’ effectiveness
INTENDED USE CASES FOR THE ONTOLOGIES II

- A search engine for information on NTDs in biomedical documents
  - Averbis GmbH (www.averbis.de)
  - Semantic search: takes advantage not only of keywords, but also from the ontological relations, structure, axioms, etc
- Intelligent agents/decision support systems
  - provide support on diagnosis and prognosis of the neglected diseases in patients and populations.
  - serve for instruction
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more explicit! which basic categories? Relate to BioTop!
BIOLOGICAL PART STRUCTURE

Remove this picture (out of context)
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Regions are politically defined for management purposes, but endemics don't respect such divisions. They depend upon natural sources of the vectors/hosts, mostly geographical accidents. Actions can only be well succeeded/assessed if they focus on endemic spaces. They vary according to the disease:

- Schistosomiasis: hydrographic basins
- Dengue/Malaria/Filariasis: sources of still water
- Bubonic plague: mounts
- ...

We need an ontology of habitats and geographical entities.
MODELING CHALLENGES

- Different granularities
  + individual disease vs. affected populations
- Linking very different types of entities (e.g., socioeconomic factors, housing, mobility,...)
- Public health authorities and their roles in the process
- Temporal management of data, according to what is defined in the ontology (phases, stages, action sequences, ...)
- Complicated organisms with different relevant lifecycles
- Broad spectrum of disease manifestations

Benefit: the different standpoints (health researchers, managers, workers) hopefully can live in harmony
Instead of one illegible screenshot, show explicitly the BioTop classes which matter for the ontology.

Mention also which ontologies can be re-used.