Systematic Drug Repositioning: Data and Informatics Showcase?

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“The most fruitful basis for the discovery of a new drug is to start with an old drug.” … Sir James Black

**Drug Repositioning**
Drugs repositioning or repurposing is the application of known drugs and compounds to new disease indications.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Original indication</th>
<th>New indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viagra</td>
<td>Hypertension</td>
<td>Erectile dysfunction</td>
</tr>
<tr>
<td>Wellbutrin</td>
<td>Depression</td>
<td>Smoking cessation</td>
</tr>
<tr>
<td>Minoxidil</td>
<td>Hypertension</td>
<td>Hair loss</td>
</tr>
<tr>
<td>Thalidomide</td>
<td>Antiemetic</td>
<td>Leprosy</td>
</tr>
<tr>
<td>AZT</td>
<td>Cancer</td>
<td>AIDS</td>
</tr>
</tbody>
</table>

**Computational Repurposing**

**GWAS**

- **Repurposing with GWAS**

**Key Evidence**

- **External**
  - **PubMed**

- **Internal Knowledge Management**: Socrates Search is a Google-like application that has been enhanced for chemistry, biology, and disease search. The system has indexed more than 20 terabytes of electronic lab notebooks (ELNs), Documentum archives, SharePoint sites, emails and databases. The system uses sophisticated text indexing and analytics to identify chemical structure, gene, species and disease entities. Bio-IT World 2013 Best Practices Award.

**Take Home: Systematic Repurposing**

**Pros**
- Leverage existing data on drug and genes

**Cons**
- Information expertise & role
- 28% Pharma revenue
- No one's function

**Electronic Health Records (EHRs)**

- Large-scale mining
  - GEO data sets had ~400 disease comparisons
  - 60% of 585 MeSH disease links are from same therapeutic area
  - Negative disease-drug interaction represent repositioning opportunities
  - Challenges:
    - Signatures for more diseases
    - Sub populations
    - Scoring metrics

**Shorter timelines**

- Patient Benefit: Better Safety
- Corporate Benefit: Less Risk

**Systematic Use of Clinical Side Effects**


**Drug Repositioning**

- **Challenges**
  - Confidence in the precision measures
  - Diseases
  - GEO data sets had ~400 disease comparisons
  - 60% of 585 MeSH disease links are from same therapeutic area
  - Association Studies
  - Transplant rejection
  - Screening
  - Phenotype
  - Target
  - Compound Tool
  - Candidate Compound
  - Target
  - Side Effects
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