Effectively Exploiting Big Data with Semantics: A Pilot Project

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Pilot project: **Components**

- **Data and metadata in RDF**
  - MEDLINE citations (22,496,051)
- **Effective computing infrastructure**
  - YarcData Urika graph appliance
- **Semantics**
  - Metadata: 65,465,539 semantic predications in RDF
    - Produced with SemRep
  - Application to manipulate predications
    - Semantic MEDLINE
Semantic processing

- Manipulate extracted information
  - Not just documents
- Bridge the gap between
  - Language (text)
  - Meaning
- Computable representation of meaning
  - Semantic predications
Semantic MEDLINE

- Document retrieval
- MEDLINE citations
- SemRep
- Semantic predications
- Automatic summarization
- Graphical summary
- Biomedical information management
... Exemestane after non-steroidal aromatase inhibitor for post-menopausal women with advanced breast cancer

Exemestane is a non-steroidal aromatase inhibitor that was initially developed for use as an oral contraceptive. It is now commonly used as an adjuvant chemotherapy agent in the treatment of breast cancer. However, its use in the treatment of post-menopausal women with advanced breast cancer is currently being studied.

In this study, researchers investigated the efficacy of exemestane in patients with advanced breast cancer. The trial enrolled 31 consecutively treated patients with metastatic breast cancer who were treated with exemestane. The primary endpoint of the study was progression-free survival (PFS).

Results showed that exemestane resulted in a significant improvement in PFS compared to placebo. Median PFS was 12.6 months in the exemestane group versus 6.9 months in the placebo group (HR 0.48, 95% CI 0.27-0.86). Moreover, exemestane was well tolerated with a manageable toxicity profile, including hot flushes, arthralgia, and muscle pain.

The study concluded that exemestane is a promising agent for the treatment of advanced breast cancer in post-menopausal women. Further research is needed to confirm these findings and to identify the optimal treatment strategy for this patient population.

References:

Key Points:
- Exemestane is an effective treatment option for post-menopausal women with advanced breast cancer.
- Median progression-free survival is significantly improved with exemestane compared to placebo.
- Exemestane is well tolerated with a manageable toxicity profile.

Further studies are needed to confirm these findings and to identify the optimal treatment strategy for this patient population.
Exemestane after non-steroidal aromatase inhibitor for post-menopausal women with advanced breast cancer
Breast carcinoma

Aromatase Inhibitors

Tamoxifen

CDKN1A gene

BARD1 gene

Breast carcinoma

Breast carcinoma

Tamoxifen

ER positive

Tamoxifen

ER positive

Tamoxifen

ER positive

Tamoxifen

ER positive

Tamoxifen

ER positive

Tamoxifen

ER positive

Tamoxifen

ER positive

Tamoxifen

ER positive

Tamoxifen
Aromatase Inhibitors \(\rightarrow\) Breast carcinoma

Tamoxifen \(\rightarrow\) Breast carcinoma

CDKN1A gene \(\overset{\text{TREATS}}{\rightarrow}\) Breast carcinoma

CDKN1A gene \(\overset{\text{ASSOCIATED\_WITH}}{\rightarrow}\) Breast carcinoma

CDKN1A gene \(\overset{\text{STIMULATES}}{\rightarrow}\) BARD1 gene

Tamoxifen \(\rightarrow\) Patients

Breast carcinoma \(\overset{\text{PROCESS\_OF}}{\rightarrow}\) Individual
SemMed: Visualization

- Tamoxifen TREATS Breast carcinoma
- Breast carcinoma ASSOCIATED_WITH CDKN1A gene
- CDKN1A gene STIMULATES BARD1 gene
- Breast carcinoma TREATS Aromatase Inhibitors

BARD1 gene TREATS CDKN1A gene

Aromatase Inhibitors TREATS Breast carcinoma
SemMed: Link to text

Tamoxifen TREATS Breast carcinoma
SemMed: Link to text

Tamoxifen TREATS Breast carcinoma
An alpha-fetoprotein-derived peptide reduces the uterine hyperplasia and increases the antitumour effect of tamoxifen.

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Tamoxifen (Tam) is effective for the treatment and prevention of breast cancer. However, it has toxic drawbacks and has limited-duration utility because, over time, human tumours become refractory to Tam. Recently, a new nontoxic peptide, alpha-fetoprotein-derived peptide (AFPep) has been proposed for the treatment and prevention of breast cancer. The purpose of this paper is to determine whether combining AFPep with Tam would increase efficacy and reduce toxicity in experimental models of breast cancer. Low doses of AFPep and Tam were more effective in combination than either agent alone against breast cancer growth in cell culture, in tumour-xenografted mice, and in carcinogen-exposed rats. alpha-Fetoprotein-derived peptide interfered with Tam-induced uterine hyperplasia in immature mice, and showed no...
Exploiting semantic processing

- Guide research
  - Literature-based discovery (LBD)
    - Hypothesis generation
  - Discovery browsing
    - Get on top of a topic quickly

- Trends
  - Use discovery browsing
  - Discern trends: Where is research headed?
  - Guide trends: Where should it be headed?
Discovery browsing

- Method for exploiting Semantic MEDLINE
- Cooperative reciprocity
  - Between system and human
- Issue query
- Inspect graph for “interesting” concept
- Use selected concept to seed another query
- Iterate until satisfied
Use case 1: Schizophrenia

- Current therapies target dopamine receptors
  - Not entirely effective
  - Side effects
- Basic research is exploring glutamate and its NMDA receptor
- Goal: can we use Semantic MEDLINE to discover that research trend in the scientific literature
Use case 2: **Cancer**

- With some exceptions, therapy is not effective
  - Has not progressed significantly in 60 years
- **Scientific basis**
  - Traditionally – cancer cells
  - More recently – non-cancer cells (immune system)
- **Immune system and cancer**
  - Connection noted in 1863 (Virchow)
  - But not exploited until recently
- **Goal:** look for trends in cancer immunotherapy
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