

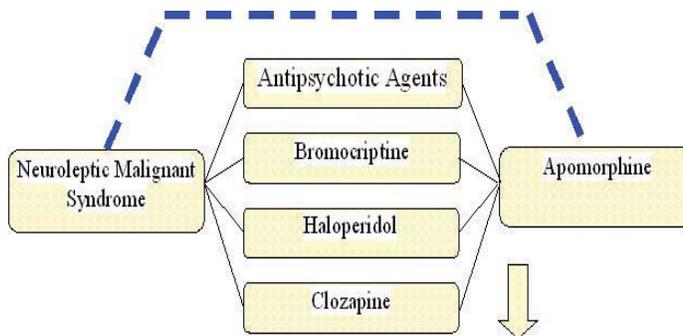


Current research on conceptual biology focuses on hypothesis generation from biomedical literature. Most of these algorithms are dedicated to produce one type of hypothesis called Pairwise relation by interacting with certain search engines such as PubMed®. In order to fully implement the potential of Conceptual Biology, Araicom Life Sciences developed a comprehensive conceptual biology research supporting platform, which supports generating and conceptually testing multiple types of biomedical hypotheses.

### Pairwise

The research activities in the domain of conceptual biology can be traced back to Swanson’s work in 1986 that discovered the novel connection between Raynaud disease and fish oils by examining two disjointed biomedical literature sets [1]. The hypothesis of the beneficial effect of fish oils on Raynaud disease was proven by an independent clinical trial two years later, which demonstrated the value of literature as a potential source of new knowledge. Swanson’s hypothesizing model can be simply described as “A relates to B, B relates to C, therefore A may relate to C”, so called Swanson’s ABC model [2, 3].

One of the types of hypothesis generated by the platform is called Pairwise, which is based on Swanson’s ABC model. Nevertheless, our platform generates this type of hypotheses in a **batch/mining** mode rather than retrieval mode adopted by other works. In other words, our platform is able to generate all Pairwise hypotheses embedded in the underlying literature database, instead of generating one or several hypotheses at one time based on the users query. The advantage of using batch/mining mode is that it may generate hypotheses that are really novel and crossing fields, rather than being bounded by the user’s initial thinking.

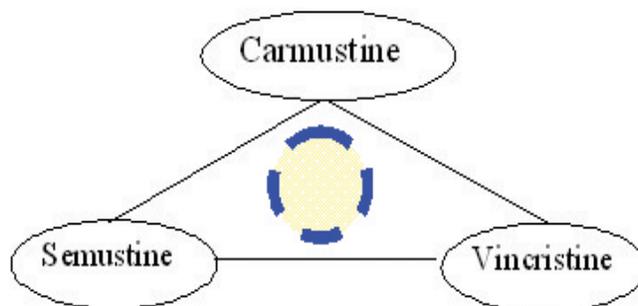


### Chaining

Our platform also automatically generates another new type of hypotheses that is called “chaining”. The basic model for chaining is that “If concept A relates to B, B relates to C, and A relates to C, then A, B, and C may be related altogether”. This type of hypothesis may help identify chaining relation among chemical compounds, predict biologic pathways, and analyze combinational effects of drugs.

#### Example:

*Vincristine* and *Carmustine* are chemotherapy drugs given as a treatment for some types of cancer. Articles also show that *Carmustine* and *Vincristine* are used in combination chemotherapy. *Semustine* is an investigational chemo-therapy drug and articles show its use in combination with *Vincristine*. However there has not been any evidence of all three drugs being used in combination and thus our algorithm suggests this as a hypothesis.

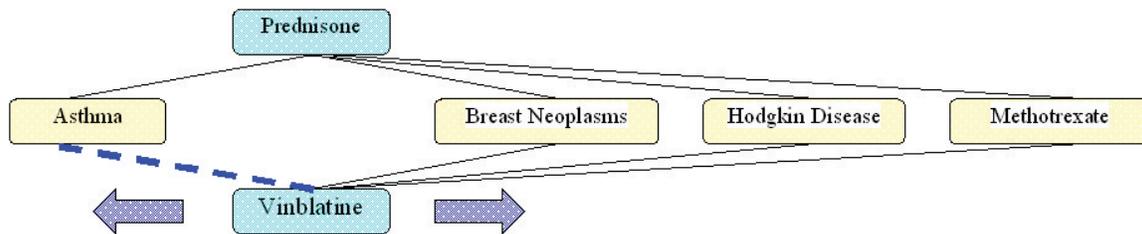


## Substitution

Another new type of hypotheses generated by our platform is called “substitution”. The basic model for substitution can be described as “If concept *A* is similar with *C*, and *A* is strongly related to *B*, then *C* may be also related to *B*”.

### Example:

“Vinblastine” and “Prednisone” have strong relations with quite a few common concepts including “Methotrexate”, “Breast Neoplasms”, “Hodgkin Disease”, and many others. These two concepts are found to be similar to each other according to context similarity. “Asthma” is one of the concepts that is associated with “Prednisone,” but not with “Vinblastine”.



## References for: Hypothesis Generation Algorithms

<http://www.ncbi.nlm.nih.gov/sites/entrez?db=PubMed>

Xie Y., Katukuri J. R., Raghavan V., and Presti T., *Conceptual Biology Research Supporting Platform: Current Design and Future Issues*, Applications of Computational Intelligence in Biology, Springer Berlin / Heidelberg, vol. 122/2008, pp. 307-324

1. Swanson DR: **Fish oil, Raynaud's syndrome, and undiscovered public knowledge.** *Perspectives in Biology and Medicine* 1986, **30(1)**:7-18.
2. Swanson DR: **Medical literature as a potential source of new knowledge.** *Bulletin of the Medical Library Association* 1990, **78(1)**:29-37.
3. Bekhuis T., *Conceptual Biology, Hypothesis Discovery, and Text Mining: Swanson's Legacy*, Biomedical Digital Library, 3 (2006), pp. 2.



## Find the Hidden Relationships in Biomedical Research

To walk through a demonstration, go to [www.araicom.com](http://www.araicom.com) and click DEMO.  
In this self-guided demo, you will be able to:

- Select a biomedical concept
- View the related PubMed® articles
- Select hypotheses supporting available literature

If you have questions about system features or how to use the demo  
contact Araicom via e-mail: [info@araicom.com](mailto:info@araicom.com)