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Short communication

Aging-kb: A knowledge base for the study of the aging process

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ABSTRACT

As the science of the aging process moves forward, a recurring challenge is the integration of multiple types of data and information with classical aging theory while disseminating that information to the scientific community. Here we present AGING-kb, a public knowledge base with the goal of conceptualizing and presenting fundamental aspects of the study of the aging process. Aging-kb has two interconnected parts, the Aging-kb tree and the Aging Wiki. The Aging-kb tree is a simple intuitive dynamic tree hierarchy of terms describing the field of aging from the general to the specific. This enables the user to see relationships between areas of aging research in a logical comparative fashion. The second part is a specialized Aging Wiki which allows expert definition, description, supporting information, and documentation of each aging keyword term found in the Aging-kb tree. The Aging Wiki allows community participation in describing and defining concepts and terms in the Wiki format. This aging knowledge base provides a simple intuitive interface to the complexities of aging.

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1. Introduction

Information related to the scientific study of the aging process grows unabated. Theoretical concepts, animal models of aging, aging manipulations and interventions, tissue and molecular studies, as well as genetic and clinical studies all contribute to the ever growing body of knowledge in aging. Although some attempts have been made to build central knowledge bases in some aspects of aging (Fuller et al., 2004; de Magalhaes et al., 2009; Craig et al., 2010), providing a framework to learn, conceptualize, visualize, and compare between theory and evidence in the field of aging research would aid in teaching as well as in breaking down barriers between isolated academic pursuits. Here we describe Aging-kb; a simple web-based intuitive dynamic knowledge base for the study of aging.

Aging-kb is built upon two complementary interconnected functions; the Aging-kb tree and the Aging Wiki. The Aging-kb tree is a tool to navigate through keywords and concepts, but with minimal content, while the Aging Wiki is a repository for detailed and growing content organized by the Aging-kb tree.

2. The Aging-kb tree

The top organizing level of Aging-kb is a dynamic hierarchical keyword tree viewer of aging related concepts and keywords. This viewer, based on tree viewing approaches used in Spacetree (Plaisant and Bederson, 2002) and Javascript InfoVis Toolkit (Belmonte, 2010) allows the user to begin with the broad concept of aging and walk through the tree with a increasing degree of definition and specificity. Table 1 shows the major top level headings of the tree. The keyword at each node expands to reveal subcategories of that major term. The tree is dynamic in that unwanted branches collapse as the user moves forward to the end of each branch. Keyword terms can be divided and subdivided *ad infinitum*. At any point a reset button returns the user to the root of the tree. The search function will take the user directly to a specific term found in the tree. Fig. 1 shows an expansion of the branch for "Conserved Aging Phenotypes".

Importantly, each node is capable of being linked to a number of outside sources of information relevant to that keyword in the context of aging. Most keywords are linked to PubMed to perform an automatic search of the most recent medical literature for that keyword in the context of aging; to Wikipedia for additional public information, and importantly to a dedicated nascent Aging Wiki (see below). Besides the common links, any keyword can be linked to any supporting information on the web, including datasets, images, videos, laboratory web pages, etc.

In addition, keywords can be linked to PubMed Select. This unique feature allows an automatic PubMed retrieval of a selected set of classic and authoritative papers on that specific topic in aging. For example, if the user were on the node for "free radical theory of aging", a simple automatic PubMed search would retrieve a chronological list of all papers relevant to those terms. This is useful, but in some cases may be somewhat overwhelming for some users. However, clicking on PubMed Select returns the original paper

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Table 1
Major aging headings.

Theories of aging
Normal aging phenomena
Aging models
Diseases of aging
Aging interventions
Conserved Aging Phenotypes
Longevity and longevity studies

describing the theory and other selected papers. Curated sets of important seminal papers found in PubMed can be defined for PubMed Select for any aging related keyword. The Aging-kb tree is accessible at this web address: http://aging-kb.nia.nih.gov.

3. The aging Wiki

The Wiki approach to editing and archiving information on the web has revolutionized the ability to share and distribute information of all types. The scientific community has taken advantage of this technology for the development of topic specific databases and knowledge bases. Examples include Bio Wiki, Array Wiki (Stokes et al., 2008), Gene Wiki (Huss et al., 2010), miRDB (Wang, 2008), YTPdb (Brohee et al., 1798) among others.

The Aging Wiki component of Aging-kb provides a standardized familiar Wiki format using MediaWiki software, on which Wikipedia is based. The Aging Wiki allows expert curation, and community participation from the aging research community to provide keyword definitions, images, tables, references, and other classes of information as well as links to additional resources on the web. In addition, there is a discussion page for each aging related term for outstanding scientific questions regarding that term in the context of aging. Unlike Wikipedia, the Aging Wiki is moderated, contribution is with permission and the content is curated.

The Aging Wiki is directly linked to and mirrors the Aging-kb tree with every keyword in the tree having a corresponding page in the Aging Wiki for detailed expert curation definitions and information. The current list of topics found in the Aging Wiki, each having a branch in the Aging-kb tree can found at this web address: http://aging-kb.nia.nih.gov/wiki/index.php/Topics_in_the_Aging_Wiki.

4. Community contribution

The success of any community project is dependent on community participation. The aging research community can

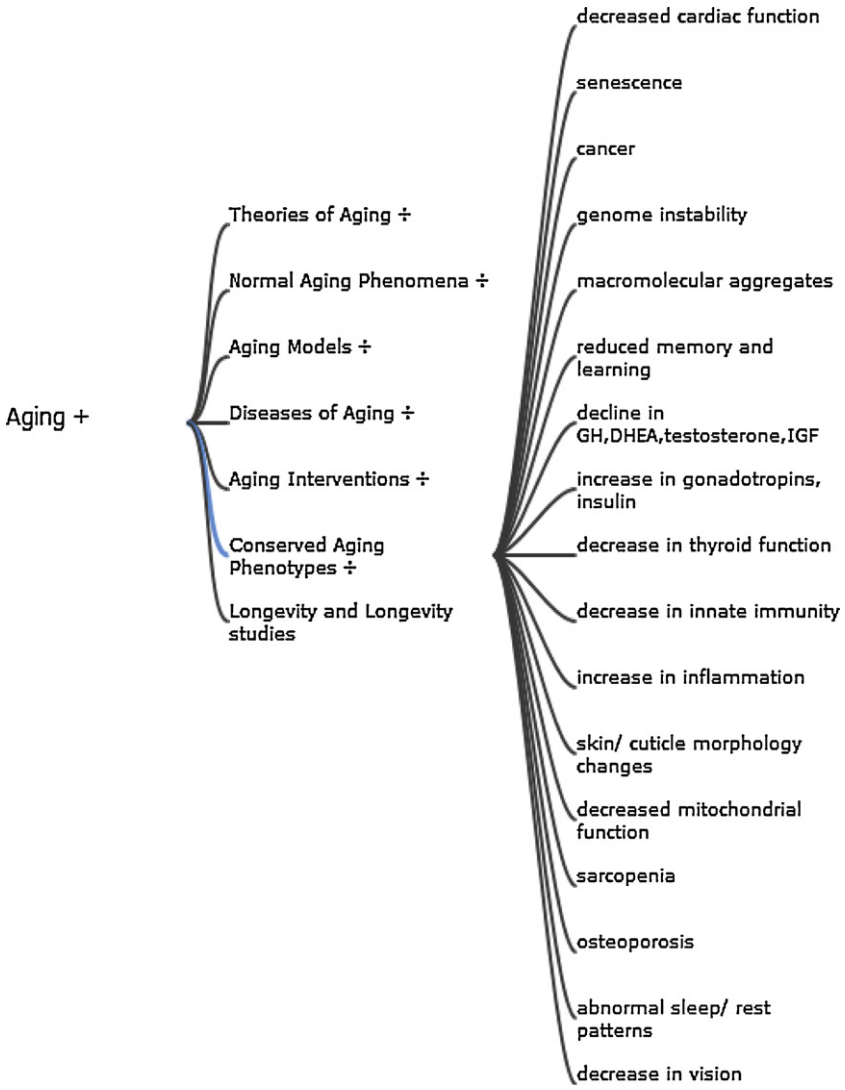

Fig. 1. An expansion of the branch in the Aging-kb tree for the term "Conserved Aging Phenotypes".

participate in the Aging-kb knowledgebase in the following ways: (1) suggest a new branch for the Aging-kb tree. This will create a corresponding Aging Wiki page; (2) suggest specific classical or authoritative papers in PubMed for the PubMed Select feature of the Aging-kb tree; (3) contribute a new page or contribute content for an existing page in the Aging Wiki; (4) edit or correct existing content in the Aging-kb tree or the Aging Wiki.

5. Conclusion

Aging research covers a broad landscape of diseases, animal models, and normal aging phenomena. The relationship between highly technical and often arcane specialties and subspecialties in any scientific discipline, but in particular aging research, is often difficult to navigate for people engaged in that field, as well as for students entering the field. Moreover, placing modern scientific advancements in aging research in a historical context of many decades of the study of aging is often daunting. The use of modern web based interfaces and information archives may help in addressing that challenge. Hopefully, with robust participation by members of the aging scientific community, the Aging-kb knowledge base will grow to be a useful resource for education, comparison, and as an engine for new idea driven research.

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