Abstract Sifter: A literature informatics tool for research in developmental toxicology

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Introduction

Identifying environmental chemicals that adversely affect children's health requires assembling information from a wide variety of sources, including the millions of articles in the biomedical literature. Literature informatics approaches can help researchers make use of this literature in more effective ways. We have developed a freely available Excel-based tool called the Abstract Sifter to retrieve and triage articles and to visualize the literature landscape for a set of chemicals.

Goal: Demonstrate use of the Abstract Sifter for building and applying adverse outcome pathways (AOPs) for developmental toxicity.

Defining AOPs through PubMed queries

Aop: 43 Disruption of VEGFR Signaling Leading to Developmental Defects

Aopwiki.org

Events: Molecular Initiating Events (MIE) | Key Events (KE) | Adverse Outcomes (AO)

Sequence	Type	Event ID	Title	Short name
1	MIE	305	Inhibition, VegfR2	Inhibition, VegfR2
2	KE	28	Reduction, Angiogenesis	Reduction, Angiogenesis
3	KE	110	Impairment, Endothelial network	Impairment, Endothelial network
4	KE	298	Insufficiency, Vascular	Insufficiency, Vascular
5	AO	1001	Increased, Developmental Defects	Increased, Developmental Defects

Pathway_queries sheet has sample queries organized by AOPs.

aop43	aop43	1mie
aop43	aop43	2ke
aop43	aop43	3ke
aop43	aop44	4ke
aop43	aop43	5ao1
aop43	aop43	6ao2
aop42	aop42	1mie
aop42	aop42	2ke
aop42	aop42	3ke
aop42	aop42	4ke
aop42	aop42	5ke
aop42	aop42	6ke
aop42	aop42	7ke
aop42	aop42	8ao
aop42	aop42	8ao_broad
HeartDev putative AOP	CHD	1mie
HeartDev putative AOP	CHD	2mie
HeartDev putative AOP	CHD	3ke:Subcellular
HeartDev putative AOP	CHD	4ke:Cell
HeartDev putative AOP	CHD	5ke:Tissue
HeartDev putative AOP	CHD	6ke:Organ
HeartDev putative AOP	CHD	9accao

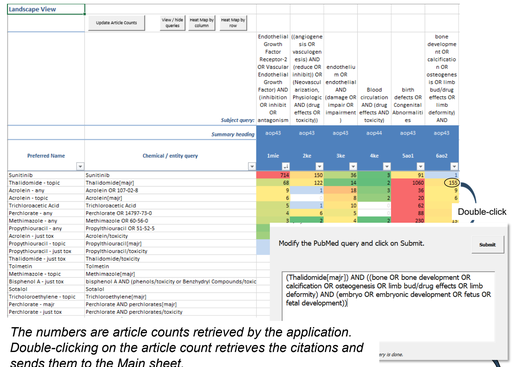
aop43	(Vascular Endothelial Growth Factor Receptor-2 OR Vascular Endothelial Growth Factor) AND (inhibition OR inhibit OR antagon
aop43	((angiogenesis OR vasculogenesis) AND (reduce OR inhibit)) OR (Neovascularization, Physiologic AND (drug effects OR toxicit
aop43	endothelium OR endothelial AND (damage OR impair OR impairment)
aop44	blood circulation AND (drug effects AND toxicity)
aop43	birth defects OR Congenital Abnormalities
aop43	(bone OR bone development OR calcification OR osteogenesis OR limb bud/drug effects OR limb deformity) AND (embryo OR
aop42	((thyroperoxidase OR Iodide Peroxidase OR TPO) AND (inhibition OR inhibit OR decrease))
aop42	(thyroid hormone OR T3 OR T4) AND (synthesis or inhibition)
aop42	(thyroid hormone OR T3 OR T4) AND (serum or blood or plasma) and (decrease OR inhibition OR down-regulate)
aop42	((thyroid hormone OR T3 OR T4) AND (brain or cortex or hippocampus))
aop42	((hippocampus) and (gene expression) and (development))
aop42	((hippocampus AND (anatomy) and (development))
aop42	((hippocampus) AND (physiology) and (development))
aop42	((memory or learning) and (spatial or temporal or contextual))
aop42	(Cognition Deficits OR cognition/drug effects OR Cognitive Dysfunction OR Intelligence/drug effects OR (brain AND embryon
HeartDev putative AOP	"bone morphogenic protein 2" OR bmp2 OR vegf-A OR ephrin)
HeartDev putative AOP	(Wnt Signaling Pathway OR Wnt Proteins OR WNT Receptors)
HeartDev putative AOP	(endothelial mesenchymal transition OR Endothelial-Mesenchymal Transition)
HeartDev putative AOP	(Cell Adhesion OR Cell Proliferation OR Extracellular Matrix OR Basement Membrane OR Mesenchymal Stromal Cells OR Myc
HeartDev putative AOP	(Mesoderm OR Myocardium OR Endocardium) AND drug Effects
HeartDev putative AOP	(Endocardial Cushions OR Atrial Septum OR Ductus Arteriosus OR Fetal Heart OR Heart OR Heart Atria OR Heart Septum OR He
HeartDev putative AOP	(Endocardial Cushion Defects OR Arteriovenous Malformations OR Heart Septal Defects OR Heart Valve Diseases OR endocard

Landscape view for various adverse outcome pathways (AOPs)

Landscape Overview

The Landscape sheet lets the scientist build an overview of a literature domain by entering entity and subject matter queries.

AOP 43: Vascular disruption

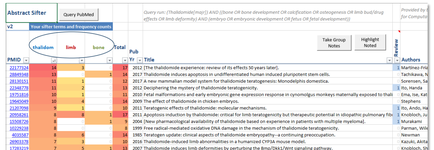


The numbers are article counts retrieved by the application. Double-clicking on the article count retrieves the citations and sends them to the Main sheet.

Retrieve and sift the citations

The Main sheet is where the user can browse and use the novel *sifting* technology to find relevant articles.

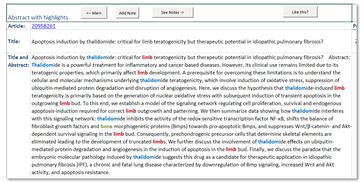
To sift, enter terms or characters of interest here and let the Abstract Sifter count occurrences of the terms in the title and abstract. Then sort. Double-clicking on a row sends the user to the Abstract sheet.



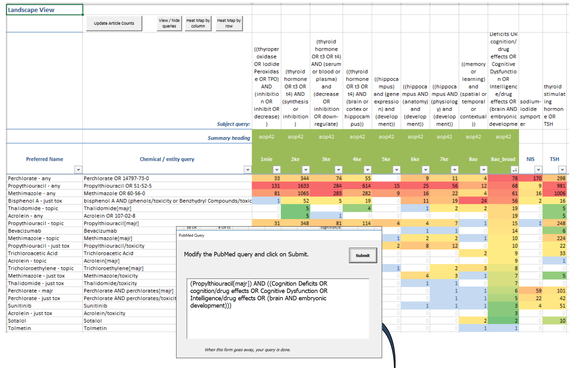
What other things can you do?

Look here to see other useful and fun capabilities.

Here's the Abstract sheet with the sifter terms colorized for easy reading.



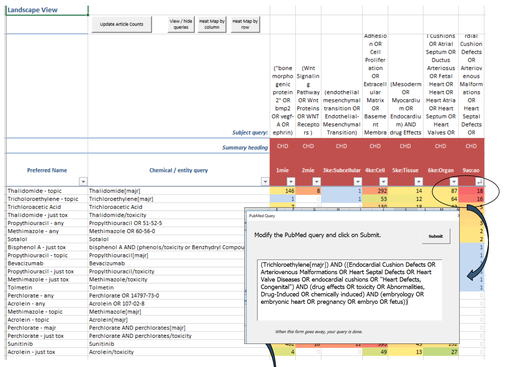
AOP 42: Thyroid disruption

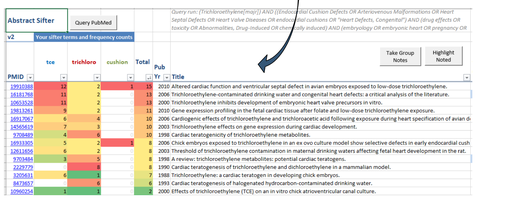


Select a row and click on Take Notes to enter tags, notes, and flags. Notes are inserted on the Notes sheet.

Citations on the Notes sheet can be exported to other software.

Putative AOP - cardiac development





Summary

The Abstract Sifter is a free, flexible literature retrieval tool that provides an overview of a complex literature landscape and the capability of focusing on specific areas of toxicity. Available for download here: ftp://newftp.epa.gov/COMPTOX/Sustainable_Chemistry_Data/Chemistry_Dashboard/Abstract_Sifter/

For live demonstration, come to Dine and Dash(board) Breakfast on Friday.

U.S. Environmental Protection Agency
Office of Research and Development

This poster does not necessarily represent U.S. EPA policy.

References: 1) Baker N et al. F1000 Res. 2017 Dec 21;6. pii: Chem Inf Sci-2164.
2) Makris S et al. Reprod Toxicol. 2016 Oct;65:321-358