Conducting a Basic Literature Search
September 10, 2018

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Course Objectives

- IHS Library Services
- What is a Literature Search?
- Creating a Searchable Question
- Explain Boolean Logic
- Conducting a Search
- Zotero
- Let’s Get Interactive!
- Questions??
Your IHS Library
Commons Area
Quiet Study Room

- Practically sound proof
- Plenty of outlets!
- No booking necessary!
Availability

Librarians available: 8:00am - 6:00pm Monday - Friday

Access 24/7
IHS Website
https://library.shu.edu/ihs
For SHMS Students

Toolkits and links of interest to School of Health and Medical Sciences students:

By Specialty:
- Athletic Training
- Healthcare Administration
- Occupational Therapy
- Physical Therapy
- Physician Assistant
- Speech Language Pathology

Other:
- Staying Current with the Medical Literature: How-to guide to resources that can make staying up-to-date with the medical literature easier.

FYI: You can also book a study room here and request a consultation!
Stop on By!

For general assistance or inquiries, email hslibrary@shu.edu

Kyle Downey, MLIS
Health Sciences Librarian | College of Nursing & School of Health and Medical Sciences Liaison

📞 973-642-6967
📧 kyle.downey@shu.edu
Room 1410
Reserving a Study Room

- The IHS Library has 20 study rooms for students to reserve.
- Single study rooms can hold 1-2 students.
- Group Study Rooms can hold 6-8 students.
- Each room has a white board.
- You must book a room to use it! (This is to protect YOU from getting kicked out.)
To Reserve a Room
Booking Details

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<th>Category</th>
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<th>To</th>
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<td>Single Rooms</td>
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<td>3:30pm Friday, August 17, 2018</td>
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Fill out this form to complete the booking.

- **Full Name**: [First Name] [Last Name]
- **Email**: 
- **What is your school affiliation?**
  - School of Health and Medical Sciences
  - School of Medicine
  - College of Nursing
  - Other

[Submit my Booking]
How to Conduct a Literature Search?
A literature search is a well thought out and organized search for all of the literature published on a topic.

A well-structured literature search is the most effective and efficient way to locate sound evidence on the subject you are researching.

Your evidence may be found in: books, journals, government documents, guidelines, databases and the internet.
Information Overload

PubMed contains over 27 millions citations as of 2017

https://www.nlm.nih.gov/bsd/bsd_key.html

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Search Plan

1. Pose a searchable question
2. Find Subject Terms
3. Select the best database
4. Manipulate the database
Creating a searchable question

**Patient**
What are the characteristics of the patient?
What is the condition or disease you are interested in?

**Comparison**
What is the alternative to the intervention (different drug, surgery, etc.)

**Intervention**
What intervention, therapy, treatment, etc. are you interested in?

**Outcome**
What do you want to prove, measure, affect, etc.

**Types of Studies**
Systematic reviews, case studies, Guidelines, Qualitative, Quantitative
**P** for Patient, Population or Problem

- How is the disease/condition defined?
- What are the most important characteristics that describe the people?
- Are there any relevant demographic factors (e.g., age, sex, ethnicity)? What is the setting (e.g., hospital, community, etc)?
- Who should make the diagnosis?
- Are there any other types of people who should be excluded from the review (because they are likely to react to the intervention in a different way)?
Intervention and Comparison

What do you want to do for the patient?
What are the experimental and control (comparator) interventions of interest?
Intervention may be a clinical intervention or a process change
What are you comparing this to?
Is there a traditional intervention?
Is there no intervention?
Are there standard or alternative treatments to compare with the planned intervention?
*Not all PICO questions will have an established comparison component*
Outcomes

What do you hope to accomplish, measure, improve, or affect?

When entering search terms for a literature search, you won’t be searching for the O—outcome—you use the Outcome as you assessment of whether or not the article answers your question.
## P.I.C.O. (T. T. T)

<table>
<thead>
<tr>
<th>P</th>
<th>Patient, Population, Problem</th>
<th>How would I describe a group of patients similar to mine?</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intervention</td>
<td>Which main intervention, prognostic factor, or exposure am I considering?</td>
</tr>
<tr>
<td>C</td>
<td>Comparison</td>
<td>What is the main alternative to compare with the intervention?</td>
</tr>
<tr>
<td>O</td>
<td>Outcome</td>
<td>What can I hope to accomplish, measure, improve or affect?</td>
</tr>
<tr>
<td>T</td>
<td>What type of question you are asking</td>
<td>Therapy/Treatment, Diagnosis, Prognosis, Harm/Etiology</td>
</tr>
<tr>
<td>T</td>
<td>Type of Study you want to find</td>
<td>What would be the best study design/methodology?</td>
</tr>
<tr>
<td>T</td>
<td>Time</td>
<td>What changed can occur over time?</td>
</tr>
</tbody>
</table>

(Best Evidence Statement, 2018)
# The Type of Question & Type of Study

<table>
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<tr>
<th>Type of Question</th>
<th>Type of Study</th>
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<tr>
<td>Therapy</td>
<td>RCTs, Systematic Review, Meta-Analysis</td>
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<tr>
<td>Prognosis</td>
<td>Cohort studies, case controls</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Controlled Trails, Systematic Reviews</td>
</tr>
<tr>
<td>Harm</td>
<td>Cohort Studies</td>
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<tr>
<td>Prevention</td>
<td>RCTs</td>
</tr>
<tr>
<td>Quality Improvement</td>
<td>RCTs</td>
</tr>
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</table>
One of your soccer players comes to see you about her sprained ankle. She asks you if taping would help prevent future sprains.

P = soccer player
I = taping
C = None
O = reduced occurrence of future sprained ankles
Do weekly exercise sessions allow 40-50 year old women to maintain their weight loss better than biweekly exercise sessions?

P = 40-50 year old women
I = weekly exercise sessions
C = biweekly exercise sessions
O = better weight loss management
PICO Example 3

Does exercise help reduce stress in college students?
P = college students
I = exercise
C = no exercise / no comparison
O = reduce stress
Keep in Mind...

1. You do not need every part of the PICO formula
2. Some questions will not have a comparison
3. Some questions will not have a time factor
4. Some questions might not even have an intervention
5. Remember, it’s a model, not a structure.
   - Use it guide you, not to make things harder
Controlled Vocabulary and Key Word Searching

- How to search using key word terms
- Concept of Controlled Vocabulary
- The Pros and Cons
Key word concepts

KEYWORD SEARCHING = MATCHING CHARACTERS

KEYWORDS ARE SEARCHED IN ALL DATABASE FIELDS UNLESS YOU LIMIT THE SEARCH TO A SINGLE FIELD, LIKE TITLE OR AUTHOR

KEYWORD SEARCHES RETURN A LOT OF RESULTS, BUT MOST OF THEM AREN’T VERY USEFUL

KEYWORD SEARCHING ONLY GIVES YOU ARTICLES THAT MENTION YOUR TOPIC
Controlled Vocabulary concepts

ARTICLES IN DATABASES ARE ASSIGNED SUBJECT LABELS BY INDEXERS

OFTEN CALLED, “SUBJECT HEADINGS”, “DESCRIPTORS”, OR “TAGS”

SUBJECT TERMS DESCRIBE THE MAIN CONCEPTS OF AN ARTICLE

SUBJECT SEARCHING GIVES YOU ARTICLES THAT ARE ABOUT YOUR TOPIC
Using the Right Terms

subject vs. keyword searching

Controlled Vocabulary

• Matches terms against a specific field in the record.
• Database hierarchy trees with suggest other subject terms to either narrow or expand on your search
• Heart Attack = Myocardial Infarction

Free-text (keyword) searching

• Some concepts have many synonyms. A free-text search statement would mean "OR"ing all those terms together
• Matches terms against words anywhere in record (abstract, title, etc.).
What are some Advantages to Controlled Vocabulary?

• Using the controlled vocabulary can make you search more precise and easier

• Increases the relevancy of results

• The indexers have already done much of the work for you.

• Searchable tree structures of terms can help you find new terms to use.
Issues with Controlled Vocabulary

• NOT all databases use a controlled vocabulary
• New concepts take time to be added
• There is often a lag phase during which the newest articles aren’t indexed
• Controlled vocabularies can contain some very strange things and some concepts may not be handled well
• The controlled vocabulary must be easily searchable
• Trying to understand what is and isn’t in a particular controlled vocabulary can give you a big headache!
MeSH on Demand suggests MeSH vocabulary based on the keywords you type in. This is automated, so no human review (not perfect!) A very useful tool if you are trying to find subject terms that you may not know. https://meshb.nlm.nih.gov/MeSHonDemand
Uses PMID’s (PubMed) to organize your searches in grid form
You can compare several articles to see how they are related
Analysis grid covers Authors, MeSH Headings, and Author Keywords
http://mesh.med.yale.edu/
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<th>Faces Fossils</th>
<th>Female</th>
<th>Fatal Outcome</th>
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<th>Humans</th>
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<table>
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<th>Male Middle Aged</th>
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<th>Kitesurfing</th>
<th>Top predator</th>
<th>Unprovoked</th>
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### Examples of Keyword vs. Subject Headings

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<th>Medical Subject Heading (MeSH)</th>
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<td>Heart Attack</td>
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<td>Myocardial Infarction</td>
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<td>Distance education</td>
<td>Education, non-tradiational</td>
<td>Education, distance</td>
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<tr>
<td>EHR</td>
<td>Computerized patient record</td>
<td>Electronic Health Records</td>
</tr>
<tr>
<td>LGBT</td>
<td>GLBT persons</td>
<td>Bisexuality or Homosexuality</td>
</tr>
</tbody>
</table>
Identifying key concepts

What are the main concepts in your question?

Sample Question:
Does nutrition therapy improve decubitus pressure ulcer healing in an elderly patient?
Does music therapy help to reduce preoperative anxiety in the surgical patient?

- Anxiety
  - Fear, anxiousness, agitation, worry, nervousness, unease, stress
- Music
  - Recording, CD, are there others?
- Surgery
  - Operation, procedure, excision
- Preoperative
  - Preoperative care, preoperative period, preoperative nursing
Example

- How many words could you think of for the idea of “cancer”?  
  - tumor,
  - malignancy,
  - neoplasm,
  - sarcoma...

- Articles in a database  
  - Article one: “Breast tumors in young women”  
  - Article two: “Surgery for prostrate cancer.”  
  - Article three: “Diagnosing Melanoma.”

All three articles are about types of cancer but different terms are used in titles.
Boolean Logic and Operators
What they are and how they work
Boolean Logic

What is it?

Boolean logic defined logical relationships between terms in a search. The Boolean search operators are **And**, **OR**, and **NOT**.

- **AND** combines search terms so that each search result contains all of the terms.
- **OR** combines search terms so that each search result contains at least one of the terms.
- **NOT** excludes terms so that each search result does not contain any of the terms that follow it.
  - **Note**: When executing a search, **AND** takes precedence over **OR**.
<table>
<thead>
<tr>
<th>AND</th>
<th>OR</th>
<th>NOT</th>
</tr>
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<tr>
<td>Each result contains <strong>all</strong> search terms</td>
<td>Each result contains at least one search term</td>
<td>Results do not contain specified terms.</td>
</tr>
<tr>
<td>The search <em>children AND infant</em> finds items that contain <strong>both</strong> <em>children</em> and <em>infant</em></td>
<td>The search <em>children OR infant</em> finds items that contain <strong>either</strong> <em>children OR items that contain infant</em></td>
<td>The search <em>children NOT infant</em> finds items that contain <em>children</em> but do not contain <em>infant</em></td>
</tr>
</tbody>
</table>
Example

Does exercise help reduce stress in college students?
And NARROWS

Exercise AND Stress
1. **Exercise versus vasodilator stress** limb perfusion imaging for the assessment of peripheral artery disease.

   (includes abstract) Davidson, Brian P.; Belkic, J. Todd; Landry, Gregory; Linden, Joel; Lindner, Jonathan R.; Echocardiography, Aug 2017, 34(6): 1187-1194. 8p. (Article - diagnostic images, research, tables/charts) ISSN: 0742-2822

   Subjects: Exercise; Perfusion Imaging; Peripheral Vascular Disease; Radiography

2. **A 12-Week Exercise and Stress Management Pilot Program From Theory Through Implementation and Assessment.**

   (includes abstract) Packel, Lora; Pang, Carolyn Y.; Handorf, Elizabeth; Rodalitz, Michelle; Rehabilitation Oncology, Oct 2017, 35(4): 172-180. 8p. (Article - research, tables/charts) ISSN: 2168-3808

   Subjects: Program Evaluation; Therapeutic Exercise; Stress Management; Cancer Fatigue; Cancer Survivors

3. Four-dimensional echocardiography area strain combined with **exercise stress** echocardiography to evaluate left ventricular regional systolic function in patients with mild single vessel coronary artery stenosis.

   (includes abstract) Deng, Yan; Peng, Long; Liu, Yuan - Yuan; Yin, Li - Xue; Li, Chun - Mei; Wang, Yi; Rao, Li; Echocardiography, Sep 2017, 34(9): 1332-1338. 7p. (Article - research, tables/charts) ISSN: 0742-2822

   Subjects: Echocardiography Methods; Ventricular Function; Left; Coronary Stenosis Diagnosis
Let’s Expand Using OR Boolean Operator

How can we expand a search?

What other words can we possibly use along with stress?

- Pressure
- Fatigue
- Anxiety
Expand with OR

- Stress
- Fatigue
- Anxiety
OR

(Stress OR Anxiety OR Fatigue)
1. Relationship between self-reported and objectively measured physical activity and subjective memory impairment in breast cancer survivors: role of self-efficacy, fatigue and distress.

2. Study on correlation between coping style and emotional status of breast cancer patients during chemotherapy.
Exercise

AND

(Stress OR Anxiety OR Fatigue)
1. Relationship between self-reported and objectively measured physical activity and subjective memory impairment in breast cancer survivors: role of self-efficacy, fatigue and distress.


   (includes abstract) Paskel, Lora, Fang, Carolyn Y.; Handorf, Elizabeth; Rodolitz, Michelle; Rehabilitation Oncology, Oct 2017; 35(4): 172-180. 9p. (Article - research, tables/ charts) ISSN: 2168-3808

Subjects: Program Evaluation, Therapeutic Exercise, Stress Management, Cancer Fatigue, Cancer Survivors
Boolean Logic

There is no **Golden Rule** on how to search
It’s all about trial and error
Play around with many terms to retrieve different results!

Example:

**Exercise** -> Training -> Therapeutic Exercise -> Walking -> Physical Fitness

**Stress** -> Fatigue -> Depression -> Anxiety -> Anger

**Students** -> Students, College -> Students, Graduate -> Students, non-traditional
Boolean Refresher

1. Which Boolean operator will give you the most research results?
   1. OR,
   2. AND,
   3. NOT

   Answer: OR

2. The Operator AND, when used to link to concept terms (e.g. diabetes and exercise) will retrieve only those records that contain both concept terms.
   1. True or False

   1. TRUE

3. Using the operator AND to combine concept terms is a good way to increase the number of records retrieved in a search
   1. True or False

   - FALSE (OR increases results)
Let’s Begin A Literature Search

Where Do I Begin?
Two Databases
Let’s Start with a Searchable Question

In patients with cancer, does yoga help improve their quality of life?
With Years 2013-2018

1. Multicenter, randomized controlled trial of yoga for sleep quality among cancer survivors.

2. Integrating yoga into cancer care.

3. Effects of a Yoga Program on Mood States, Quality of Life, and Toxicity in Breast Cancer Patients Receiving Conventional Treatment: A Randomized Controlled Trial.
What are some limiters/filters to use?
Getting Access to Full Text

14. Results of a Pilot Yoga Intervention to Improve Pediatric Cancer Patients' Quality of Life and Physical Activity and Parents' Well-being.

Orsey, Andrea D.; Park, Crystal L.; Pulaski, Regan; Shankar, Nilani L.; Popp, Jill M., Wakefield, Dorothy; Rehabilitation Oncology, Jan2017. 35(1): 15-23. 9p. (Article - research, tables/charts) ISSN: 2168-3

Subjects: Pediatric Care; Cancer Patients; Yoga; Treatment Outcomes; Family Psychosocial Factors; Child: 6-12 years; Adolescent: 13-18 years; Female: Male.

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Search for information below and press the Submit Information button to send.

Describe the item you want

Title (Journal, Conference Proceedings, Anthology)

Rehabilitation Oncology

Volume 35

Issue Number or Designation 1

Month

Year 2017

Inclusive Pages 1-5

ISSN/ISBN (International Standard Serial/Book Number)

2168-3808

Article Author

Orsey, Andrea D.

Article Title

Not Wanted After Date

07/15/2019

Will you accept the item in a language other than English?

No

Notes

Put any information here that may help us find the item, as well as any other pertinent information.

Where did you learn about this item?

How did you find this item cited?

Comes up in search for healthcare topics.

Date of the work that cited the item.

Volume number of the work that cited the item.

Pages where the item is cited.

Submit Request Clear Form Cancel - Return to Main Menu
• We will do a similar search
• Using MeSH Subject Headings
• Limiters/filters to narrow down our results
• Save our search results
• Create an alert
Search Yoga as a keyword term

Notice we get over 4500 results

Let’s scroll down to view some details on this search
"yoga"[MeSH Terms] OR "yoga"[All Fields]
We have the same amount of results but you can see in detail how the database searched these terms.
Now Let’s See How PubMed Searches the Other Terms

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<th>Quality of Life</th>
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<tbody>
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<td><strong>Search Details</strong></td>
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<td><strong>User query:</strong></td>
<td>quality of life</td>
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<tr>
<td><strong>Search Details</strong></td>
<td></td>
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<tr>
<td><strong>Query Translation:</strong></td>
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Let’s Combine our Searches using the Advanced Search Option
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<th>Time</th>
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AND
yoga[MeSH Terms] OR yoga[All Fields]
AND
quality of life[MeSH Terms] OR (quality[All Fields] AND life[All Fields]) OR quality of life[All Fields]
Results are significantly narrowed

Now let us use the limiters/filters!
Limiters/Filters

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  • Publication Dates
  • Species – Human
  • Languages – English
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Could yoga practice improve treatment-related side effects and quality of life in breast cancer? A systematic review and meta-analysis.

Fan Y1, Xiong K2, Yao Y2, Zhang L4, Lin H2.

Abstract

AIM: To determine if yoga as a complementary and alternative therapy was associated with enhanced health and treatment-related side effects in patients with breast cancer. This systematic review examines whether yoga practice provides any measurable benefit, both physically and psychologically, for women with breast cancer.

METHODS: PubMed, EMBASE and the Cochrane Library for randomized controlled trials (RCTs) throughout June 2015. We evaluated the quality of the included studies by the Cochrane Handbook 5.2 standards and analyzed the data using the Stata software, version 10.0. Meta-regression and subgroup analysis were also performed to identify additional predictors of outcome and to assess heterogeneity.

RESULTS: Sixteen RCTs with a total of 990 participants were included. Comparing yoga groups to control groups, there was a statistically significant difference in overall health-related quality of life, depression, anxiety and gastrointestinal symptoms. Meta-regression analyses revealed that the duration of yoga practice and type of control group partly explained the heterogeneity. Subgroup analyses revealed that yoga had a positive effect on anxiety only when it had been practiced for longer than 3 months. Only the wait-list control group showed an effect of yoga on physical well-being.

CONCLUSION: The current evidence demonstrates that yoga practice could be effective in enhancing health and managing some treatment-related side effects for patients recovering from breast cancer. In future clinical studies, clinicians should consider the patient’s wishes along with the current best evidence of the effects of yoga practice in their clinical decision-making.

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KEYWORDS: breast cancer; complementary and alternative medicine; meta-analysis; treatment-related side effect; yoga
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RESULTS: Sixteen RCTs with a total of 530 participants were included. Comparing yoga groups to control groups, there was a statistically significant difference in overall health-related quality of life, depression, anxiety and gastrointestinal symptoms. Meta-regression analyses revealed that the duration of yoga practice and type of control group partly explained the heterogeneity. Subgroup analyses revealed that yoga had a positive effect on anxiety only when it had been practiced for longer than 3 months. Only the well-timed control group showed an effect of yoga on physical well-being.

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Pan Y, Yang L, Wang Y, Zhang L, Liang L.

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RESULTS: Sixteen RCTs with a total of 930 participants were included. Comparing yoga groups to control groups, there was a statistically significant difference in overall health-related quality of life, depression, anxiety and gastrointestinal symptoms. Meta-regression analyses revealed that the duration of yoga practice and type of control group partly explained the heterogeneity. Subgroup analyses revealed that yoga had a positive effect on anxiety only when it had been practiced for longer than 3 months. Only the wait-list control group showed an effect of yoga on physical well-being.

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KEYWORDS: breast cancer, complementary and alternative medicine, meta-analysis, treatment-related side effects, yoga

Cited by 7 PubMed Central articles

Review: Efficacy of Complementary Therapies in the Quality of Life of Breast C [Front Oncol. 2017]
Cancer Patients' Knowledge and Acceptance of Physical Activities for Rehabilitation [In Vivo. 2017]
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@ Author information

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Could yoga practice improve treatment-related side effects and quality of life for women with breast cancer? A systematic review and meta-analysis.

Authors: Ran, Yuanqing1
Yang, Kehu2 kehuyangbm2006@126.com
Wang, Yuliang3
Zhang, Laping4
Liang, Hanqing5


Document Type: Article

Subject Terms: *YOGA
*BRoEST cancer treatment
*DRUG side effects
Some Helpful Tips

• Practice using both keywords and subject terms
• You can use Google to find other terms
• Play around with AND & OR to expand and limit your search
• NOT isn’t widely used
• Use your limiters/filter!
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Quick Guide on Appraisal

• What is it?
  • Critical appraisal is the process of carefully and systematically examining research to judge its trustworthiness, its value, and its relevance in a particular context.

• When appraising research, keep the following three criteria in mind:
  • **Quality**
    Trials that are randomized and double blind, to avoid selection and observer bias, and where we know what happened to most of the subjects in the trial.
  • **Validity**
    Trials that mimic clinical practice, or could be used in clinical practice, and with outcomes that make sense. For instance, in chronic disorders we want long-term, not short-term trials.
  • **Size**
    Trials (or collections of trials) that have large numbers of patients, to avoid being wrong because of the random play of chance.
What you should be looking for

Ask yourself these questions when reading a study:

The Introduction
• What is the subject and purpose of the study?
  • Are they clearly stated?
• How does this report differ from previous publications on the subject?
  • Does the author discuss the differences?
• Are the assumptions and limitations of the study described?
  • What are they?
• Does the author(s) present specific questions and clearly state their hypothesis?
Literature Review

- Is the related literature fully covered and described?
- Are the most important findings from other studies presented?
- Is the review well organized?
Mitochondria: Structure, Function and Clinical Relevance

George LM* and Kim A
Department of Medical Cell Biology, University of Saskatchewan, Canada

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Department of Medical Cell Biology, University of Saskatchewan, 105 Administration Place, Saskatoon, Saskatchewan, Canada

Received: May 30, 2017; Accepted: June 22, 2017; Published: June 29, 2017

Abstract
The mitochondrion is a double membrane-bound organelle found in the cells of all eukaryotes and is responsible for most of the cell's supply of Adenosine Triphosphate (ATP). As the central "powerhouse of the cell", mitochondria (also referred to as midichlorians) serve a vital function and have been implicated in numerous human diseases, including midichlorian disorders, heart disease and circulatory failure, and autism. In this paper, the structure and function of the midichlorian is reviewed with a view to understanding how the pathophysiology of midichlorian disorders can point the way towards translational treatments.

Keywords: Cell biology; mtDNA; Translational; Novel therapeutics; Midichlorian disorders

Introduction
The midichlorian (pl. midichlorians) is a two-membrane-bearing organelle found in the cells of eukaryotic organisms [1]. Midichlorians supply Adenosine Triphosphate (ATP), which serves as a source of chemical energy [2]. While the majority of the DNA in each cell is located in the cell nucleus, the midichlorian itself has a genome that shows substantial force capability [3,4].

Midichlorians are typically 0.75-3μm across but they have variable size and shape [1]. Unless specially stained, they are too small to be visible. Beyond supplying cellular energy, midichlorians perform functions such as Force sensitivity, cell differentiation, signaling, and maintaining control of cell growth and the cell cycle [5]. Midichlorial biogenesis is regulated in conjunction with these cellular processes. Midichlorian dysfunction may be responsible for several human diseases, including autism, midichlorian disorders, cardiac dysfunction, and force failure [6].

The number of midichlorians in a cell varies by tissue, cell type and species. Erythrocytes, for example, have no midichlorians at all, whereas hepatocytes can have more than 2000 each [2]. The organelle is divided into regions with unique functions: the inner and the outer consist of proteins ensconced in a phospholipid bilayer [8]. This bimembranous floor plan means that a midichlorian consists of five distinct parts [9], namely:

1. Outer midichlorian membrane,
2. Inter membrane space (between inner and outer membranes),
3. Inner Midichlorial membrane,
4. Cristae (folds of the inner membrane)

The matrix
The midichlorian is enveloped by the outer membrane, which is roughly 70 angstroms in thickness [10]. Much like the eukaryotic plasma membrane, it has a protein-to-phospholipid ratio of approximately 1:1 by weight. It features many integral membrane proteins called force porins. The outer membrane also contains enzymes including fatty acid Co-A ligase, lumanenine hydroxylase, and monoamine oxidase. These undertake functions such as the elongation of fatty acids, epinephrine oxidation, and tryptophan degradation [10,11].
Mitochondria: Structure, Function and Clinical Relevance

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Introduction

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The number of mitochondria in a cell varies by tissue, cell type and species. Erythrocytes, for example, have no mitochondria at all, whereas hepatocytes can have more than 2000 each [2]. The organelle is divided into regions with unique functions: the inner and the outer membrane, inner membrane space, matrix, and cristae [3,6].

Methods

The matrix

The mitochondrion is enrobed by the outer membrane, which is roughly 70 angstroms in thickness [10]. Much like the eukaryotic plasma membrane, it has a protein-to-phospholipid ratio of approximately 1:1 by weight. It features many integral membrane proteins called force pumps. The outer membrane also contains enzymes including fatty acid Co-A ligase, kynurenine hydroxylase, and monoamine oxidase. These undertake functions such as the elongation of fatty acids, epinephrine oxidation, and tryptophan degradation [10,11].

The inner mitochondrion, on the other hand, contains proteins with five functions:

1. Oxidative phosphorylation
Midichlorians-mediated oxidative stress causes cardio-myopathy in Type 2 diabetics. As more fatty acids are delivered to the heart, and into cardiomyocytes, the oxidation of fatty acids in these cells increases. Did you ever hear the tragedy of Darth Plagueis the Wise? I thought not. It is not a story the Jedi would tell you. It was a Sith legend. Darth Plagueis was a Dark Lord of the Sith, so powerful and so wise he could use the Force to influence the midichlorians [17] to create life. This process increases the number of reducing equivalents available to the midchiorial electron transport chains, and thus generates Reactive Oxygen Species (ROS) [14,15]. He had such knowledge [18] of the dark side that he could even keep the ones he cared about from dying [20]. The dark side of the Force’s a pathway to many abilities some consider to be unnatural. ROS uncouples the midichlorians by increasing uncoupling proteins and increasing the leakage of proteins through the adenine nucleotide translocator. He became so powerful... the only thing he was afraid of was losing his power, which eventually, of course, he did. Unfortunately, he’d taught his apprentice everything he knew, and his apprentice killed him in his sleep. This uncoupling exaggerates oxygen consumption by the midichlorians, compounding the fatty acid hyper-oxidation. Ironic: he could save others from death, yet not himself. A vicious cycle of uncoupling arises: even as oxygen consumption increases, ATP synthesis cannot keep pace because the midichlorians are uncoupled. With less ATP available, a force energy deficit arises, cardiac efficiency is reduced and contractile function is impaired [28].

Potential relevance to aging

Given the role of midichlorians as the cell’s force power station, if high-energy dark side electrons leak out, they can form harmful
Some other strategies

When you conduct a search, use these tips as well!

- Retrospective searching – you find the most recent study and work backwards
- Berry picking – follow the citations of an article you are interested in to find related material
- Find by author – most databases have an author field.
- Create alerts early! – starting a search can be daunting but if you start creating alerts now, you may find things easier in the future.
Describing your Strategy

When conducting a literature search you should be recording your methods.
This way you can keep track of what you have done to avoid mistakes and repetition.
A good record track will make it easier to replicate your search when needed.
<table>
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<th>Item</th>
<th>Description</th>
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<td>Filters are clearly described and appropriate for search process (years of publication, language used, humans...)</td>
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<td>Searching additional resources</td>
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<td>Mention if you searched by author, similar articles, or citations</td>
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One more interactive search

Let’s practice with just one more!
Do resistive ankle exercises improve ankle stability in active adults with functional ankle instability?