Part 2: Developing an Effective Research Strategy

Steps for Developing an Effective Research Strategy

1. Create a Timeline for Research.
2. Define Your Information Need.
3. Identify Concepts Related to Research.
4. Consult Subject Specific Experts / Resources.
5. Explore General Reference Resources.
6. Select the Most Appropriate Databases.
7. Utilize Graduate Study Research Techniques.
Part 2: Developing an Effective Research Strategy

Step 1: Create a Timeline for Research

- Thesis Projects: Begin literature review as soon as you begin lab work.
- Research Paper: Begin research 2-4 weeks before you plan to start writing your paper.

  1. It takes 3-6 days to receive articles through MyILL Account.
  2. It takes 1-2 weeks to receive books through MyIIT / I-Share Account.
  3. It can take 2-4 weeks to receive books through MyILL Account.
Part 2: Developing an Effective Research Strategy

Step 2: Define Your Information Need

- Your information need is obviously a function of your topic.

  1. Topic You Select

     Determine that there is enough information on the topic 
     *before you actually select the topic.*

  2. Assigned Topic

     With an assigned topic, the instructor establishes the 
     research parameters. For example -

     “Write a 5 page paper that describes the chemical 
     processes and issues associated with the browning 
     of fruit. You must use at least 5 scholarly journal 
     articles and cite those articles using APA Format.”
Part 2: Developing an Effective Research Strategy

**Step 2: Define Your Information Need (Cont.)**

Once you have a research topic you define your information need in your own words. For example -

“l need 5 scholarly journal articles that describe the chemical processes and issues associated with the browning of fruit."
Part 2: Developing an Effective Research Strategy

Step 3: Identify Concepts Related to Your Research

Information Need Defined in Your Own Words:

“I need 5 scholarly journal articles that describe the chemical processes and issues associated with the browning of fruit.”

Key concepts and terms from your Information Need:

1) Browning
2) Fruit
3) Chemical Processes
Part 2: Developing an Effective Research Strategy

**Step 4: Consult Subject Specific Experts / Resources**

1. Principle Investigator
2. Professor
3. Subject Librarian
4. Food Science Library Guide at - [http://guides.library.iit.edu/FoodSafety/](http://guides.library.iit.edu/FoodSafety/)
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Reference Sources

- General reference resources are important because:
  1. They help you generate additional search terms.
  2. They help you write an introduction to your thesis or paper.
  3. They lead you to other resources through the bibliography.
  4. They allow you to see the connection between related ideas.
Part 2: Developing an Effective Research Strategy

- **Step 5: Explore General Information Sources**
  - General references resources related to Food Science can be found at - [http://guides.library.iit.edu/FoodSafety](http://guides.library.iit.edu/FoodSafety).

**Illinois Tech Library Guides**

- **Print Reference Resources**
  - Handbook of Food Science, Technology, and Engineering, TP270.A4382006
    This four volume set contains a wealth of up to date information on food science and technology and should be the starting point for any research topic.
  - The Companion Thesaurus to Food Science and Technology Abstracts, 2695.1.F6C651992
    This incredibly important resource should be used to generate additional search terms and synonyms related to your research topic.
  - Encyclopedia of Food Microbiology, REF.QR115.E53 2000
    This three volume encyclopedia set is entirely devoted to Food Microbiology and is geared toward academia.
  - The Microbiological Safety and Quality of Food, vol 1-2, REF.QR115.M4662000
    This 2 volume set contains a huge amount of information regarding the practical aspects of maintaining the safety and quality of food within a manufacturing context.

- **Electronic Reference Resources**
  - Essentials of Food Science, 2008 (By Springer)
  - Food Science and Technology, 2009 (By EBSCOHost)
  - Handbook of Food Science and Technology 1: Food Alteration and Food Quality, 2016 (By EBSCOHost)
  - Handbook of Food Science and Technology 2: Food Process Engineering and Packaging, 2016 (By EBSCOHost)
  - Handbook of Food Science and Technology 3: Food Biotechnology, 2016 (By EBSCOHost)
  - Encyclopedia of Food Microbiology (Science Direct)
Step 5: Explore General Information Sources

a. Electronic Resources – Ebooks

1. Handbook of Food Science and Technology 1: Food Adulteration and Food Quality

Series: Handbook of Food Science and Technology, 1, Food adulteration and food quality

Authors: Jeantet, Romain
          Croguennec, Thomas
          Schuck, Pierre
          Bruié, Gérard


Resource Type: eBook.

Description: This book serves as a general introduction to food science and technology, based on the academic courses presented by the authors as well as their personal research experiences. The authors’ main focus is on the biological and physical-chemical stabilization of food, and the quality assessment control methods and normative aspects of the subsequent processes. Presented across three parts, the authors offer a detailed account of the scientific basis and technological knowledge needed to understand agro-food transformation. From biological analyses and process engineering, through to the development of food products and biochemical and microbiological changes, the different parts cover all aspects of the control of food quality.
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Information Sources

a. Electronic Resources – Ebooks

2. Handbook of Food Science and Technology 2: Food Process Engineering and Packaging

Handbook of Food Science and Technology 2: Food Process Engineering and Packaging

Series: Handbook of Food Science and Technology, 2, Food process engineering and packaging
Authors: Jeantet, Romain
Resource Type: eBook
Description: This book is a source of basic and advanced knowledge in food science for students or professionals in the food science sector, but it is also accessible for people interested in the different aspects concerning raw material stabilisation and transformation in food products. It is an updated and translated version of the book ‘Science des aliments’ published in 2006 by Lavoisier. ‘Science des aliments’ is a general and introductory food science and technology handbook, based on the authors’ Masters and PhD courses and research experiences. The book is concise, pedagogical and informative and contains numerous illustrations (approximately 500 original figures and tables). In three volumes, it summarizes the main knowledge required for working in food industries as scientists, technical managers or qualified operators. It will also be helpful for the formation of students in food science and biotechnologies (bachelor’s and master’s degree).
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Information Sources

a. Electronic Resources – Ebooks

3. Handbook of Food Science and Technology 2: Food Biochemistry and Technology

Handbook of Food Science and Technology 3: Food Biochemistry and Technology

Series: Handbook of Food Science and Technology, 3, Food biochemistry and technology
Authors: Jeantet, Romain
Resource Type: eBook
Description: This third volume in the Handbook of Food Science and Technology Set explains the processing of raw materials into traditional food (bread, wine, cheese, etc.). The agri-food industry has evolved in order to meet new market expectations of its products; with the use of separation and assembly technologies, food technologists and engineers now increasingly understand and control the preparation of a large diversity of ingredients using additional properties to move from the raw materials into new food products. Taking into account the fundamental basis and technological specificities of the main food sectors, throughout the three parts of this book, the authors investigate the biological and biochemical conversions and physicochemical treatment of food from animal sources, plant sources and food ingredients.
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Information Sources

a. Electronic Resources – EBooks

4. Handbook of Food Science and Technology 2: Food Biochemistry and Technology
Part 2: Developing an Effective Research Strategy

**Step 5: Explore General Reference Resources**

b. Print Resources

1. *Handbook of Food Science, Technology, and Engineering*
   REF TP370.4.H382006
   
   This four volume set is the best single resource in the library. Always start out with this resource no matter what the topic!

2. *The Companion Thesaurus to Food Science and Technology* Z695.1.F6C651992

   This useful resource should be used to generate additional search terms and synonyms related to your topic.
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Reference Resources

3. Encyclopedia of Food Microbiology, REF.QR115.E532000

This three volume encyclopedia set is entirely devoted to Food Microbiology and is geared toward academia.

4. The Microbiological Safety and Quality of Food REF.QR115.M4662000

This two volume set relates to food microbiology within a manufacturing context.
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Reference Resources

5. Dictionary of Food Microbiology, REFQR115.F68130

This resource provides basic definitions for words and concepts connected with food microbiology.

6. Wiley Encyclopedia of Food Science and Technology, REF.TP3682E622000

This four volume set can be used to find additional information not available in the Handbook of Food Science.
Part 2: Developing an Effective Research Strategy

- **Step 5: Explore General Reference Resources**


    This one volume encyclopedia provides useful background information on topics connected with food packaging.

  8. **Google**

    Although websites indexed by Google may not be suitable for use in your paper, Google is a great resource when it comes to background information.
Part 2: Developing an Effective Research Strategy

- **Step 5: Explore General Reference Resources**

  - Here again is our information need in our own words:
    
    “I need 5 scholarly journal articles that describe the chemical processes and issues associated with the browning of fruit.”

  - Here again our the key concepts from that information need.
    
    1) Browning
    2) Fruit
    3) Chemical Processes

  - Two of the reference resources have information on your topic:
    
    1) *Wiley Encyclopedia of Food Science and Technology*,
    2) *The Companion Thesaurus to Food Science and Technology*. 
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Information Sources

1. *Wiley Encyclopedia of Food Science and Technology*

The Wiley Encyclopedia of Food Science has a 6 page article on “Enzymatic Browning” which relates to fruit as opposed to non-enzymatic browning.

This specific chemical reaction is called “polyphenol oxidase” which is also called “PPO.” The article also has 2 pages of references.
Part 2: Developing an Effective Research Strategy

Step 5: Explore General Information Sources

2. The Companion Thesaurus to Food Science and Technology.

The Companion Thesaurus to Food Science and Technology offers a similar set of synonyms including the phrase, “Browning Reactions”
Step 5: Explore General Reference Resources

Using these general references resources we have generated four more search terms that relate to “browning” -

*Browning Reaction*

*or*

*Enzymatic Browning*

*or*

*Polyphenol Oxidase* and *Fruit*

*or*

*PPO*
Part 2: Developing an Effective Research Strategy

Step 6: Select the Most Appropriate Database

Once you have generated all of your search terms click on the “JOURNAL ARTICLES” tab - http://guides.library.iit.edu/FoodSafety/.

Click the “JOURNAL ARTICLES” Tab
Step 6: Select the Most Appropriate Database

- Each database on this list has been selected because it indexes journals in the food sciences: The order was based on a series mock searchers using words related to food science. The databases on the top have the highest number of Food Science related Journal Articles.

Food Science and Technology: Journal Articles

Primary Food Science Research Databases

The databases below have been arranged from top to bottom based on the number of food science articles contained in each database. Therefore, to be efficient, search the databases from top to bottom in the order that they appear. For graduate research, it is usually best to start off with 2-3 search terms in the databases "Title Field."

- Proquest Scitech Collection
- Web of Science
- Medline
- PubMed
  Covers biomedical and life sciences journal literature.
Step 6: Select the Most Appropriate Database

Primary Food Science Research Databases

The databases below have been arranged from top to bottom based on the number of food science articles contained in each database. Therefore, to be efficient, search the databases from top to bottom in the order that they appear. For graduate research, it is usually best to start off with 2-3 search terms in the databases "Title Field."

- Proquest SciTech Collection
- Web of Science
- Medline
- PubMed
  Covers biomedical and life sciences journal literature.
- Articles First
- Academic Search Complete
- Science Direct
- Papers First
- Wiley Interscience
- Sage Journals
- Google Scholar
Part 2: Developing an Effective Research Strategy

Step #7 Use Graduate Study Research Techniques

- When searching research databases start out with no more than 2-3 search terms in the *title field*. A common mistake is to use too many search terms!

- Boolean Operators connect your search terms and either narrow or broaden your search results ("And," "Or," "Not").
Part 2: Developing an Effective Research Strategy

The “AND” Boolean Operator

- The AND Boolean Operator is used when you want to find articles that contain all of your search terms. The AND Boolean Operator always narrows your search results (you get less results).

If you initiate this search you will obtain articles that contain the words “Mineral” and “Deposit” in the title field of the article.
Part 2: Developing an Effective Research Strategy

The “AND” Boolean Operator (Continued)

All of the search results contain the words “deposit” and “mineral” in the title the field.

1. Implications of nano- and micrometer-size platinum-group element minerals in base metal sulfides of the Yangliuping Ni-Cu-PGE sulfide deposit, SW China
   By: Liang, Qing; Lin; Song, Xie-Yan; Wirth, Richard; et al.
   CHEMICAL GEOLOGY Volume: 517 Pages: 7-21 Published: JUL 5 2019
   Find Full Text View Abstract ▼

2. 3D Geological Modeling for Mineral System Approach to GIS-Based Prospectivity Analysis: Case Study of an MVT Pb-Zn Deposit
   By: Li, Nam; Song, Xianglong; Li, Canghai; et al.
   NATURAL RESOURCES RESEARCH Volume: 28 Issue: 3 Pages: 995-1019 Published: JUL 2019
   Find Full Text View Abstract ▼

3. An Improved Prediction-Area Plot for Prospectivity Analysis of Mineral Deposits
   By: Roshanravan, Bijan; Aghajani, Hamid; Yousefi, Mahyar; et al.
   NATURAL RESOURCES RESEARCH Volume: 28 Issue: 3 Pages: 1089-1105 Published: JUL 2019
   Find Full Text View Abstract ▼

4. The Geology, Mineral Associations, and Composition of Native Gold in the Mineral Deposits of the Taimyr-Severnaya Zemlya Orogen
   By: Proskurnin, V. F.; Polyanova, G. A.; Gavrich, A. V.; et al.
   DOKLADY EARTH SCIENCES Volume: 484 Issue: 1 Pages: 12-17 Published: JUL 2019
   Find Full Text View Abstract ▼
Part 2: Developing an Effective Research Strategy

The “AND” Boolean Operator (Continued)

IMPORTANT!!! Most databases interpret a space between search terms the same as the Boolean Operator “AND.”

A space between the search terms is interpreted as an “AND”

Both of these searches will yield identical results – The words “mineral” and “deposit” will be in the title field.
Part 2: Developing an Effective Research Strategy

The “AND” Boolean Operator (Continued)

So again we see that all of the search results contain the words “deposit” and “mineral” in the title the field.

1. Implications of nano- and micrometer-size platinum-group element minerals in base metal sulfides of the Yangluping Ni-Cu-PGE sulfide deposit, SW China
   By: Liang, Qing-Lin; Song, Xie-Yan; Wirth, Richard; et al.
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   By: Proskurnin, V. F.; Palyanova, G. A.; Gavrish, A. V.; et al.
   DOKLADY EARTH SCIENCES Volume: 484 Issue: 1 Pages: 12-17 Published: JUL 2019
   Find Full Text View Abstract
Part 2: Developing an Effective Research Strategy

**The “OR” Boolean Operator**

The *OR* Boolean Operator is used when you want to find articles that contain either of your search terms. The *OR* Boolean Operator is used when you want to broaden your search (obtain more records).

If you initiate this search you will obtain articles that contain the words either “Mineral” or “Deposit” in the title field of the article.
The “OR” Boolean Operator

We see that all of the search results contain either the words “mineral” or “deposit” in the title field.
Part 2: Developing an Effective Research Strategy

- **The “NOT” Boolean Operator**
  - The NOT Boolean Operator is used when you want to find articles that contain one search term but not the other.

- If you initiate this search you will obtain articles that contain the words “Mineral Deposit” but not “Mining” in the title field of the article.
Part 2: Developing an Effective Research Strategy

The “NOT” Boolean Operator

We see that all of the search results contain the words “Mineral Deposit” but not the word “mining.”

Note: Most experienced researchers rarely use the Boolean Operator “NOT” as they are afraid they will inadvertently screen something out. It is best to stick with the Boolean Operator “OR” and the operator “AND.”
Part 2: Developing an Effective Research Strategy

- Effectively Using of Boolean Operators
  - Ill-Defined Information Need (Undergraduate Students)
    Using Boolean Operators to broaden or narrow your search can be effective.
  - Defined Information Need (Graduate Students)
    Just use the “AND” operator. To broaden or narrow your search use different search terms and different fields.
Part 2: Developing an Effective Research Strategy

Review of Graduate Study Research Techniques

- **Using Search Terms**
  
  1. Add search terms to narrow your search (get less results).
  
  2. Subtract search terms to broaden your search (get more results).

- **Using Database Fields**
  
  1. The **title field** is the narrowest field so you get less results.
  
  2. The **abstract field** is a broader field so you get more results.
  
  3. The **default field** searches many fields so you get the most results.

- **Using Subject Headings**
  
  Many databases allow you to use the subject headings to link to other related books and articles that have the same subject heading.
Remember when we talk about database fields we are talking about fields within individual records. The default field (e.g. “topic,” “general,” “all fields,” and “default”) is a search parameter.

<table>
<thead>
<tr>
<th>Record #1 (1st Article)</th>
<th>Title</th>
<th>Author</th>
<th>Abstract</th>
<th>Subjects (LCSH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect of Deletion of Genes Involved in Lipopolysaccharide Core</td>
<td>Monadi, A. R.; Mirzaei, H.; Javadi, A.; Hosseinzade, N.</td>
<td>In this study, the effects of Lactobacillus casei and Bifidobacterium angulatum and Immunology Infectious Diseases</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Record #2 (2nd Article)</th>
<th>Title</th>
<th>Author</th>
<th>Abstract</th>
<th>Subjects (LCSH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A foodborne outbreak of enterotoxigenic E. coli</td>
<td>Wall, Daniel M.; Srikanth, C. V.; McCormick, Beth</td>
<td>When one considers the organism Salmonella and Immunology Infectious Diseases</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pharmacology Molecular Genetics Tumor Biology
Part 2: Developing an Effective Research Strategy

Using Subject Headings to Find Related Material

A very powerful search strategy is to identify one book or journal article that is relevant to your information need, and then use the Subject Headings to link to other material that uses the same subject heading.

<table>
<thead>
<tr>
<th>Database</th>
<th>Calls its Subject Headings –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galvin Library Catalog</td>
<td>Topics</td>
</tr>
<tr>
<td>Academic Search Premier</td>
<td>Subject Terms</td>
</tr>
<tr>
<td>Medline</td>
<td>Descriptors</td>
</tr>
<tr>
<td>Science Direct</td>
<td>Keywords</td>
</tr>
<tr>
<td>Wiley Interscience</td>
<td>Keywords</td>
</tr>
</tbody>
</table>
Part 2: Developing an Effective Research Strategy

Galvin Library Catalog Subject Headings

A search of the Galvin Library Catalog for “Salmonella” located this book on salmonella.

To link to other books on Salmonella click on the on the Topic (e.g. Library of Congress Subject Heading) “Salmonella”
Part 2: Developing an Effective Research Strategy

Galvin Library Catalog Subject Headings

By clicking on the subject heading “Salmonella” the Galvin Library Catalog has located more books related to Salmonella.
Part 2: Developing an Effective Research Strategy

Academic Search Complete Subject Headings

A search of the database Academic Search Complete for “Salmonella” located this journal article.

Salmonella Enteritidis and Salmonella Typhimurium identification in poultry carcasses.

Authors:
- Afshari, Asma¹
- Baratpour, Ahmad²
- Khanzade, Saeed²
- Jamshidi, Abdollah² jamshidi638@yahoo.com

Source:

Document Type:
Article

Subject Terms:
- *POULTRY carcasses
- *SALMONELLA enteritidis
- *SALMONELLA typhimurium
- *ZOONOSES
- *POLYMERASE chain reaction

To link to other articles related to Salmonella click on the subject terms, “Salmonella enteritidis” or “Salmonella typhimurium”
Part 2: Developing an Effective Research Strategy

Academic Search Complete Subject Headings

By clicking the subject heading “Salmonella,” Academic Search Premier located 31,790 articles that use the subject heading salmonella. You can would narrow these results by adding additional search terms.

1. A common Salmonella Enteritidis sequence type from poultry and human gastroenteritis in Ibagué, Colombia.


Subjects: SALMONELLA enteritidis; POULTRY diseases; GASTROENTERITIS; NUCLEOTIDE sequence; IBAQUE (Colombia); Meat Markets, Poultry and Poultry Product Merchant Wholesalers; Poultry and egg merchant wholesalers; Other Poultry Production; Live animal merchant wholesalers

PDF Full Text (3.4MB)

2. The diversity, evolution and ecology of Salmonella in venomous snakes.

By: Pulford, Caisey V.; Wenner, Nicolas; Redway, Martha L.; Rodwell, Ella V.; Webster, Hermione J.; Escudero, Roberta; Kröger, Carsten; Canals, Rocío; Rowe, Will; Lopez, Javier; Hall, Neil; Rowe, Paul D.; Timoffe, Dorina; Harrison, Robert A.; Baker, Kate S.; Hinton, Jay C. D. PLoS Neglected Tropical Diseases. 6/4/2019, Vol. 13 Issue 6, p1-21. 21p. DOI: 10.1371/journal.pntd.0007169.

Subjects: POISONOUS snakes; SALMONELLA; SALMONELLA enterica; COLD-blooded animals; ECOLOGY

PDF Full Text (1.8MB)
Medline Subject Headings

A search of the database Medline for “Salmonella” located this journal article.

Title: Evaluation of 3M Molecular Detection System and ANSR Pathogen Detection System for rapid detection of Salmonella from egg products.

Source: Poultry science 2017 May 01; 96(5): 1410-1418

Additional Info: England

Standard No: ISSN: 0032-5791 (Print); 1525-3171 (Electronic); NLM Unique Journal Identifier: 0401150

DOI: http://dx.doi.org/10.3382/ps/paw399

Language: English

Abstract: Isothermal amplification assay is a novel simple detection technology that amplifies DNA with high speed, efficiency, and specificity under isothermal conditions. The objective of this study was to compare the 3M Molecular Detection System (MDS) and ANSR Pathogen Detection System (PDS) for the detection of Salmonella in egg products as compared to the Food and Drug Administration’s Bacteriological Analytical Manual (BAM) culture methods. Two Salmonella ser. Enteritidis (18579, PT4; CDC_2010K_1441, PT8), one Salmonella ser. Heidelberg (607310-1), and one Salmonella ser.Typhimurium products and 13 dry egg products were inoculated with these strains individually at 1 to 5 CFU/25 g. One set of test portions was prepared following FDA BAM procedures [with lactose prepared using buffered peptide water (BPW) as pre-enrichment broth], as instructed by the two detection systems. Results from 3M MDS and ANSR PDS were 100% in agreement with 3M MDS and ANSR PDS. The number of Salmonella positive test portions (80 tested), identified with the BAM, 2M MDS, and ANSR PDS, were 63, 61, and 60, respectively. In conclusion, both BPW based culture methods and were equivalent to the BAM culture method for the detection of Salmonella in egg products. These sensitive isothermal assays can be used as rapid as pre-enrichment broth.

Published by Oxford University Press on behalf of Poultry Science Association 2016. This work is written by (a) US Government employee(s) and is in the public domain in the US.

To link to other articles related to Salmonella click on the descriptor “Salmonella – isolation and purification”
Part 2: Developing an Effective Research Strategy

Medline Subject Headings

By clicking the subject heading “Salmonella – isolation and purification,” Medline located 8,524 articles that use the same subject heading. You can narrow these results by adding additional search terms.

1. **Salmonella, Shigella, and yersinia.**
   - **Author:** Dekker JP; Frank KM
   - **Source:** Clinics in laboratory medicine 2015 Jun; 35(2): 225-46
   - **Libraries Worldwide:** 503
   - [See more details for locating this item](#)

2. **Bactericidal activity of different forms of lactoferrin.**
   - **Author:** Alon DT; Lu MQ; Lu SJ, and others
   - **Source:** Advances in experimental medicine and biology 1994; 357: 61-70
   - **Libraries Worldwide:** 366
   - [See more details for locating this item](#)

3. **Oral delivery of antigens in live bacterial vectors.**
   - **Author:** Brey RN; Bixler GS; Fulginiti JP, and others
   - **Source:** Advances in experimental medicine and biology 1991; 303: 169-84
   - **Libraries Worldwide:** 366
   - [See more details for locating this item](#)

4. **Investigation of endotoxin binding cationic proteins from granulocytes; agglutination of erythrocytes sensitized with Re-LPS.**
   - **Author:** Hirata M; Yoshida M; Inada K, and others
   - **Source:** Advances in experimental medicine and biology 1990; 255: 287-99
   - **Libraries Worldwide:** 366
   - [See more details for locating this item](#)

5. **Lipid A fractions analyzed by a technique involving thin-layer chromatography and enzyme-linked immunosorbent assay.**
   - **Author:** Matsuy-Baltzer I; Alving CR
   - **Source:** European journal of biochemistry 1984 Jan 16; 138(2): 333-7
   - **Libraries Worldwide:** 1408
   - [Illinois Institute of Technology](#)
   - [See more details for locating this item](#)

6. **In vitro synthesis of CDP-d-xylose using Salmonella enzymes of cloned rfb genes. Production of CDP-6-deoxy-D-xylo-4-hexulose, CDP-3,6-dideoxy-D-xylo-4-hexulose and CDP 3,6-dideoxy-D-galactose, and isolation by HPLC.**
   - **Author:** Lindqvist L; Schweda KH; Reeves PR, and others
   - **Source:** European journal of biochemistry 1994 Nov 01; 225(3): 863-72
   - **Libraries Worldwide:** 1408
   - [Illinois Institute of Technology](#)
   - [See more details for locating this item](#)
Part 2: Developing an Effective Research Strategy

Wiley Interscience Subject Headings

A search of the database Wiley Interscience for “Salmonella” located this journal article. Wiley Interscience calls it subjects headings “Keywords” and these subject headings must be cut and pasted into the search box.

You must cut and paste the subject heading into the search box, and then choose the “Keyword” field to initiate the search.
Part 2: Developing an Effective Research Strategy

Wiley Interscience Subject Headings

By cutting and pasting the subject heading “Salmonella” into the search box and initiating the search Science Direct located 2,415 articles that relate to salmonella.

These results can be further limited by adding additional search terms.
Part 2: Developing an Effective Research Strategy

Recap of Steps for an Effective Research Strategy

1. **Create a Timeline for Research**
   For a research paper give yourselves at least 2-4 weeks for research

2. **Define Your Information Need**
   Our information need was defined as follows: “Identify the chemical processes associated with the browning of fruit.”

3. **Identify Concepts Related to Research**
   Our key concepts were –
   - Browning,
   - Chemical Processes
   - Fruit
Part 2: Developing an Effective Research Strategy

Recap of Steps for an Effective Research Strategy

4. Consult Subject Specific Experts / Resources

We will use the Food Science and Technology Library Guide to conduct our research - http://guides.library.iit.edu/FoodSafety.

5. Explore General Information Resources

Reference Resources were used to generate additional search terms:

- Enzymatic Browning
- Browning Reaction
- Polyphenol Oxidase
- PPO
- Fruit

6. Select The Most Appropriate Database

To be efficient we will search the Food Science Research Databases from top to bottom in the order they appear starting with ProQuest SciTech collection.
7. **Utilize Graduate Study Research Techniques**

1) Start out searching with 2 to 3 search terms in the *title field*.

2) Separated our search terms with a space – same as “AND.”

3) To broaden or narrow our search we will try using the different search terms or different fields (title, abstract, and default field).

4) Once we locate a relevant article or book we will use the Library of Congress Subject Headings to find other related articles or books.

5) Remember every database calls its subject headings something different.
Let’s Start Searching - Terms That Will Be Used

“Browning,” or “Enzymatic Browning,” or “Browning Reaction,” or “Polyphenol Oxidase,” or “PPO” and “Fruit.”
Part 2: Developing an Effective Research Strategy

Initiating the Database Search – Web of Science

Select 2-3 search terms separated by a space same as “And.” Then choose “title” for your search.

Initiate the search
Reviewing the Search Results

As you can see the search located 367 records or articles that contain the word “fruit” and some variant of the word “Browning” in the title.
Since we retrieved 367 records we want to narrow the results. Changing the database field to *abstract* or *default* would only give us more results.

To narrow add another search term – “Polyphenol” for “Polyphenol Oxidase”

We added the word “polyphenol” to our search string, but we are still searching in the title field.
By adding the search term, “polyphenol” was have narrowed our search results from 367 articles to 21 articles.
Part 2: Developing an Effective Research Strategy

Using The Computer Program -

“Find Full Text” is not a database but rather a computer program that searches all of IIT’s databases to determine which database accesses the full-text of the journal article that you want.

1. Comparative study of the banana pulp browning process of ‘Giant Dwarf’ and FHIA-23 during fruit ripening based on image analysis and the polyphenol oxidase and peroxidase biochemical properties

By: Escalante-Minakata, Pilar; Ibarra-Junquera, Vrani; de Jesus Ornelas-Paz, Jose; et al.
3 BIOTECH Volume: 8   Article Number: 30   Published: DEC 26 2017

Since Web of Science only accesses the abstract to this article click “Find Full Text”
Part 2: Developing an Effective Research Strategy

Using The Computer Program -

“Find Full Text” has determined that the database “American Chemical Society Journals” accesses the full-text. “Find Full Text” has determined that the database “American Chemical Society Journals” accesses the full-text.

American Chemical Society Journals has taken you directly to the full text of the journal article. Depending on the database, you may have to scroll through various years and volumes of the journal to access the full-text.
Refining the Database Search Results

Now will click on Record #2 to demonstrate using your MyILL Account

![Database search results with Record #2 highlighted]

1. Comparative study of the banana pulp browning process of 'Giant Dwarf' and FHIA-23 during fruit ripening based on image analysis and the polyphenol oxidase and peroxidase biochemical properties
   - By: Escalante-Minakata, Pilar; Ibarra-Junquera, Vrani; de Jesus Ornelas-Paz, Jose; et al.
   - 3 BIOTECH Volume: 8 Article Number: 30 Published: DEC 26 2017
   - [Find Full Text] [View Abstract]

2. Enzymatic browning and antioxidant activities in harvested litchi fruit as influenced by apple polyphenols
   - By: Zhang, Zhengke; Huber, Donald J.; Qu, Hongxia; et al.
   - FOOD CHEMISTRY Volume: 171 Pages: 191-199 Published: MAR 15 2015
   - [Find Full Text] [View Abstract]

3. Characterisation of Polyphenol Oxidase and Peroxidase and the Role in Browning of Loquat Fruit
Part 2: Developing an Effective Research Strategy

Using The Computer Program -

If “Find Full Text” cannot find a database that accesses the full-text of an article that you want, you will be prompted to request the article through your MyILL Account.

Since we don’t have a database that accesses the full-text of this journal, you must request this article by clicking on the “MYILL” link.
Part 2: Developing an Effective Research Strategy

Using The Computer Program -

Before you can request an article through your MyILL Account you must login to your account. If you don’t have an account, you can create an account by going to https://iit.illiad.oclc.org/illiad/logon.html

Enter your Username and Password, and click “Log in”
The “Find Full Text” program has transferred all of the articles data to the article request form. To initiate your request click “Submit Request.”
Part 2: Developing an Effective Research Strategy

Using The Computer Program -

After you successfully submit your article request you will be transferred to this screen where you can view your “Current Requests.”

You can see your article request information here. It will probably take you around 3-4 days to get your article but it could be longer.
Part 2: Developing an Effective Research Strategy

- Using The Computer Program -

After you receive an email that your article request has been filled you must log back onto your MyILL Account to access your article.

To access your article click “Access Your Articles.”
Part 2: Developing an Effective Research Strategy

Using The Computer Program -

You may now access your article in PDF Format.

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Part 2: Developing an Effective Research Strategy

Trying Another Database Search – ProQuest

Select 2-3 search terms separated by a space which is the same as the Boolean Operator “And.” Choose the “Abstract - AB” field and then initiate the search.
Part 2: Developing an Effective Research Strategy

Try another database – ProQuest

The title search for “browning and fruit” located 400 records. To broaden this search (get more results) we would choose a broader field.
Refining a Database Search – ProQuest

Using the exact same search terms we will now select the “Abstract” field to broaden our search (obtain more results). This configuration would look for search terms in the title field, the abstract field and also the keyword field.
Part 2: Developing an Effective Research Strategy

Refining a Database Search – ProQuest

The “title, abstract, keyword” search identified 2,778 articles related to our information need. To narrow these search results to a more manageable number we would add another search term.
To narrow our search we will add the search term “polyphenol,” but will continue searching in the same field – “Abstract.”

Remember leaving a space between the search terms is interpreted by the database as the Boolean Operator “AND.”
Part 2: Developing an Effective Research Strategy

Initiating a Database Search – ProQuest

Searching for “browning, fruit, and polyphenol” in the abstract field located 614 articles which is a more manageable number.

ab(browning fruit polyphenol)

614 results

Diversity and Relationships in Key Traits for Functional and Apparent Quality Activity, Polyphenol Oxidase Activity, and Browning

Plazas, Mariola; López-Gresa Marila P.; Vilanova Santiago; Torres, Cristina; Hurtado, Maria

...polyphenol oxidase (PPO) activity, liquid extract browning, and fruit flesh... quality, but may display greater fruit flesh browning. We evaluated 18... and 6.0% in the variation in fruit flesh browning, and PPO activity was not...
Part 2: Developing an Effective Research Strategy

- Trying Another Database Search – Medline

Select 2-3 search terms separated by a space which is the same as the Boolean Operator “And.” Then choose the “title” field, and initiate the search.
Part 2: Developing an Effective Research Strategy

- **Trying Another Database Search – Medline**

  The title search for “browning and fruit” located 34 records. To broaden this search (get more results) we would switch to the abstract field.

1. **Melatonin Delays Postharvest Browning in Litchi Fruit by Enhancing Anti-oxidative Processes and Oxidation Repair.**
   - Author: Zhang Y; Huber DJ; Hu M, and others
   - Source: Journal of agricultural and food chemistry 2018 Jun 28
   - Libraries Worldwide: 975
   - See more detail

2. **Browning Index of Anthocyanin-Rich Fruit Juice Depends on pH and Anthocyanin Loss More Than the Gain of Solub**
   - Author: Dorris MR; Voss DM; Bollom MA, and others
   - Source: Journal of food science 2018 Apr; 83(4): 911-921
   - Libraries Worldwide: 1077
   - See more detail

3. **A multidisciplinary approach providing new insight into fruit flesh browning physiology in apple (Malus x domestica)**
   - Author: Di Guardo M; Tadiello A; Farneti B, and others
   - Source: PloS one 2013; 8(10): e78004
   - See more details for locating this item

4. **The roles of ROS production-scavenging system in Lasiodiplodia theobromae (Pat.) Griff. & Maubl.-induced pericarp**
   - Author: Sun J; Lin H; Zhang S, and others
   - Source: Food chemistry 2018 May 01; 247: 16-22
   - Libraries Worldwide: 853
   - Illinois Institute of Technology
Part 2: Developing an Effective Research Strategy

Trying Another Database Search – Medline

Using the exact same search terms we will now select the “Abstract” field to broaden our search, and then initiate the search.
Part 2: Developing an Effective Research Strategy

Trying Another Database Search – Medline

By broadening our search for “browning and fruit” to the abstract field we located an additional 236 records in total. Let’s try using the subject headings again to find articles related to our information need.
Part 2: Developing an Effective Research Strategy

Trying Another Database Search – Medline

Let’s assume we looked all these articles and then came to #26 and clicked on the abstract. To locate more articles like this one we would click on the Descriptor “Fruit” to link to articles with the same subject heading.

Click on the Descriptor “Fruit” to find other relevant articles.
Part 2: Developing an Effective Research Strategy

Trying Another Database Search – Medline

Using “Fruit” we identified 37,184. This is obviously too high to work with so let’s use this subject heading on conjunction with a title search. Click on searching.

1. **A Pooled Analysis of 15 Prospective Cohort Studies on the Association between Fruit, Vegetable, and Mature Bean Con...**
   Author: Petimar J; Wilson KM; Wu K, and others Source: Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Res Libraries Worldwide: 494 See more details for locating this item

2. **Vegetable and fruit intake in Australian adolescents: Trends over time and perceptions of consumption.**
   Author: Jongenelis MJ; Scully M; Morley B, and others Source: Appetite 2018 Jun 30; 129: 49-54 Libraries Worldwide: 845 See more details for locating this item

3. **Fruit and vegetable consumption and its relation to risk of asthenopia among Chinese college students.**
   Author: Guo F; Zhang Q; Fan MN, and others Source: International journal of ophthalmology 2018; 11(6): 1020-1027 Libraries Worldwide: 170 See more...

4. **Morpho-anatomical, physiological and biochemical changes in rubber tree seeds.**
Part 2: Developing an Effective Research Strategy

Trying Another Database Search – Medline

Another effective search strategy is to cut and paste a subject heading into the search box and then do a title search for 1-2 relevant words. This is a very effective search strategy if you find that the same subject heading is being used over and over again in articles that relate to your topic.

Paste the Descriptor exactly as it appears, and select MeSH Heading which stands for Medical Subject Headings.

Make sure the Boolean Operator “And” is chosen and then use the word “Browning” for a title search. Initiate the search.
Part 2: Developing an Effective Research Strategy

- **Trying Another Database Search – Medline**

  By using subject headings and relevant search term in the title field you have identified 81 highly relevant articles.

1. **Effect of Grinding at Modified Atmosphere or Vacuum on Browning, Antioxidant Capacities, and Oxidative Enzyme Activities.**
   Author: Kim AN; Lee KY; Kim HJ, and others Source: Journal of food science 2018 Jan; 83(1): 84-92 Libraries Worldwide: 1077 Illinois Institute of Technology

2. **A multidisciplinary approach providing new insight into fruit flesh browning physiology in apple (Malus x domestica Borkh.).**
   Author: Di Guardo M; Tadiello A; Farneti B, and others Source: PloS one 2013; 8(10): e78004 See more details for locating this item

3. **A robust impact assessment that informs actionable climate change adaptation: future sunburn browning risk in apple.**
   Author: Webb L; Darbyshire R; Erwin T, and others Source: International journal of biometeorology 2017 May; 61(5): 891-901 Libraries Worldwide: 718 See more c
Part 2: Developing an Effective Research Strategy

Review of Graduate Study Research Techniques

- Use no more than 2-3 words and start out in the title field
- Separate your search terms with a space which is same as “AND”
- If you get too many results then you can add another search term or try a different search term.
- If you get too few results you can -
  1. Subtract a search term or try a different search term
  2. Select a broader field like the abstract or default field
- Identify one article that is particular relevant and then use the subject headings to link to other material with the same classification