

National Aeronautics and Space Administration



# NASA

# Space Life Sciences Library

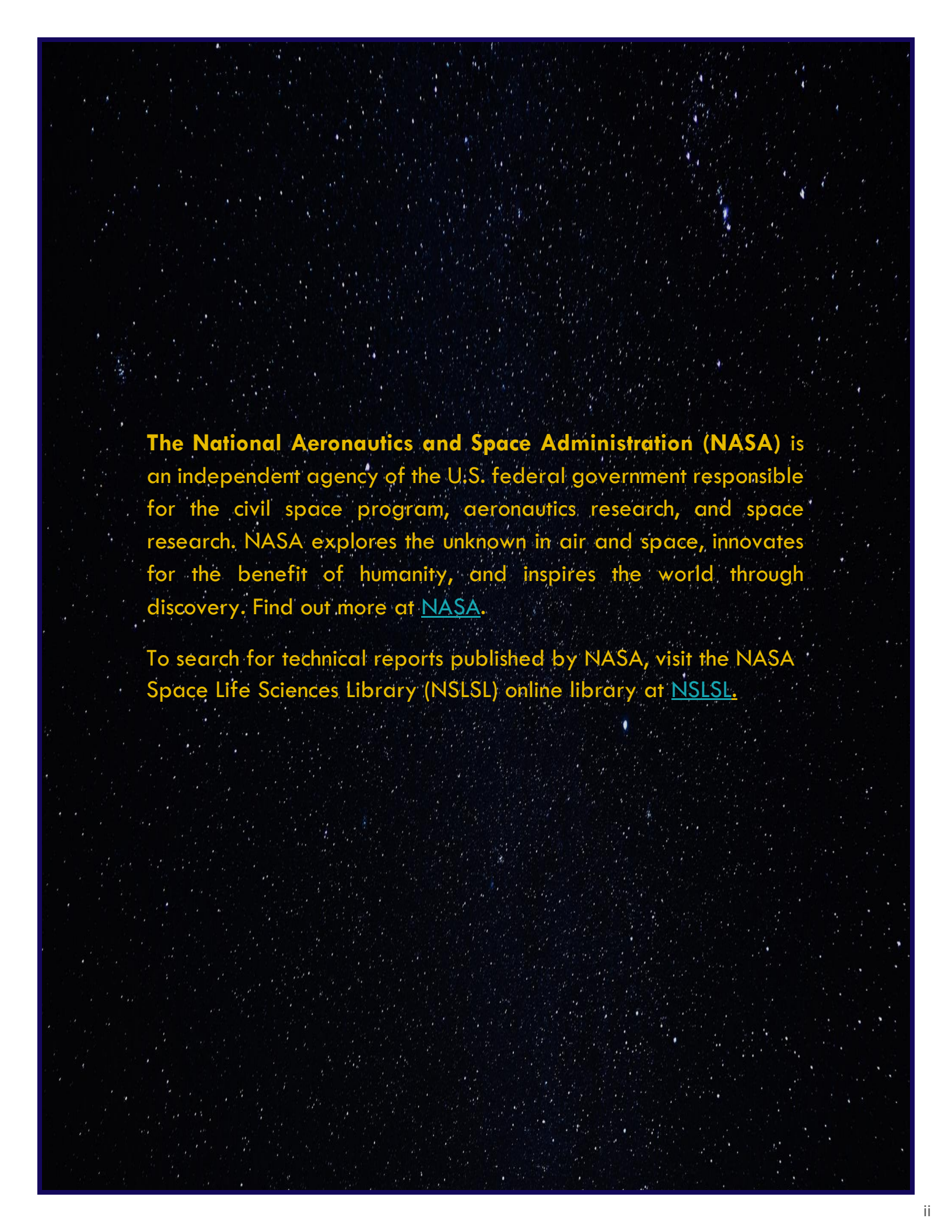
*External User's Guide*

*Version 1.0, June 2023*



NSLSL Version 1.0





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# The External NSLSL User's Guide

**A Companion Tool for Space Life Sciences Researchers & Scientists, Version 1.0**

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## Abstract

The [NASA Space Life Sciences Library \(NSLSL\)](#) seeks to consolidate global space life sciences literature into a single database to support research that addresses the effects of the space environment on biological systems.

The library is co-funded by NASA's Biological and Physical Sciences (BPS) division and Kennedy Space Center (KSC) and is managed by the Utilization and Life Sciences Office (UB) within the KSC's Exploration Research & Technology program while the publications themselves exist in, and come from, the public domain and are funded by their respective institutions.

The purpose of the library is to consolidate world-wide, peer-reviewed articles, dissertations, technical publications, and patent publications related to Space Life Sciences research into a single, global, central repository that is accessible to the public.

The public-facing library is accessible to all space life sciences researchers and scientists around the globe. There, you can search 200K+ articles related to space life sciences research and submit new, relevant publications to be included in the library.

This detailed User's Guide has been created as a companion tool for when performing advanced searching, using wild cards (\*), saving search results, metadata field terms and definitions, as well as how to submit a new publication.

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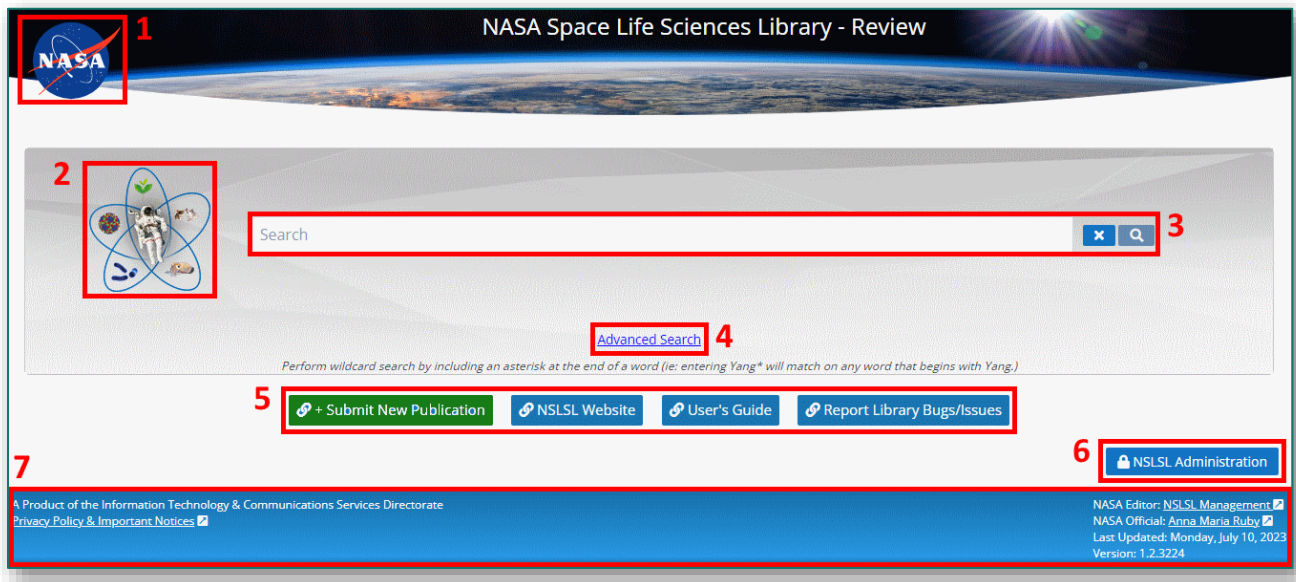


# External Library

*Explore features of the External Library and the various WebParts of the library's interface.*

# WEBPARTS

When a user accesses the public, external-facing library for the first time they will see the home/landing page as shown in Figure 1-1.



**Figure 1-1**

On this landing page, there are seven main webparts; each are defined and detailed in order of appearance below. As a note, for a list of all Acronyms and Field Terms & Definitions, see [Appendix A](#) and [Appendix B](#), respectively. This User's Guide also contains many ToolTips; for a full list of ToolTips listed throughout this User's Guide, see [Appendix V](#). For Full Navigation, see [Appendix W](#).

## NASA Logo

The NASA Logo is the first webpart on the NASA Space Life Sciences Library's homepage. By clicking the logo, the user will be taken to the NASA.gov homepage.

## Library Icon

The NSLSL Logo is the second webpart on the NASA Space Life Sciences Library's homepage. By clicking the logo, the user will be taken back to the NSLSL homepage.

## Search Box

The Search Box is where the user can enter their initial search term or complex combination SQL query if they are versed in SQL syntax.

There are two buttons directly to the right of the Search Box; an X, and a Magnifying Glass. Each have a unique functionality when clicked as described below:

- ▶ **X** – After typing in a term or terms into the search box, the user can click X to erase the search term



- **Magnifying Glass** – After typing in a term or terms into the search box, the user can hit enter on their keyboard to initiate the search or click on the magnifying glass

### Advanced Search

The Advanced Search link is the fourth webpart on the NASA Space Life Sciences Library's homepage. By clicking the link, the user will be taken to the Advanced Search page where they can perform more complex searches.

### External Links

The External Links area is the fifth webpart on the NASA Space Life Sciences Library's homepage. Here the user has direct access to the [NASA Space Life Sciences Library Website](#), this User's Guide, [Reporting Bugs/Issues](#), and [Submitting a New Publications](#). After clicking any of these links on the homepage of the library, a new tab will open to the corresponding website/page.

When clicking the Submit New Publication button, the window will refresh to the New Publication Details Page where the user can fill out a form to have a new publication added to the library if it does not already exist.

### NSLSL Administration

The NSLSL Admin button, in the sixth webpart area, is reserved for authorized NASA Site Administrators and Managers ONLY. Unauthorized users who click this button will receive a permissions error.

### Footer

The Footer is the last webpart on the NASA Space Life Sciences Library's homepage. Here users will find information such as the site Version, refresh date, the NASA Official, NASA Editor, and development directorate, as well as the Privacy Policy, and & Important Notices.

**Note:** For any/all library/site issues, questions, etc., please use the [Report Site Bug/Issue](#) link. Please DO NOT contact the NASA Official or Owner as they may not receive the email or respond due to security measures in place and spam blocking.



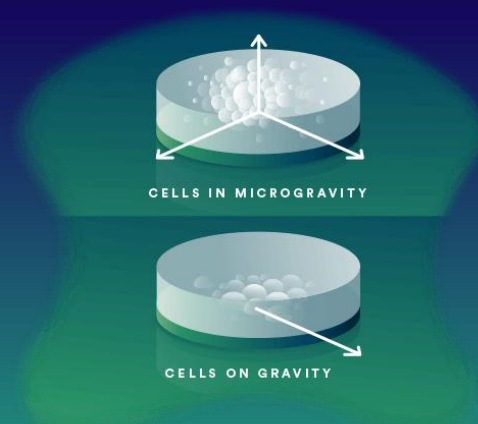
### ToolTip:

*You can initiate a combination Query directly in the Search Box using SQL syntax.*



### Fun Fact:

*While some cancer cells die in microgravity, some important stem cells proliferate and increase in size in space.*







# Search Box

*Explore how to use the default Simple Search box as well as when to use Wildcards \*.*





## SIMPLE SEARCH

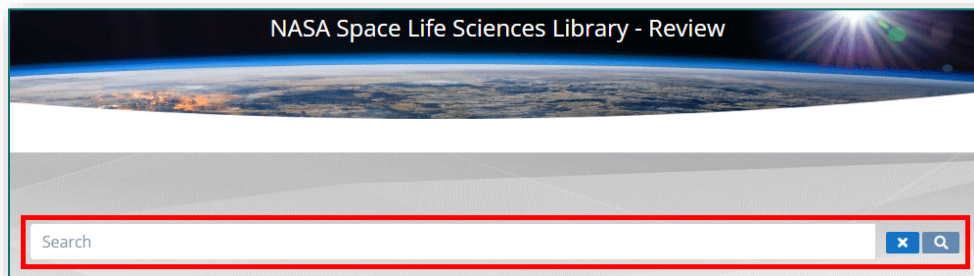
When accessing the library, users can immediately perform a search using the Simple Search Box shown in **Figure 2-1**.

As noted in the previous section, there are three main parts to the Simple Search; the Simple Search Box, and two buttons directly to the right of the Simple Search Box.

When the user enters a single search term or multiple search terms using SQL syntax, they can clear the text and values by clicking on the X to the right of the Simple Search Box.

Similarly, when executing a search, the user can hit Enter on their keyboard or click the Magnifying Glass to initiate the search.

For Simple Search examples, see [Appendix C](#).



**Figure 2-1**

## USING WILDCARDS

The wildcard for this library is the asterisk **\*** and can be used in both the Simple Search Box and the Advanced Search Box for every full or partial term.

When using an asterisk, place the asterisk at the end of the search term(s) being used. Using a wildcard in **most** instances, will broaden and return more search results than when not using an asterisk. Not using a wildcard will yield results with the EXACT search term used in **most** cases, while including the wildcard will return ALL instances of the word used and therefore more results.

It is recommended that users test the wildcard in various scenarios and with various fields selected to better understand its nuanced use.

For Wildcard examples, see [Appendix D](#).

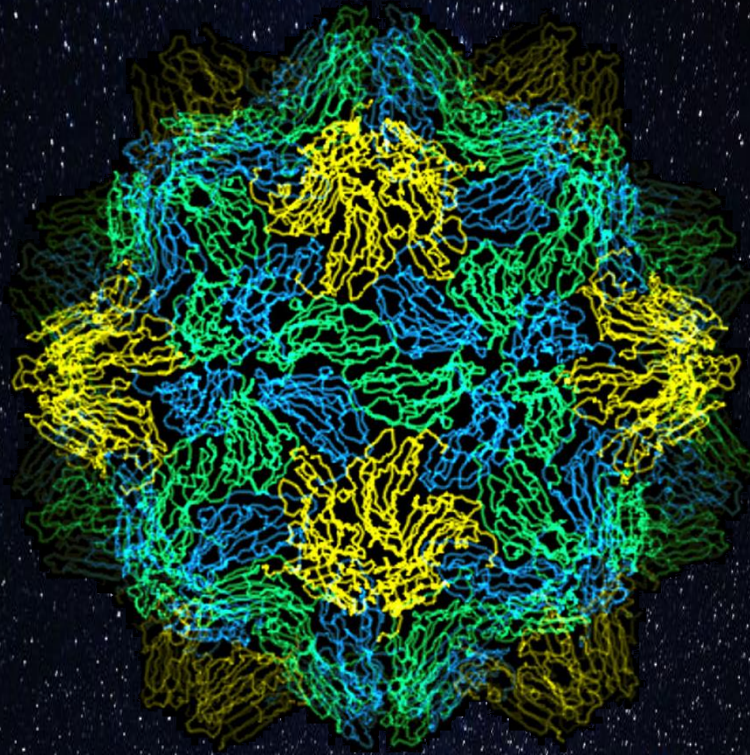
### Fun Fact:



*Rockets have better thrust in space because exhaust gases can exit much easier and faster due to there being no atmosphere.*





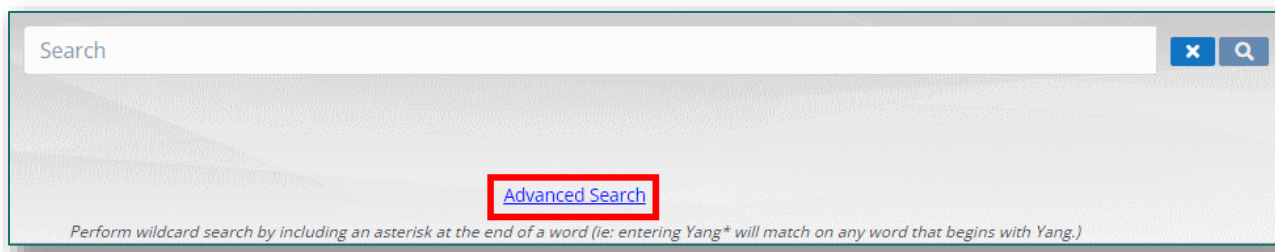


# Advanced Search

*Explore how to perform Advanced Searching and when to use the And, Not, and Or conjunctions.*

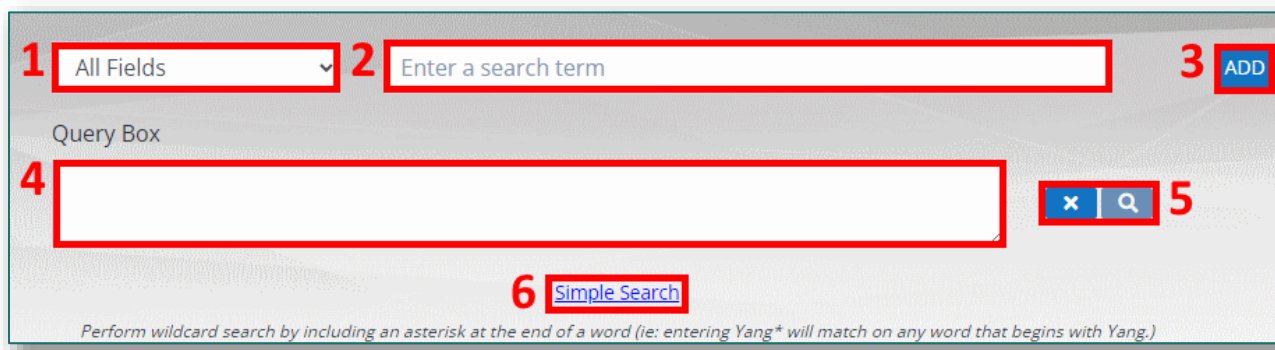
## ADVANCED SEARCHING

On the landing page of the library, below the Search Box, there is a link to access the Advanced Search as illustrated in **Figure 3-1**. When a user is performing a search, they can go directly to the Advanced Search screen, or enter an initial/starting term in the Search Box and click Advanced Search; the search term(s) will be preserved when transitioning to the Advanced Search screen.



**Figure 3-1**

After navigating to the Advanced Search page, the user will see six webparts as shown in **Figure 3-2**.



**Figure 3-2**

### All Fields

The first webpart on the Advanced Search screen is All Fields, which contains 34 metadata fields to individually search to include an All Fields selection. The All Fields selection is the default search field for both Simple Search and Advanced Search.

### Search Box

The second webpart is the Search Box; here users will enter their various search term(s) to begin their query.

### And, Not, & Or

The third webpart has only one button initially, Add, and after the initial search term is added, three buttons will appear that allows the user to add conjunctions for performing more complex searching; And, Not, and Or. It is advisable that users experiment with the conjunctions and using the asterisk. For detailed examples illustrating the differences in using [Field Combinations](#), [Multiple Conjunctions](#), and [Field and Conjunction Combinations](#), see Appendices [E](#), [E](#), and [G](#), respectively.



## ToolTip:

*You can directly edit text in the Query box. You can press Enter as well as use the magnifying glass. The search term(s) will be preserved if you navigate back to Simple Search.*

## Query Box

The fourth webpart on the Advanced Search screen is the Query Box; here users are able to see what the native SQL query syntax looks like when a search term is added or when multiple search terms are added for multiple fields while using multiple conjunctions. Any asterisk used will also show up in the Query Box.

The text in the Query Box can be directly edited; however, this is only recommended for advanced users who are familiar and versed with SQL syntax for when performing queries.

## Search Icons

Immediately to the right of the Query Box are two Search Icons, an X and a Magnifying Glass as shown in **Figure 3-2**.

After entering in one or more search terms, the Query Box will populate the syntax automatically. When the user is ready to execute their search, they can simply press Enter on their keyboard or click the Magnifying Glass.

Similarly, to clear the search, the syntax in the Query Box, and begin a new search, the user can click the X button.

**Note:** *When the user clicks the X button to clear the search terms and syntax from the Query Box, the actual results on the Search Result screen will not refresh to show zero results.*

## Return To Simple Search

If the user has performed an initial Simple Search and switches to the Advanced Search and wishes to go back to the Simple Search screen, the user can click on the hyperlink text for Simple Search as shown in **Figure 3-2**, Item 6.

If a user has not cleared out the search terms from the Advanced Search, the search terms will be preserved upon returning to the Simple Search screen. When this occurs, the Simple Search will now contain the SQL syntax from the Query Box now in the Simple Search box.

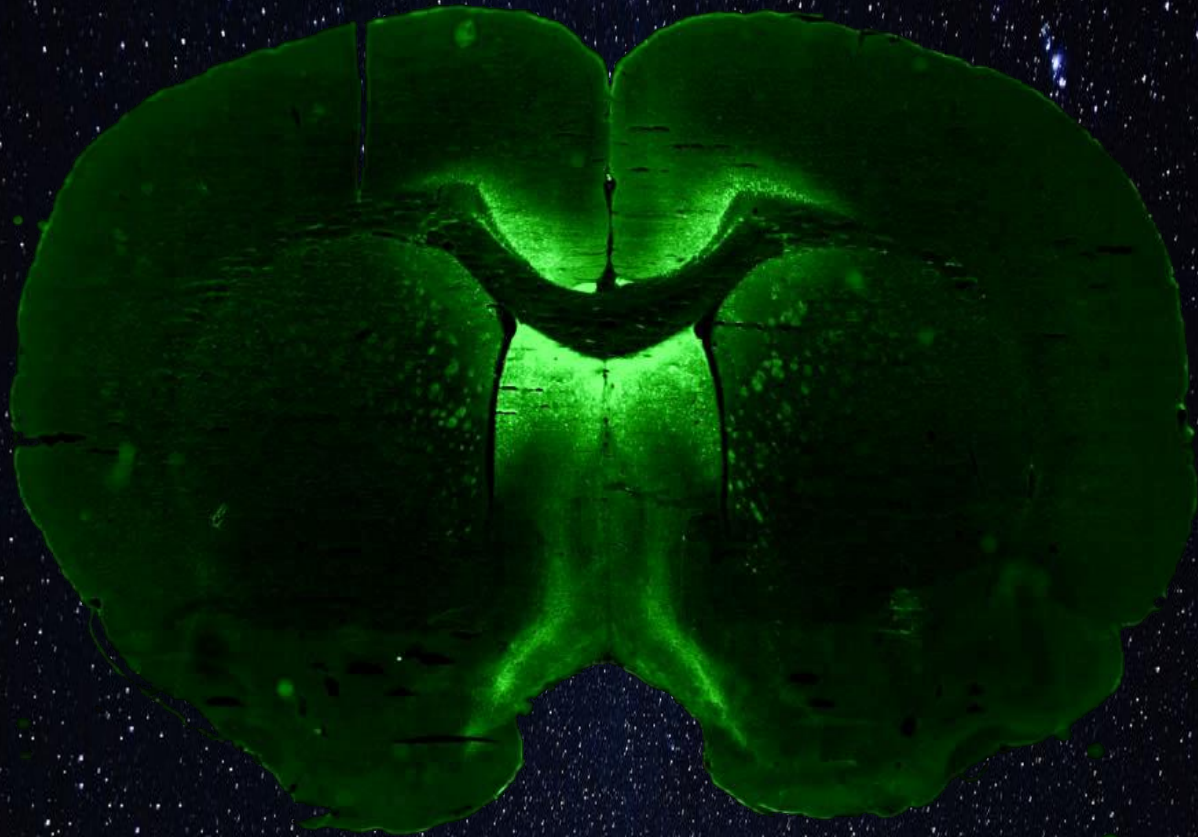
If a user has cleared out the search terms in the Query Box, when they click on the Simple Search link to return to the Simple Search screen, there will be no terms present in the Search Box and the user is able to begin a new search.

## Fun Fact:



*Although microgravity temporarily effects the sense of smell, many astronauts describe the 'smell of space' as metallic, ozone, brake pads, gunpowder, welding fumes/burnt metal.*





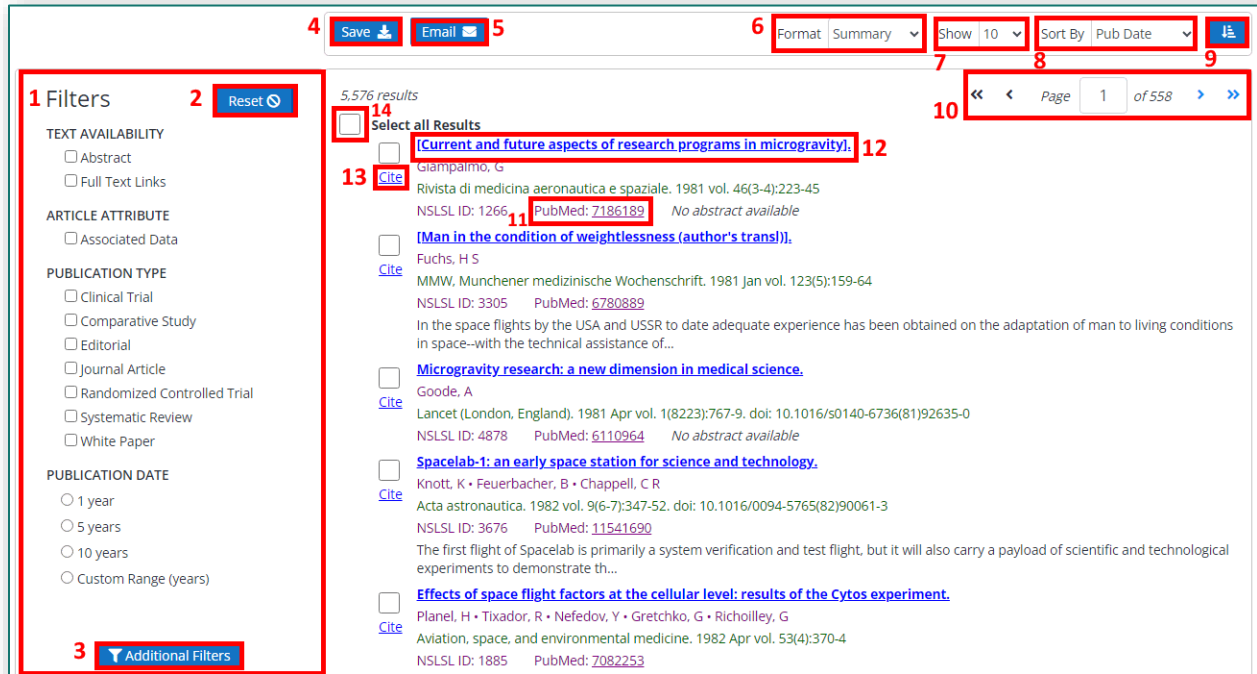
# Results Page

*Explore the various fields on the Search Results Screen and where items are located.*



# SEARCH RESULTS SCREEN

After a user performs a initial search, they are taken to the Search Results screen, which is comprised of 14 main parts as shown in **Figure 4-1**. Each of these parts are further defined and detailed below in corresponding, sequential order.



**Figure 4-1**

## Filters

The Filters area lets a user further refine their search results with quick, selectable options under four main headings; Text Availability, Article Attribute, Publication Type, and Publication Date.

## Filter Reset

When and after a user has Filters selected and they wish to clear all Filters, whether within the Filters list or in the Additional Filters list, a user can click on the Reset button to clear all filters selected.

## Additional Filters

Users can further refine search results by clicking on the Additional Filters button. Here, the user will be met with a pop-up window with many more specific metadata fields from which to select.

## Save

The Save button provides the user with several format and output options in which to save their results.



### *Email*

Similar to the Save button, the Email button provides users with several format and result options for emailing their results.

### *Format*

In the display pane, the user can select between the Format options for how results are displayed on screen.

### *Show*

Also in the display pane, users can select how many results they wish to see at a time by selecting from the Show menu.

### *Sort By*

Additionally, the Sort By menu in the display pane will allow users several options to choose from to select how the results are sorted.

### *Ascending/Descending*

Lastly, the Ascending/Descending button in the display pane will sort the results in alpha-numeric order.

### *Navigation*

The Navigation Pane is located at the top and bottom of the Search Results screen and displays the page the user is actively on as well as Previous, Next, First, and Last navigation arrows.

### *External Link*

The area reserved for External Links identifies the source name and will take the user to the article's hosting site when clicked.

### *Internal Link*

The area reserved for Internal Links is the title of the article and will take the user to view the article's metadata on the NSLSL site.

### *Cite*

The Cite feature to the left of every article will allow the user to copy a citation in one of four formats: AMA, APA, MLA, and NLM.

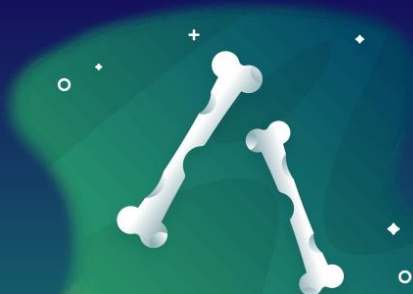
### *Select All*

For saving and emailing, the Select All feature allows the user to Select All results on screen and/or specific results by deselecting.

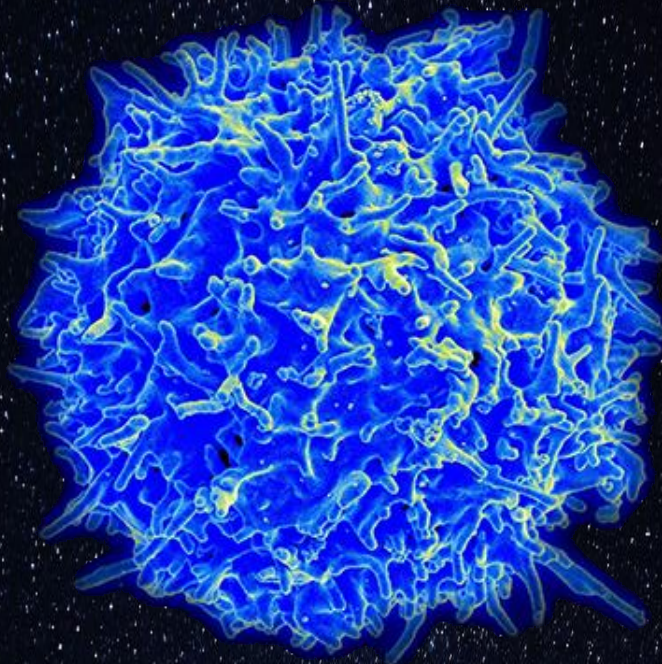
### **Fun Fact:**



*In microgravity, parts of the human skeleton prematurely age by up to 10 years with an average bone loss of 1-2% per month.*







# Filters

*Explore the default Filter categories and fields and learn how to Reset the selection.*

## DEFAULT FILTERS

Users are able to quickly further refine their search results by using the Filters pane on the left-hand side of the Search Results screen as shown in **Figure 5-1**. Here, users can select one or more boxes to narrow search results based on the defined criteria selected.

It is important to note that by selecting any one or more of these boxes that the criteria is 'inclusive' and not 'exclusive.' For example, by selecting Associated Data under Article Attribute, this will filter the current search result set to only *include* those articles that have metadata in the Associated Data field.

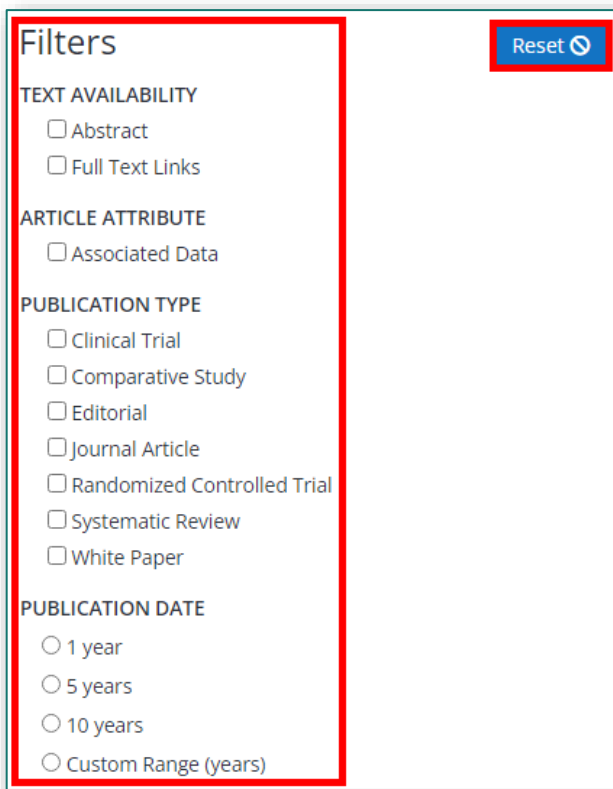


Figure 5-1

### Reset

The Reset button to the right of the Filters pane will reset all filter boxes to be unselected. Clicking on Reset button will also unselect any items that were selected using the Additional Filters option. When the Reset button is clicked, the Search Results screen will refresh with the original search results selections/list.

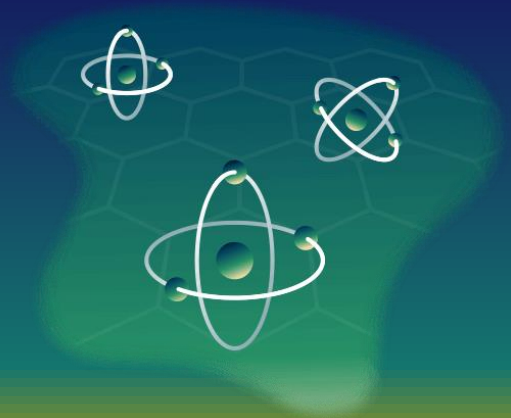
### ToolTip:

*The Custom Date Range will allow you to go back to any year in history.*

### Fun Fact:



*Created by scientists in space and coined the 5<sup>th</sup> state of matter, Bose-Einstein condensates are a group of atoms that were cooled to near absolute zero, began to clump together, and behave as if they were one big super-atom.*







# Advanced Filters

*Explore the Advanced Filter categories and fields  
and learn how to Reset the selection.*

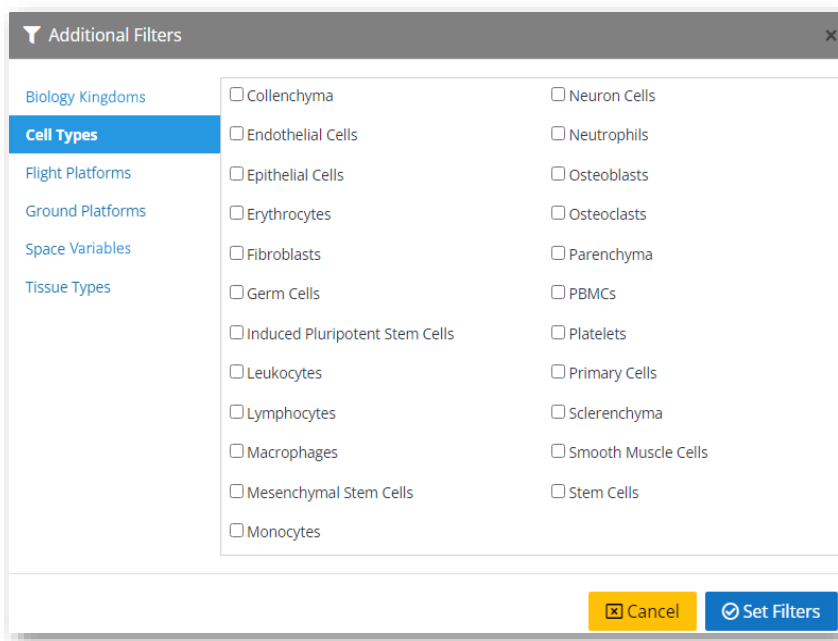


## ADDITIONAL FILTERS

To access the Additional Filters menu from the Search Results screen, see Item 3 in **Figure 4-1** in [Section 4](#), Search Results Screen.

When the Additional Filters button is clicked, a pop-up window will open as shown below in **Figure 6-1**; here, users can further refine their search results by selecting any box(es) under any of the different categories. For a full list, see [Appendix H](#).

Currently there are six Additional Filter categories with a number of options available under each category.



**Figure 6-1**

### Set Filters

After the user has checked and selected the boxes they wish to include in the filtering, the user will click Set Filters as shown in the bottom right-hand corner of **Figure 6-1**.

Upon clicking Set Filters, the pop-up window will close, and the Search Results screen will automatically refresh with new results.

### Reset

As detailed in [Section 5](#) - Filters, and illustrated in **Figure 5-1**, the Reset button to the right of the Filters pane will reset all filter boxes to be unselected to include those checked under Advanced Filters. When the Reset button is clicked, the Search Results screen will refresh with the original search results selections/list.

### Fun Fact:



Satellites orbit in extreme conditions and can experience 20K volt electrostatic discharge and temperature fluctuations of 300°C.







# Results Display

*Explore how to Display, Format, Show, and Sort search results.*

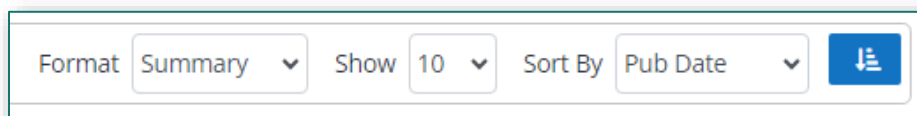
## SORTING & DISPLAY

The Sorting & Display Panel is located in the upper right-hand area on the Search Results screen as shown in **Figure 4-1**, Items 6, 7, 8, and 9 in [Section 4](#), Search Results.

Here users will be able to format and sort their results using the Format, Show, and Sort By selection options identified below in **Figure 7-1**.

Users will be able to toggle these features in order to achieve optimal results to meet their research needs.

After selecting any value from either list/field, the search results will automatically be refreshed on-screen and display the user results based on the specified criteria.



**Figure 7-1**

- ▶ **Format** – Users can select between two values, Abstract and Summary, under the Format menu
- ▶ **Show** – Users can select how many results they would like to see populated on the Search Result Screen at a time; whether 10, 20, 50, 100, or 200
- ▶ **Sort By** – Users can Sort their results by any of the seven options under Sort By; Publication Date, First Author, Title, Journal Title, NSLSL ID, Source ID, Source Name

**Note:** When Sort By is used, the default sort/display order is alpha-numeric ascending.

### Display

After the user has selected the Format of the results, how many results to show on a page at a time, and chosen their preferred sorting method, the user can then select the Display button shown on the far right-hand side of the Display Panel in **Figure 7-1** to further sort results in alpha-numeric Ascending or Descending Order.

**Note:** The arrows will not change orientation when clicked but the horizontal bars will.

### ToolTip:

*The Search Results will automatically update after selecting Format, Show # of Results, or Sort By.*

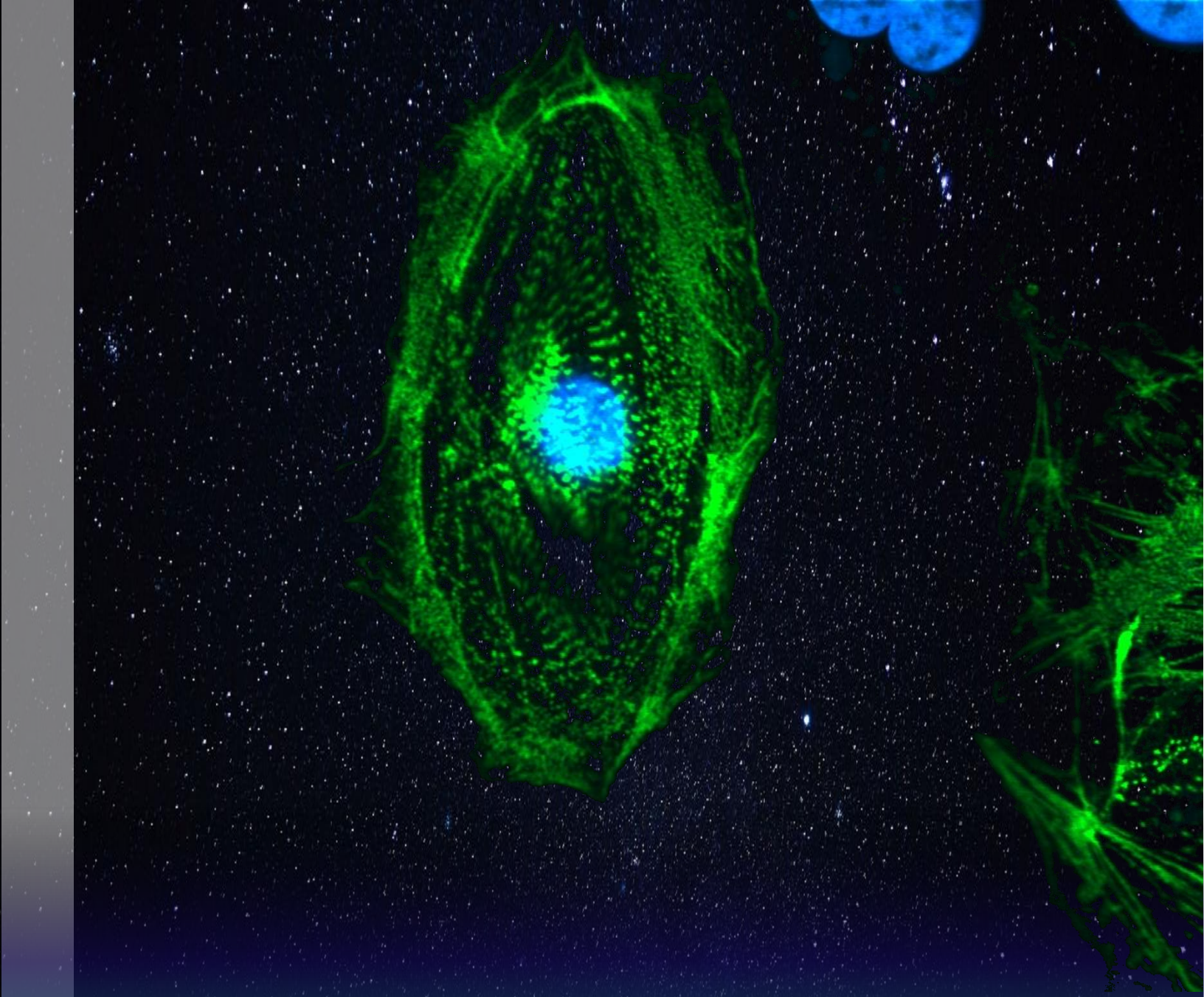
### Fun Fact:



*On Earth, plants grow upward while roots grow downward, but in microgravity, direction is unregulated, and some roots extend in the same direction as the stems.*







# Navigation

*Explore how to Navigate between Next, Previous, First, and Last pages when viewing search results.*



## NAVIGATION DISPLAY

There are two Navigation Panels that the user will encounter within the library; the first is on the Search Results screen as shown in **Figure 4-1**, Item 10 in [Section 4](#) – Search Results, and below in **Figure 8-2**. The second Navigation Panel is on the Publication Details Page as shown below in **Figure 8-1**.

### Publication Details Screen Navigation Panel

When a user clicks on the title of a publication from the Search Results screen, a new tab will open to display the Publication Details. On the right-hand side of the screen, the user will see the Navigation Panel; using this feature, the user can navigate forwards and backwards between publications without having to go back to the Search Results screen and click on every title. When using the Navigation Panel to migrate between records, the “next” record displayed will be the same as the “next” record on the Search Result screen.

Journal of colloid and interface science. 2002 Nov 15. vol. 255(2):375-81. doi: 10.1006/jcis.2002.8618

### The thermocapillary migrations of two bubbles in microgravity environment.

Cite



Figure 8-1

### Fun Fact:



Plants in space have to be watered via a syringe into a foam block to ensure water does not ‘float’ away and that plant roots can breathe and not become waterlogged.



### Search Results Screen Navigation Panel

After results are populated from performing an initial Simple or Advanced Search, users can navigate through the Search Result pages using the on-screen Navigation Panel.

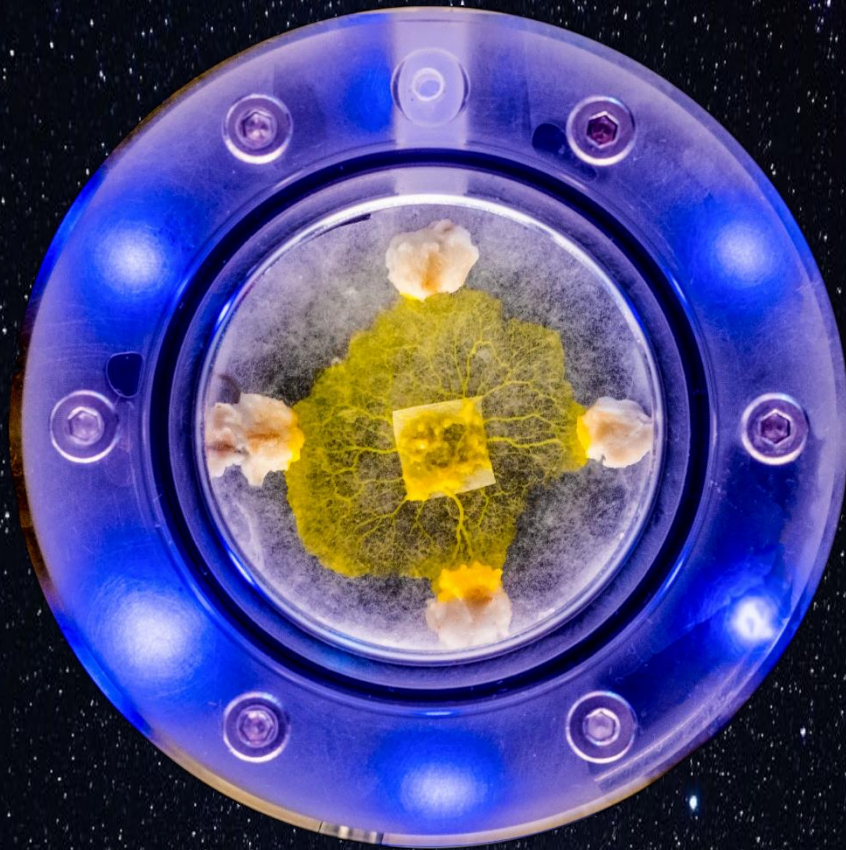
The Navigation Panel allows a user to navigate the search result set by means of Next, Previous, First, and Last navigation arrows/buttons. The Navigation Panel will also display the current page the user is on as well as the total number of pages.

This Navigation Panel is also duplicated at the bottom of the screen for the user’s convenience should the user elect to Show 50, 100, or 200 results on-screen at a time.



Figure 8-2





# Search Results

*Explore the Default Search Result Fields and how to Expand and Collapse the Abstracts.*

## DEFAULT FIELDS DISPLAYED

After a user executes a initial Simple or Advanced Search, the active window will refresh with the search results displayed on-screen. There are 11 default fields for every result as identified in **Figure 9-1** below; as a note, Item 1 is a static value for the number of results found and is included in the count while the actual metadata fields are 10 in total.

Each field is further listed and defined below, as numbered, in order of appearance. The order actually shown on the user's screen may differ slightly based on the Sort By values and/or Format the user has selected in the Display Panel. The image below depicts the default order.

134 results 1

Page 1 of 14

Select all Results

2

3 4 5 6

Plant signaling & behavior 2018 Jan vol. 13(1) e1422468 doi: 10.1080/15592324.2017.1422468

7 [Growth and cortical microtubule dynamics in shoot organs under microgravity and hypergravity conditions.](#)

8 Soga, Kouichi • Wakabayashi, Kazuyuki • Hoson, Takayuki

9 NSLSL ID: 1686 PubMed: 29286875 10

11 The body shape of plants varied in proportion to the logarithm of the magnitude of gravity in the range from microgravity to hypergravity to resist the gravitational force. Here we discuss the roles of cortical microtubule and 65 kDa microtubule-associated protein-1 (MAP65-1) in gravity-induced modification of growth anisotropy. Microgravity stimulated elongation growth and suppressed lateral expansion in shoot organs, such as hypocotyls and epicotyls. On the other hand, hypergravity inhibited elongation growth and promoted lateral expansion in shoot organs. The number of cells with transverse microtubules was increased by microgravity, but decreased by hypergravity. Furthermore, the levels of MAP65-1, which is involved in the maintenance of the transverse microtubule orientation, were increased by microgravity, but decreased by hypergravity. Therefore, the regulation of orientation of cortical microtubules via changes in the levels of MAP65-1 may contribute to the modification of the body shape of plants to resist the gravitational force.

Cite

Figure 9-1

### Number Of Results

The Number of Results is a static value that will remain at the top-left of the Search Results Page regardless of how many pages there are.

### Journal Title

The Journal Title is the title of the original publication source of the article.

### Publish Date

The Publish Date is the original publication date of the article in the original source journal/site.

### Volume & Issue

The Volume & Issue is from the original publication source; as a note, not all articles have an issue number.



## E-Location

The E-Location ID Contains location information for a publication and is always present for publications that do not have standard page numbers.

## Digital Object Identifier

The DOI is a unique ID assigned to an article and provides it with a permanent web address.

## Title

The Title of a publication will be the original title from the original source.

## Authors

The Author fields list the authors in order as they are listed on the original article from the original source.

## NSLSL Identifier

The NSLSL ID is unique for each publication and is assigned upon the article's import into the library. This is used internally by the NSLSL Admins when managing the library.

## External Source Identifier

The External Source ID has two parts, the name/title of the External Source, usually the library/database from which a publication was imported, and the ID itself, which is a unique ID assigned to a article by the hosting site, library, or database. The majority of articles will have a PubMed, PubMed Central, NTRS, or EuropePubMed Central External Source ID.

## Expand/Collapse Abstract

Item 11 in **Figure 9-1** shows an up-facing arrow in the top, left-hand corner of the field. This indicates that the Format selected is Abstract and the field displays the full abstract of the article.

By clicking on the arrow, the user is able to Expand/Collapse the abstract while viewing the Search Results list. In contrast, if the user has Summary selected as the display Format, the user will not see the Expand/Collapse button. For an example of the difference between displaying Summary Vs. Abstract, see [Appendix I](#).

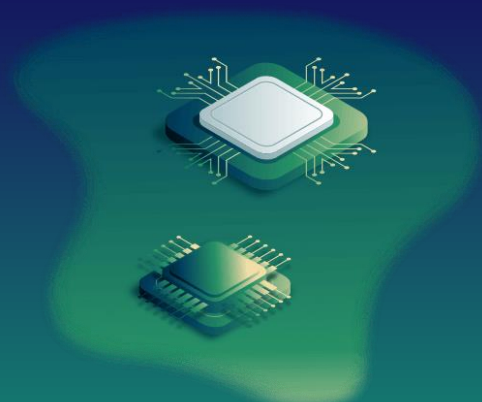
## ToolTip:

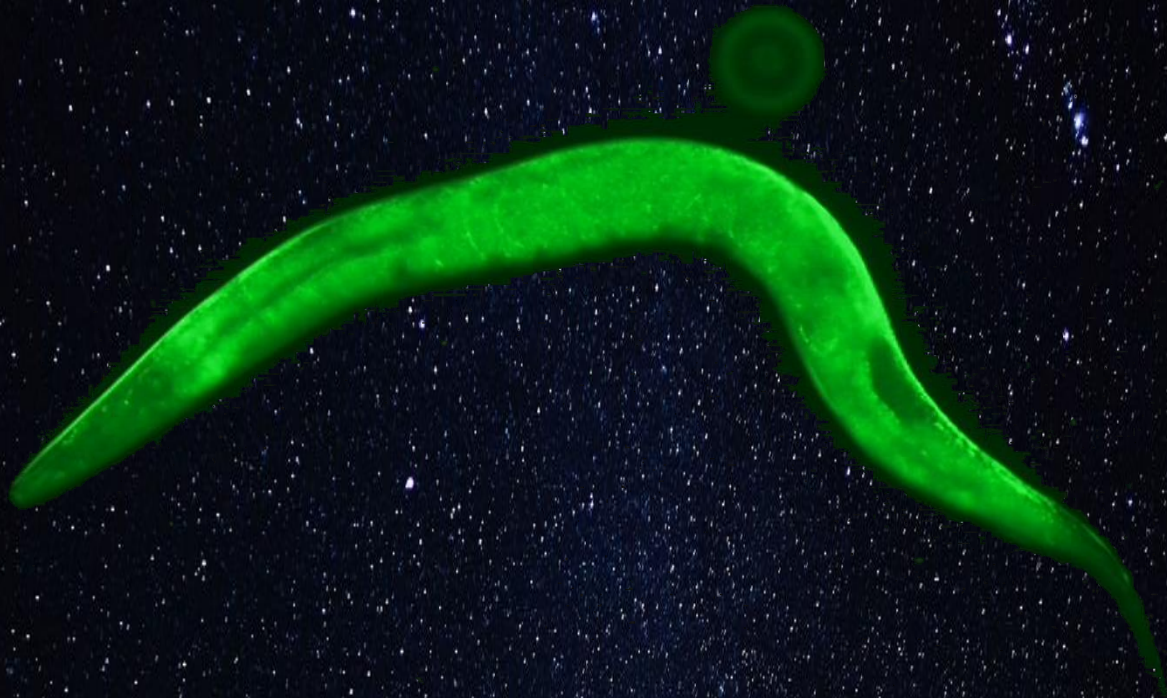
*To better refine Search Results, use the asterisk symbol \* after your search term(s).*



## Fun Fact:

*Tin, zinc, and cadmium plating are prohibited in space electronics as tin whiskers (crystals) can grow causing shorts.*





# Citing

*Explore how to create, format, and export/copy a Citation.*

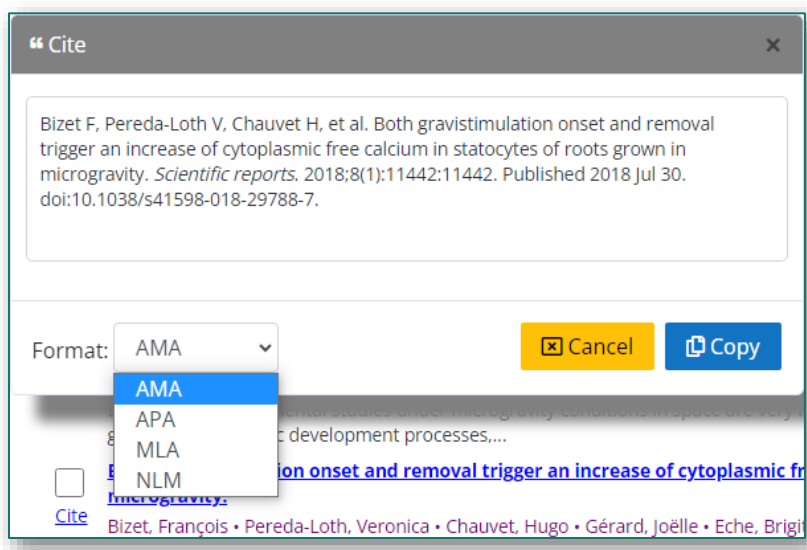




## FORMAT SELECTION

After a user performs an initial Simple or Advanced Search, the user can select and copy the citation for any publication. The Cite button for every article is located on the left-hand side of the publication's metadata details as shown in **Figure 4-1**, Item 13, in [Section 4](#), Search Results.

When a user clicks the Cite button, a pop-up window will open where the user can select from four Format choices as shown below in **Figure 10-1**. For detailed examples of [AMA and APA](#), and [MLA and NLM](#) formats, see Appendices [J](#) and [K](#), respectively.



**Figure 10-1**

- ▶ **AMA** – American Medical Association: Used by authors in the medical, health, and other life science fields
- ▶ **APA** – American Psychological Association: Used by authors in the psychology, sociology, and other social science fields
- ▶ **MLA** – Modern Language Association: Used by authors in the Language, Literary, and other humanities fields
- ▶ **NLM** – National Library of Medicine: Used by authors in the medical field

### Copy Citation

After a user selects their preferred Format of the citation, they can click the Copy button shown in **Figure 10-1**, and copy the citation to any source, which will also preserve the format as well as formatting of the citation.

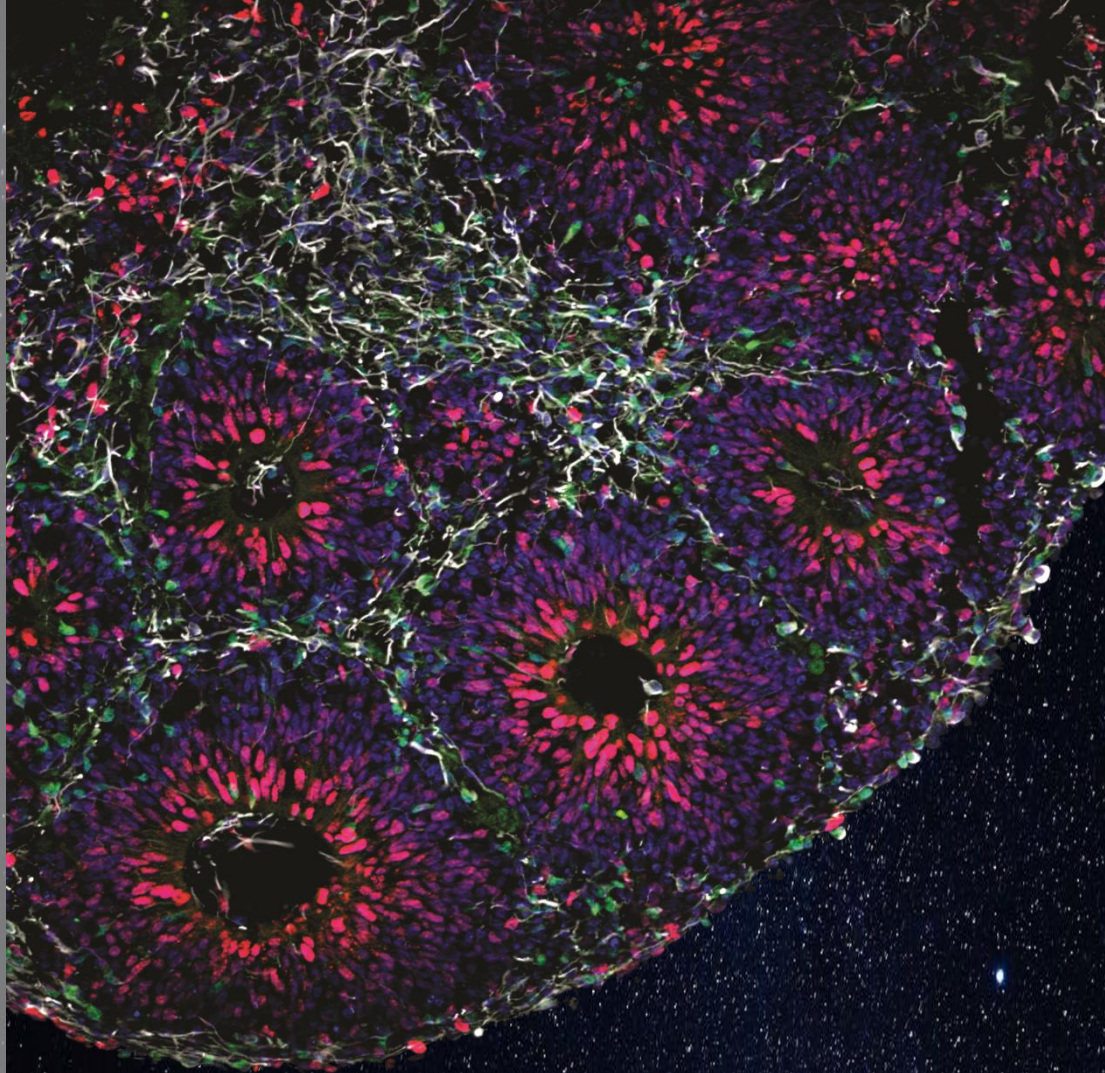
### Fun Fact:



*In microgravity, liquids are held together by surface tension and can be much larger and slower than liquids on the ground.*







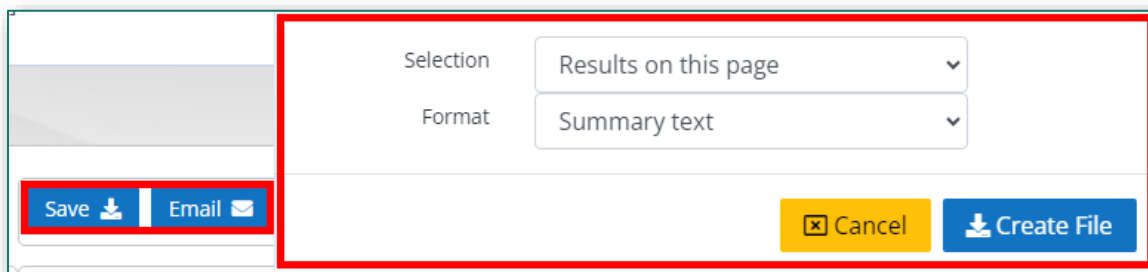
# Saving & Emailing

*Explore how to format, download, Save, and Email search results.*



## EMAILING & SAVING RESULTS

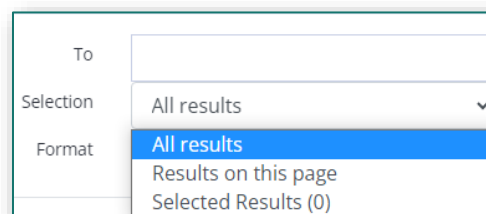
On the Search Results page, the user has the option to Save or Email the search results list by clicking the Save or Email button. After clicking either option, a pop-up window will appear allowing the user to specify the selection and format criteria of the results as shown in **Figure 11-1**. The main difference between the pop-up windows, is that the Email option will have a To field for entering an email address of the recipient.



**Figure 11-1**

### Email Selection Options

When a user clicks the Email button, a pop-up window will open with Selection and Format options. The Selection drop-down menu contains the following as shown in **Figure 11-2**:

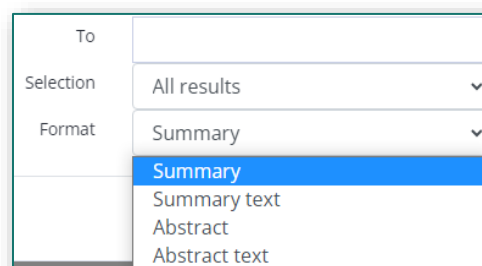


**Figure 11-2**

- ▶ **All Results** – This will select all results; not just those on screen or selected
- ▶ **Results On This Page** – This will select all results on the current page, which directly correlates to value in the Display pane under Show; 10, 20, 50, 100, or 200 items per page
- ▶ **Selected Results** – This will select only the results that have a checked check box

### Email Format Options

The second drop-down menu is Format and contains the following options as shown in **Figure 11-3**:

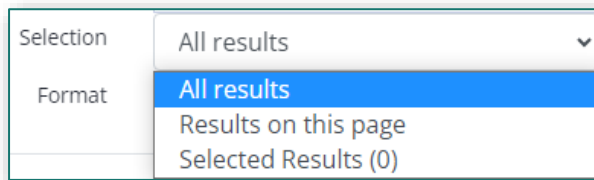


**Figure 11-3**

- ▶ **Summary** – Selecting this option will display the link and primary metadata such as Title, Author, Journal, Date, DOI, and External Source ID. See [Appendix Q](#) for example.
- ▶ **Summary Text** – Selecting this option will display the same information as the Summary option but in plaintext format (no links). See [Appendix P](#) for example.
- ▶ **Abstract** – Selecting this option will display the same metadata as the Summary option plus the full Abstract and with hyperlinks. See [Appendix Q](#) for example.
- ▶ **Abstract Text** – Selecting this option will display the same data as Summary Text plus the full Abstract but with no hyperlinks (plaintext). See [Appendix R](#) for example.

## Save Selection Options

Identical to the Email Selection options, the Save Selection drop-down menu in **Figure 11-4** contains the following:

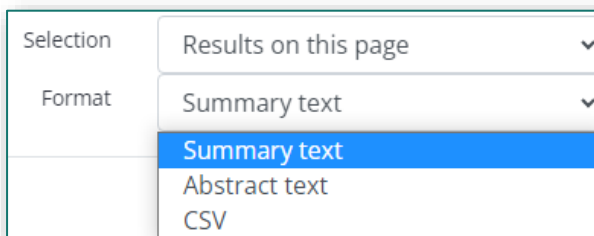


**Figure 11-4**

- ▶ **All Results** – This will select all results; not just those on screen or selected
- ▶ **Results On This Page** – This will select all results on the current page, which relates to the value in the Display pane under Show; 10, 20, 50, 100, or 200 items per page
- ▶ **Selected Results** – This will select only the results that have a checked check box

## Save Format Options

Similar to the Email Format options, the Save Format options, shown in **Figure 11-5**, include the Summary and Abstract Text versions of the result set as well as a CSV (plaintext, unformatted Excel file) version.



**Figure 11-5**

- ▶ **Summary Text** - Selecting this option will save the results as a plaintext .TXT file (no links) with data such as Title, Author, Journal, Date, DOI, and External ID. See [Appendix L](#) for example.
- ▶ **Abstract Text** – Selecting this option saves the results the same as the Summary Text options plus the full abstract. See [Appendix M](#) for example.
- ▶ **CSV** – Selecting this option saves the results the same as Abstract Text but in a plaintext, CSV Excel file. See [Appendix N](#) for example.

## ToolTip:

*When Saving or Emailing results, you do not have to 'Select All' as this is an option in the pop-up window. Multiple email addresses are not allowed.*

## Fun Fact:



*Bacteria exhibit enhanced growth and increased virulence due to the way microgravity alters the environment around the cells, which leads to behavioral changes.*

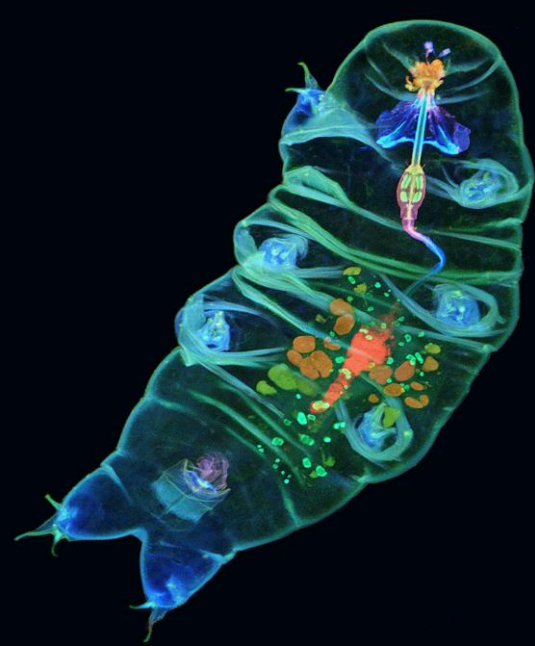






# Viewing

*Explore how to View a publication's metadata as well as the native/original source.*



## INTERNAL & EXTERNAL LINKS

After a user has performed an initial Simple or Advanced Search, the search results will be displayed in a list fashion. By default, the same metadata will be displayed for each search result as illustrated and detailed in [Section 9](#) – Default Fields, **Figure 9-1**.

As part of the metadata displayed for each article is the article’s Internal Link (Item 1) and External link (Item 2) as identified in **Figure 12-1** below, respectively.

### Viewing Articles Internally

The Internal Link for any article will always be the clickable, hyperlinked title of the article. When a user clicks on the title of

Select all Results **1**  
 [Growth and cortical microtubule dynamics in shoot organs under microgravity and hypergravity conditions.](#)  
 Soga, Kouichi • Wakabayashi, Kazuyuki • Hoson, Takayuki  
[Cite](#) Plant signaling & behavior. 2018 Jan vol. 13(1):e1422468. doi: 10.1080/15592324.2017.1422468  
 NSLSL ID: 1686 [PubMed: 29286875](#) **2**

**Figure 12-1**

the article, the article’s publication details will open in a new tab in the user’s web browser. Here, the user can view all the associated metadata of the publication on one page to include the full-text link and a downloadable PDF of the article, if it exists.

To see an Internal Link example, see [Appendix S](#).

**Note:** The full-text link is different from the External Link described below; the full-text link will take the user to the original source where the article is published (Journal of Medicine, etc.) while the External Link will take the user to the publication details on the External Source site.

### Viewing Articles Externally

The External Link for any article will always be the clickable, hyperlinked External Source ID Number. When a user clicks on the link, a new tab will open in the user’s web browser and take them to the External Source page. The External Source page is the website where the article was imported from into the library.

To see an External Link example, see [Appendix T](#).

**Note:** For the majority of publications in the NSLSL library, the External Source site/page will be PubMed, PubMed Central, EuropePubMed Central, or NSTI (NASA Scientific & Technical Information).

### Fun Fact:



In microgravity, flames don’t extinguish under low-oxygen conditions as on earth – instead, they break apart into “flamelets,” and move towards oncoming oxygen.







# Adding Articles

*Explore how to submit a new publication to be evaluated for inclusion in the library.*

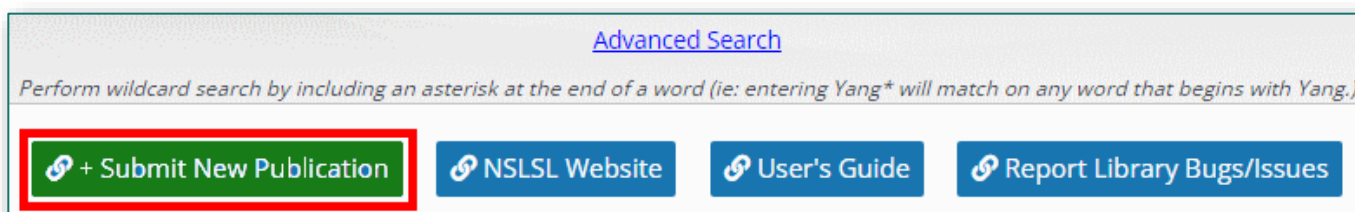
## SUBMITTING NEW PUBLICATIONS

When performing general, space life science research, users will use a variety of resources at their disposal. If a user comes across a publication that does not exist in the NSLSL, the user can submit a request for it to be added to the library.

On the homepage of the library, on the left under the Advanced Search link, there is a button "Submit New Publication," shown in **Figure 13-1**. Here, users can fill out a detailed form for any space life science article to be evaluated for inclusion in the library.

### ToolTip:

*If you are adding an article from PubMed, PubMed Central, NTRS/STI, or Europe PubMed Central, identify the External Source Id.*



**Figure 13-1**

After the user completes filling out the form and submits, the request is received by the NSLSL Admin team for evaluation, and it enters into a workflow. During the workflow process, the request, by default, is routed to Under Review where an NSLSL Admin will review the article to ensure it meets the following acceptance criteria:

- ▶ **Relevancy** – The article is specific to space life science research
- ▶ **Completeness** – The article has all relevant metadata fields filled out
- ▶ **Currency** – The article is moderately current, having been published in the last 5-10 years
- ▶ **Type** – Although the library accepts many article types, those that have been peer-reviewed will take priority

### Publication Fields

For a full list of the publication and metadata fields as well as their definitions, see [Appendix B](#). For an example of what the New Publication Form looks like, see [Appendix U](#).

**Note:** Fields noted with a red asterisk \* are required fields.

### Fun Fact:



*Optical fiber in microgravity significantly reduces imperfections leading to higher-quality fibers than can be produced on the ground.*





## APPENDIX A – ACRONYMS & GLOSSARY

ACRONYM	DEFINITION
<b>AMA</b>	American Medical Association
<b>APA</b>	American Psychological Association
<b>API</b>	Application Programming Interface
<b>BPS</b>	Biological and Physical Sciences
<b>CSV</b>	Comma-Separated Values
<b>DOI</b>	Digital Object Identifier
<b>ID</b>	Identification
<b>KSC</b>	Kennedy Space Center
<b>MLA</b>	Modern Language Association
<b>NASA</b>	National Aeronautics and Space Administration
<b>NLM</b>	National Library of Medicine
<b>NSLSL</b>	NASA Space Life Science Library
<b>NTRS</b>	NASA Technical Reports Server
<b>PDF</b>	Portable Document Format
<b>SQL</b>	Structured Query Language
<b>STI</b>	Scientific & Technical Information
<b>TXT</b>	Text
<b>UB</b>	Utilization and Life Sciences

## APPENDIX B – FIELD TERMS & DEFINITIONS

FIELD TERM	DEFINITION
<b>Abstract</b>	A short summary of the article/publication
<b>All Fields</b>	Default search field when performing a Simple Search or Advanced Search; also, an independent field that can be selected for all subsequent search terms
<b>Associated Data</b>	A general field to add additional article/subject information
<b>Author</b>	Identifies all authors in the same order as the original article
<b>Biology Kingdom*</b>	Custom field created by the NSLSL Management Team to identify the taxonomy/kingdom of the article's research
<b>Cell Type*</b>	Custom field created by the NSLSL Management Team to identify the specific cell types referenced in the article
<b>DOI</b>	Digital Object Identifier of the original article source
<b>E-Location</b>	Contains location information for a publication and is always present for publications that do not have standard page numbers
<b>Epub Year</b>	Original year the article was published online
<b>External Source ID</b>	Unique identification number assigned by the publisher
<b>Flight Platform*</b>	Custom field created by NSLSL Management Team to identify the specific flight platform used to conduct the research
<b>Flight Platform Link*</b>	Customer field created by the NSLSL Management Team to enter a link to the flight platform information used to conduct the research
<b>Full Text</b>	The original full text of the article as imported from the article's API
<b>Full Text Link*</b>	A link to the full text version of an article
<b>GeneLab Link*</b>	Custom field to identify the link for more information if GeneLab equipment was used to conduct the research
<b>Grant Support</b>	Identifies the article's grant/funding source
<b>Ground Platform*</b>	Custom field to identify the various hardware used to conduct the research
<b>Ground Platform Link*</b>	Custom field to identify the link to more information about specific hardware used to conduct the research



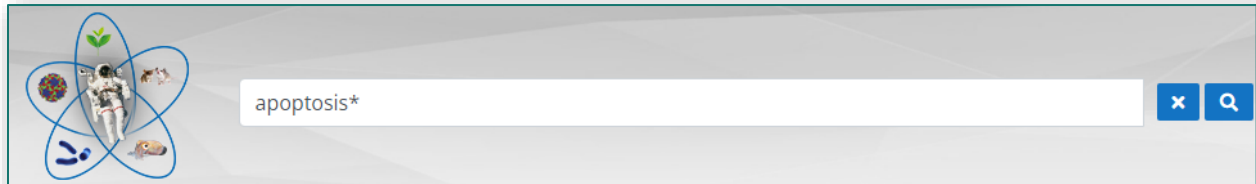
FIELD TERM	DEFINITION
<b>Issue</b>	Identifies the original issue the article was published in if the article came from a journal or similar source that has volumes and issues
<b>Journal Title</b>	Identifies the title of the journal where the article was originally published
<b>Keyword</b>	Identifies the primary subject/topics of the conducted research and article
<b>Language</b>	Identifies the native language of the original publish article
<b>NSLSL ID*</b>	Custom field used to internally manage and tract entries/records in the NSLSL
<b>ORCID*</b>	An author's unique identification number
<b>Organism*</b>	Custom field used to identify the specific organism (s) used in the research
<b>Pages</b>	Identifies the number of pages of the original article
<b>Pub Year</b>	Identifies the year the original article was published
<b>Publication Type</b>	Identifies the nature of the publication
<b>Space Variables*</b>	Custom field used to identify the specific space environments of conducted research
<b>Tissue Type*</b>	Custom field used to identify the specific tissue used to conduct research of the organism
<b>Title</b>	Identifies the original title of the article
<b>Volume</b>	Identifies the volume of the journal or similar medium of the original article

**Note:** Items identified with an \* asterisk are custom fields created for the NSLSL by the NSLSL Management Team; these fields are manually entered and are not public APIs pulled/imported from external sources such as PubMed, PubMed Central, NTRS/STI, or Europe PubMed Central. All fields that do not have an asterisk are API fields and are imported with no alterations to their data from the original source.

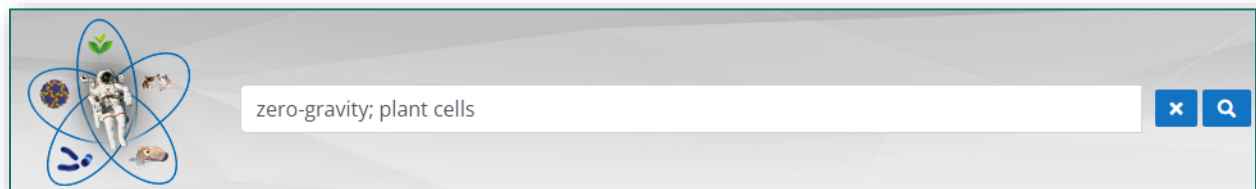
## APPENDIX C – SIMPLE SEARCH EXAMPLES



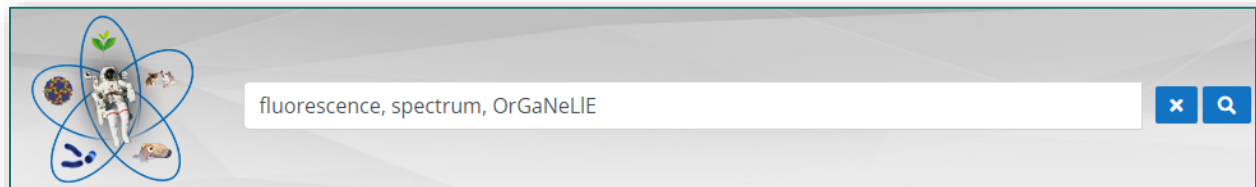
Basic search term, all lowercase example



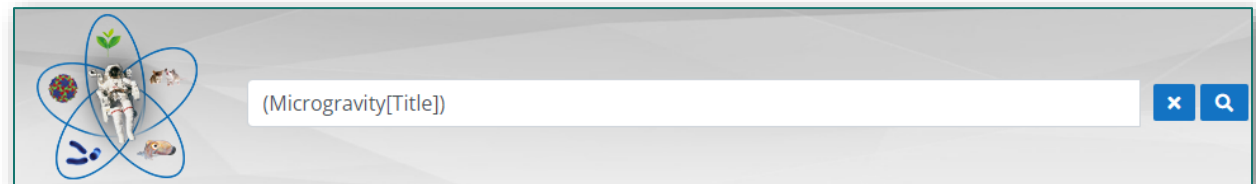
Basic search term, all lowercase, with asterisk wildcard example



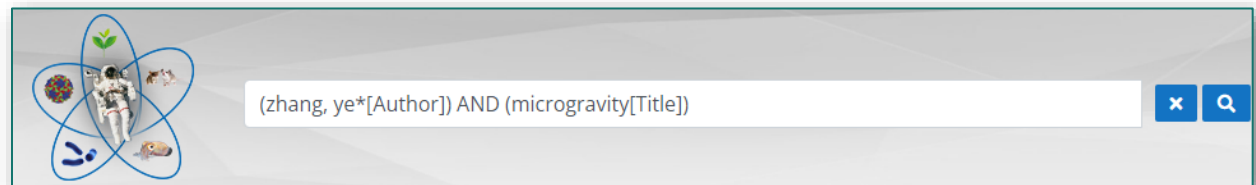
Multiple search terms, all lowercase, multiple special characters example



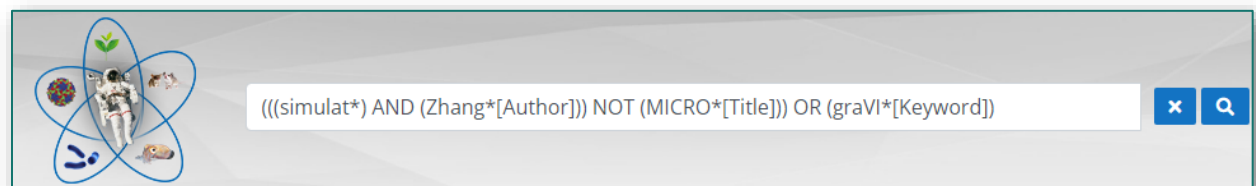
Multiple search terms, mixed-case, special characters example



Basic SQL search term and field; mixed-case example



Multiple SQL search terms and fields, basic conjunction, all lowercase, with asterisk wildcard example



Multiple SQL search terms and fields, multiple conjunctions, mixed-case, with asterisk wildcard example



## APPENDIX D – WILDCARD USE DIFFERENCES

A screenshot of an Advanced Search interface. The search bar contains the text "radiat". Below the search bar, there are buttons for "Save" and "Email". To the right, there are dropdown menus for "Format" (set to "Summary"), "Show" (set to "10"), and "Sort By" (set to "Title"). At the bottom, there is a pagination bar showing "Page 1 of 3" and "28 results".

A partial word with no asterisk and All Fields selected for the initial search (results are specific to EXACT word)

A screenshot of an Advanced Search interface. The search bar contains the text "radiat\*". Below the search bar, there are buttons for "Save" and "Email". To the right, there are dropdown menus for "Format" (set to "Summary"), "Show" (set to "10"), and "Sort By" (set to "Title"). At the bottom, there is a pagination bar showing "Page 1 of 4,682" and "46,820 results".

A partial word no asterisk and All Fields selected for the initial search (results include ALL partial word)

A screenshot of a Simple Search interface. The search bar contains the text "Enter a search term". Below the search bar, there are buttons for "AND", "NOT", and "OR". A "Query Box" contains the text "(radiat[All Fields]) AND (cell[All Fields])". Below the query box, there are buttons for "Save" and "Email". To the right, there are dropdown menus for "Format" (set to "Summary"), "Show" (set to "10"), and "Sort By" (set to "Title"). At the bottom, there is a pagination bar showing "Page 1 of 2" and "17 results".

Two partial words with no asterisk and All Fields selected for the initial search (results are specific to EXACT words)

A screenshot of a Simple Search interface. The search bar contains the text "Enter a search term". Below the search bar, there are buttons for "AND", "NOT", and "OR". A "Query Box" contains the text "(radiat\* [All Fields]) AND (cell\* [All Fields])". Below the query box, there are buttons for "Save" and "Email". To the right, there are dropdown menus for "Format" (set to "Summary"), "Show" (set to "10"), and "Sort By" (set to "Title"). At the bottom, there is a pagination bar showing "Page 1 of 2,910" and "29,098 results".

Two partial words with asterisk and All Fields selected for the initial search (results include ALL partial words)

## APPENDIX E – FIELD COMBINATIONS

Query Box

microgravit\*[All Fields]

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

5,623 results Page 1 of 563

A partial word with asterisk and All Fields selected for the initial search result count

Query Box

(microgravit\*[All Fields] AND (radiat\*[Title]))

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

132 results Page 1 of 14

Another partial word with asterisk was added as well as separate field, which narrowed the search result count

Query Box

((microgravit\*[All Fields] AND (radiat\*[Title])) AND (cell\*[Abstract]))

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

35 results Page 1 of 4

Yet another partial word with asterisk was added and another separate field, which further narrowed the results

Query Box

(((microgravit\*[All Fields] AND (radiat\*[Title])) AND (cell\*[Abstract])) AND (space\*[Keyword]))

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

13 results Page 1 of 2

An additional partial word with asterisk was added and yet another separate field to get the results down to 13



## APPENDIX F – MULTIPLE CONJUNCTIONS

Query Box

(microgravity\*[All Fields])

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

5,597 results Page 1 of 560

A full word with asterisk and All Fields selected with no conjunction for the initial search result

Query Box

(microgravity\*[All Fields]) AND (radiat\*[All Fields])

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

1,137 results Page 1 of 114

A full and partial word with asterisk, All Fields, with the AND conjunction to narrow/broaden results

Query Box

((microgravity\*[All Fields]) AND (radiat\*[All Fields])) OR (electromag\*[All Fields])

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

5,695 results Page 1 of 570

A full and (2) partial words with asterisk, All Fields, with AND and OR conjunction to narrow/broaden results

Query Box

((microgravity\*[All Fields]) AND (radiat\*[All Fields])) OR (electromag\*[All Fields]) NOT (cell\*[All Fields])

Simple Search

Save Email

Format Abstract Show 10 Sort By Title

1,904 results Page 1 of 191

Mix of full and partial words with asterisk, All Fields, with all conjunctions (AND, OR, NOT) to narrow/broaden results

## APPENDIX G – FIELD & CONJUNCTION COMBOS

Query Box

microgravity\*[Title]

Simple Search

Save Email Format Summary Show 10 Sort By Title

2,916 results Page 1 of 292

A full word with asterisk and single Fields selected with no conjunction for the initial search

Query Box

((microgravity[Title]) NOT (cell[Keyword]))

Simple Search

Save Email Format Summary Show 10 Sort By Title

2,683 results Page 1 of 269

Two full words, no asterisk, multiple fields, with one conjunction to narrow/broaden results

Query Box

((microgravity[Title]) NOT (cell[Keyword])) AND (radiation[All Fields])

Simple Search

Save Email Format Summary Show 10 Sort By Title

238 results Page 1 of 24

Three full words, no asterisk, multiple fields, with multiple conjunctions to narrow/broaden results

Query Box

((microgravity[Title] NOT (cell[Keyword])) AND (radiation[All Fields])) OR (gamma[Abstract])

Simple Search

Save Email Format Abstract Show 10 Sort By Title

1,555 results Page 1 of 156

Four full words, no asterisk, multiple fields, with all conjunctions to narrow/broaden results



## APPENDIX H – ADDITIONAL FILTERS LIST

### BIOLOGY KINGDOMS

Animalia  
Fungi  
Monera  
Plantae  
Protista

### CELL TYPES

Collenchyma  
Endothelial Cells  
Epithelial Cells  
Erythrocytes  
Fibroblasts  
Germ Cells  
Induced Pluripotent  
Stem Cells  
Leukocytes  
Lymphocytes  
Macrophages  
Mesenchymal Stem  
Cells  
Monocytes  
Neuron Cells  
Neutrophils  
Osteoblasts  
Osteoclasts  
Parenchyma  
PBMCs  
Platelets  
Primary Cells  
Sclerenchyma  
Smooth Muscle Cells  
Stem Cells

### FLIGHT PLATFORMS

Beyond Low Earth  
Orbit  
International Space  
Station  
Other Low Earth Orbit  
Parabolic Flight  
Satellite  
Shuttle  
Sounding Rocket  
Suborbital Flight

### GROUND PLATFORMS

2D Clinostat  
3D Clinostat  
Centrifugation  
Magnetic Levitation  
Radiation Exposure  
Random Positioning  
Machine  
Thermal Vacuum  
Chamber

### SPACE VARIABLES

Cyclic  
Enclosed Environment  
High-CO2  
Hydrostatic Pressure  
Hypergravity  
Microgravity  
Radiation  
Reduced Pressure  
Regolith  
Vacuum

### TISSUE TYPES

1BR-hTERT  
Albumin-specific T cell  
Line  
ARPE-19  
BL6-10  
C2C12  
Caco-2  
Connective  
CRL-5889  
DLD1  
EA.hy926  
Epithelial  
H1703  
HDLM-2  
HepG2  
hFOB1.19  
HL-1  
HUVEC  
Jurkat  
L-549  
MC3T3-E1  
MCF-7  
MDA-MB-231  
Muscle  
Nerve  
Primary Osteoblasts  
RAW 264.7  
RAW264.7  
SW620

## APPENDIX I – SUMMARY VS. ABSTRACT

Save Email

Format **Summary** Show 10 Sort By Pub Date

8 results

Select all Results

[Transplantation of sertoli-islet cell aggregates formed by microgravity: prolonged survival in diabetic rats.](#)  
 Han, Xiaoming • Qiu, Liyuan • Zhang, Ye • Kong, Qingxue • Wang, Hong • Wang, Haibin • Li, Hongbo • Duan, Cuimi • Wang, Yanmeng • Song, Ying • Wang, Changyong  
 Experimental biology and medicine (Maywood, N.J.). 2009 May vol. 234(5):595-603. doi: 10.3181/0812-RM-359  
 NSLSL ID: 13109 PubMed: [19244542](#) No abstract available

[Impact of simulated microgravity on microvascular endothelial cell apoptosis.](#)  
 Kang, Chun-Yan • Zou, Lin • Yuan, Ming • Wang, Yang • Li, Tian-Zhi • Zhang, Ye • Wang, Jun-Feng • Li, Yan • Deng, Xiao-Wei • Liu, Chang-Ting  
 European journal of applied physiology. 2011 Sep vol. 111(9):2131-8. doi: 10.1007/s00421-011-1844-0  
 NSLSL ID: 12850 PubMed: [21287193](#) No abstract available

[Effects of simulated microgravity on expression profile of microRNA in human lymphoblastoid cells.](#)  
 Mangala, Lingegowda S • Zhang, Ye • He, Zhenhua • Emami, Kamal • Ramesh, Govindarajan T • Story, Michael • Rohde, Larry H • Wu, Honglu  
 The journal of biological chemistry. 2011 Sep vol. 286(37):32483-90. doi: 10.1074/jbc.M111.267765  
 NSLSL ID: 3858 PubMed: [21775437](#)

This study explores the changes in expression of microRNA (miRNA) and related genes under simulated microgravity conditions. In comparison with static 1 × g, microgravity has ...

When the Summary format is selected, only a portion of the abstract is visible.

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Format **Abstract** Show 10 Sort By Title

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International journal of molecular sciences. 2020 Sep vol. 21(18). doi: 10.3390/ijms21186762

[Changes in Nuclear Shape and Gene Expression in Response to Simulated Microgravity Are LINC Complex-Dependent.](#)

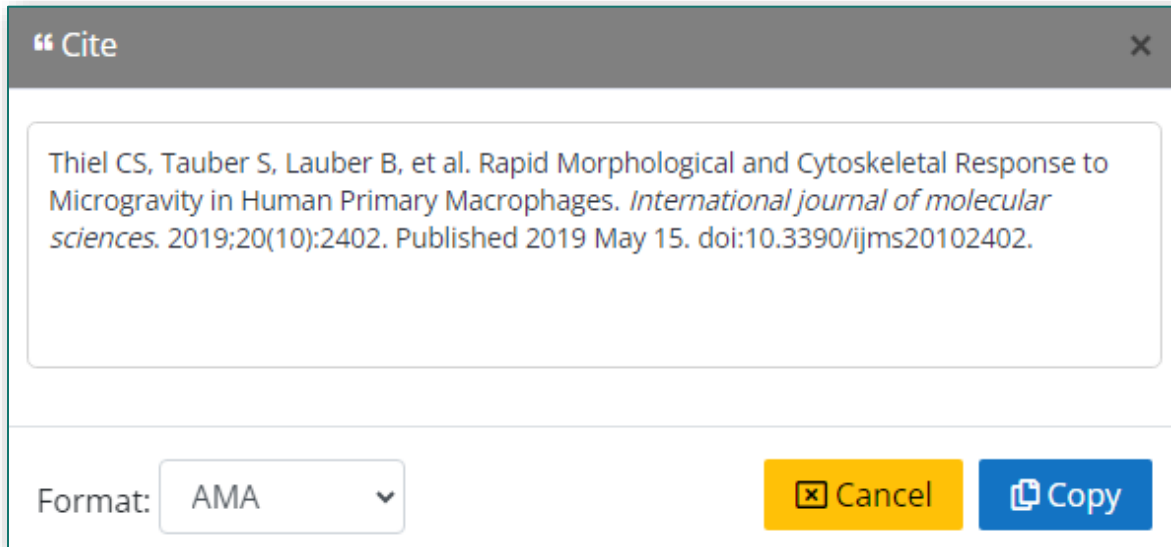
Neelam, Srjana S • Richardson, Brian B • Barker, Richard R • Udave, Ceasar C • Gilroy, Simon S • Cameron, Mark J MJ • Levine, Howard G HG • Zhang, Ye Y  
 NSLSL ID: 4333 PubMed: [32942630](#)

Microgravity is known to affect the organization of the cytoskeleton, cell and nuclear morphology and to elicit differential expression of genes associated with the cytoskeleton, focal adhesions and the extracellular matrix. Although the nucleus is mechanically connected to the cytoskeleton through the Linker of Nucleoskeleton and Cytoskeleton (LINC) complex, the role of this group of proteins in these responses to microgravity has yet to be defined. In our study, we used a simulated microgravity device, a 3-D clinostat (Gravite), to investigate whether the LINC complex mediates cellular responses to the simulated microgravity environment. We show that nuclear shape and differential gene expression are both responsive to simulated microgravity in a LINC-dependent manner and that this response changes with the duration of exposure to simulated microgravity. These LINC-dependent genes likely represent elements normally regulated by the mechanical forces imposed by gravity on Earth.

When the Abstract format is selected, the full Abstract is visible and can be Collapsed and Expanded in the Search Results window/screen.

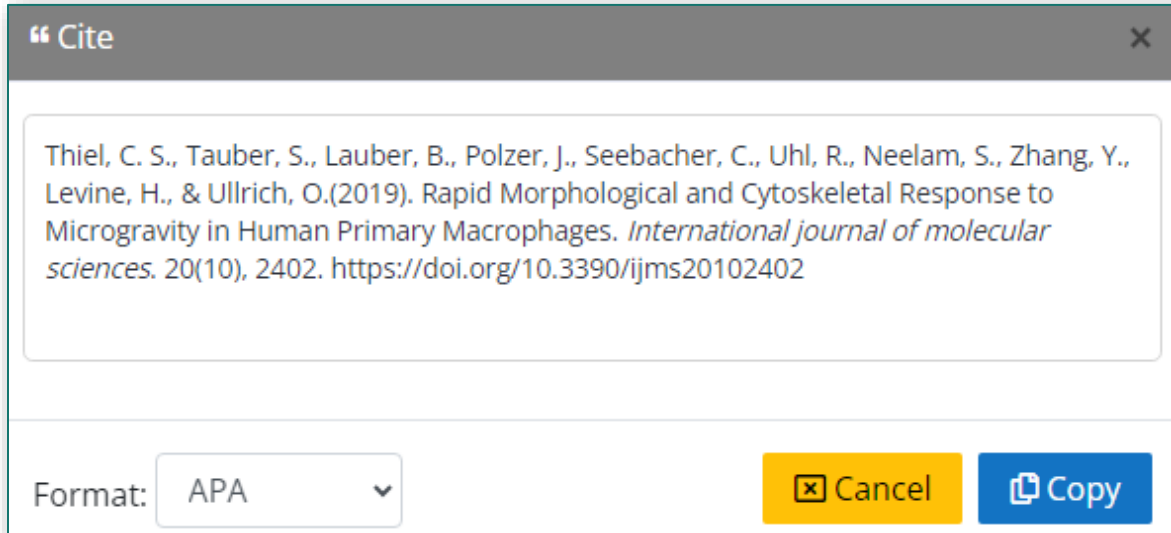


## APPENDIX J – AMA & APA CITATION FORMAT



When copied and pasted, an AMA citation will look like this:

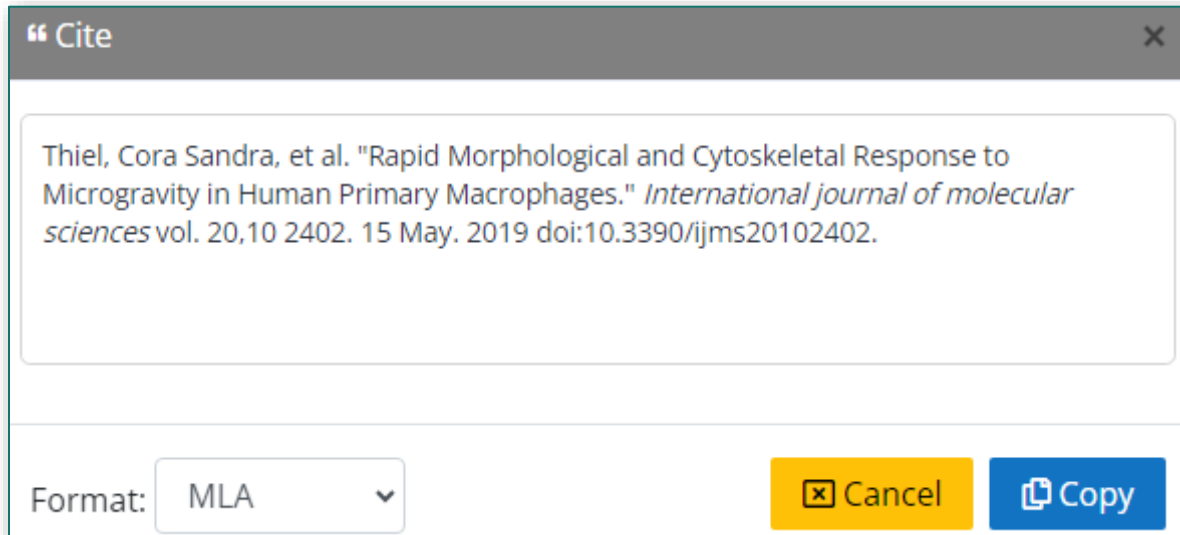
Thiel CS, Tauber S, Lauber B, et al. Rapid Morphological and Cytoskeletal Response to Microgravity in Human Primary Macrophages. *International journal of molecular sciences*. 2019;20(10):2402. Published 2019 May 15. doi:10.3390/ijms20102402.



When copied and pasted, an APA citation will look like this:

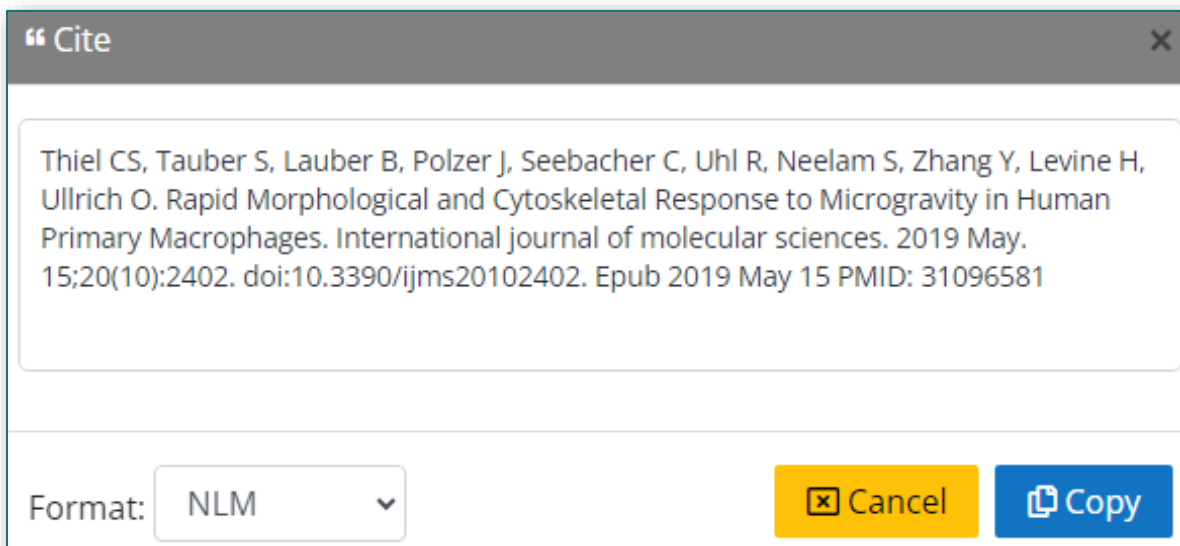
Thiel, C. S., Tauber, S., Lauber, B., Polzer, J., Seebacher, C., Uhl, R., Neelam, S., Zhang, Y., Levine, H., & Ullrich, O.(2019). Rapid Morphological and Cytoskeletal Response to Microgravity in Human Primary Macrophages. *International journal of molecular sciences*. 20(10), 2402. <https://doi.org/10.3390/ijms20102402>

## APPENDIX K – MLA & NLM CITATION FORMAT



When copied and pasted, an MLA citation will look like this:

Thiel, Cora Sandra, et al. "Rapid Morphological and Cytoskeletal Response to Microgravity in Human Primary Macrophages." *International journal of molecular sciences* vol. 20,10 2402. 15 May. 2019 doi:10.3390/ijms20102402.

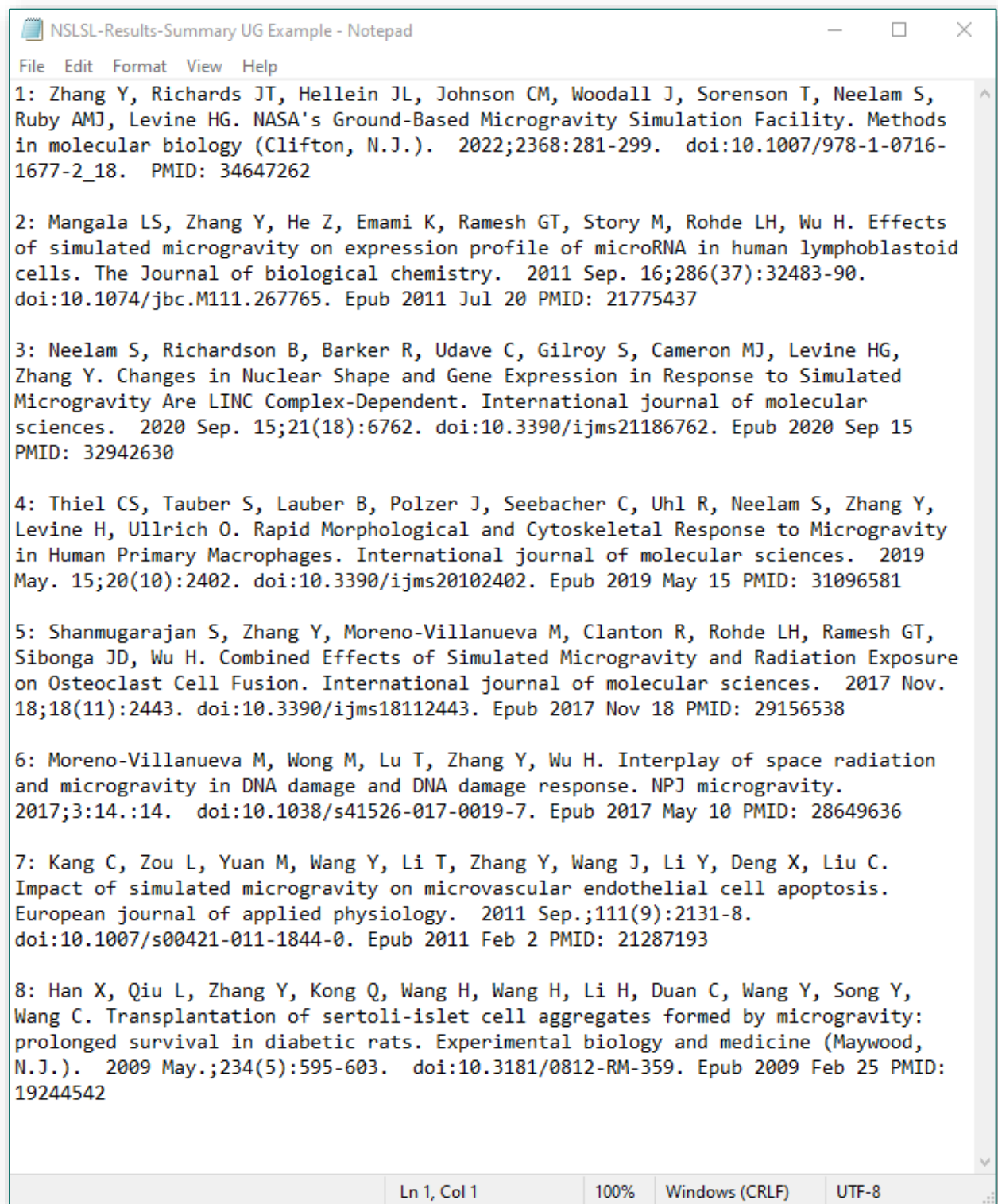


When copied and pasted, an NLM citation will look like this:

Thiel CS, Tauber S, Lauber B, Polzer J, Seebacher C, Uhl R, Neelam S, Zhang Y, Levine H, Ullrich O. Rapid Morphological and Cytoskeletal Response to Microgravity in Human Primary Macrophages. *International journal of molecular sciences*. 2019 May. 15;20(10):2402. doi:10.3390/ijms20102402. Epub 2019 May 15 PMID: 31096581

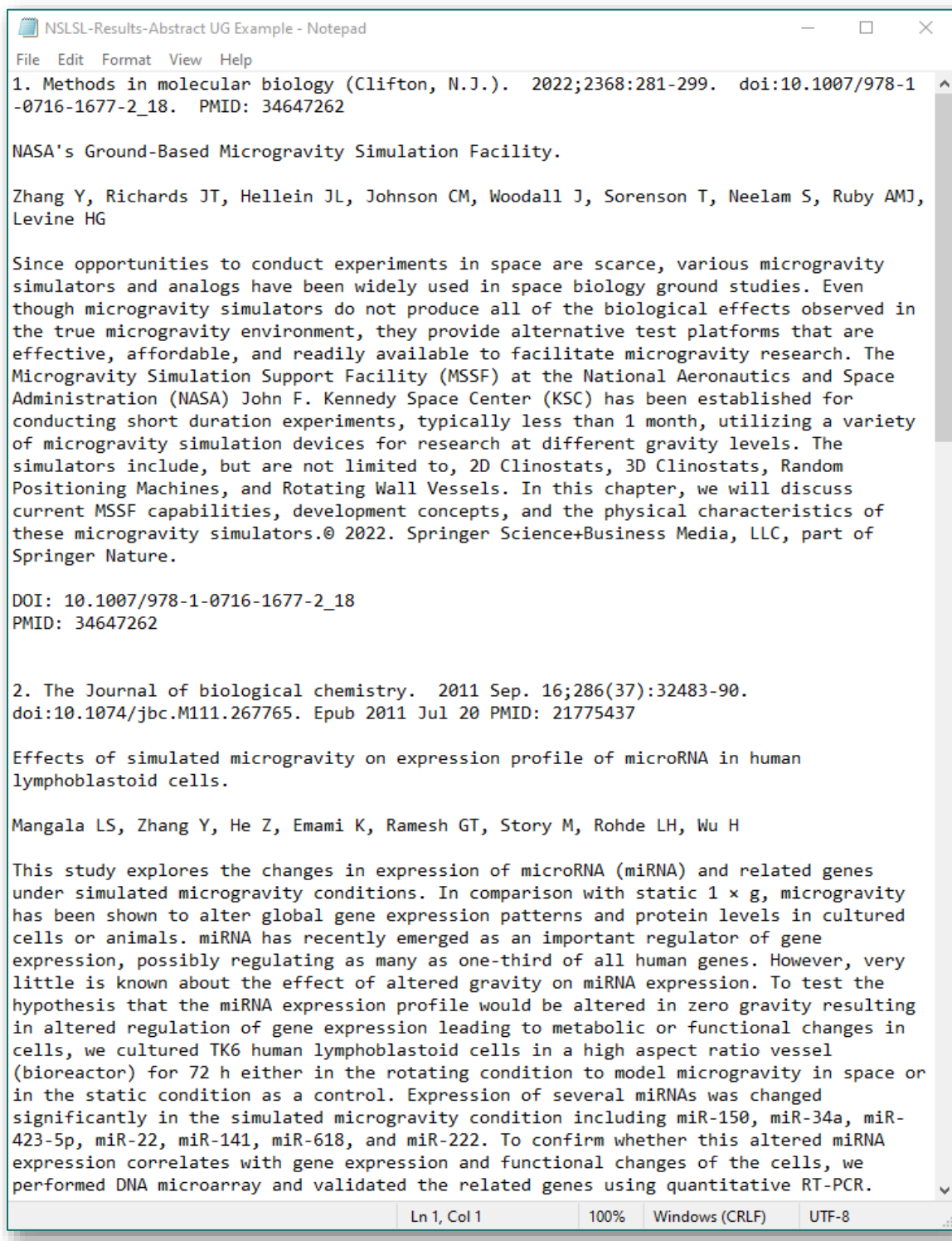


## APPENDIX L – SAVE FILE SUMMARY EXAMPLE



When saving search results in the Summary format, the output is a .TXT file with only the very basic metadata displayed and condensed together; similar to how the actual search results are displayed on the Search Results screen/window.

## APPENDIX M – SAVE FILE ABSTRACT EXAMPLE



When saving search results in Abstract format, the output is a .TXT file with the full abstract displayed as well as other basic metadata; the data is somewhat formatted with line breaks unlike the Summary format example where all the metadata is condensed together.




# APPENDIX N – SAVE FILE CSV EXAMPLE

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	PMID	Title	Authors	Citation	FirstAuth	JournalTit	PubYear	PMCID	DOI	Abstract					
2	34647262	NASA's Gr	Zhang Y, R	Methods i	Zhang Y	Methods i	2022		10.1007/9	Since opportunities to conduct experiments in space are s					
3	21775437	Effects of	Mangala L	The Journ	Mangala L	The Journ	2011		10.1074/jk	This study explores the changes in expression of microRN					
4	32942630	Changes i	Neelam S,	Internatio	Neelam S	Internatio	2020		10.3390/ij	Microgravity is known to affect the organization of the cyt					
5	31096581	Rapid Mor	Thiel CS, T	Internatio	Thiel C	Internatio	2019		10.3390/ijms20102402						
6	29156538	Combinec	Shanmuga	Internatio	Shanmuga	Internatio	2017		10.3390/ijms18112443						
7	28649636	Interplay	Moreno-V	NPJ micro	Moreno-V	NPJ micro	2017		10.1038/s41526-017-0019-7						
8	21287193	Impact of	Kang C, Zc	European	Kang C	European	2011		10.1007/s00421-011-1844-0						
9	19244542	Transplan	Han X, Qi	Experime	Han X	Experime	2009		10.3181/0812-RM-359						
10															

When saving search results as a CSV (comma-separated value) Excel file, basic metadata is displayed as well as the full abstract in a column/row table structure without any text or cell formatting.

## APPENDIX O – EMAIL SUMMARY

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- [NASA's Ground-Based Microgravity Simulation Facility.](#)  
Zhang Y, Richards JT, Hellein JL, Johnson CM, Woodall J, Sorenson T, Neelam S, Ruby AMJ, Levine HG  
Methods in molecular biology (Clifton, N.J.). 2022;2368:281-299. doi:10.1007/978-1-0716-1677-2\_18. PMID: 34647262
- [Effects of simulated microgravity on expression profile of microRNA in human lymphoblastoid cells.](#)  
Mangala LS, Zhang Y, He Z, Emami K, Ramesh GT, Story M, Rohde LH, Wu H  
The Journal of biological chemistry. 2011 Sep. 16;286(37):32483-90. doi:10.1074/jbc.M111.267765. Epub 2011 Jul 20 PMID: 21775437
- [Changes in Nuclear Shape and Gene Expression in Response to Simulated Microgravity Are LINC Complex-Dependent.](#)  
Neelam S, Richardson B, Barker R, Udave C, Gilroy S, Cameron MJ, Levine HG, Zhang Y  
International journal of molecular sciences. 2020 Sep. 15;21(18):6762. doi:10.3390/ijms21186762. Epub 2020 Sep 15 PMID: 32942630
- [Rapid Morphological and Cytoskeletal Response to Microgravity in Human Primary Macrophages.](#)  
Thiel CS, Tauber S, Lauber B, Polzer J, Seebacher C, Uhl R, Neelam S, Zhang Y, Levine H, Ullrich O  
International journal of molecular sciences. 2019 May. 15;20(10):2402. doi:10.3390/ijms20102402. Epub 2019 May 15 PMID: 31096581
- [Combined Effects of Simulated Microgravity and Radiation Exposure on Osteoclast Cell Fusion.](#)  
Shanmugarajan S, Zhang Y, Moreno-Villanueva M, Clanton R, Rohde LH, Ramesh GT, Sibonga JD, Wu H  
International journal of molecular sciences. 2017 Nov. 18;18(11):2443. doi:10.3390/ijms18112443. Epub 2017 Nov 18 PMID: 29156538
- [Interplay of space radiation and microgravity in DNA damage and DNA damage response.](#)  
Moreno-Villanueva M, Wong M, Lu T, Zhang Y, Wu H  
NPJ microgravity. 2017;3:14.:14. doi:10.1038/s41526-017-0019-7. Epub 2017 May 10 PMID: 28649636
- [Impact of simulated microgravity on microvascular endothelial cell apoptosis.](#)  
Kang C, Zou L, Yuan M, Wang Y, Li T, Zhang Y, Wang J, Li Y, Deng X, Liu C

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- 1: Zhang Y, Richards JT, Hellein JL, Johnson CM, Woodall J, Sorenson T, Neelam S, Ruby AMJ, Levine HG. NASA's Ground-Based Microgravity Simulation Facility. *Methods in molecular biology* (Clifton, N.J.). 2022;2368:281-299. doi:10.1007/978-1-0716-1677-2\_18. PMID: 34647262
- 2: Mangala LS, Zhang Y, He Z, Emami K, Ramesh GT, Story M, Rohde LH, Wu H. Effects of simulated microgravity on expression profile of microRNA in human lymphoblastoid cells. *The Journal of biological chemistry*. 2011 Sep. 16;286(37):32483-90. doi:10.1074/jbc.M111.267765. Epub 2011 Jul 20 PMID: 21775437
- 3: Neelam S, Richardson B, Barker R, Udave C, Gilroy S, Cameron MJ, Levine HG, Zhang Y. Changes in Nuclear Shape and Gene Expression in Response to Simulated Microgravity Are LINC Complex-Dependent. *International journal of molecular sciences*. 2020 Sep. 15;21(18):6762. doi:10.3390/ijms21186762. Epub 2020 Sep 15 PMID: 32942630
- 4: Thiel CS, Tauber S, Lauber B, Polzer J, Seebacher C, Uhl R, Neelam S, Zhang Y, Levine H, Ullrich O. Rapid Morphological and Cytoskeletal Response to Microgravity in Human Primary Macrophages. *International journal of molecular sciences*. 2019 May. 15;20(10):2402. doi:10.3390/ijms20102402. Epub 2019 May 15 PMID: 31096581
- 5: Shanmugarajan S, Zhang Y, Moreno-Villanueva M, Clanton R, Rohde LH, Ramesh GT, Sibonga JD, Wu H. Combined Effects of Simulated Microgravity and Radiation Exposure on Osteoclast Cell Fusion. *International journal of molecular sciences*. 2017 Nov. 18;18(11):2443. doi:10.3390/ijms18112443. Epub 2017 Nov 18 PMID: 29156538
- 6: Moreno-Villanueva M, Wong M, Lu T, Zhang Y, Wu H. Interplay of space radiation and microgravity in DNA damage and DNA damage response. *NPJ microgravity*. 2017;3:14.:14. doi:10.1038/s41526-017-0019-7. Epub 2017 May 10 PMID: 28649636
- 7: Kang C, Zou L, Yuan M, Wang Y, Li T, Zhang Y, Wang J, Li Y, Deng X, Liu C. Impact of simulated microgravity on microvascular endothelial cell apoptosis. *European journal of applied physiology*. 2011 Sep.;111(9):2131-8. doi:10.1007/s00421-011-1844-0. Epub 2011 Feb 2 PMID: 21287193
- 8: Han X, Qiu L, Zhang Y, Kong Q, Wang H, Wang H, Li H, Duan C, Wang Y, Song Y, Wang C. Transplantation of sertoli-islet cell aggregates formed by microgravity: prolonged survival in diabetic rats. *Experimental biology and medicine* (Maywood, N.J.). 2009 May.;234(5):595-603. doi:10.3181/0812-RM-359. Epub 2009 Feb 25 PMID: 19244542

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- [NASA's Ground-Based Microgravity Simulation Facility.](#)

Methods in molecular biology (Clifton, N.J.). 2022;2368:281-299. doi:10.1007/978-1-0716-1677-2\_18. PMID: 34647262

**Authors**

Zhang Y, Richards JT, Hellein JL, Johnson CM, Woodall J, Sorenson T, Neelam S, Ruby AMJ, Levine HG

**Abstract**

Since opportunities to conduct experiments in space are scarce, various microgravity simulators and analogs have been widely used in space biology ground studies. Even though microgravity simulators do not produce all of the biological effects observed in the true microgravity environment, they provide alternative test platforms that are effective, affordable, and readily available to facilitate microgravity research. The Microgravity Simulation Support Facility (MSSF) at the National Aeronautics and Space Administration (NASA) John F. Kennedy Space Center (KSC) has been established for conducting short duration experiments, typically less than 1 month, utilizing a variety of microgravity simulation devices for research at different gravity levels. The simulators include, but are not limited to, 2D Clinostats, 3D Clinostats, Random Positioning Machines, and Rotating Wall Vessels. In this chapter, we will discuss current MSSF capabilities, development concepts, and the physical characteristics of these microgravity simulators. © 2022. Springer Science+Business Media, LLC, part of Springer Nature.

**Keywords:** Facility, Microgravity simulation, MSSF, Plant research, space biology

DOI: [10.1007/978-1-0716-1677-2\\_18](https://doi.org/10.1007/978-1-0716-1677-2_18)  
PMID: [34647262](https://pubmed.ncbi.nlm.nih.gov/34647262/)
- [Effects of simulated microgravity on expression profile of microRNA in human lymphoblastoid cells.](#)

The Journal of biological chemistry. 2011 Sep. 16;286(37):32483-90. doi:10.1074/jbc.M111.267765. Epub 2011 Jul 20 PMID: 21775437

**Authors**

Mangala LS, Zhang Y, He Z, Emami K, Ramesh GT, Story M, Rohde LH, Wu H


**Abstract**

This study explores the changes in expression of microRNA (miRNA) and related genes under simulated microgravity conditions. In comparison with static 1 × g, microgravity has been shown to alter global gene expression patterns and protein levels in cultured cells or animals. miRNA has recently emerged as an important regulator of gene expression, possibly regulating as many as one-third of all human

When sending search results via email with Abstract format selected, the email will contain the original search criteria used and the full abstract as a numbered list of the results with a link to the internal metadata as the publication Title. The results list will have minimal formatting. The email will also contain a link to access the results list in the Library.

## APPENDIX R – EMAIL ABSTRACT (TEXT)

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**Search Criteria:** (microgravity[Title]) AND (zhang, ye\*[Author])

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1. Methods in molecular biology (Clifton, N.J.). 2022;2368:281-299. doi:10.1007/978-1-0716-1677-2\_18. PMID: 34647262  
 NASA's Ground-Based Microgravity Simulation Facility.  
 Zhang Y, Richards JT, Hellein JL, Johnson CM, Woodall J, Sorenson T, Neelam S, Ruby AMJ, Levine HG  
 Since opportunities to conduct experiments in space are scarce, various microgravity simulators and analogs have been widely used in space biology ground studies. Even though microgravity simulators do not produce all of the biological effects observed in the true microgravity environment, they provide alternative test platforms that are effective, affordable, and readily available to facilitate microgravity research. The Microgravity Simulation Support Facility (MSSF) at the National Aeronautics and Space Administration (NASA) John F. Kennedy Space Center (KSC) has been established for conducting short duration experiments, typically less than 1 month, utilizing a variety of microgravity simulation devices for research at different gravity levels. The simulators include, but are not limited to, 2D Clinostats, 3D Clinostats, Random Positioning Machines, and Rotating Wall Vessels. In this chapter, we will discuss current MSSF capabilities, development concepts, and the physical characteristics of these microgravity simulators. © 2022. Springer Science+Business Media, LLC, part of Springer Nature.  
 DOI: 10.1007/978-1-0716-1677-2\_18  
 PMID: 34647262
2. The Journal of biological chemistry. 2011 Sep. 16;286(37):32483-90. doi:10.1074/jbc.M111.267765. Epub 2011 Jul 20 PMID: 21775437  
 Effects of simulated microgravity on expression profile of microRNA in human lymphoblastoid cells.  
 Mangala LS, Zhang Y, He Z, Emami K, Ramesh GT, Story M, Rohde LH, Wu H  
 This study explores the changes in expression of microRNA (miRNA) and related genes under simulated microgravity conditions. In comparison with static 1 × g, microgravity has been shown to alter global gene expression patterns and protein levels in cultured cells or animals. miRNA has recently emerged as an important regulator of gene expression, possibly regulating as many as one-third of all human genes. However, very little is known about the effect of altered gravity on miRNA expression. To test the hypothesis that the miRNA expression profile would be altered in zero gravity resulting in altered regulation of gene expression leading to metabolic or functional changes in cells, we cultured TK6 human lymphoblastoid cells in a high aspect ratio vessel (bioreactor) for 72 h either in the rotating condition to model microgravity in space or in the static condition as a control. Expression of several miRNAs was changed significantly in the simulated microgravity condition including miR-150, miR-34a, miR-423-5p, miR-22, miR-141, miR-618, and miR-222. To confirm whether this altered miRNA expression correlates with gene expression and functional changes of the cells, we performed DNA microarray and validated the related genes using quantitative RT-PCR. Expression of several transcription factors including EGR2, ETS1.

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## APPENDIX S – INTERNAL LINK EXAMPLE

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[Changes in Nuclear Shape and Gene Expression in Response to Simulated Microgravity Are LINC Complex-Dependent.](#)

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Neelam, Srujana S • Richardson, Brian B • Barker, Richard R • Udave, Ceasar C • Gilroy, Simon S • Cameron, Mark J Mj • Levine, Howard G HG • Zhang, Ye Y

International journal of molecular sciences. 2020 Sep vol. 21(18). doi: 10.3390/ijms21186762

NSLSL ID: 4333    PubMed: [32942630](#)

Microgravity is known to affect the organization of the cytoskeleton, cell and nuclear morphology and to elicit differential expression of genes associated with the cytoskeleton...

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International journal of molecular sciences. 2020 Sep 2020. vol. 21(18). doi: 10.3390/ijms21186762. Epub: 2020 Sep 15.

### Changes in Nuclear Shape and Gene Expression in Response to Simulated Microgravity Are LINC Complex-Dependent.

[Cite](#)

Neelam, Srujana S • Richardson, Brian B • Barker, Richard R • Udave, Ceasar C • Gilroy, Simon S • Cameron, Mark J Mj • Levine, Howard G HG • Zhang, Ye Y

PubMed: [32942630](#)    DOI: [10.3390/ijms21186762](#)

Courtesy of the U.S.National Library of Medicine

**Abstract**

Microgravity is known to affect the organization of the cytoskeleton, cell and nuclear morphology and to elicit differential expression of genes associated with the cytoskeleton, focal adhesions and the extracellular matrix. Although the nucleus is mechanically connected to the cytoskeleton through the Linker of Nucleoskeleton and Cytoskeleton (LINC) complex, the role of this group of proteins in these responses to microgravity has yet to be defined. In our study, we used a simulated microgravity device, a 3-D clinostat (Gravite), to investigate whether the LINC complex mediates cellular responses to the simulated microgravity environment. We show that nuclear shape and differential gene expression are both responsive to simulated microgravity in a LINC-dependent manner and that this response changes with the duration of exposure to simulated microgravity. These LINC-dependent genes likely represent elements normally regulated by the mechanical forces imposed by gravity on Earth.

**Keywords**

- LINC complex
- nuclear morphology
- simulated microgravity

**Publication Types**

- Journal Article

**Languages**

- English

**ELocations**

- 6762
- 10.3390/ijms21186762

**Cell Types**

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**Organisms**

- Human

**Biology Taxonomies**

- Animals

**Tissue Types**

- 1BR-hTERT

**GeneLab Links**

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7555797/>

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- 2D Clinostat

**Hardware Links**

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7555797/>

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**Ground Platform Links**

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**Investigation Types**

- Comparative

**Associated Data**

- Cell Line Cell Nucleus / physiology\* Cytoskeleton / physiology\* Extracellular Matrix / physiology Focal Adhesions / physiology Gene Expression / physiology\* Humans Nuclear Matrix / physiology\* Weightlessness Weightlessness Simulation / methods

**Full Text Links**

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## APPENDIX T – EXTERNAL LINK EXAMPLE

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Thiel, Cora Sandra • Tauber, Svantje • Lauber, Beatrice • Polzer, Jennifer • Seebacher, Christian • Uhl, Rainer • Neelam, Srujana • Zhang, Ye • Levine, Howard • Ullrich, Oliver  
International journal of molecular sciences. 2019 May vol. 20(10). doi: 10.3390/ijms20102402

NLSL ID: 7400 **PubMed: 31096581** No abstract available

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> [Int J Mol Sci. 2019 May 15;20\(10\):2402. doi: 10.3390/ijms20102402.](#)

### Rapid Morphological and Cytoskeletal Response to Microgravity in Human Primary Macrophages

Cora Sandra Thiel <sup>1 2</sup>, Svantje Tauber <sup>3 4</sup>, Beatrice Lauber <sup>5</sup>, Jennifer Polzer <sup>6</sup>, Christian Seebacher <sup>7</sup>, Rainer Uhl <sup>8</sup>, Srujana Neelam <sup>9</sup>, Ye Zhang <sup>10</sup>, Howard Levine <sup>11</sup>, Oliver Ullrich <sup>12 13 14 15 16</sup>

Affiliations + expand  
PMID: 31096581 PMCID: PMC6567851 DOI: 10.3390/ijms20102402  
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#### Abstract

The FLUMIAS (Fluorescence-Microscopic Analyses System for Life-Cell-Imaging in Space) confocal laser spinning disk fluorescence microscope represents a new imaging capability for live cell imaging experiments on suborbital ballistic rocket missions. During the second pioneer mission of this microscope system on the TEXUS-54 suborbital rocket flight, we developed and performed a live imaging experiment with primary human macrophages. We simultaneously imaged four different cellular structures (nucleus, cytoplasm, lysosomes, actin cytoskeleton) by using four different live cell dyes (Nuclear Violet, Calcein, LysoBrite, SiR-actin) and laser wavelengths (405, 488, 561, and 642 nm), and investigated the cellular morphology in microgravity ( $10^{-4}$  to  $10^{-5}$  g) over a period of about six minutes compared to 1 g controls. For live imaging of the cytoskeleton during spaceflight, we combined confocal laser microscopy with the SiR-actin probe, a fluorogenic silicon-rhodamine (SiR) conjugated jasplakinolide probe that binds to F-actin and displays minimal toxicity. We determined changes in 3D cell volume and surface, nuclear volume and in the actin cytoskeleton, which responded rapidly to the microgravity environment with a significant reduction of SiR-actin fluorescence after 4-19 s microgravity, and adapted subsequently until 126-151 s microgravity. We conclude that microgravity induces geometric cellular changes and rapid response and adaptation of the potential gravity-transducing cytoskeleton in primary human macrophages.


**Keywords:** cytoskeleton; immune cells; live cell imaging; microgravity; nucleus; suborbital rocket.

#### Conflict of interest statement

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

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Organisms						<input type="button" value="Add Organism"/>
Biology Taxonomies						<input type="button" value="Add Biology Taxonomy"/>
Tissue Types						<input type="button" value="Add Tissue Type"/>
GeneLab Links						<input type="button" value="Add GeneLab Link"/>
Languages						<input type="button" value="Add Language"/>
Hardware						<input type="button" value="Add Hardware"/>
Hardware Links						<input type="button" value="Add Hardware Link"/>
Space Environments						<input type="button" value="Add Space Environment"/>
Flight Platforms						<input type="button" value="Add Flight Platform"/>
Flight Platform Links						<input type="button" value="Add Flight Platform Link"/>
Ground Platforms						<input type="button" value="Add Ground Platform"/>
Ground Platform Links						<input type="button" value="Add Ground Platform Link"/>
Investigation Types						<input type="button" value="Add Investigation Type"/>
Associated Data						<input type="button" value="Add Associated Data"/>
Full Text Links						<input type="button" value="Add Full Text Link"/>
Grant Support						<input type="button" value="Add Grant Support"/>

Full Text

Is Public

Number of Views

Cancel Submit Request

When Submitting a New Publication for inclusion in the library, please enter data as completely and accurately as possible for all fields. The article should be from a source that is **NOT** PubMed, PubMed Central, NTRS/STI, or Europe PubMed Central. If there are articles from these (4) sources that the user would like included in the library that do not already exist, please use this link to send the ID numbers and/or links as we can rapidly import them with all metadata from just the link: [Submit Recommended Articles from API Sources](#).



## APPENDIX V - LIST OF TOOL TIPS

LN	ToolTip	Page	Section	Site Location
1	You can initiate a combination Query directly in the Search Box using SQL syntax.	3	External Library	Search Box
2	You can directly edit text in the Query box. You can press Enter as well as use the magnifying glass. The search term(s) will be preserved if you navigate back to Simple Search.	8	Advanced Search	Advanced Search Box
3	The Custom Date Range will allow you to go back to any year in history.	13	Filters	Default Filters
4	The Search Results will automatically update after selecting Format, Show # of Results, or Sort By.	17	Results Display	Search Result Screen
5	To better refine Search Results, use the asterisk symbol * after your search term(s).	22	Search Results	Search Box / Advanced Search Box
6	When Saving or Emailing results, you do not have to 'Select All' as this is an option in the pop-up window. Multiple email addresses are not allowed.	27	Saving & Emailing	Saving/Emailing Pop-up Window
7	If you are adding an article from PubMed, PubMed Central, NTRS/STI, or Europe PubMed Central, identify the External Source Id.	31	Adding Articles	Submit New Publication Details Page

## APPENDIX W – FULL NAVIGATION

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