

Drive-Thru Data: Using NLM APIs to Access Information Fast

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U.S. National Library of Medicine

After this session, you should be able to...

- Explain...
 - what an API is,
 - how APIs can help you interact with systems, and
 - why users might choose to use APIs.
- Describe the basic mechanics of using an API
- Identify...
 - some of NLM's APIs, and
 - know when a specific NLM API would be useful.



The World of NLM

Literature

- PubMed
- PMC
- Bookshelf

Consumer Health

- MedlinePlus

Terminology

- MeSH
- RxNorm
- UMLS



Molecular Biology

- Nucleotide
- Protein
- SRA

Drugs and Chemicals

- DailyMed
- PubChem

Other

- ClinicalTrials.gov

And many more...

Poll: Which categories of NLM products do you use?

- Literature
- Consumer Health
- Terminology
- Molecular Biology
- Drugs and Chemicals
- Other



Example: Health info for patients in EHRs

The screenshot shows a patient's EHR Health Summary page. At the top, there are navigation tabs for "Health Summary", "Medical Record", "Message Center", "Appointments", "Pharmacy", "Coverage & Costs", and "Health & Wellness". Below the navigation is a "COVID-19 updates" section. The main content area features a patient profile for Jane Smith and a "Your Health Summary – Conditions" table. The table lists three conditions: Acquired Cystic Kidney Disease (dated 5/02/2022), Acute Sinusitis (dated 09/10/2020), and Influenza (dated 04/19/2019). Each condition has an information icon (i) next to it. On the left side of the patient profile, there are buttons for "Appointments", "Medications", "Test Results", "Messages", and "Insurance".

Issue	Date
Acquired Cystic Kidney Disease <i>i</i>	5/02/2022
Acute Sinusitis <i>i</i>	09/10/2020
Influenza <i>i</i>	04/19/2019



The screenshot shows the MedlinePlus website page for "Kidney Cysts". The page features a search bar at the top right, navigation tabs for "Health Topics", "Drugs & Supplements", and "Videos & Tools", and a "Español" link. The main content area includes a "Kidney Cysts" title, a "Summary" section with a detailed description of kidney cysts, and a "Stay Connected" section with a newsletter sign-up form. A "MEDICAL ENCYCLOPEDIA" section is also visible at the bottom right, listing related topics like "Abdominal CT scan" and "Polycystic kidney disease".

Kidney Cysts

Summary

A cyst is a fluid-filled sac. You may get simple kidney cysts as you age; they are usually harmless. There are also some diseases which cause kidney cysts. One type is polycystic kidney disease (PKD). It runs in families. In PKD, many cysts grow in the kidneys. This can enlarge the kidneys and make them work poorly. About half of people with the most common type of PKD end up with kidney failure. PKD also causes cysts in other parts of the body, such as the liver.

Often, there are no symptoms at first. Later, symptoms include

- Pain in the back and lower sides
- Headaches
- Blood in the urine

Doctors diagnose PKD with imaging tests and family history. There is no cure. Treatments can help with symptoms and complications. They include medicines and lifestyle changes, and if there is kidney failure, dialysis or kidney transplants.

Acquired cystic kidney disease (ACKD) happens in people who have chronic kidney disease, especially



Example: Finding clinical trials for cancer patients

The screenshot shows the BioPortal Clinical Trial Search interface. At the top, the BioPortal logo and navigation links are visible. The patient profile is displayed as 'Testpatient, Mary Jane, Female, 60 years old, Breast Carcinoma, LIVING (12 months), Recurred/Progressed (4 months)'. Below this, there are tabs for 'Summary', 'Pathways', 'Clinical Data', 'MTB', and 'ClinicalTrialsGov'. A search bar contains the text 'Search clinical trials'. The results section shows '96 results have been found. The results are based on: Search parameters'. A table of results is displayed with columns for Status, Matching Criteria, Study Title, Conditions, Interventions, Eligibility Criteria, and Locations. Three results are visible in the table.

Status	Matching Criteria	Study Title	Conditions	Interventions	Eligibility Criteria	Locations
Recruiting	Age is matching Gender is matching Condition is matching Found keywords: BRAF	AN OPEN-LABEL, MULTICENTER, RANDOMIZED PHASE 3 STUDY OF FIRST-LINE ENCORAFENIB PLUS CETUXIMAB WITH OR WITHOUT CHEMOTHERAPY VERSUS STANDARD OF CARE THERAPY WITH A SAFETY LEAD-IN OF ENCORAFENIB AND CETUXIMAB PLUS CHEMOTHERAPY IN PARTICIPANTS WITH METASTATIC BRAF V600E-MUTANT COLORECTAL CANCER	Neoplasms	Encorafenib Cetuximab Oxaliplatin Irinotecan Leucovorin show more	show	Phoenix Mayo Clinic - Phoenix Oncology Pharmacy Arizona Phoenix Mayo Clinic Hospital Arizona Scottsdale Mayo Clinic in Arizona - Scottsdale Arizona Beverly Hills Tower Hematology Oncology Medical Group (THO) California Los Angeles Keck Hospital of USC California show more
Recruiting	Age is matching Gender is matching Condition is matching Found keywords: BRAF	An Open-label Phase 1 Study to Evaluate Drug-Drug Interactions of Agents Co-Administered With Encorafenib and Binimetinib in Patients With BRAF V600-mutant Unresectable or Metastatic Melanoma or Other Advanced Solid Tumors	Advanced Solid Tumors Metastatic Melanoma	losartan dextromethorphan caffeine omeprazole midazolam show more	show	Orange UC Irvine Health California Aurora University of Colorado Hospital - Anschutz Cancer Pavilion (ACP) Colorado Chicago University of Illinois at Chicago Illinois Saint Paul Regions Cancer Care Center Minnesota Saint Paul HealthPartners Specialty Center-Eye Care Minnesota show more
Recruiting	Age is matching Gender is matching Condition is matching	Detection and Metabolic Characterization in DOPA PET/CT of ne Treated Brain Metastases of Lung	Brain Metastases MRI	F-DOPA PET/CT	show	Angers CHU Angers Angers Institut de Cancerologie de l'Ouest



Example: Author nationality trends in PubMed

The screenshot shows a PubMed article page for the paper "Bioanalytical strategies in drug discovery and development". The authors listed are Aarzo Thakur, Zhiyuan Tan, Tsubasa Kameyama, Eman El-Khateeb, Shakti Nagpal, Stephanie Malone, Rohitash Jamwal, and Chukwunonso K Nwabufo. The affiliations list includes institutions from Singapore, China, USA, UK, and Canada. The nationalities are highlighted in red boxes in the original image.

NIH National Library of Medicine
National Center for Biotechnology Information

PubMed.gov Search

Search results

Review > Drug Metab Rev. 2021 Aug;53(3):434-458. doi: 10.1080/03602532.2021.1959606.
Epub 2021 Aug 23.

Bioanalytical strategies in drug discovery and development

Aarzo Thakur^{1,2}, Zhiyuan Tan³, Tsubasa Kameyama⁴, Eman El-Khateeb^{5,6}, Shakti Nagpal⁷, Stephanie Malone⁸, Rohitash Jamwal⁹, Chukwunonso K Nwabufo¹⁰

Affiliations:

Affiliations

- 1 Innovations in Food and Chemical Safety, Agency for Science, Technology, and Research, Singapore **Singapore**
- 2 Skin Research Institute of Singapore, Agency for Science, Technology, and Research, Singapore, **Singapore**
- 3 Department of Early Clinical Development, dMed-Clinipace, Shanghai **China**
- 4 Department of Bioengineering and Therapeutic Sciences, Schools of Pharmacy and Medicine, University of California San Francisco, San Francisco, CA **USA**
- 5 Centre for Applied Pharmacokinetic Research, University of Manchester, Manchester **UK**
- 6 Clinical Pharmacy Department, Faculty of Pharmacy, Tanta University, Tanta **Egypt**
- 7 Department of Pharmacy, Faculty of Science, National University of Singapore, Singapore, **Singapore**
- 8 Theravance Biopharma US, Inc., South San Francisco, CA **USA**
- 9 College of Pharmacy, University of Rhode Island, Kingston, RI **USA**
- 10 Gilead Alberta ULC, Edmonton, **Canada**

PREV RESULT 19 of 108

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[Title & authors](#)
[Abstract](#)
[Similar articles](#)
[Cited by](#)
[Publication types](#)
[MeSH terms](#)

NEXT RESULT 21 of 108



Example: Author nationality trends in PubMed (continued 1)

The image displays a series of overlapping screenshots of the PubMed website, illustrating author nationality trends for two specific articles. The screenshots are arranged in a cascading, overlapping manner, showing the progression of the search results page.

Article 1: Nickel in soil and water: Sources, biogeochemistry, and remediation using biochar
DOI: 10.1016/j.jhaemat.2021.126421
Epub 2021 Jun 16
Authors: Ali H. Haggag¹, Naveed Ahmed², Mohamed Mosa³, Naveed Khan Naveed⁴, Sahar Yousof⁵, Aniket Sharma⁶, Enayot Serfaty⁷, Nanjiang Cai⁸, Scott X. Chang⁹
Affiliations: 1 expand
PMID: 34171670 DOI: 10.1016/j.jhaemat.2021.126421

Article 2: Universal health coverage and intersectoral action for health: key messages from Disease Control Priorities, 3rd edition
Epub 2017 Nov 25
Authors: Ethan J. Larson¹, Ala Fawaz², Charles M. Mack³, Rachel Nugent⁴, David Watkins⁵, Obiang Asky⁶, Shaah Ahmad⁷, Rishad Ahsan⁸, Stefano Bertozzi⁹, Zulfiqar Bhutta¹⁰, Agnes Binagwaho¹¹, Robert Black¹², Mark Blucher¹³, Barry E. Bouco¹⁴, Elizabeth Braveman¹⁵, Howard A. Bundy¹⁶, Dan Chhabra¹⁷, Marco Coiro¹⁸, Mark Cuban¹⁹, Kristen Derlet²⁰, Naveen de Silva²¹, Hala T. Dabbas²², Peter Donkor²³, Soum Das²⁴, Kenneth A. Fleming²⁵, Mark Gillman²⁶, Patricia J. Garcia²⁷, Anil Gawaande²⁸, Thomas Gidycz²⁹, Helen Gelband³⁰, Roger Glasziou³¹, Amanda Glasman³², Glenda Gray³³, Demisse Habte³⁴, King K. Holmes³⁵, Susan Horton³⁶, Guy Huzar³⁷, Prabhat Jha³⁸, Felicia M. Knaul³⁹, Chie Koenigsmeyer⁴⁰, Eric L. Krakauer⁴¹, Margaret E. Kruk⁴², Peter Lachance⁴³, Ramona Laminrayan⁴⁴, Carol Levin⁴⁵, Lai Mong Looi⁴⁶, Nisa Medwar⁴⁷, Abdul-Muhammad⁴⁸, Ivan Claudio Miana⁴⁹, Anthony Measham⁵⁰, Maria Elena Medina Mora⁵¹, Carol Meillon⁵², Anne Mills⁵³, Indira Devi Mills⁵⁴, James Montoya⁵⁵, Cite Nkomo⁵⁶, Jeffrey Okun⁵⁷, Lubechek Ouedraogo⁵⁸, Henk Oppenheimer⁵⁹, Indu Ojha⁶⁰, Willem van Riel⁶¹, George C. Patton⁶², John Pridmore⁶³, Ekhoang Phumthasarn⁶⁴, Brynne Qi⁶⁵, Ina Reynolds⁶⁶, Svetlana Roustan⁶⁷, Ranganarany Saranamanyan⁶⁸, Sameh Sepúlveda⁶⁹, Richard Shilling⁷⁰, Vicki R. Smith⁷¹, Malven Tenenbaum⁷², Stephen Solomon⁷³, Silphana Srengat⁷⁴, Damian G. Walker⁷⁵, Neff Walker⁷⁶, Yangpeng Wu⁷⁷, Kun Zhao⁷⁸
Affiliation: 4 expand
PMID: 29779954 PMID: 30090806 DOI: 10.1016/S0140-6736(17)32906-8

Footnote 9: College of Pharmacy, University of Rhode Island, Kingston, RI, USA.

Footnote 10: Gilead Alberta ULC, Edmonton, Canada.



Example: Author nationality trends in PubMed (continued 2)

This XML file does not appear to have any style information associated with it. The document tree is shown below.

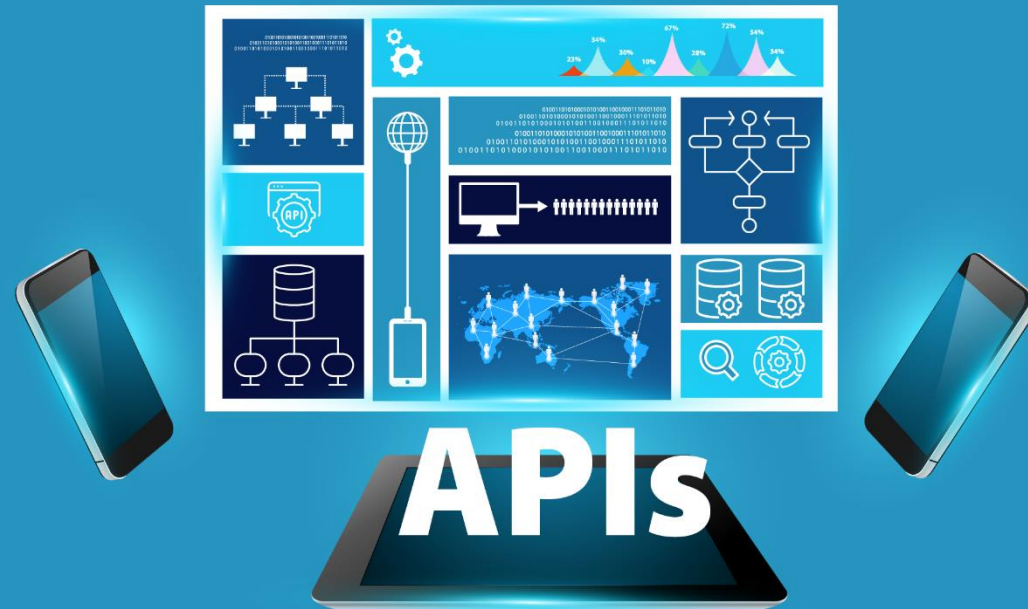
```
▼<PubmedArticleSet>
  ▼<PubmedArticle>
    ▼<MedlineCitation Status="MEDLINE" IndexingMethod="Curated" Owner="NLM">
      <PMID Version="1">34310243</PMID>
      ▼<DateCompleted>
        <Year>2022</Year>
        <Month>04</Month>
        <Day>04</Day>
      </DateCompleted>
      ▼<DateRevised>
        <Year>2022</Year>
        <Month>05</Month>
        <Day>31</Day>
      </DateRevised>
      ▼<Article PubModel="Print-Electronic">
        ▼<Journal>
          <ISSN IssnType="Electronic">1097-9883</ISSN>
          ▼<JournalIssue CitedMedium="Internet">
            <Volume>53</Volume>
            <Issue>3</Issue>
            ▼<PubDate>
              <Year>2021</Year>
              <Month>08</Month>
            </PubDate>
          </JournalIssue>
          <Title>Drug metabolism reviews</Title>
          <ISOAbbreviation>Drug Metab Rev</ISOAbbreviation>
        </Journal>
        <ArticleTitle>Bioanalytical strategies in drug discovery and development.</ArticleTitle>
        ▼<Pagination>
          <MedlinePgn>434-458</MedlinePgn>
        </Pagination>
        <ElocationID EIdType="doi" ValidYN="Y">10.1080/03602532.2021.1959606</ElocationID>
        ▼<Abstract>
          <AbstractText>A reliable, rapid, and effective bioanalytical method is essential for the determination of the pharmacokinetic, pharmacodynamic, and toxicokinetic parameters that inform the safety and efficacy profile of investigational drugs. The overall goal of bioanalytical method development is to elucidate the procedure and operating conditions under which a method can sufficiently extract, qualify, and/or quantify the analyte(s) of interest and/or their metabolites for the intended purpose. Given the difference in the physicochemical properties of small and large molecule drugs, different strategies need to be adopted for the development of an effective and efficient bioanalytical method. Herein, we provide an overview of different sample preparation strategies, analytical platforms, as well as procedures for achieving high throughput for bioanalysis of small and large molecule drugs.</AbstractText>
        </Abstract>
        ▼<AuthorList CompleteYN="Y">
          ▼<Author ValidYN="Y">
            <LastName>Thakur</LastName>
            <ForeName>Aarzoo</ForeName>
            <Initials>A</Initials>
          </Author>
          ▼<AffiliationInfo>
            <Affiliation>Innovations in Food and Chemical Safety, Agency for Science, Technology, and Research, Singapore, Singapore
          </AffiliationInfo>
        </AuthorList>
      </Article>
    </MedlineCitation>
  </PubmedArticle>
</PubmedArticleSet>
```



What do these projects have in common?

- Each uses information from NLM resources...
 - ...but **not** those resources' websites!
- They need a different type of access:
 - Outside of a web browser
 - With limited (or zero) direct human interaction
 - To information in a specific format.
 - To information as data.

The solution?



Application Programming Interfaces (APIs)

Poll: What is your experience with APIs?

- Use them all the time!
- Use them periodically.
- Have used them in the past.
- Know about them, but haven't used them.
- This is all new to me!



What is an API?

- A set of protocols for contacting a remote system and making requests.
- Designed to be used “programmatically,” not directly by humans.
- APIs typically include:
 - a server, and
 - a set of rules for making requests (or "calls") to that server

A Drive Thru for Data



Why are APIs useful?

- API calls can be built-in to programs/applications.
 - Data can be requested/retrieved much faster
 - Less need for human intervention
- Some APIs offer more options for data retrieval.
 - Retrieval in specialized formats
 - Retrieval of otherwise unavailable data.

How (many) APIs work

- The way you access the API is via a URL
- The specific URL you use includes the address of the API you're using, plus the details of your request
- What information you get back depends on how you construct the URL.

The two parts of (many) API requests

The base URL

Indicates which API
you're using

Some parameters

The details of what
you're asking for



The Base URL

- The address of the API server
- Specific to each individual API
- Some examples:
 - MedlinePlus: <https://wsearch.nlm.nih.gov/ws/query>
 - E-utilities: <https://eutils.ncbi.nlm.nih.gov/entrez/eutils/>
 - MeSH RDF: <https://id.nlm.nih.gov/mesh>



Parameters

- Parameter options are specific to the API in question
 - Actual parameters are specific to each request
- Can include things like:
 - Search strings
 - Results restrictions
 - Formatting options
 - etc.
- An example:
 - `db=pubmed&id=1602668&retmode=xml&rettype=full`

Building an API URL: MedlinePlus

- Start with the Base URL for MedlinePlus API
 - <https://wsearch.nlm.nih.gov/ws/query>



Building an API URL: Part Two

- Determine your parameters
 - Language: English or Spanish?
 - db=healthTopics
 - Search query: What are you looking for?
 - term=acid+reflux
 - Other options: How many results?
 - retmax=5

Putting it all together: MedlinePlus

Base URL

<https://wsearch.nlm.nih.gov/ws/query>

Parameters

Database

db=healthTopics

Search Query

term=acid+reflux

of
Results

retmax=5

<https://wsearch.nlm.nih.gov/ws/query?db=healthTopics&term=acid+reflux&retmax=5>



What we get

This XML file does not appear to have a title associated with it. The document tree is shown below.

```
<nlmSearchResult>
  <term>acid reflux</term>
  <file>viv_i0hNNB</file>
  <server>pvlb7srch15</server>
  <count>12</count>
  <retstart>0</retstart>
  <retmax>5</retmax>
  <list num="12" start="0" per="5">
    <document rank="0" url="https://medlineplus.gov/gerd.h
      <content name="title">GERD</content>
      <content name="organizationName">National Library of Medicine</content>
      <content name="altTitle"><span class="qt0">Acid</span> <span class="qt1">Reflux</span></content>
      <content name="altTitle"><span class="qt2">Gastroesophageal </span><span class="qt1"><span class="qt2">Reflux</span></span></content>
      <content name="altTitle"><span class="qt2">Gastroesophageal </span><span class="qt1"><span class="qt2">reflux</span></span> disease</content>
      <content name="FullSummary"><p>Your esophagus is the tube that carries food from your mouth to your stomach. <span class="qt2">Gastroesophageal
      </span><span class="qt1"><span class="qt2">reflux</span></span> disease (GERD) happens when a muscle at the end of your esophagus does not
      close properly. This allows stomach contents to leak back, or <span class="qt1">reflux</span>, into the esophagus and irritate it. </p><p>You
      may feel a burning in the chest or throat called heartburn. Sometimes, you can taste stomach fluid in the back of the mouth. If you have these
      symptoms more than twice a week, you may have GERD. You can also have GERD without having heartburn. Your symptoms could include a dry cough,
      asthma symptoms, or trouble swallowing.</p><p>Anyone, including infants and children, can have GERD. If not treated, it can lead to more
      serious health problems. In some cases, you might need medicines or surgery. However, many people can improve their symptoms by:</p><ul>
      <li>Avoiding alcohol and spicy, fatty or acidic foods that trigger heartburn</li><li>Eating smaller meals</li><li>Not eating close to bedtime
      </li><li>Losing weight if needed </li><li>Wearing loose-fitting clothes</li></ul><p>NIH: National Institute of Diabetes and Digestive and
      Kidney Diseases</p></content>
      <content name="mesh"><span class="qt2">Gastroesophageal </span><span class="qt1"><span class="qt2">Reflux</span></span></content>
      <content name="groupName">Digestive System</content>
      <content name="snippet"> Your esophagus is the tube that carries food from your mouth to your stomach. <span class="qt2">Gastroesophageal
      </span><span class="qt1"><span class="qt2">reflux</span></span> disease (GERD) happens when a muscle at the end of your ... </content>
    </document>
    <document rank="1" url="https://medlineplus.gov/heartb
      <content name="title">Heartburn</content>
      <content name="organizationName">National Library of Medicine</content>
      <content name="altTitle"><span class="qt0">Acid</span> <span class="qt1">Reflux</span></content>
      <content name="altTitle"><span class="qt0">Acid</span> indigestion</content>
```

You Need a Car



=



What kind of car?

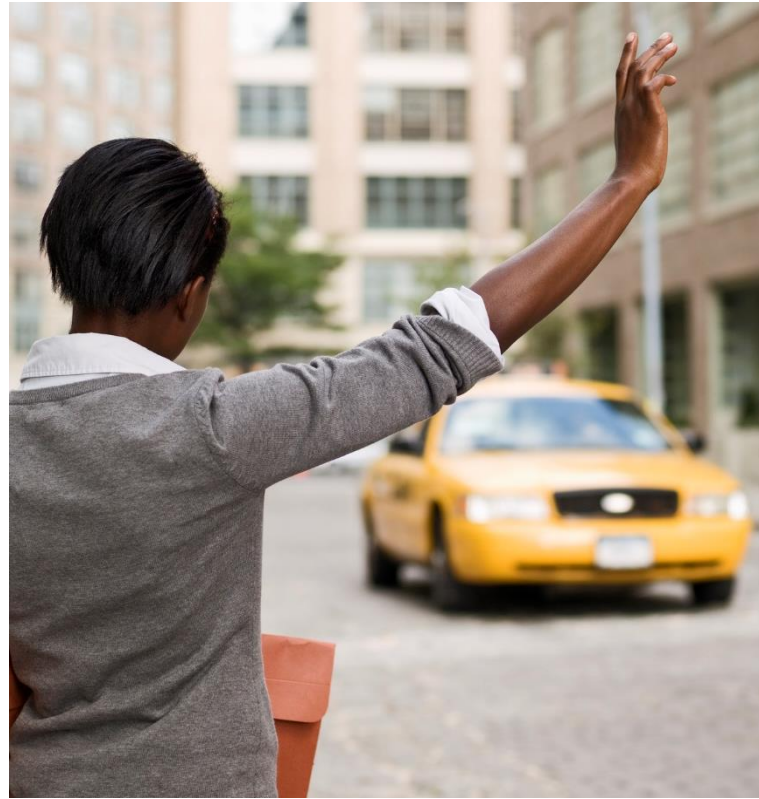


What if I don't know how to drive?

Learn to drive...



...or find a driver!



Poll: Any programming experience?

- R
- Python
- C++
- Shell scripting (Linux/Unix)
- PHP/JavaScript
- MatLab
- Other (tell us in chat)
- None yet!

What's on the menu? NLM data!



Choosing the right API

- Remember! Different APIs for different purposes!
- When deciding to use an API, first question: does it have what I need?
- If a resource has multiple APIs, may serve different data in different formats.

MedlinePlus

- MedlinePlus Web Service
 - Retrieves MedlinePlus Health Topics in XML
 - Can help embed MedlinePlus content on a webpage
- MedlinePlus Connect
 - Integrated into Electronic Health Records
 - Used primarily by EHR vendors/developers



PubMed

- E-Utilities
 - Access 35+ NCBI databases, including PubMed
 - Best way to access PubMed via API
- Literature Citation Exporter
 - Converts PMIDs/PMCIDs into citation strings
- Citation Matcher
 - Programmatic access to PubMed Citation Matcher



PMC/Bookshelf

- E-utilities (again)
 - Access metadata and (some) full-text
 - Uses same syntax as E-utilities for PubMed
- OAI-PMH/OAI-PMH LitArch
 - Full-text from PMC/Bookshelf Open Access subsets
 - Uses industry standard for online digital repositories



Medical Subject Headings (MeSH)

E-utilities (yet again)

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
<eSummaryResult>
  <DocSum>
    <Id>68056989</Id>
    <Item Name="DS_YearIntroduced" Type="String">2010</Item>
    <Item Name="DS_ScopeNote" Type="String">MYOCARDIAL INFARCTION in which the inferior wall of the heart is involved. It is often caused by occlusion of the right coronary artery.</Item>
    <Item Name="DS_RegistryNumber" Type="String"/>
    <Item Name="DS_HeadingMappedTo" Type="String"/>
    <Item Name="DS_MeshTerms" Type="List">
      <Item Name="string" Type="String">Inferior Wall Myocardial Infarction</Item>
      <Item Name="string" Type="String">Diaphragmatic Myocardial Infarction</Item>
      <Item Name="string" Type="String">Diaphragmatic Myocardial Infarctions</Item>
      <Item Name="string" Type="String">Infarction, Diaphragmatic Myocardial</Item>
      <Item Name="string" Type="String">Infarctions, Diaphragmatic Myocardial</Item>
      <Item Name="string" Type="String">Myocardial Infarction, Diaphragmatic</Item>
      <Item Name="string" Type="String">Myocardial Infarctions, Diaphragmatic</Item>
      <Item Name="string" Type="String">Myocardial Infarction, Inferior Wall</Item>
      <Item Name="string" Type="String">Inferior Myocardial Infarction</Item>
      <Item Name="string" Type="String">Infarction, Inferior Myocardial</Item>
      <Item Name="string" Type="String">Infarctions, Inferior Myocardial</Item>
      <Item Name="string" Type="String">Inferior Myocardial Infarctions</Item>
      <Item Name="string" Type="String">Myocardial Infarction, Inferior</Item>
      <Item Name="string" Type="String">Myocardial Infarctions, Inferior</Item>
      <Item Name="string" Type="String">Acute Inferior Myocardial Infarction</Item>
    </Item>
    <Item Name="DS_Subheading" Type="List">
      <Item Name="string" Type="String">analysis</Item>
      <Item Name="string" Type="String">anatomy and histology</Item>
      <Item Name="string" Type="String">blood</Item>
      <Item Name="string" Type="String">chemically induced</Item>
      <Item Name="string" Type="String">classification</Item>
      <Item Name="string" Type="String">complications</Item>
      <Item Name="string" Type="String">diagnosis</Item>
      <Item Name="string" Type="String">diagnostic imaging</Item>
      <Item Name="string" Type="String">drug therapy</Item>
      <Item Name="string" Type="String">epidemiology</Item>
      <Item Name="string" Type="String">ethnology</Item>
      <Item Name="string" Type="String">etiology</Item>
      <Item Name="string" Type="String">genetics</Item>
      <Item Name="string" Type="String">immunology</Item>
      <Item Name="string" Type="String">metabolism</Item>
      <Item Name="string" Type="String">mortality</Item>
      <Item Name="string" Type="String">pathology</Item>
      <Item Name="string" Type="String">physiology</Item>
      <Item Name="string" Type="String">physiopathology</Item>
      <Item Name="string" Type="String">prevention and control</Item>
      <Item Name="string" Type="String">statistics and numerical data</Item>
      <Item Name="string" Type="String">surgery</Item>
      <Item Name="string" Type="String">therapy</Item>
    </Item>
  </DocSum>
</eSummaryResult>
```

MeSH RDF

MeSH RDF API ^{1.0.1}

[Base URL: id.nlm.nih.gov/mesh]
<https://id.nlm.nih.gov/mesh/swagger/swagger.json>

Spargl Endpoint and Lookup service for MeSH RDF
[SPARQL API technical documentation](#)

Schemes

HTTPS

spargl The SPARQL 1.1 endpoint returns RDF results and graphs - see the [query page](#)

GET /spargl Perform SPARQL query

lookup The lookup API returns simple JSON - see the [lookup page](#)

GET /lookup/descriptor Search for Descriptors, also known as Headings.

GET /lookup/pair Search for Descriptor-Qualifier pairs, also known as Subheadings.

GET /lookup/term Search for Entry Terms

GET /lookup/qualifiers Return all allowed Qualifiers for a Descriptor.

GET /lookup/details Lookup some details for a descriptor

GET /lookup/years Returns the current status of various years in MeSH RDF

GET /lookup/label Return the label or labels for a Resource URI.



RxNorm


NIH National Library of Medicine
Lister Hill National Center for Biomedical Communications

[What's New in RxMix](#) | [Comments? Contact us](#)

Workflow Export

```

some name
  ↓
▶ findRxcuiByString
  ↓ F1_rxnormld
▶ getRelatedByType
  ↓ F2_rxcui
▶ getNDCs [X]
  ↓
▶ Add another function?
          
```



[RxNorm API](#) | [RxClass API](#) | [RxTerms API](#)

Guide:

- ✓ Select a function to start building a workflow or choose from the Workflow Library.
- ✓ Specify an interesting data value.
- ✓ Add functions to attain the desired results.
- ✓ Run a report to check your work so far.

⚠ Process data from your file through the workflow.

Data

One name:
 File (one name per line)
 All names or codes...
 Run

Report

Previewing the first 51 rows of the report. Finish and Download

Data		findRxcuiByString ("F1")			getRelatedByType ("F2")		getNDCs ("F3")
name	F1_rxnormld	F2_rxcui	F2_name	F2_synonym	F2_tty	F3_ndc	
simvastatin	36567	1790679	simvastatin 4 MG/ML Oral Suspension	simvastatin 20 MG per 5 ML Oral Suspension	SCD	00574171015	
simvastatin	36567	1944264	simvastatin 8 MG/ML Oral Suspension	simvastatin 40 MG per 5 mL Oral Suspension	SCD		
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	00615805605	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	00615805639	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	00781507331	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	00781507392	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	10135051105	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	10135051130	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	10135051190	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	10544048790	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	16714068401	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	16714068402	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	16714068403	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	16729000610	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	16729000612	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	16729000615	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	16729000617	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	24658021310	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	24658021330	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	24658021345	
simvastatin	36567	198211	simvastatin 40 MG Oral Tablet		SCD	24658021390	



ClinicalTrials.gov

On this page

- [Introduction](#)
- ClinicalTrials.gov REST API**
- [Resources](#)

ClinicalTrials.gov REST API 2.0.1

This API is made available to provide users meta data, statistics, and the most recent version of the clinical trials available on ClinicalTrials.gov.

[Expand all](#) | [Collapse all](#) sections

Studies

Related to clinical trial studies

GET /studies	Studies
GET /studies/{nctId}	Single Study
GET /studies/metadata	Data Model Fields
GET /studies/search-areas	Search Areas
GET /studies/enums	Enums

Stats

Data statistics

GET /stats/size	Study Sizes
GET /stats/field/values	Field Values
GET /stats/field/sizes	List Field Sizes

Version

Version info

GET /version	Version
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Resources

- [Study Data Structure](#)

[→ Back to Top](#)
[Feedback](#)



Poll: Which API is most interesting?

- MedlinePlus Web Service/MedlinePlus Connect
- E-utilities (PubMed, MeSH, PMC)
- Other PubMed APIs
- OAI-PMH (PMC, Bookshelf)
- MeSH RDF
- RxNormAPI
- ClinicalTrials.gov
- Something else
- Still not sure why I would use an API...



To recap: when should I use APIs?

- Working in a programming environment
- Need NLM data in a machine-readable format
- Need up-to-date data quickly/on-demand
- Have specific things to search for/request

When should I *not* use APIs?

- When you're NOT programming!
- When APIs aren't an option
- When exploring/browsing a resource
- When you need **all** of the data



Bulk Downloads

The screenshot shows the National Library of Medicine (NLM) website. At the top, there is a navigation bar with the NIH logo and the text "National Library of Medicine". To the right of the logo is a search box labeled "Search NLM". Below the navigation bar are four menu items: "PRODUCTS AND SERVICES", "RESOURCES FOR YOU", "EXPLORE NLM", and "GRANTS AND RESEARCH". The main content area features a heading "National Library of Medicine Data Distribution" and a paragraph explaining the NLM Data Distribution program. Below this, there are four sections, each with a heading and a brief description: "MEDLINE/PubMed", "MeSH", "Catalog Record Data", and "Data Discovery".

An official website of the United States government [Here's how you know](#)

NIH National Library of Medicine Search NLM

PRODUCTS AND SERVICES RESOURCES FOR YOU EXPLORE NLM GRANTS AND RESEARCH

[Home](#)

National Library of Medicine Data Distribution

The NLM Data Distribution program is the preferred access point for bulk downloading of the data for the products listed below. Downloading and use of these datasets is free of charge and implies agreement to the [Terms and Conditions](#). For questions or assistance regarding the data distributed within this program, either visit the [NLM Support Center](#) or email at custserv.nlm.nih.gov.

MEDLINE/PubMed

NLM produces a baseline set of MEDLINE/PubMed citation records in XML format for download on an annual basis. Each day, NLM produces update files that include new, revised, and deleted citations.

MeSH

Medical Subject Headings (MeSH) is a hierarchically-organized terminology for indexing and cataloging of biomedical information. It is used for the indexing of PubMed and other NLM databases.

Catalog Record Data

Bibliographic records for books, journals and other materials from NLM's collections. Includes downloads of Catfile, CatfilePlus, and Serfile data in NLMXML, MARCXML and MARC 21 formats.

Searching for other resources?

Data Discovery

NLM's [Data Discovery](#) is a catalog of NLM products and services with information and links to product information, data downloads, APIs, and other programmatic interfaces.

https://www.nlm.nih.gov/databases/download/data_distrib_main.html



Where to go next?

- Learn about programming or find a programmer
 - Online courses
 - Library Carpentry
 - Ask around!
- Think about your project
 - What do you know?
 - What do you need to know?
- Find the right API for you

NLM Data Discovery

NIH National Library of Medicine

Full Catalog List of NLM Products About

Data Discovery

Access, explore, and build with datasets and APIs from the National Library of Medicine

- Full Catalog**
Browse all datasets, APIs, and other assets in the Data Discovery catalog
- List of NLM Products**
A comprehensive listing of products and services at the National Library of Medicine
- Annual MeSH Processing**
Overview and reports detailing annual changes made to MeSH

[About Data Discovery at the NLM](#) [Terms and Conditions](#)



Read the documentation!

- Tells you what the API can and can't do
- Instructions on syntax, formatting requests
- Provide guidelines for usage
- May include example API calls

Poll: What else do you need?

- More examples of APIs in action
- More info on available NLM APIs
- Help with programming
- Something else? – In the chat!



Questions?



How to Get Your MLA CE

Close survey

Thank you for completing this evaluation survey. Your feedback will support efforts to improve future Network of the National Library of Medicine (NNLM) training sessions.

If your training session offered Continuing Education credit from the Medical Library Association and you would like to claim it, please follow these instructions. See Step 4 for enrollment code.

1. Go to www.medlib-ed.org
2. Login (for information on how to create a free MEDLIB-ED account, [visit MLA's FAQ page for further help](#)).
3. Click My Learning on the blue bar near the top of the page
4. Enter the following enrollment code in the appropriate field:
██████████ (please copy)
5. Click Redeem, then Claim

If you have questions or run into problems with MEDLIB-ED, please email MEDLIB-ED@mail.mlahq.org

Copy the code from the evaluation survey



U.S. National Library of Medicine