An Introduction to the COVID-19 Therapeutic Information Browser

http://covidtib.c19hcc.org/

August 2021
Purpose

▪ Enable biomedical researchers to easily find and track scientific information about potential COVID-19 therapeutics and vaccines

Functionality

▪ Presents results from natural language processing of paper abstracts and clinical trial summaries at scale
▪ Enables users to search for terms in some full text of papers and view relevant figures and text snippets

Possible uses

▪ Tracking latest research on drugs
▪ Identifying promising drug candidates
▪ Writing literature reviews
▪ Conducting meta-analyses
▪ Identifying knowns and unknowns for research decisions
▪ And more...
A resource for finding publications and clinical trials about:

Viruses: SARS-CoV-2, SARS, MERS, and ten other viruses

Therapeutics: System reads for ~12,000 unique drugs & biologics

Vaccine research: Sorted by six types of vaccines*: vector-based, RNA, DNA, protein subunit, live attenuated, inactivated

Documents are classified by research stage*:
- Clinical study
- Case report
- Nonhuman primate
- Small animal
- Cell assay
- In vitro
- In silico
- Review

Document sources:
- PubMed
- clinicaltrials.gov
- Full text papers from open source and xDD² partner publishers

* Definitions for the research stages and vaccine types are available on the website

¹ https://www.semanticscholar.org/cord19
² https://xdd.wisc.edu/
Demo with Examples
The home page briefly describes platform content and how to use it.

Update: August 3, 2021
COVID-TIB Virus-Drug Pair Data
A dataset containing results from all documents processed through July 6, 2021 is now available for download. This includes virus-drug pairs identified in documents, assignments of documents to research stages, and some additional information. The data description file also contains precision and recall statistics. Please click the "Data" tab in the navigation bar to the left to access this dataset.

About the COVID-19 Therapeutic Information Browser (COVID-TIB)
Welcome! This site provides browsable therapeutic and vaccine-related information about SARS-CoV-2 (COVID-19) and other viruses. This information was extracted via natural language processing (NLP) of more than 200 PubMed, MedRxiv, and BioRxiv abstracts and clinicaltrials.gov summaries. The summary tables show the number of documents with information about a given virus and drug (Viral Therapeutics page) or vaccine type (Vaccine Type page). The numbers of papers are arranged by selected research stages, e.g. clinical studies. Metadata about the papers, as well as a link to figures and tables about COVID-19 and a selected drug, are available below. This site also enables keyword full-text search for a subset of papers that are open access.

For information on how to use this site, please see the demo briefing available in the navigation bar on the left. For more information about the NLP pipeline, please see the briefing and description of data available for download in the navigation bar. For more information about term definitions, see the tabs under the "About" menu in the navigation bar. Full text search is powered by xDD and COSMOS from the University of Wisconsin-Madison.

Caveat: Machines are now great at processing documents at-scale but currently are not nearly as accurate as human subject matter experts. Consequently, you will see mistakes in raw machine-extracted information posted here.

Browser recommendation: Internet Explorer is not supported by this application. Please consider using an updated version of Chrome, Edge, Firefox, or Safari.

This is a beta version prototype. Your feedback is welcome. Please send comments, suggestions, or bug reports to covid-browser@groups.mitre.org.

[1]: The natural language processing (NLP) uses REACH reading software developed by the University of Arizona (M. Valenzuela-Escárciga et al), Large-scale automated machine reading discovers new cancer driving mechanisms, Database; Volume 2018, 2018, bay098 that was adapted for virus-related information by MITRE. Data sources include: NCBI, clinicaltrials.gov, the CORD-19 Open Research Dataset, UniProt, and DrugBank.

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The pages under About provide term definitions and other information.

There is a page for Viral Therapeutics and a page for Vaccine Type information.
On the Viral Therapeutics page, the upper table shows number of documents found about a particular virus, sorted by research stage (columns) for a therapeutic (rows). The red box shows document counts for the 5 candidate therapeutics for SARS-CoV-2 with the most documents.

<table>
<thead>
<tr>
<th>Therapeutic</th>
<th>All</th>
<th>Review</th>
<th>In Silico</th>
<th>Cell Assay</th>
<th>Animal Models</th>
<th>Case Reports</th>
<th>Clinical Studies</th>
<th>All</th>
<th>Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroxychloroquine</td>
<td>2542</td>
<td>605</td>
<td>131</td>
<td>54</td>
<td>10</td>
<td>381</td>
<td>900</td>
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<td>Remdesivir</td>
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<td>472</td>
<td>184</td>
<td>90</td>
<td>15</td>
<td>197</td>
<td>307</td>
<td>60</td>
<td>31</td>
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<tr>
<td>Corticosteroid</td>
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<td>305</td>
<td>3</td>
<td>13</td>
<td>0</td>
<td>280</td>
<td>561</td>
<td>131</td>
<td>46</td>
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<tr>
<td>Convalescent Plasma</td>
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<td>314</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>193</td>
<td>441</td>
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<td>27</td>
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<tr>
<td>Tocilizumab</td>
<td>1061</td>
<td>233</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>253</td>
<td>454</td>
<td>18</td>
<td>10</td>
</tr>
</tbody>
</table>

Search for therapeutic
Expand to see more drugs, or click Next
Scroll to see more viruses
Example: What drugs are reported to have had recent *in silico* studies?

<table>
<thead>
<tr>
<th>Therapeutic</th>
<th>All</th>
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<th>Cell Assay</th>
<th>Animal Models</th>
<th>Case Reports</th>
<th>Clinical Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protease inhibitor</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
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<tr>
<td>Favipiravir</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
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<tr>
<td>Hydroxychloroquine</td>
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<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
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<tr>
<td>Human Immunoglobulin G</td>
<td>21</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Zinc</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Zanamivir</td>
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<td>1</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>Viomycin</td>
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<td>1</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>Tacrolimus</td>
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<td>1</td>
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<td>1</td>
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<tr>
<td>Silibinin</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
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<td>0</td>
<td>0</td>
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<tr>
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<td>0</td>
<td>0</td>
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<td>0</td>
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<td>Ritonavir</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ribavirin</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Remdesivir</td>
<td>19</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>5</td>
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<tr>
<td>Quinine</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Peramivir</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Oseltamivir acid</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Naratriptan</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1. Filter for recent papers in Settings
2. Sort by clicking on In Silico to see drugs with highest numbers of documents on top
3. See drugs with recently published *in silico* studies
Example: What clinical studies have been published about Bamlanivimab?

1. Search for drug name in text box

<table>
<thead>
<tr>
<th>Therapeutic</th>
<th>SARS-CoV-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All ↓</td>
</tr>
<tr>
<td>baml</td>
<td>85</td>
</tr>
</tbody>
</table>

2. Click on number, then scroll down to table below to see information about those documents

<table>
<thead>
<tr>
<th>Article ID</th>
<th>Title</th>
<th>Date</th>
<th>Journal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>34250192</td>
<td>Impact of Bamlanivimab Monoclonal Antibody Treatment on Hospitalization and Mortality Among Nonhospitalized Adults With Severe Acute Respiratory Syndrome Coronavirus 2 Infection.</td>
<td>2021-05-17</td>
<td>Open Forum Infect Dis</td>
</tr>
<tr>
<td>34258319</td>
<td>Effectiveness of Severe Acute Respiratory Syndrome Coronavirus 2 Monoclonal Antibody Infusions in High-Risk Outpatients.</td>
<td>2021-06-04</td>
<td>Open Forum Infect Dis</td>
</tr>
</tbody>
</table>

3. Click on title hyperlink to go to abstract or trial summary

To save search results, download document set as csv file
Example: What drugs have been investigated for long-haul COVID?

1. Type in terms to search for in full text papers; separate phrases with commas

2. Select Match Any to make this an “OR” search (Select Match ALL for an “AND” search)

3. Scroll up to see numbers of papers about drugs and COVID-19 that mention “long covid”; sort by All

4. Click on the number for a given therapeutic, e.g., Glucocorticoids, to see papers with snippets (next slide)
Example: What is known about Glucocorticoids and long-haul COVID?

5. From prior search, scroll down to view papers about COVID-19 and Glucocorticoids that mention long-haul COVID

6. Click on “See Snippets” to view text snippets about long-haul COVID from the full text paper via University of Wisconsin-Madison’s xDD search

<table>
<thead>
<tr>
<th>Title</th>
<th>Date</th>
<th>Journal Name</th>
<th>Research Stage</th>
<th>Search Snippets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rethinking the management of immune checkpoint inhibitor-related adrenal insufficiency in cancer patients during the COVID-19 pandemic.</td>
<td>2021-03-08</td>
<td>Endocrinol Diabetes Metab</td>
<td>Review</td>
<td>See Snippets</td>
</tr>
<tr>
<td>Early COVID-19 Therapy with Azithromycin Plus Nitazoxanide, Ivermectin or Hydroxychloroquine in Outpatient Settings Significantly Reduced Symptoms Compared to Known Outcomes in Untreated Patients.</td>
<td>2020-11-04</td>
<td>medrxiv</td>
<td>Clinical Study</td>
<td>See Snippets</td>
</tr>
<tr>
<td>The angiotensin type 2 receptor agonist C21 restores respiratory function in COVID19 - a double-blind, randomized, placebo-controlled Phase 2 trial</td>
<td>2021-01-28</td>
<td>medrxiv</td>
<td>Clinical Study</td>
<td>See Snippets</td>
</tr>
</tbody>
</table>

Show 10 entries

Snippet

1. Furthermore, in patients who develop the “long COVID-19” syndrome, when to discontinue

2. ...a recent study has been recognized to refer to patients being ill for more

3. than 4 weeks. 75 Two groups of long COVID sufferers have been identified: (1) one with mainly

4. contribute to the symptoms of the ‘long COVID-19’ syndrome. In fact, a meta-analysis of 21,350 patients

5. Although some of the symptoms of the ‘long COVID-19’ syndrome may overlap with those of AI

Showing 1 to 5 of 5 entries
Example: What is known about Remdesivir and SARS-CoV-2?

1. Search for drug name and click on number

2. Scroll down and click on the link to COSMOS

3. View tables and figures related to COVID-19 and Remdesivir from full text papers processed by the University of Wisconsin-Madison’s COSMOS system
Text-mining methods
For more information about the NLP methods and an analysis of drug research trends based on this data, see the briefing available for download on the website.

A dataset containing virus-drug results from all documents processed through July 6, 2021 is also available for download. The accompanying data description file includes additional information about methods as well as recall and precision results.
Two tools developed by University of Wisconsin-Madison

**xDD**
- A searchable digital library with full-text publication content provided by open access publishers and xDD partner publishers
- [https://xdd.wisc.edu/](https://xdd.wisc.edu/)

**COSMOS**
- An AI platform for knowledge discovery from text, tables, and images
- [https://cosmos.wisc.edu/](https://cosmos.wisc.edu/)
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MITRE Innovation Program
MITRE COVID-19 Coalition

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Questions?

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