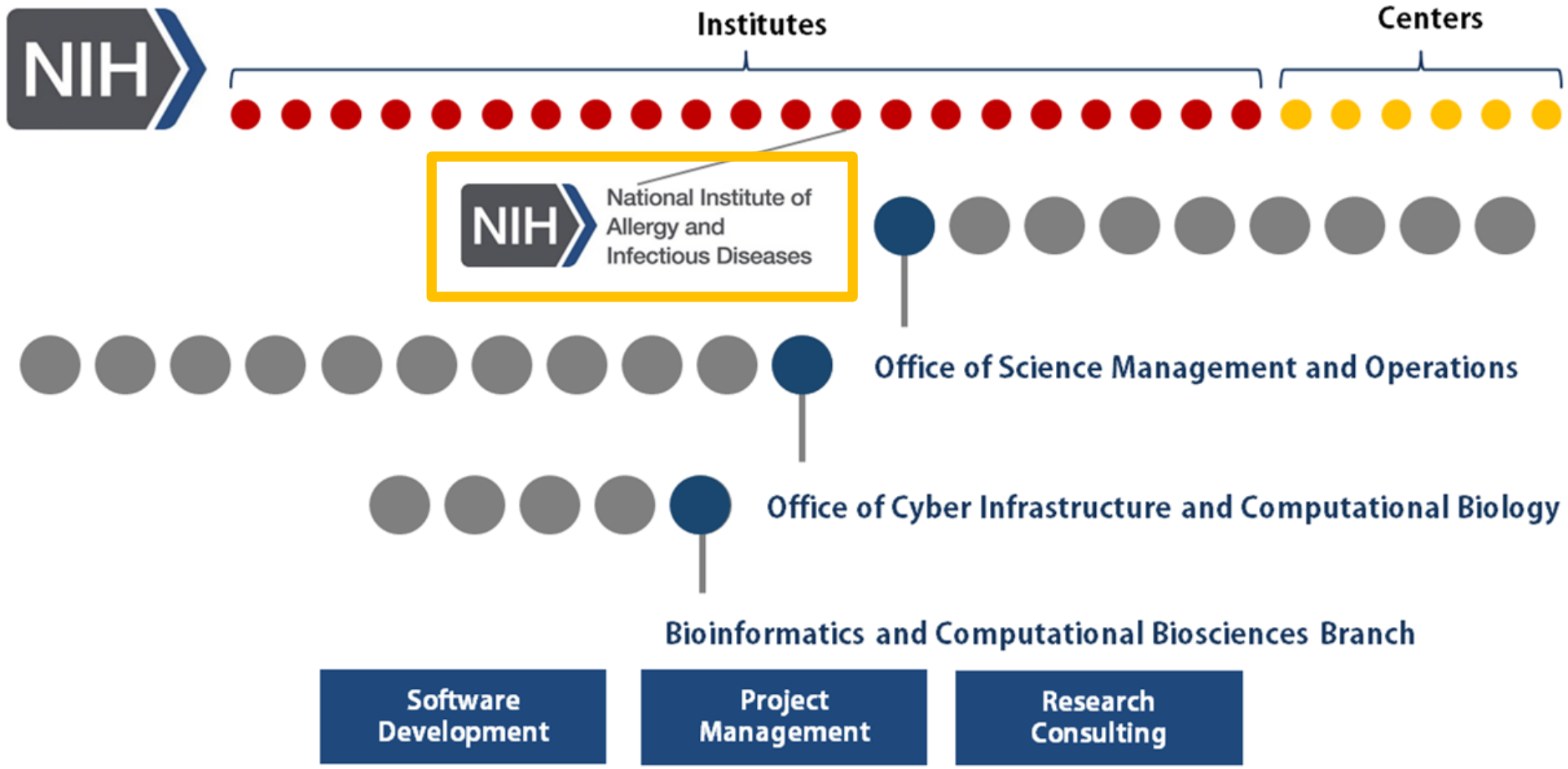
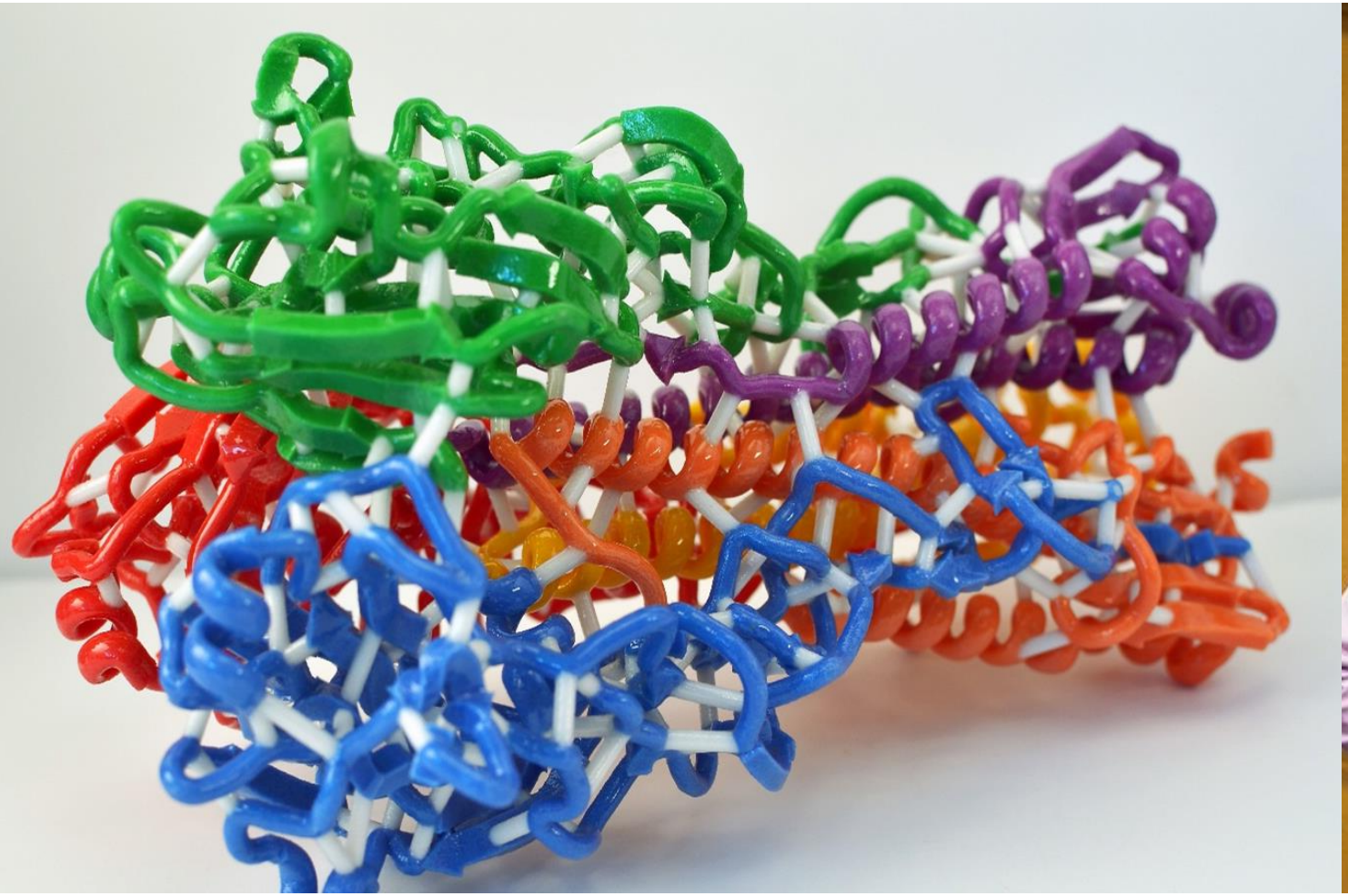
NIH 3D Print Exchange

Web3D Members Meeting
August 3, 2020

Darrell Hurt, Ph.D., and Meghan McCarthy, Ph.D.

Bioinformatics and Computational Biosciences Branch
Office of Cyber Infrastructure and Computational Biology
Office of Science Management and Operations, Office of the Director
National Institute of Allergy and Infectious Diseases
National Institutes of Health, Bethesda, Maryland


NIH
Institutes
Centers
NIH
National Institute of Allergy and Infectious Diseases
Office of Science Management and Operations
Office of Cyber Infrastructure and Computational Biology
Bioinformatics and Computational Biosciences Branch
Software Development
Project Management
Research Consulting



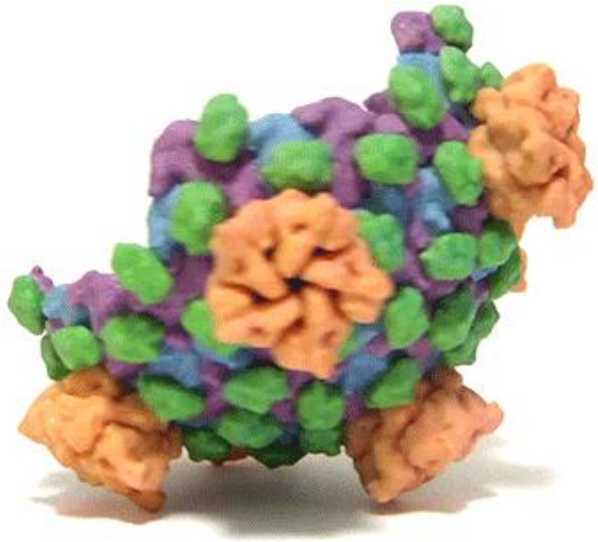
National Institutes of Health
Turning Discovery Into Health

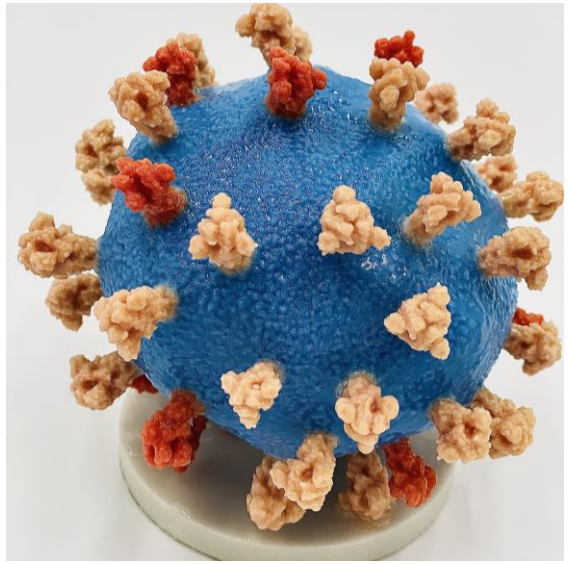
National Institute of Allergy and Infectious Diseases

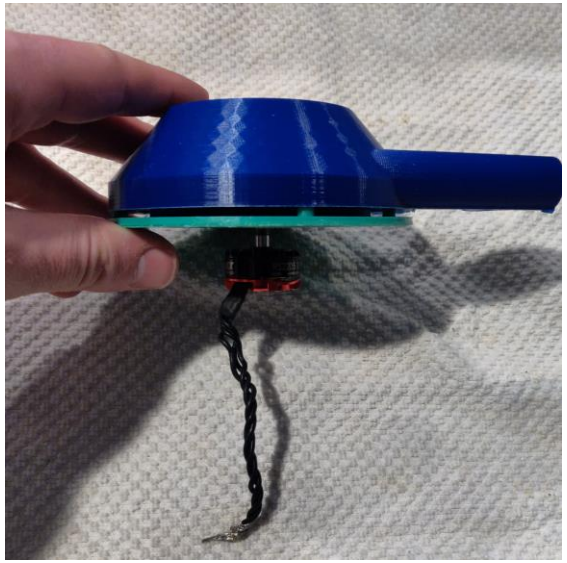
1918 H1 Hemagglutinin. Available for download at https://3dprint.nih.gov/discover/3DPX-000027. Custom model designed and 3D printed by Dr. Darrell Hurt using data from Protein Data Bank entry 1RUZ.

NIH 3D PRINT EXCHANGE

https://3Dprint.nih.gov

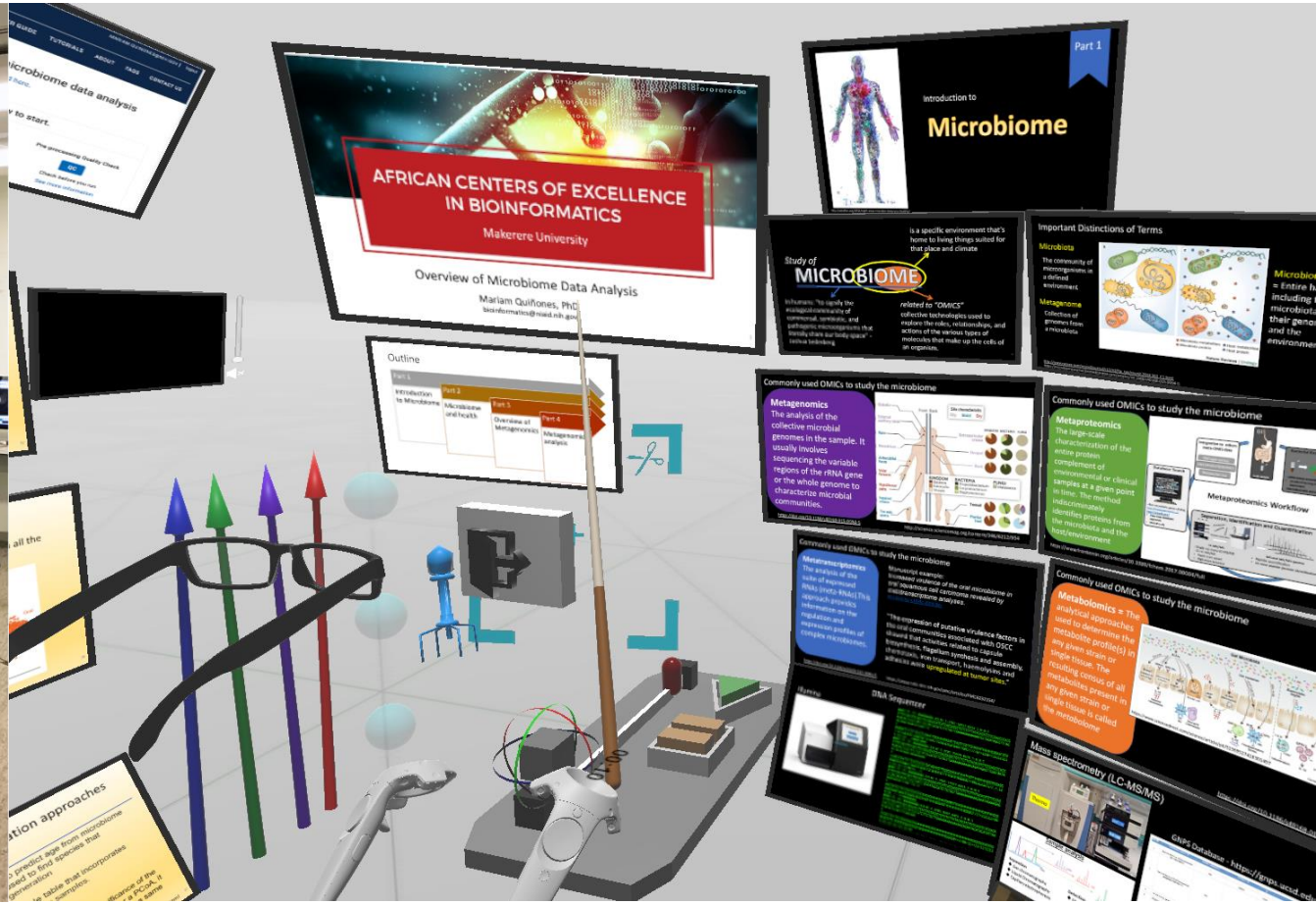






SARS-CoV-2 virion modeled on cryoelectron microscopy data. A. Athman, K. Browne, and P. Cruz (NIH/NIAID) 3DPX-013323
Visible Human Male Skull. K. Browne (NIH/NIAID) 3DPX-012260
Centrifugal Compressor by user sjwentwo 3DPX-012426

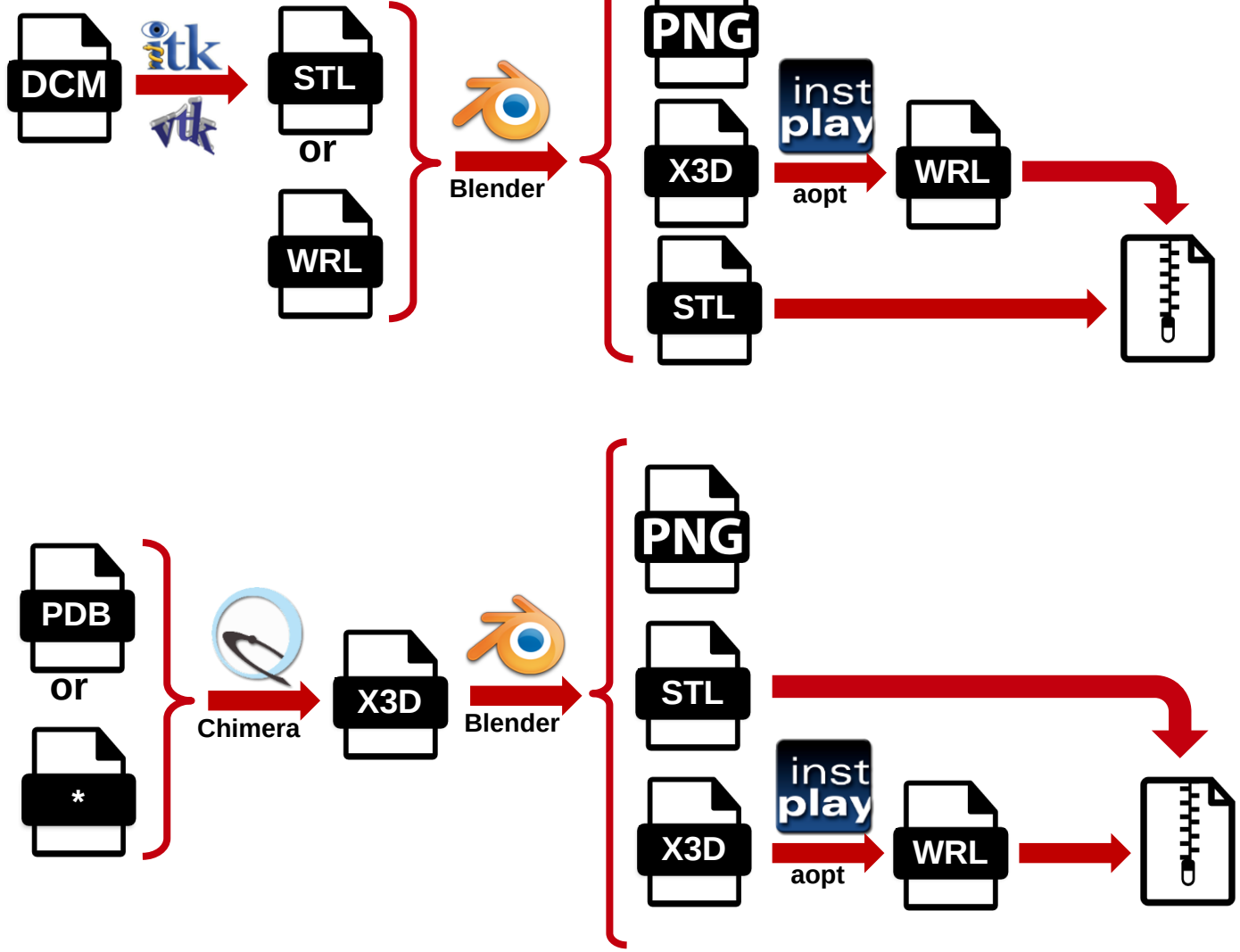

BioViz Lab


AFRICAN CENTERS OF EXCELLENCE IN BIOINFORMATICS
Makerere University
Overview of Microbiome Data Analysis
Part 1
Introduction to
Microbiome
Study of MICROBIOME
Important Distinctions of Terms
Outline
Commonly used OMICs to study the microbiome
Metagenomics
Metaproteomics
Metaproteomics Workflow
Metabolomics
Mass spectrometry (LC-MS/MS)

Drupal

Contributed code to Blender 2.72 and Cura 2.3

python
php

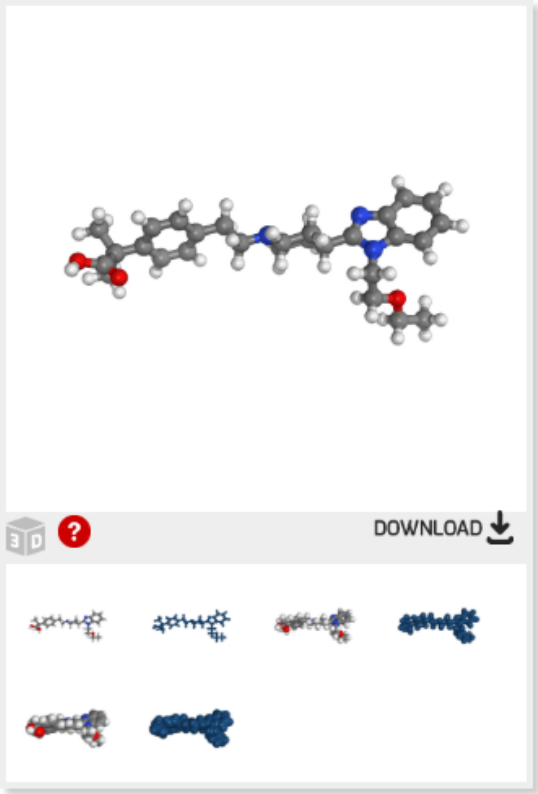


Bilastine

Autogenerated by for jeromejatzlau

Created on Sat, 2020-08-01 05:48, last updated on Sat, 2020-08-01 05:48

Remix It | I Printed This



GENERAL INFORMATION

DOCUMENTATION

This Model was autogenerated from the "Quick Submit" tool.

Model ID 3DPX-014716

Category Small Molecules

Keyword(s)
Bilastine, 202189-78-4, UNII-PA1123N395, C28H37N3O3, PA1123N395, Bilaxten, Benzeneacetic acid,4-[2-[4-[1-(2-ethoxyethyl)-1H-benzimidazol-2-yl]-1-piperidinyl]ethyl]-a,a-dimethyl-, Ilaxten, Bilastine [INN], Bilastinum

Bilastine is a member of benzimidazoles.

PubChem CID 185460

Molecular Weight 463.6 g/mol

Molecular Formula
$CCOCCN_1C_2{=}CC{=}CC{=}C_2N{=}C_1C_3CCN(CC_3)CCC_4{=}CC{=}C(C{=}C_4)C(C)(C)C(=O)O$

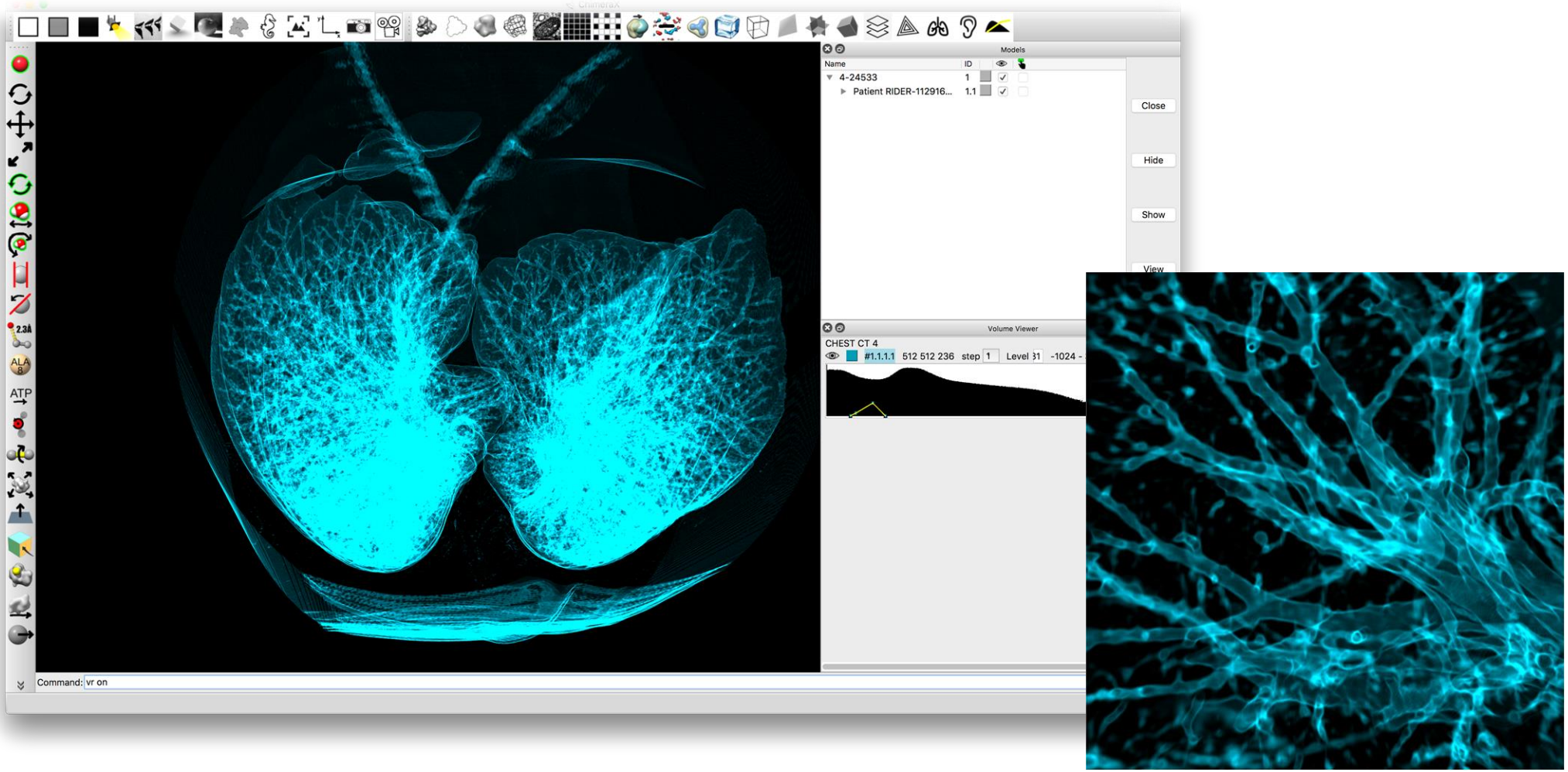
IUPAC
2-[4-[2-[4-[1-(2-ethoxyethyl)benzimidazol-2-yl]piperidin-1-yl]ethyl]phenyl]-2-methylpropanoic acid

RATING

No votes yet

LICENSING

(Repurposing) ChimeraX for DICOM visualization



Make 3D Data Accessible and Transferable

3D Printer

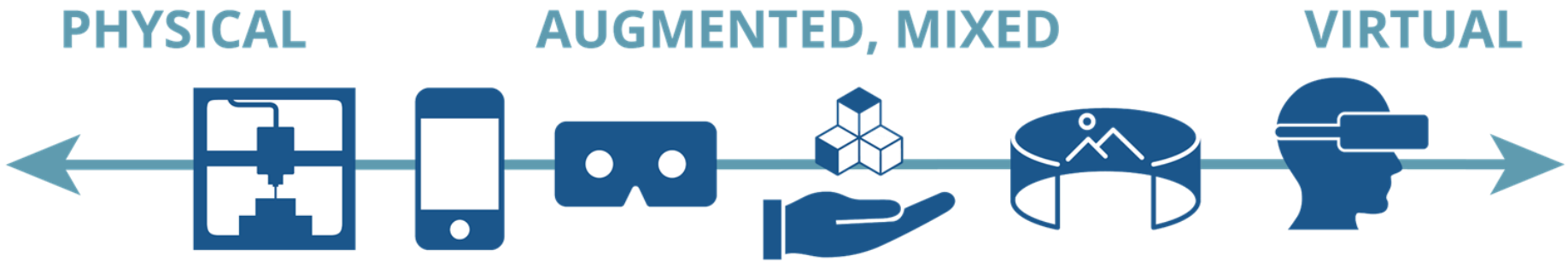
Desktop Browser

Mobile Apps

VR/AR Headsets

Coming in 2021: NIH 3D!

https://3D.nih.gov



NIH 3D Print Exchange

"NIH 3D"

Importance of Metadata

Attribution and IP

- Name
- Description
- License
- Instructions for use
- Source data
- Version

Respect rights of the content creator

Open Science

- Publication Reference(s)
- Database Identifier(s)
- Structure name
- Description
- Experimental method
- Keywords

Attribution, (CC) licensing, and source information are important to Open Access in Science!

Patient Information

- Patient Identifier
- Physician
- Diagnostic Code
- Physician's Notes
- Imaging Modality
- Version

Make 3D models part of the patient's health record

Recent support for COVID-19 and SARS-CoV-2

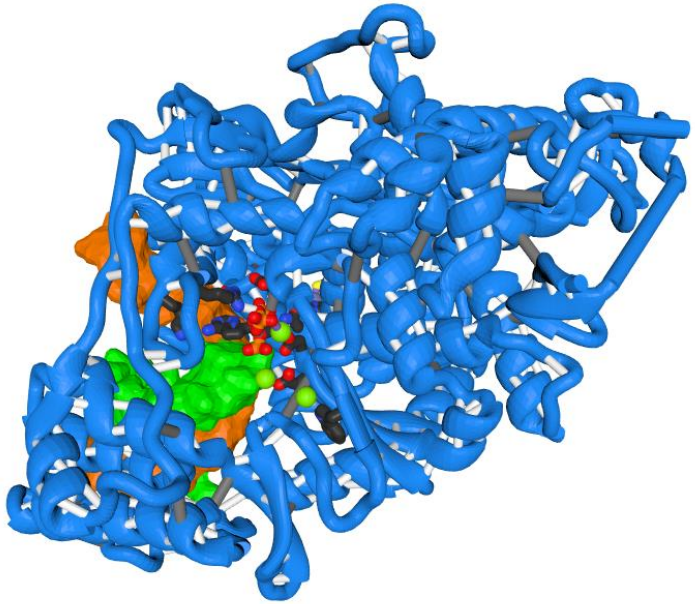
Image credits: NIH/NIAID (by Kristen Browne).

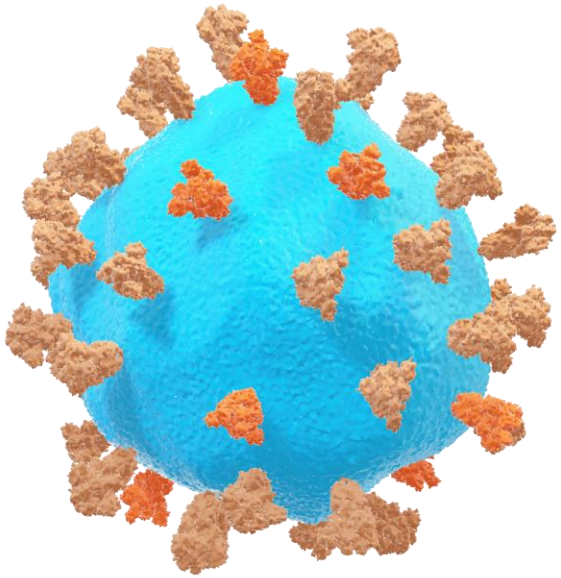
SARS-CoV-2 Virion and Proteins

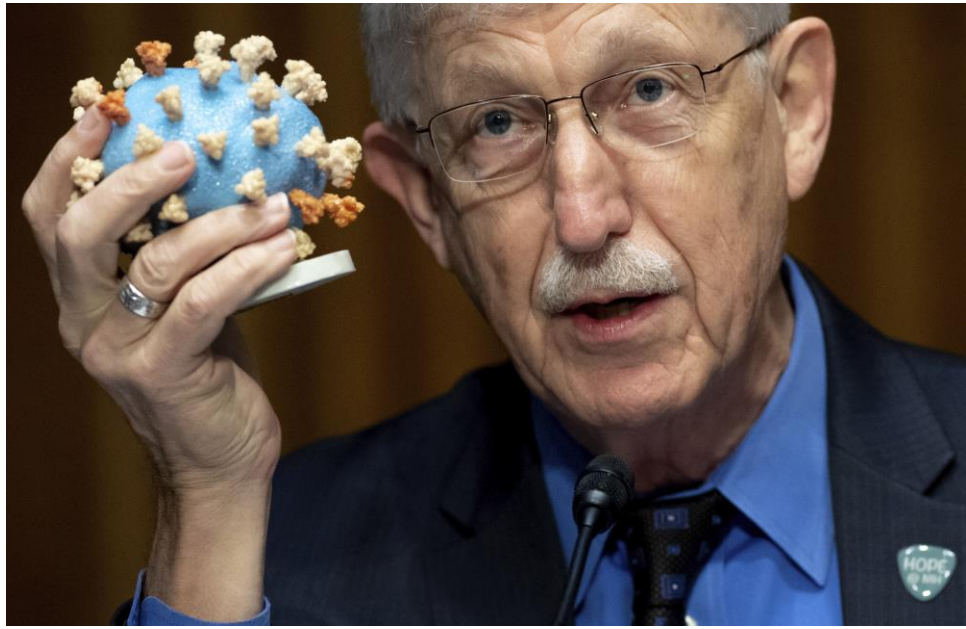
Curated by NIH/NIAID

National Institute of Allergy and Infectious Diseases

https://3dprint.nih.gov/niaid/sars-cov-2







National Institutes of Health
Turning Discovery Into Health

National Institute of Allergy and Infectious Diseases

Francis Collins, director of the National Institutes of Health, at a Senate subcommittee hearing on the plan to research, manufacture and distribute a coronavirus vaccine on July 2 in Washington. (Saul Loeb/AP).
https://www.washingtonpost.com/opinions/2020/07/14/need-some-good-news-about-covid-19-here-are-six-reasons-optimism/

Image credits: Dr. Beth Ripley and Timothy Prestero.

COVID-19 Supply Chain Response

Curated by NIH/NIAID in collaboration with the U.S. Food and Drug Administration, the Veterans Healthcare Administration, and America Makes

https://3Dprint.nih.gov/collections/covid-19-response

3DPX-014168

Stopgap Surgical Face Mask (SFM) Revision B

VHA Innovation ...

https://3dprint.nih.gov/discover/3dpx-014168

https://3dprint.nih.gov/discover/3dpx-013306

FDA Efforts to Connect Manufacturers and Health Care Entities: The FDA, Department of Veterans Affairs, National Institutes of Health, and America Makes Form a COVID-19 response Public-Private Partnership

First draft of MOU – March 23rd; Signed on March 25th; published by FDA on March 27th!!!

MOU available at https://go.usa.gov/xvHSc

Design Categorization

Warning
Potentially significant risk

Prototype
not reviewed or not optimized;
proceed with caution

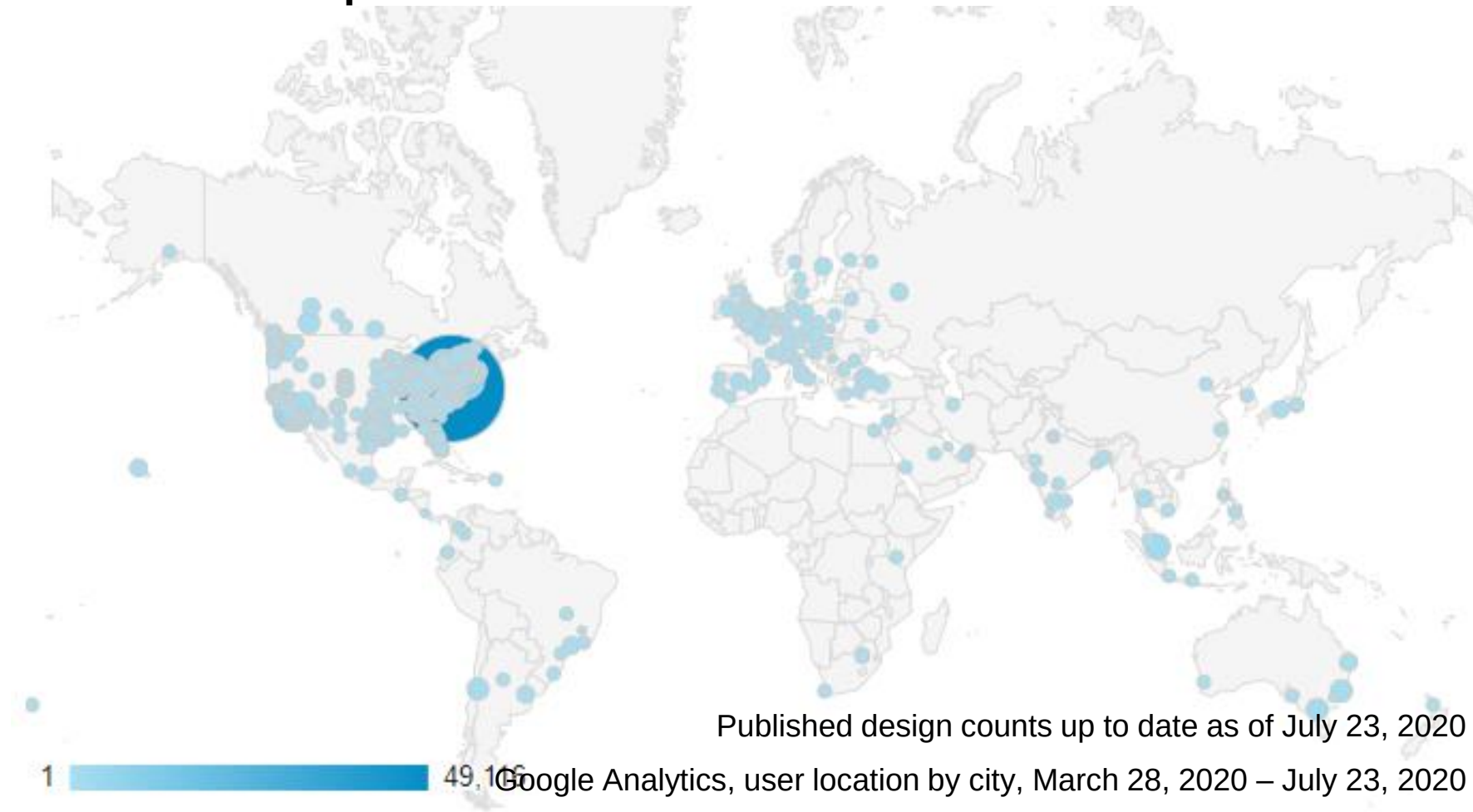
Community Use
Low risk, good instructions, not for use in a clinical setting

Clinically Reviewed
tested in a clinical setting, thoroughly documented, with IFU; must be fabricated as described, including printer type/materials

This design is for a 3D-printable nasal or throat swab, and is intended only to be manufactured in facilities that meet specific requirements. Please read the documentation carefully and contact the submitter for support.

COVID-19 Supply Chain Response Collection

- **696 published designs**
  - Clinical Use: **34** *
  - Community Use: **28** *
  - Prototypes: **506**
  - Warning: **33**
  - Nasal Swabs: **7**
- **160,000 files downloaded**
- **1.34 million** total views of designs in the collection
- **149+** “builds”
- **495+** comments



Published design counts up to date as of July 23, 2020

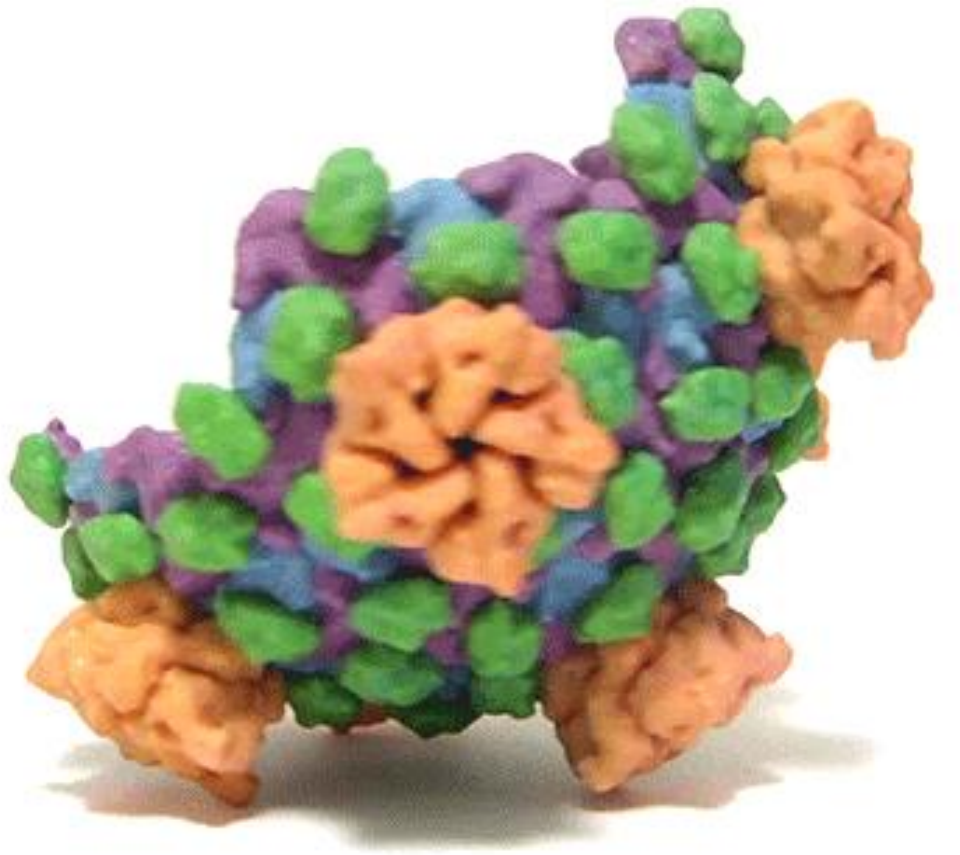
Google Analytics, user location by city, March 28, 2020 – July 23, 2020

***Clinical Use and Community Use labels are based on design testing by the Veterans Healthcare Administration, and do not indicate any formal approval by the FDA, the NIH, the VHA, or America Makes**

Embed Scientific Information

- Publication Reference(s)
- Database Identifier(s)
- Structure name
- Description
- Experimental method
- Keywords

Attribution, (CC) licensing, and source information are important to Open Access in Science!

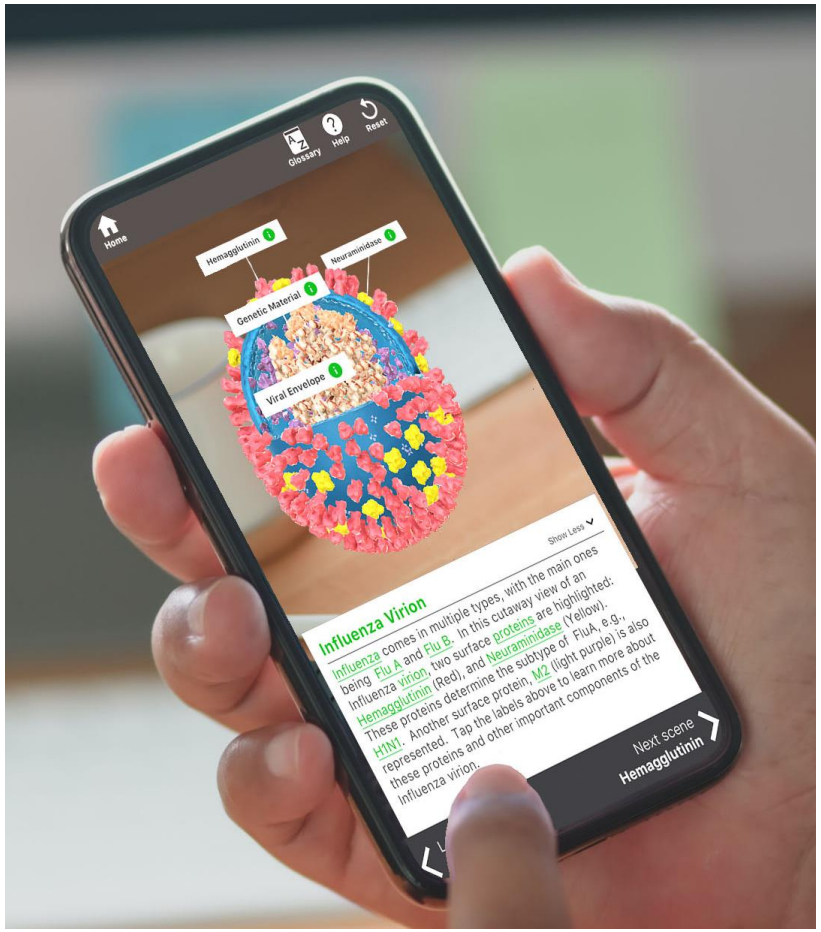


Embed patient-specific information

- Patient Identifier
- Physician
- Diagnostic Code
- Physician's Notes
- Imaging Modality
- Version

Make 3D models part of the patient's health record

PathogenAR: Search your app store!



unity

vuforia™

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National Institute of Allergy and Infectious Diseases

https://github.com/niaid/x3dom

https://github.com/niaid/3Dmodel-scripts

https://github.com/niaid/3dpx-api

Thousands of X3D models!
Download for free, or share your own!

Acknowledgements

NIAID Leadership
Anthony S. Fauci, Director
John J. McGowan, Deputy Director
Michael Tartakovsky, CIO
Darrell Hurt, Branch Chief

NIAID – 3D Print Exchange Team
Meghan McCarthy, Project Manager
Phil Cruz, Structural Biologist
Kristen Browne, Medical Illustrator

NIAID - BioViz Lab
Meghan McCarthy, Program Lead
Phil Cruz, Structural Biologist
Victor Starr Kramer, Technician
Kai Zhang, Developer

NIAID Vaccine Research Center
Barney Graham, Deputy Director
Michelle Crank, Influenza Research Program

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Dmitri Levin, Univ of Washington
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Steve Garrou, Enduvo
Paul Pribaz, Jump Simulation
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Web3D Consortium
Michael Weinberg, Shapeways

Special Thanks
The NIH 3D Print Exchanges uses **UCSF Chimera**, and VR molecular visualization is made possible by **UCSF ChimeraX,** open source software from the Resource for Biological Visualization and Informatics at the University of California San Francisco.

Special thanks to **Tom Ferrin**, Ph.D., Principal Investigator and **Tom Goddard**, Ph.D., Senior ChimeraX and VR developer

Questions and feedback to 3Dprint@nih.gov

COMMENT

Low-tech solutions for the COVID-19 supply chain crisis

Andrea M. Armani[1,3]✉, *Darrell E. Hurt*[2], *Darryl Hwang*[3,4], *Meghan C. McCarthy*[2] and *Alexis Scholtz*[3]

A global effort is ongoing in the scientific community and in the maker movement, which focuses on creating devices and tinkering with them, to reverse-engineer commercial medical equipment and get it to healthcare workers. For these 'low-tech' solutions to have a real impact, it is important for them to coalesce around approved designs.

NATURE REVIEWS | MATERIALS

https://www.nature.com/articles/s41578-020-0205-1