

# Voice Computing in Biological Crystallography

**Blaine Mooers, PhD**  
**blaine-mooers@ouhsc.edu**  
**405-271-8300**

**Slides:** <https://github.com/MooersLab/ACA2024>

Department of Biochemistry & Physiology  
University of Oklahoma Health Sciences, Oklahoma City

ACA  
2024 July 8

# The problem



deepai.org prompt: Structural biology professor working at his computer while overwhelmed with a large number of parallel writing projects.

# Three kinds of voice-computing activities

- ✓ Speech-to-text [Voice In Plus]
- ✓ Speech-to-commands (include voice-triggered snippets) [Voice In Plus]
- Speech-to-code

# Shortcut and snippet libraries for PX

- Mooers, B.H. (2020) Shortcuts for faster image creation in PyMOL. Protein Sci., 29, 268–276.
- Mooers, B. H. M. and Brown, M. E. (2021) Templates for writing PyMOL scripts. Protein Sci. 30(1):262-269
- Mooers, B.H.M. (2021). Modernizing computing by structural biologists with Jupyter and Colab. In Agarwal, M., Calloway, C., Niederhut, D. (eds), Proceedings of the 20th Python in Science Conference (SciPy2021).
- Mooers, B.H.M. (2023) Edit cctbx code in live Jupyter cells with your favorite text editor. Computational Crystallography Newsletter 14, 15-18.
- Mooers, B.H.M. (2023) Biomolecular crystallographic computing with Jupyter. In Agarwal, M., Calloway, C., Niederhut, D. (eds), Proceedings of the 22nd Python in Science Conference (SciPy2023). pp. 32–39.

# Snippet libraries complement AI assistants

ChatGPT Ready

[Prompt: default] [gpt-3.5-turbo]

1 ###

2

3 How can I assist you today?

4

5 ### What are the pros and cons of using  
libraries of code snippets as opposed to  
using an AI -assttstant to return code?

6

7 Using libraries of code snippets can provide quick access to commonly used solutions and reduce the time spent on coding tasks. However, this approach may lead to copy-pasting without fully understanding the code or context. On the other hand, using an AI assistant to provide code suggestions can offer personalized recommendations and explanations but may require more time and effort to integrate into the workflow.

# Common errors during transcription

- Wrong words inserted
- Omitted words
- Added words

# Voice In Plugin for Chrome and Edge



Voice In

Sites

Notepad

Support

Pricing

My Account ▾

INSTALL

## Get the #1 Speech-To-Text Chrome Extension.

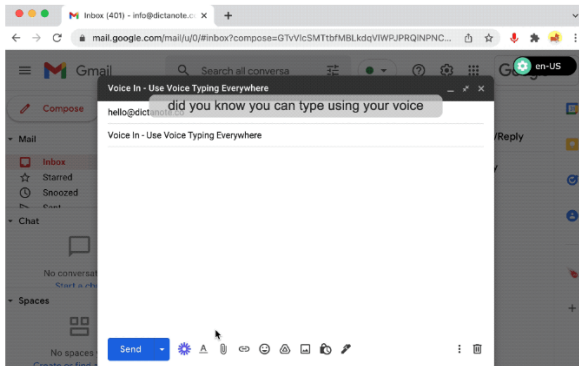
Use your voice to type on [over 10,000 websites](#) in [50+ languages](#). Voice In transcribes your speech to text in real-time.

Trusted by 300,000+ users. Get it now for free.

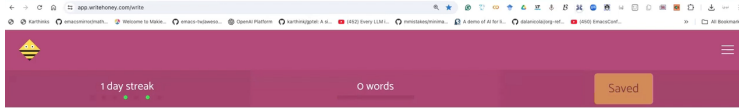
★★★★★ Rated 4.5/5 out of 2000+ reviews



ADD TO CHROME →



# Demo of generating prose



It was the best of times, ...





# Custom Commands

Enhance your experience with custom voice commands. These allow you to correct dictation errors, automate repetitive text entries, and perform actions like changing the dictation language, pressing keyboard shortcuts, etc.

For more information, [read our guide on using custom voice commands](#).

+ Add Command

📁 Bulk Add

↪ Export

↻ Sync

**Say This**

**To Insert This**

'cause

because



'cuz

because



'twas

it was



`https://github.com/MooersLab/voice-in-plus-contractions`

# Text replacements (1/2)

## Text Replacement

### Edit Voice Command

Say This

To Insert This

☐ Match within a word

Edit

## Insert code: <internal command>

### Edit Voice Command

Say This

To Insert This

☐ Match within a word

Edit

# Text replacements (2/2)

## Insert multi-line code chunks

### Edit Voice Command

Say This

To Insert This

```
\begin{itemize}
  \item <capitalize>
  \item <capitalize>
  \item <capitalize>
  \item <capitalize>
\end{itemize}
```

☐ Match within a word

Edit

## Expand acronyms

### Edit Voice Command

Say This

To Insert This

☐ Match within a word

Edit

# Homemade Voice-In commands

- **expand** acronyms
- **describe** summarizes what a program does
- **email** dsw (insert list of 190 e-mail addresses)
- **insert** code blocks
- **list** (e.g., font sizes in latex, steps in a protocol)
- **open** webpage (e.g., open ACA2024)
- **display** equation in display mode

<https://github.com/MooersLab#voice-computing>

# biocryst.csv on GitHub

biocryst.csv Edited open commands. 14 minutes ago

README MIT license

biological-crystallography-voice-in 0.2 license mit

## biological-crystallography-voice-in

### Introduction

This repo contains voice commands about biological crystallography for the automated speech recognition software Voice In Plus. Voice In Plus is a plugin for Google Chrome and Microsoft Edge. These short snippets of LaTeX are recognized and rendered correctly by most markdown typesetting languages including org-mode in Emacs and markdown cells in Jupyter and R Markdown notebooks.

### Examples of voice triggers and their results

Voice trigger	Result
expand jac	Journal of Applied Crystallography
expand iucr	International Union of Crystallography
expression for sigmaA 2fo minus fc	$2mF_o - DF_c$

# Debugging biocryst.csv

## Error Detection

We can make this file [beautiful and searchable](#) if this error is corrected: It looks like row 2 should actually have 3 columns, instead of 2. in line 1.



**MooersLab** Update biocryst.csv

77c8812 · now History

Preview

Code

Blame

576 lines (576 loc) · 26 KB

Raw



```
1 20 by hemahedron, twinning by hemihedry
2 20 by merohedry, twinning by merohedry
3 20 in operation, twinning operation
```

## After Correction

Preview

Code

Blame

570 lines (570 loc) · 25.5 KB

Raw



🔍 Search this file

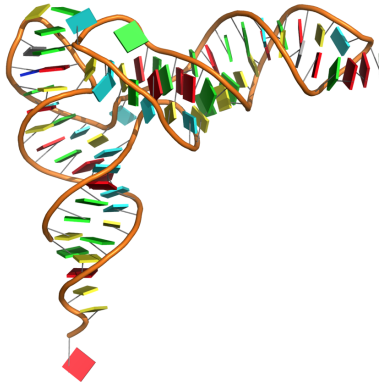
1	20 by hemahedron	twinning by hemihedry
2	20 by merohedry	twinning by merohedry
3	20 in operation	twinning operation

# Jupyter notebooks

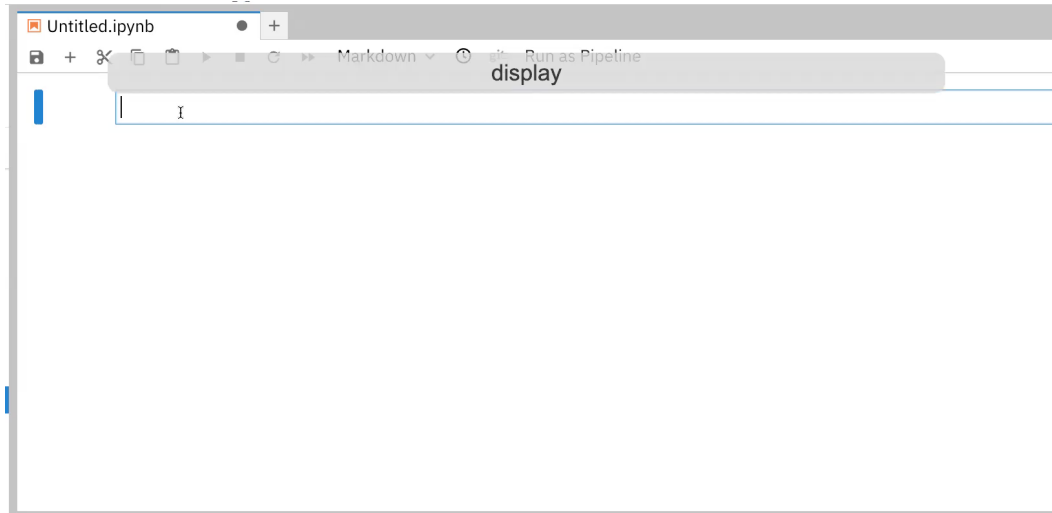
```
[4]: Image(filename = PATH + "dssrBlock2.png", width=500, height=500, unconfined=True)
```

Last executed at 2020-09-20 19:15:52 in 17ms

[4]:



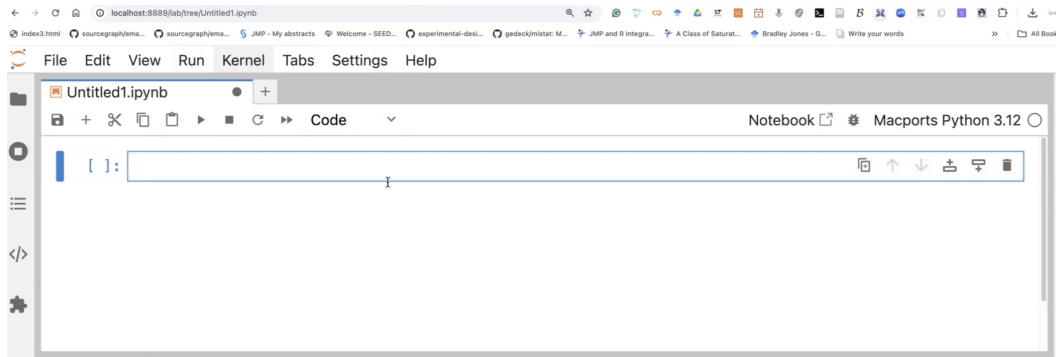
# Demo: Markdown cell



MooersLab/biological-crystallography-voice-in



# Demo: Code cell



MooersLab/jupyter-voice-in  
MooersLab/cctbx-voice-in

# Contents of biocryst.csv

- Expand > 150 acronyms.
- Open >100 websites.
- Insert space group symbols set in LaTeX.
- Return space number given a space group name.
- Insert key equations set in LaTeX in display or in-line mode.
- Insert code for PyMOL and CCTBX.

<https://github.com/MooersLab/biological-crystallography-voice-in>

# Future directions

- Expand the current libraries.
- Build quiz for biocryst.csv.
- Support the use of voice computing in Web VSCode.
- Index snippet libraries to aid in AI retrieval.

# Summary

- Speech-to-text eases writing prose.
- Text replacements can return validated information.
- Voice-triggered snippets insert equations and code in Jupyter markdown and code cells.
- Voice-triggered snippets work in all web-based editors.

# Acknowledgements

Friends and mentors:

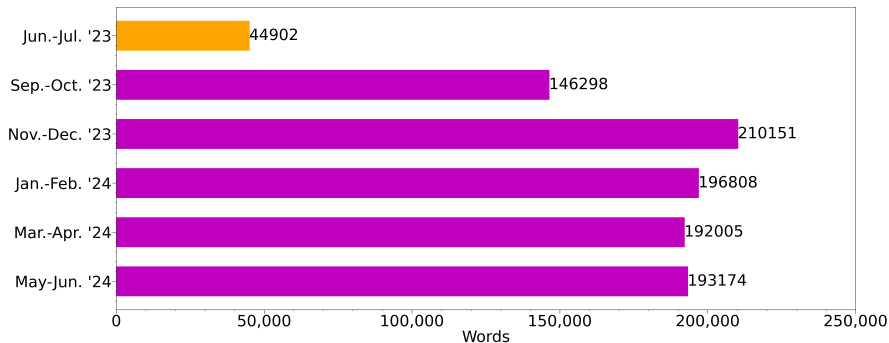
- Oklahoma Data Science Workshop
- Austin Emacs Meetups
- Aina Cohen and Artem Lyubimov, SMB at SSRL 👍

Funding:

- NIH: R01 CA242845
- NIH: P30 CA225520 (PI: R. Mannel)
- P20GM103640 and P30GM145423 (PI: A. West)

# “In God we trust. All others must bring data.”

*W. Edwards Deming (1900-1993)*



# Hazards of voice computing

- Accidental recording of a conversation with a visitor.
- Accidentally dictate into an open code cell or file.
- External and internal microphones interfere during Zoom meetings.
- Clashes between active Automated Speech Recognition software packages.

# Other software not covered in this talk

- **LilySpeaks** free and runs everywhere, Windows only
  - Nuance's **Dragon Naturally Speaking** (\$699, Windows).
  - \***Serenade** (free, future development in question, looks interesting for Speech-to-commands and Speech-to-code)
  - \***Talon Voice** (free, Python driven, tinker's rabbit hole)
  - mac OS's **Dictation**
  - Mac Os **Voice Control**
  - Digital assistants like **Siri** and **Alexa**.
- \* Analog libraries on MooersLab.



# Voice-in Quiz

