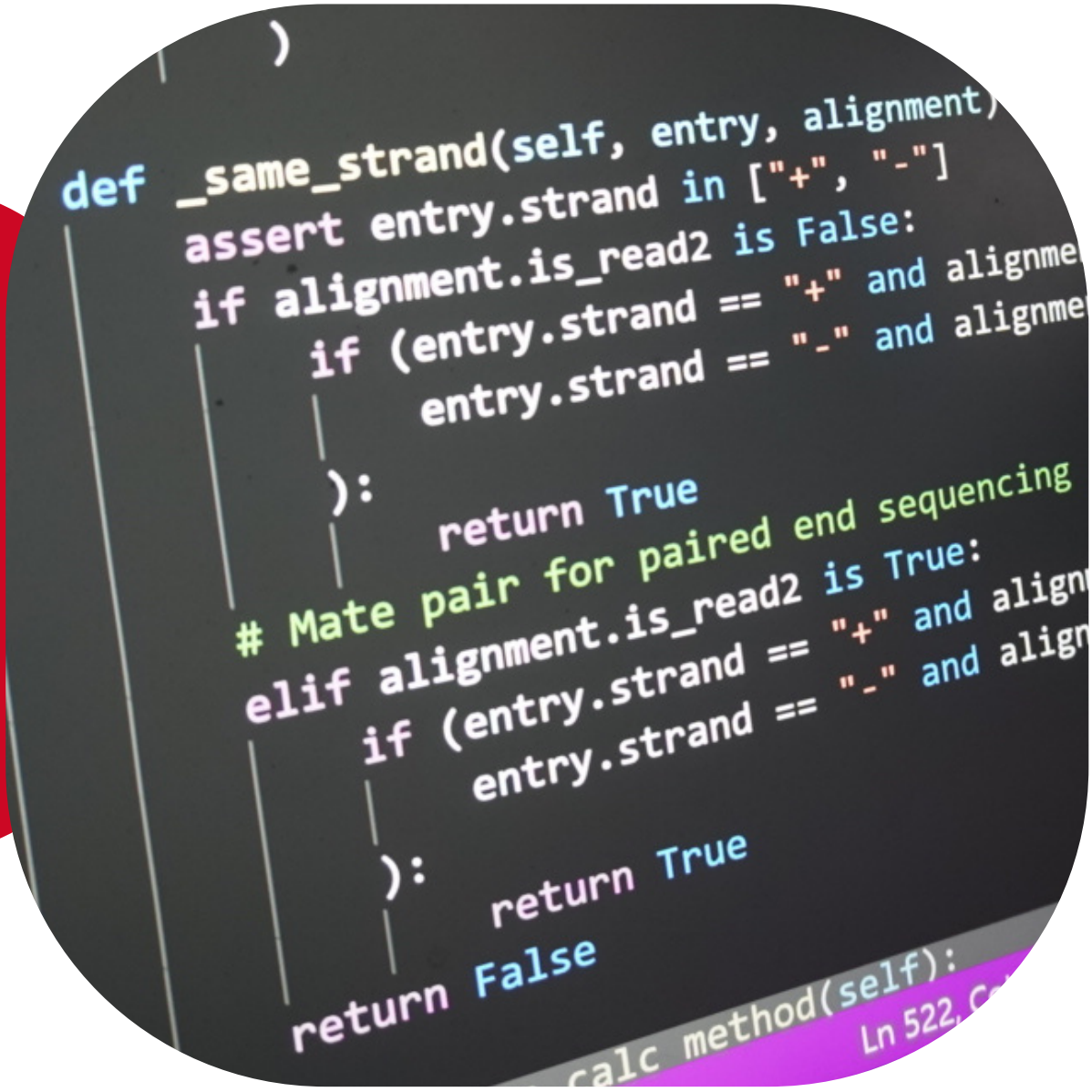
PYTHON PROGRAMMING LANGUAGE

HITTING THE SWEET SPOT: EASY TO LEARN, POWERFUL TO USE



Information Centre for Life Sciences
ZB MED

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INTRODUCTION:

Data literacy is an essential skill in our digitalised world. In fact, the ability to collect, analyse, interpret and visualise data is more in demand than ever before! We are increasingly expected to leverage data for all sorts of purposes, not just in science and academia, but also in many other workplace settings, and even in our personal lives. One of the most important data literacy skills of all is programming – and the Python programming language provides an easy way to get started.

WHAT ARE THE BENEFITS OF PYTHON? AND WHO IS IT AIMED AT?

Why should I learn programming?

Well, you know all those routine, trivial tasks that take ages to get done and are absolutely no fun? Imagine if you could automate them! Wouldn't that make life easier? Al Sweigart certainly thinks so. He wrote a book about Python – and the title says it all: Automate the boring stuff with Python.[1]

So, what kind of boring stuff can Python help you tackle in the real world? For one thing, you could write your own program to create, update, move and rename files and folders quickly and automatically. Or a program that lets you search the web for online content and download it in whatever form you want.

But Python is about so much more than just automating work processes. The Python programming language is used in data analysis, data processing and web development – and it even plays a key role in the programs behind YouTube, Netflix and Google. Python is also one of the preferred coding languages in the fields of machine learning and artificial intelligence.

> "Automate the Boring Stuff with Python."
>
> Al Sweigart

Using Python for research and everyday tasks

Many people would struggle to get their work done without automation. For example, researchers are often confronted by huge quantities of data that would be impossible to analyse and process manually. In many cases, existing programs are simply unable to crunch the data in the precise way a researcher needs for their specific project. That's when the ability to write your own program that ticks all the boxes can be so useful. Python has become a popular tool in these kinds of situations.

As digitalisation continues to make inroads in the world of research, academic libraries are also seeing big changes in how they operate. Data librarians occupy a kind of intermediary role between the IT department and library staff. They can harness their programming skills as a quick and easy way to ease their colleagues' workload – for example, by writing scripts that do exactly what users want. They can help create automated solutions for tasks such as extracting metadata or recording shelf marks.

[1] https://automatetheboringstuff.com/

WHY PYTHON IS THE PERFECT PROGRAMMING LANGUAGE FOR BEGINNERS

What is Python?

The Python programming language is a general-purpose language (GPL). That means it is a versatile language that can be used in a wide variety of applications and activities, unlike domain-specific languages that can only be used within a specific area. Other well-known GPLs include JavaScript, PHP and C++.[2]

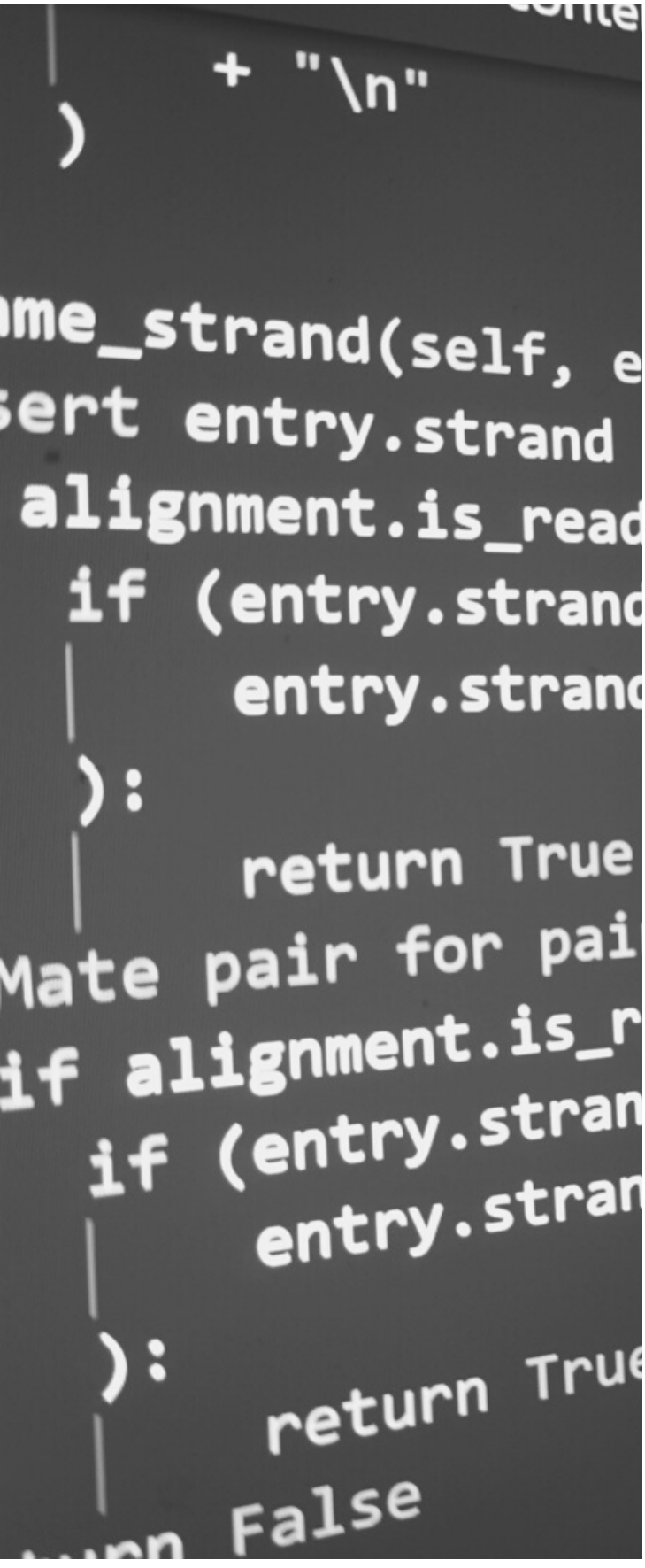
> **Beautiful is better than ugly.**
> **Explicit is better than implicit.**
> **Simple is better than complex.**
>
> The Zen of Python

"The Zen of Python" – or why Python is so easy to learn

One of the advantages of Python is that it has a very simple syntax compared to other programming languages. This is largely thanks to the Zen of Python by Tim Peters[3], a set of 19 guiding principles that set out Python's design philosophy. These include aphorisms such as "Explicit is better than implicit", "Simple is better than complex" and "Readability counts". By sticking to these simple guiding principles, programmers can achieve a clear and simple coding style without having to follow complicated rules. This makes Python faster and easier to learn while still upholding the basic tenets on which other programming languages are based. As a result, Python actually makes it easier to learn other programming languages, too.

[2] cf. Wikipedia article: https://en.wikipedia.org/wiki/General-purpose_programming_language

[3] The Zen of Python: https://peps.python.org/pep-0020/



A growing community

Python is one of the most popular programming languages, with a large and growing community of developers. Python has become one of the fastest growing languages in the world, especially since 2010. [4] In part, this is because it is so easy to learn and so versatile, with applications ranging from data science and web development to scientific research. But its rapid rise in popularity is also due to the Python community itself, which offers fast and efficient support. Programmers from all over the world offer useful tips and advice in help forums such as Stack Overflow. Python also has a comprehensive standard library as well as numerous third-party libraries called “packages”, which are written by the community and made available to everyone to help solve coding problems[5].

Open source and open community

The Python language and associated frameworks are open source and free for all to use. The libraries contain many additional functions that you can import directly into your own development environment. As well as supporting open science, the Python community also champions the concept of an open community. It explicitly prides itself on being tolerant, respectful and inclusive, welcoming anyone and everyone whatever their origin or background.

[4] cf.: https://stackoverflow.blog/2017/09/06/incredible-growth-python/
[5] A selection of Python libraries is listed at the end of this whitepaper.

LEARNING PYTHON

How to get started

From YouTube to e-learning platforms, you can find a huge range of free and paid courses and tutorials online. You will also find plenty of useful information for beginners on the Python website itself. Visit python.org to check out the wide array of tutorials, manuals and information videos, as well as information on workshops and conferences.

Python and other data literacy skills for science – The Carpentries

The Carpentries is a not-for-profit organisation made up primarily of volunteers. It is an excellent place to start learning the kind of programming skills you need in scientific and academic contexts. Its vision is to teach data and coding skills to researchers and librarians. The Carpentries is divided into three core areas:

- Data Carpentry focuses on the fundamental data literacy skills researchers need to work effectively.
- Library Carpentry focuses on building the software and data skills required by libraries and similar institutions.
- Software Carpentry, which was the first area to be established in The Carpentries, focuses on solutions for basic programming tasks.

THE CARPENTRIES - foundational coding and data science skills for researchers

Carpentry workshops

The two-day workshops teach fundamental skills in various areas of IT, such as programming languages, data structures and data management. They are designed to lay the foundations participants need to take their learning to the next level.

ZB MED is an active member of the Carpentries community. Many of its staff are certified Carpentries instructors. Since 2018, ZB MED has organised over 50 Carpentry workshops and has also been involved in developing and improving individual workshop components, including the lessons on Wikidata and Python.

What do I need to start learning Python?

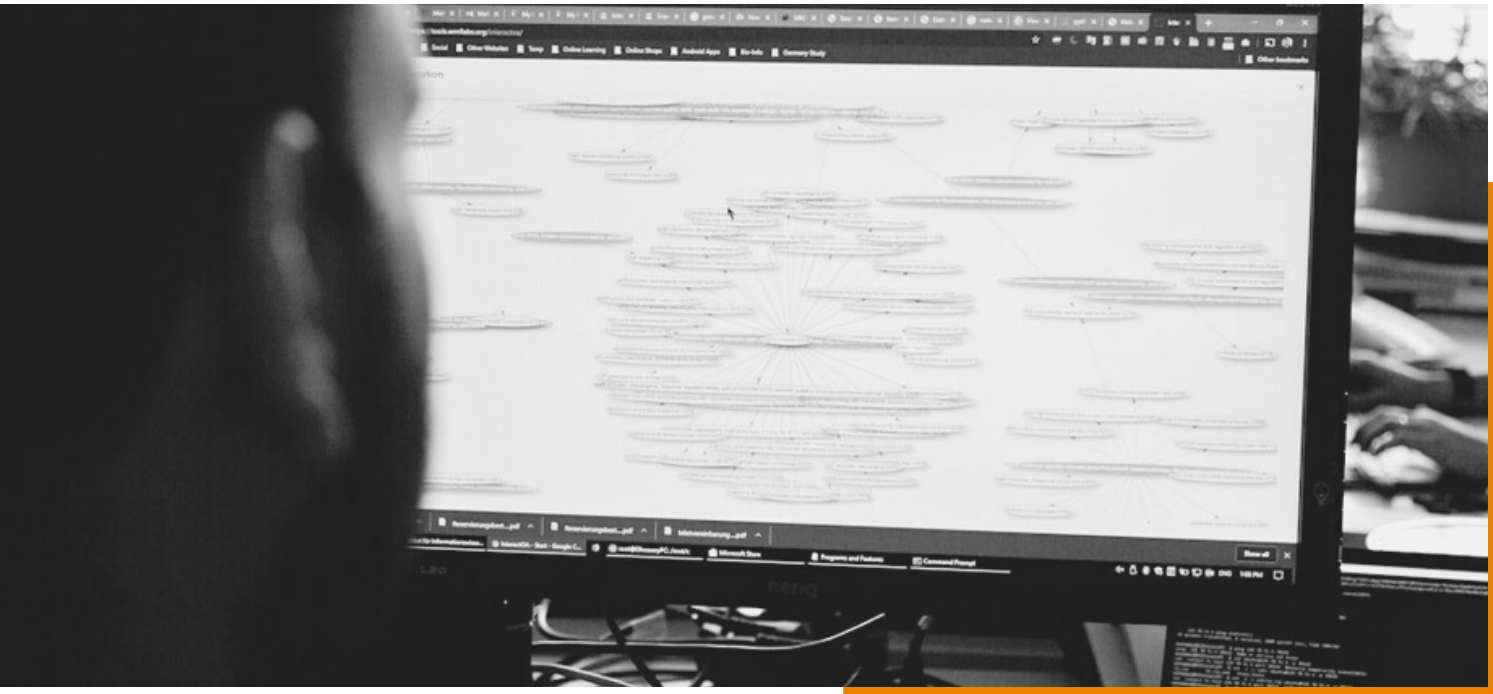
There are no special requirements to run Python. It is free and supports most common operating systems. One useful tool for Python users is Jupyter Notebook, an open-source application that enables you to write and share documents and code. The platform is based on the principle of "literate programming", which allows users to combine text and code and save them in a document. This makes the results much easier to read. Another useful tool is the free Anaconda Navigator Individual Edition, which is now known as Anaconda Distribution.

Anaconda Navigator provides a fantastic introduction to programming[6] and comes with a wide variety of applications and tools including Python, Jupyter Notebook, the Spyder Integrated Development Environment (IDE), and many more. Instead of having to install all the tools individually, users can simply access all the programs they need through Anaconda Navigator.

[6] https://www.anaconda.com/products/distribution

POSTSCRIPT:
PYTHON, LIKE THE SNAKE?

Although Python's logo shows two snakes in a style that evokes ancient Mayan drawings, the programming language was actually named not after a reptile, but after the British comedy troupe Monty Python. Dutch software developer Guido van Rossum, who began developing the programming language in 1989, chose the name Python in allusion to the TV series “Monty Python's Flying Circus”[7]. There are even references to Monty Python sketches scattered throughout the Python documentation!



[7] cf.: https://docs.python.org/2/faq/general.html#why-is-it-called-python

PYTHON FOR BEGINNERS

Find out more

- Python.org
- Al Sweigart: Automate boring stuff with Python (free to read online under a CC-BY licence)
- How Python has grown: https://stackoverflow.blog/2017/09/06/incredible-growth-python/ and https://stackoverflow.blog/2017/09/14/python-growing-quickly/
- PyCoders Weekly Newsletter
- The 35 Words You Need to Python
- Podcast Command Line Heros : "Command Line Heroes tells the epic true tales of how developers, programmers, hackers, geeks, and open source rebels are revolutionizing the technology landscape.", e.g.:
  - Python's Tale
  - Heroes in a Bash Shell

Videos about Python on the ZB MED YouTube channel:

- ZB MED Lab: The Python programming language (in German)
- ZB MED Tutorial: Series of screencasts about Python (in German)
- ZB MED Lab: Who are the Carpentries? (in German)
- ZB MED Nachgefragt: No fear of large amounts of data! Data Literacy for Libraries (in German with English subtitles)

The Carpentries and Co: a one-stop shop for data literacy

- https://carpentries.org/
- The Carpentries at ZB MED
- Data Librarian certificate course at TH Köln
- Python for Librarians: content from the Library Carpentry Workshops

MORE INFORMATION

HOW TO TAKE PYTHON TO THE NEXT LEVEL

Text editors & IDEs for programming with Python:

- PyCharm
- Spyder
- Emacs
- Visual Studio Code / VSCodium

Help forums and libraries:

- Stack Overflow
- pandas (for working with spreadsheet data)

Useful Python libraries:

Libaries for data visualisation:

- Seaborn
- bokeh

Code formatting

- black

Web-frameworks – programming web-applications

- Django
- flask

Key Python commands at a glance

Phyton cheat sheet (in German)

- https://github.com/foerstner-lab/Bits_and_pieces_for_the_carpentries_workshops/blob/main/short_references/Kurzreferenz_python.pdf

MORE INFORMATION

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German National Library of Medicine (ZB MED) – Information Centre for Life Sciences

Gleueler Str. 60 50931 Cologne +49 (0)221 478-5685
info@zbmed.de | www.zbmed.de

Authorised representatives
Scientific Director:
Prof. Dr. Dietrich Rebholz-Schuhmann
Finance and Commercial Director:
Gabriele Herrmann-Krotz

Content:
Rabea Müller, Alexandra Streck

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