Unlocking the potential of big data in biology: Applications of bioinformatics

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Wellcome Connecting Science - Genome Academy, 11 April 2024

bit.ly/GA-bioinformatics-2024

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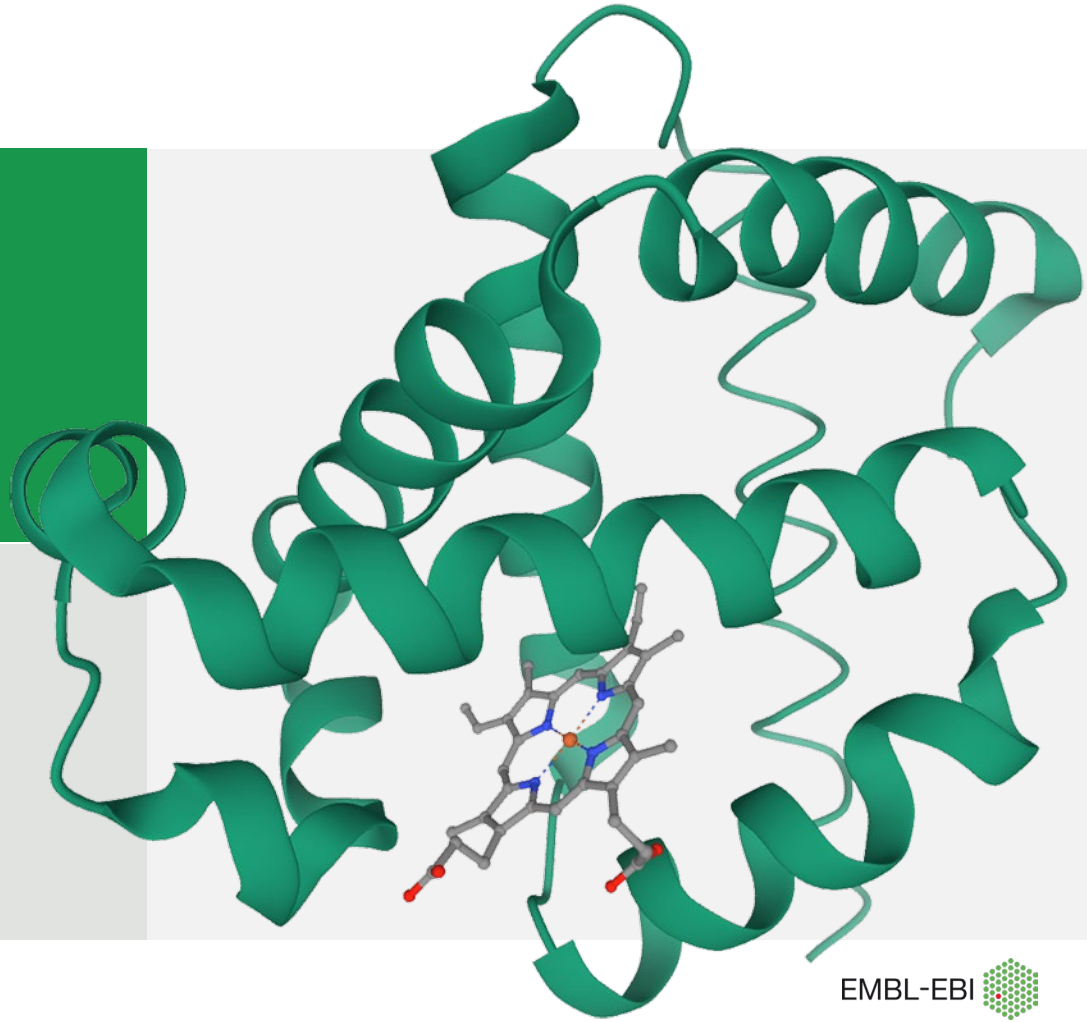
Bioinformatics

- Bioinformatics is the study of biology (bio) with computers (informatics).

- Involves storing, managing and analysing huge datasets.



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What is EMBL-EBI?

- The home of big data in biology
- One of the six sites of the European Molecular Biology Laboratory (EMBL)
- Intergovernmental organisation

EMBL-EBI

The European Molecular Biology Laboratory

EMBL-EBI

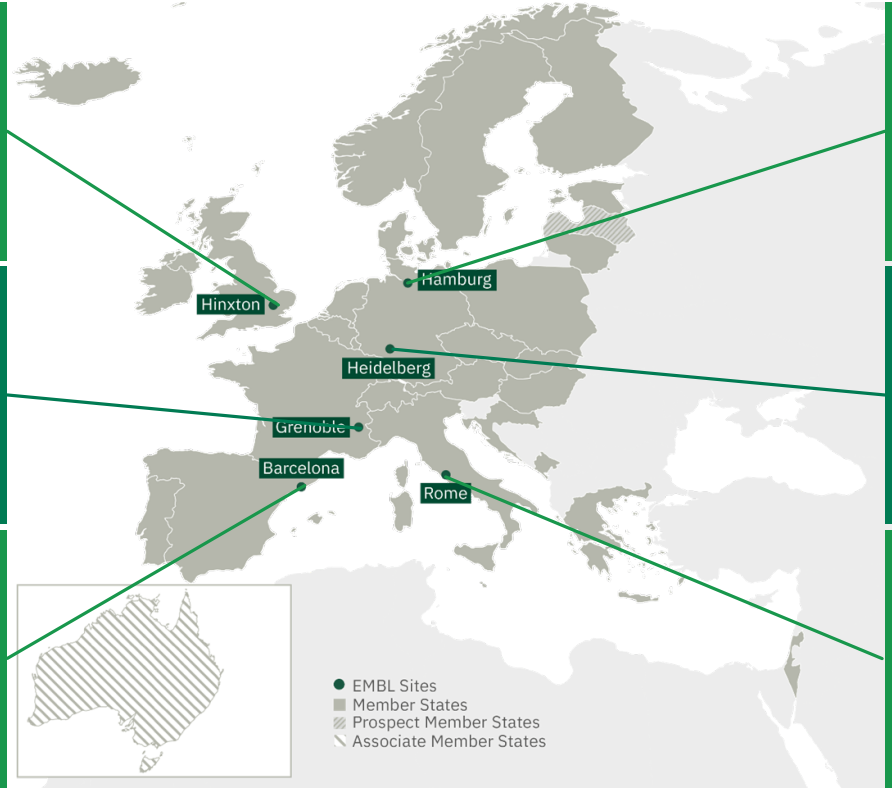
Bioinformatics

Grenoble

Structural biology

Barcelona

Tissue biology and disease modelling



Hamburg

Structural biology

Heidelberg

Life sciences

Rome

Epigenetics and neurobiology

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What does EMBL-EBI do?





Provide data resources for the life sciences

Perform excellent research

Train the next generation of scientists

Work with the private sector

Coordinate bioinformatics in Europe

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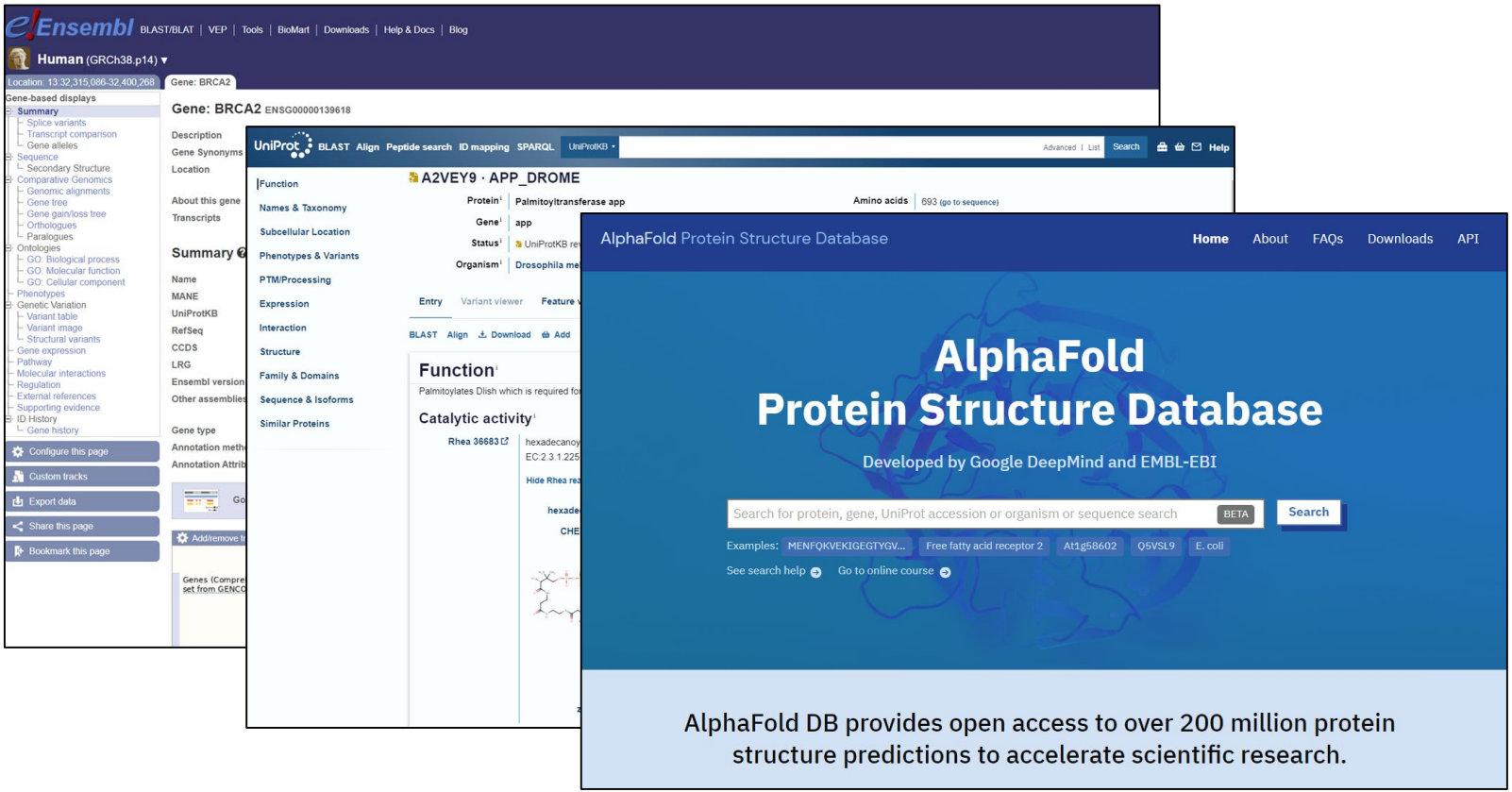
Data resources at EMBL-EBI



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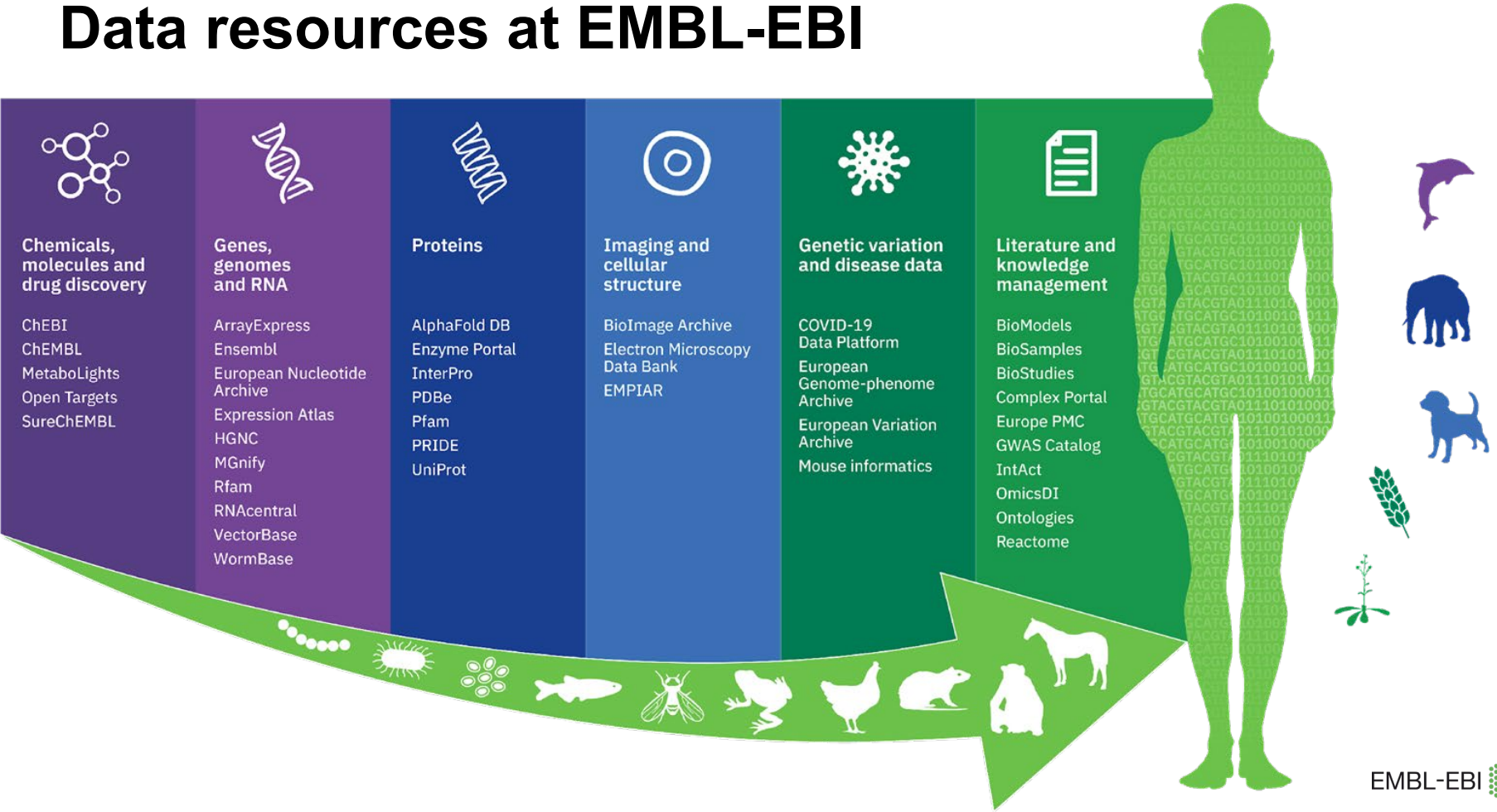
Data resources at EMBL-EBI



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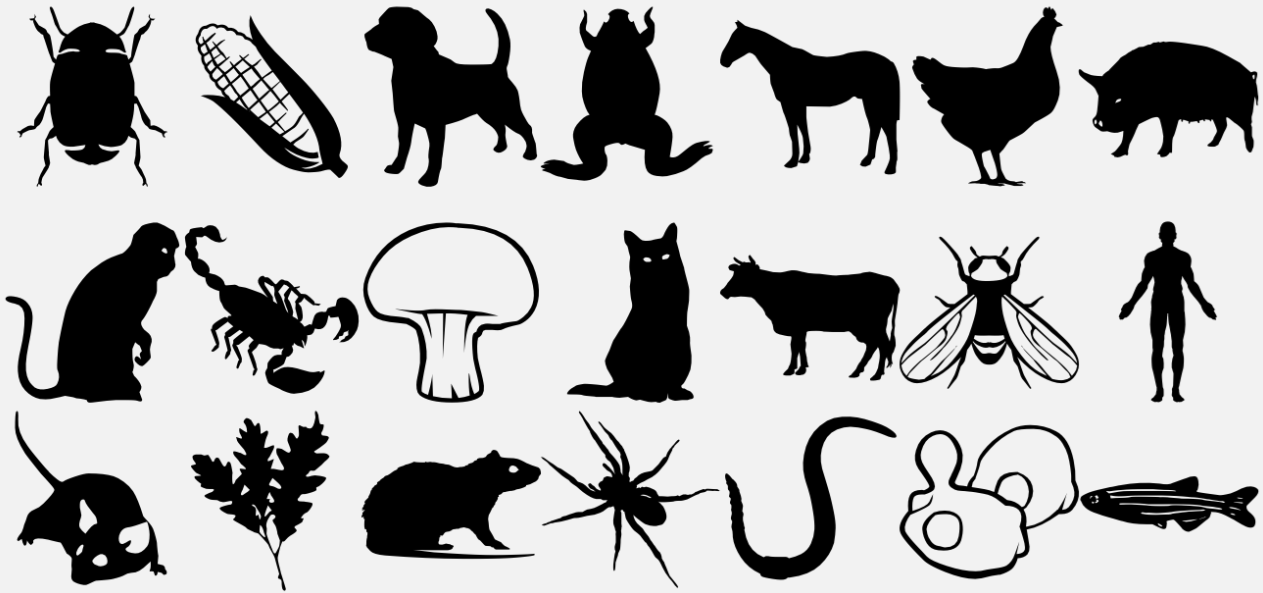
Data for many species




North Pacific Ocean
Canada
United States
Mexico
Cuba
Venezuela
Ecuador
Peru
Bolivia
Paraguay
North Atlantic Ocean
South Atlantic
South
Iceland
Sweden
Norway
Belarus
Ukraine
Kazakhstan
Mongolia
Uzbekistan
Turkey
Tunisia
Algeria
Libya
Egypt
Iraq
Iran
Saudi Arabia
Oman
Pakistan
Nepal
India
Yemen
Sudan
Mali
Niger
Senegal
Nigeria
Democratic Republic of the Congo
Kenya
Angola
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South Africa
Madagascar
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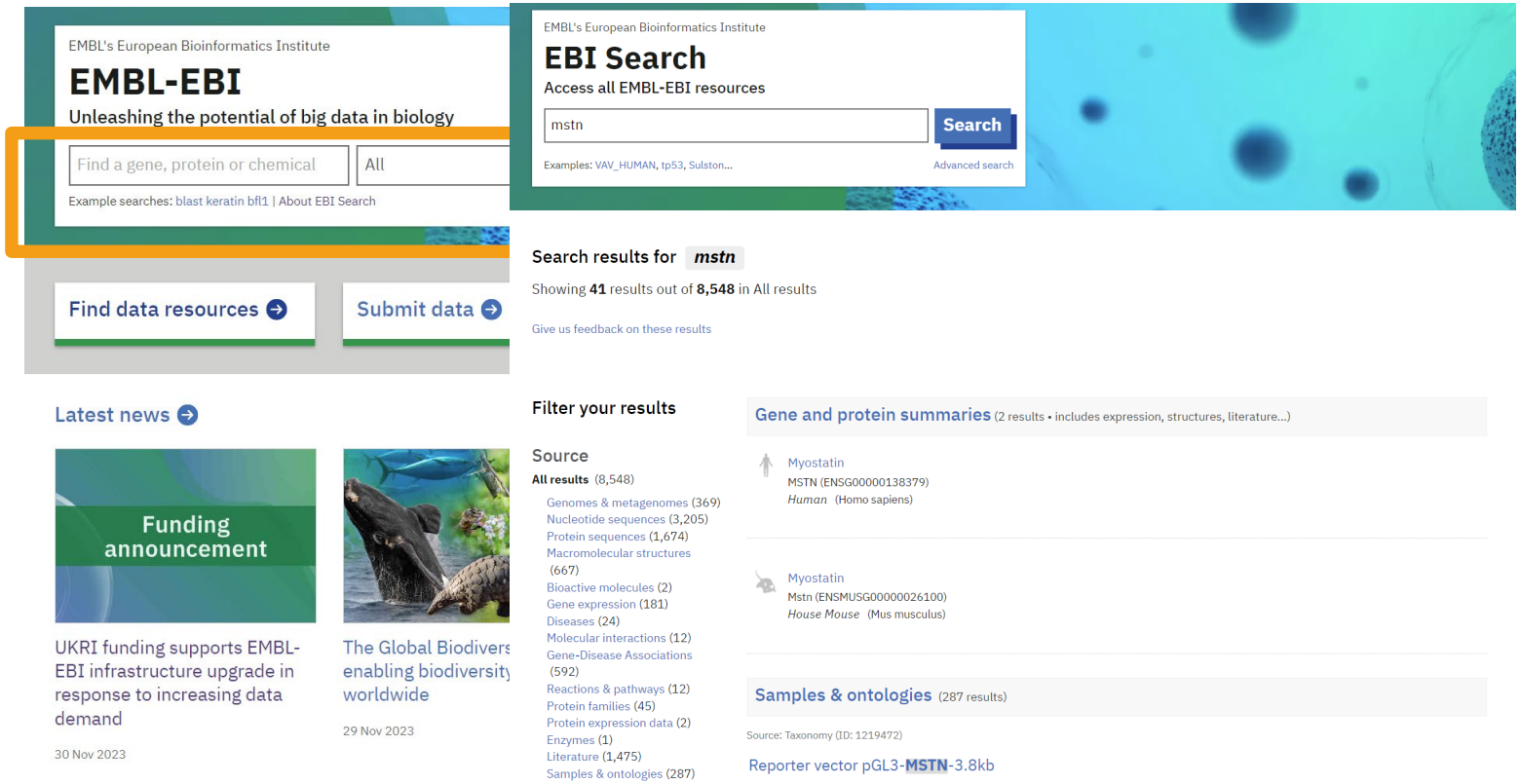
Searching for a gene, protein or chemical



https://www.ebi.ac.uk/

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Data resources at EMBL-EBI

107 million requests to our data resources on an average day

1 Scientists generate data, make discoveries

2 Deposit with EMBL-EBI on publication

3 We archive and share data with global collaborators and all scientists

4 We classify, enrich, combine and analyse

5 We distribute both raw and "value added" data resources

6 Scientists design new experiments on basis of shared global knowledge

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What is open data?

- Open data can be freely used, re-used and redistributed by anyone.
- When research data is open others can use it to ask new questions and get new insights.
- Open data saves repeating experiments
- Open data drives new discoveries.
- EMBL-EBI data resources are open data.

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We don’t wear lab coats

Biologists, physicists mathematicians

Software engineers

Biocurators

Bioinformaticians

Data wranglers

And more!

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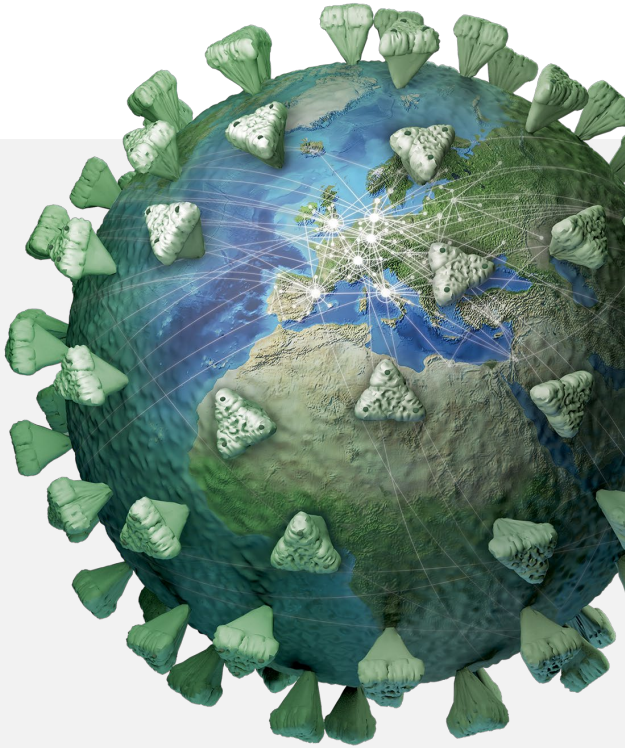
What skills are needed for bioinformatics?

- Organisational
- Problem-solving
- Creativity and Experimentation
- Communication

Pandemic preparedness



Data science was essential in the COVID-19 pandemic.

EMBL-EBI supported the pandemic response:

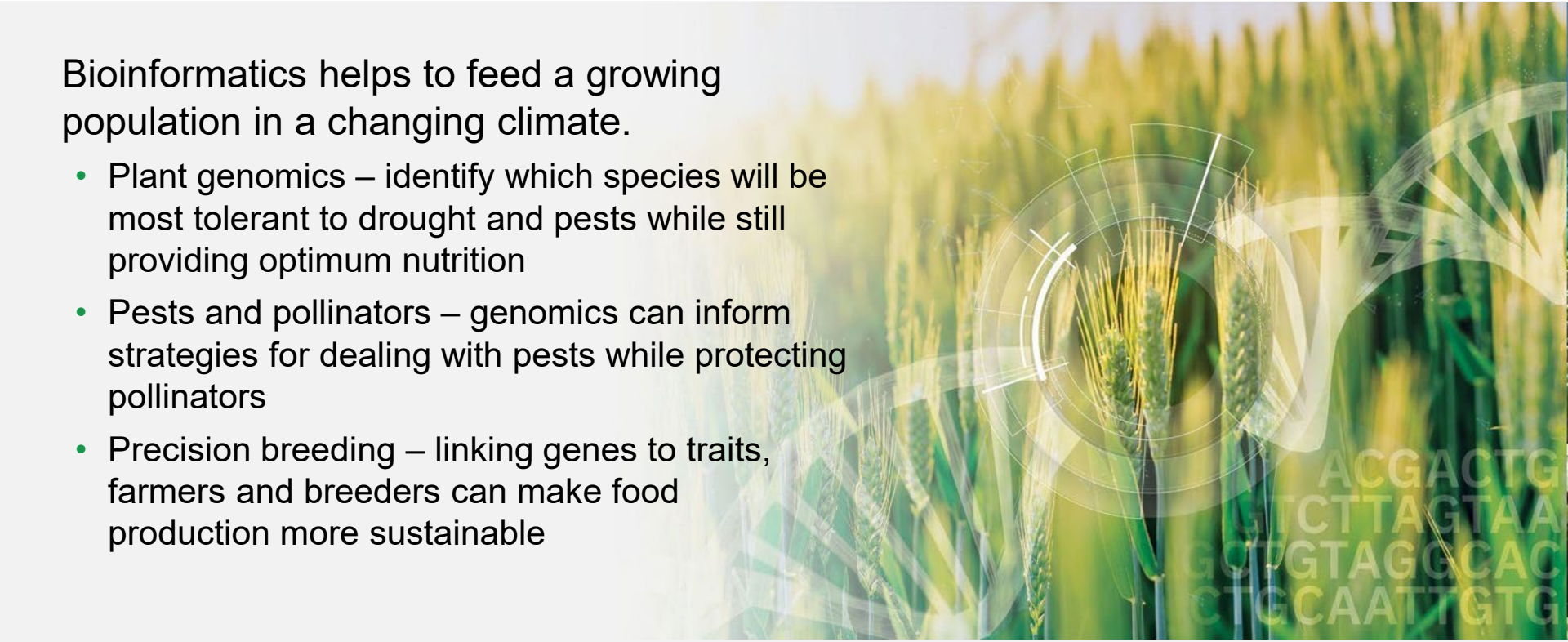
- Set up the COVID-19 Data Portal to access SARS-CoV-2 molecular and genomic data from all over the world
- Supported countries to set up data sharing platforms
- Revealed insights on new ‘variants’
- Analysed molecular causes of different immune responses
- Identified existing drugs that could be used to treat COVID-19

EMBL-EBI and collaborators are helping to improve European pandemic preparedness.

Sustainable food production

Bioinformatics helps to feed a growing population in a changing climate.

- Plant genomics – identify which species will be most tolerant to drought and pests while still providing optimum nutrition
- Pests and pollinators – genomics can inform strategies for dealing with pests while protecting pollinators
- Precision breeding – linking genes to traits, farmers and breeders can make food production more sustainable



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Biodiversity conservation

Bioinformatics helps us

- understand and protect biodiversity
- develop clean technologies to reduce environmental pollution

Darwin Tree of Life project

- Sequence 77,000 eukaryotic species in Britain and Ireland

Darwin TREE of LIFE

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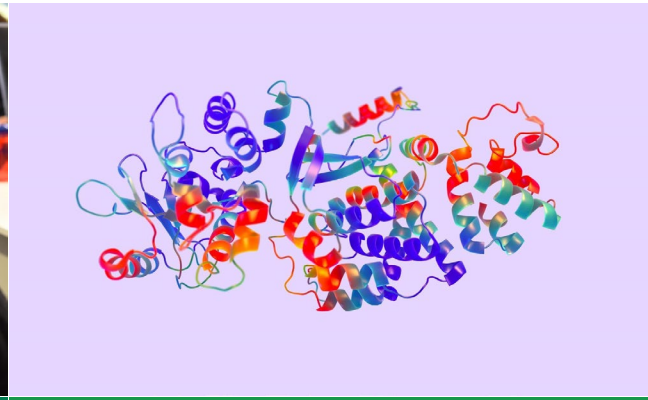
A growing field

100 million
requests to our websites
on an average day

2 million scientists
access our websites
every month



7 out of 10 users say

“not having access to EMBL-EBI data resources would have a major impact on my work”

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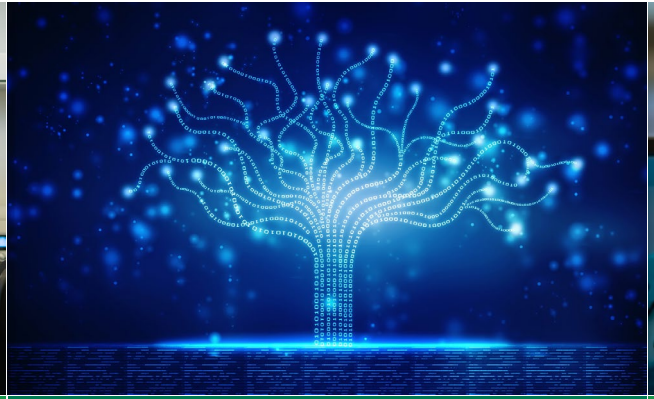
Want to learn more and develop your skills?



EMBL's TeachingBASE

Tree of Life project tutorial

EMBL-EBI tutorials - Bioinformatics for the terrified

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Thank you

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https://www.ebi.ac.uk/