# (Neuro)informatics

BILD 62

By the end of this lecture (and notebook) you will be able to:

- Define and identify multiple types of informatics and explain the role and importance of informatics research

- Identify and describe the conceptual and technical tools used to conduct informatics research (e.g. APIs, ontologies, bioentrez, BLAST)

- Identify the structure and use of **json** format

- Define **MESH** terms & describe their role in informatics research

- Conduct a pubmed search using bioentrez

Branches of informatics

- **Bioinformatics** - The field of computational science that involving the analysis of sequences of biological molecules. (National Human Genome Research Institute - NIH)
- **Biomedical Informatics** - The interdisciplinary scientific field that studies the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving and decision making, motivated by efforts to improve human health. (American Medical Informatics Association - AMIA)
- **Public Health Informatics** - The systematic application of knowledge about systems that capture, manage, analyze and use information to improve population-level health outcomes. (Centers for Disease Control and Prevention - CDC)
- **Clinical Informatics** - The application of informatics and information technology to deliver healthcare services. (American Medical Informatics Association - AMIA)
- **Neuroinformatics** - A research field devoted to the development of neuroscience data and knowledge bases together with computational models and analytical tools for sharing, integration, and analysis of experimental data and advancement of theories about the nervous system function. (International Neuroinformatics Coordinating Framework - INCF)

Application programmer interfaces (APIs) provide an **interface** for users to interact with software/data; acts as a messenger between two software components to communicate and takes requests, translates, and returns responses

Image & more information: https://www.cleveroad.com/blog/what-is-an-api/
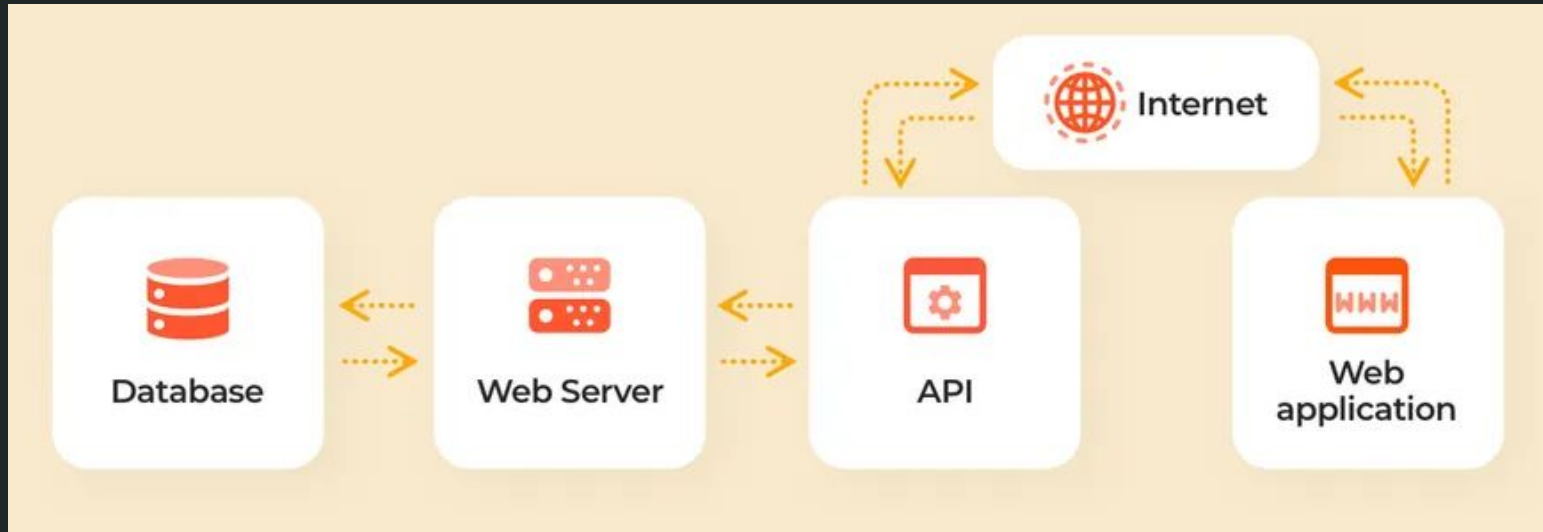
Software development kits (SDKs) provide a set of tools, libraries, documentation, code samples, etc. that allow developers to create software applications, and often *include* APIs

Image:
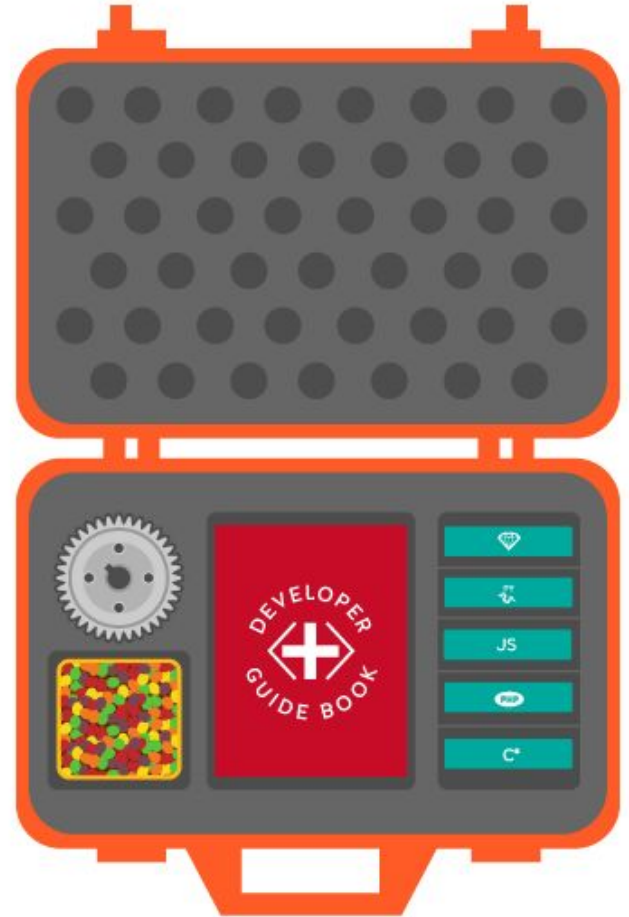
Entrez

An online molecular biology database system that provides integrated access across over 20 National Center for Biotechnology Information (NCBI) databases, including:

- Pubmed
- Pubmed Central
- Nucleotide (GenBank Sequence Database)
- Protein (Sequence Database)
- Genome (Whole Genome Database)
- Gene Expression Omnibus (GEO)
- Structure (Three Dimensional Macromolecular Structure)

- Taxonomy (Organisms in GenBank)
- SNP (Single Nucleotide Polymorphism)
- UniGene (Gene Oriented Clusters of Transcript Sequences)
- CDD (Conserved Protein Domain Database)
- 3D Domains (Domains from Entrez Structure)

Entrez help: https://www.ncbi.nlm.nih.gov/books/NBK3837/

PubMed

pubmed.gov

Literature database developed by the National Center for Biotechnology Information (NCBI)

- Currently contains approximately 34 million citations for biomedical literature
    - A subset of full-text articles are available through PubMed Central (PMC)
        - 9 million articles are archived in PMC
- Provides links to other molecular biology databases maintained by NCBI
- A general PubMed search will retrieve citations through several different pathways
    - Automatic Term Mapping - Map search terms to the **Medical Subject Headings (MeSH) terminology**

Biopython

Open source package containing Python tools for computational molecular biology

The `Bio.Entrez` module within the BioPython package provides access to multiple NCBI databases (including PubMed) via the Entrez search engine via an API call.

Additional resources

[Bioinformatics with Biopython - Full Course | 1 hour Python for Bioinformatics tutorial](#)

[Bioinformatics courses at UCSD](#)!