Transcription factors

Day 3

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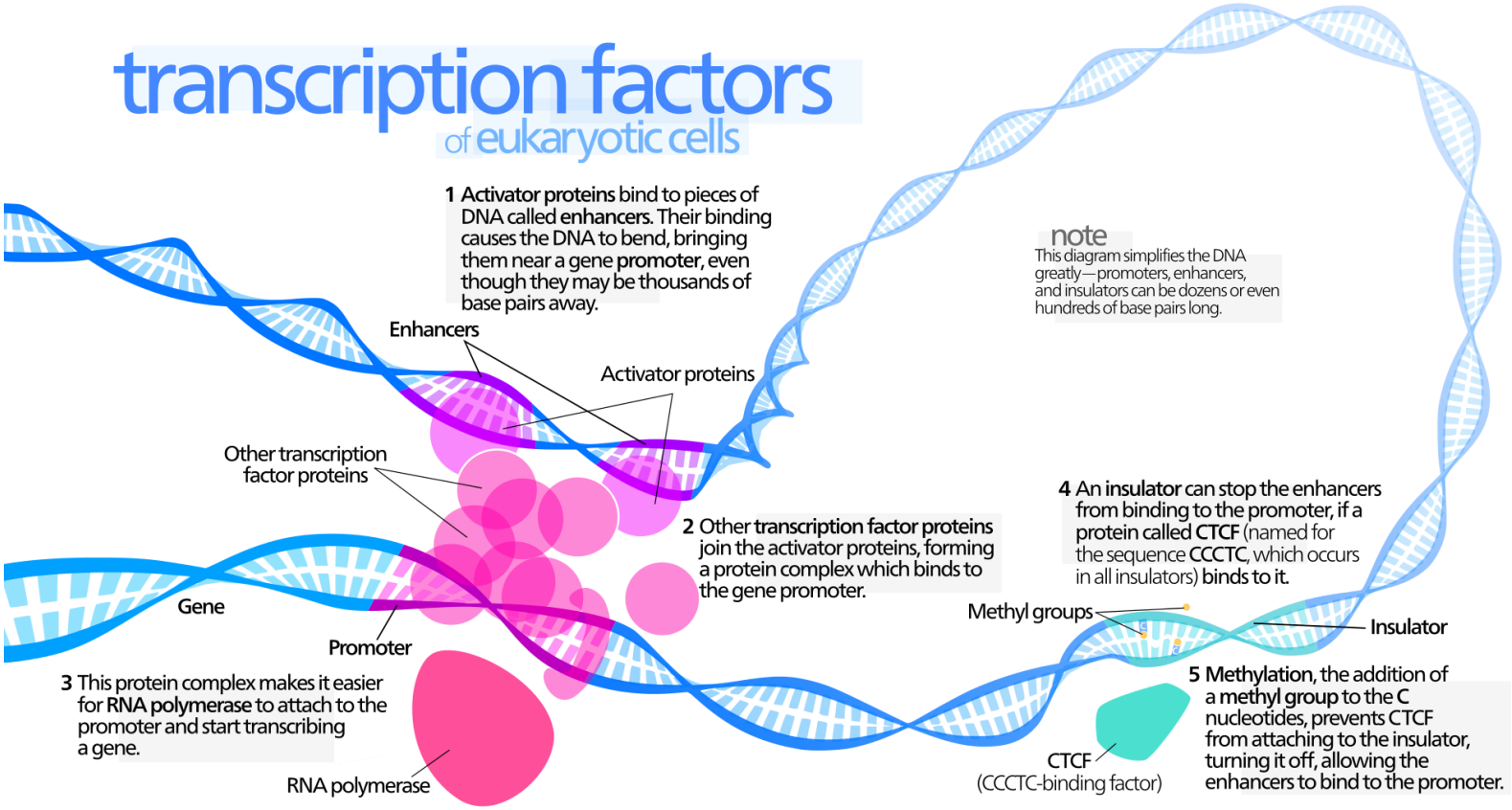
Transcription Factors

Transcription factor

From Wikipedia, the free encyclopedia

- In molecular biology, a transcription factor (TF) (or sequence-specific DNA-binding factor) is a protein that controls the rate of transcription of genetic information from DNA to messenger RNA, by binding to a specific DNA sequence.
- The function of transcription factors (TFs) is to regulate—turn on and off—genes in order to make sure that they are expressed in the right cell at the right time and in the right amount throughout the life of the cell and the organism.
- There are up to 1600 TFs in the human genome.
- TFs work alone or with other proteins in a complex, by promoting (as an activator), or blocking (as a repressor) the recruitment of RNA polymerase (the enzyme that performs the transcription of genetic information from DNA to RNA) to specific genes.

Transcription Factors



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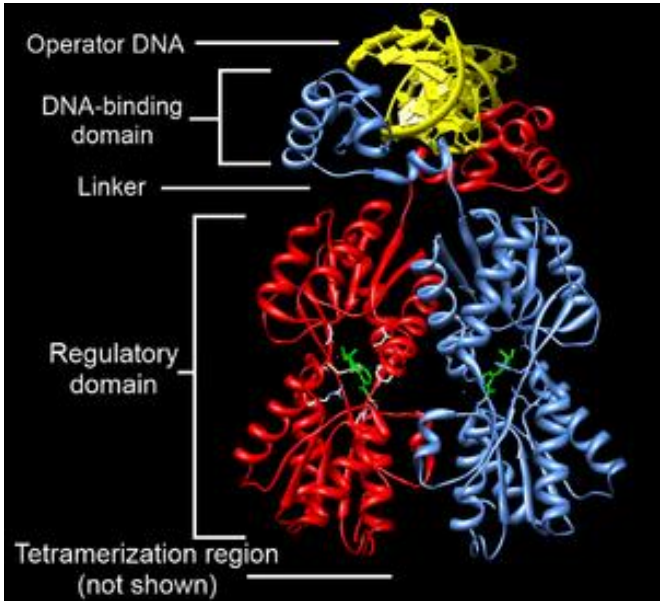
DNA binding domains

- A defining feature of TFs is that they contain at least one DNA-binding domain (DBD), which attaches to a specific sequence of DNA adjacent to the genes that they regulate.
- TFs are grouped into classes based on their DNA-binding domains (DBDs).



Example of a DNA-binding domain in the context of a protein. The N-terminal DNA-binding domain (labeled) of Lac repressor is regulated by a C-terminal regulatory domain (labeled). The regulatory domain binds an allosteric effector molecule (green). The allosteric response of the protein is communicated from the regulatory domain to the DNA binding domain through the linker region (Wikipedia).

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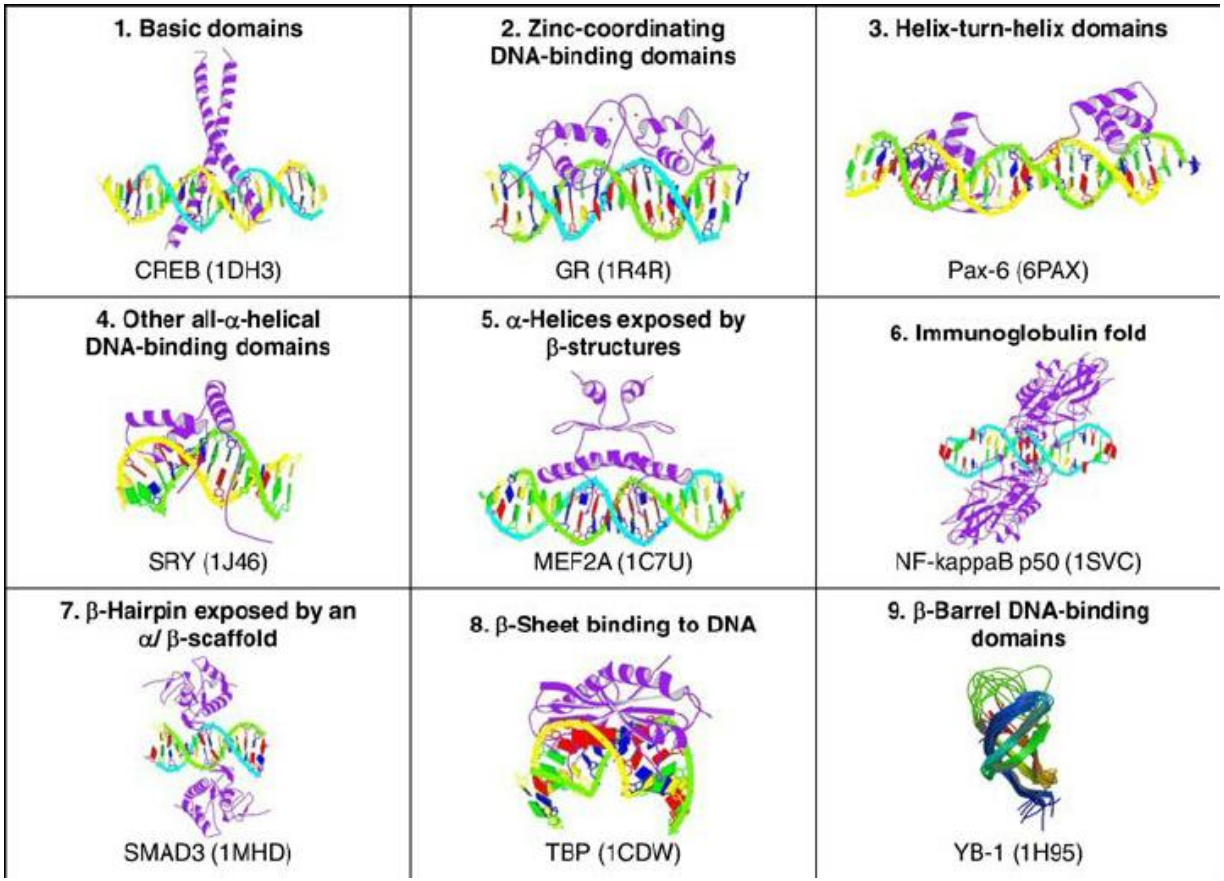
DNA binding domains



Superclasses of human TF DNA-binding domains. For each superclass, the structure of one typical representative bound to DNA (except for Superclass 9) is shown along with the name of the 1 protein and its PDB entry ID. The pictures have been taken from PDB, the orientation of the complex

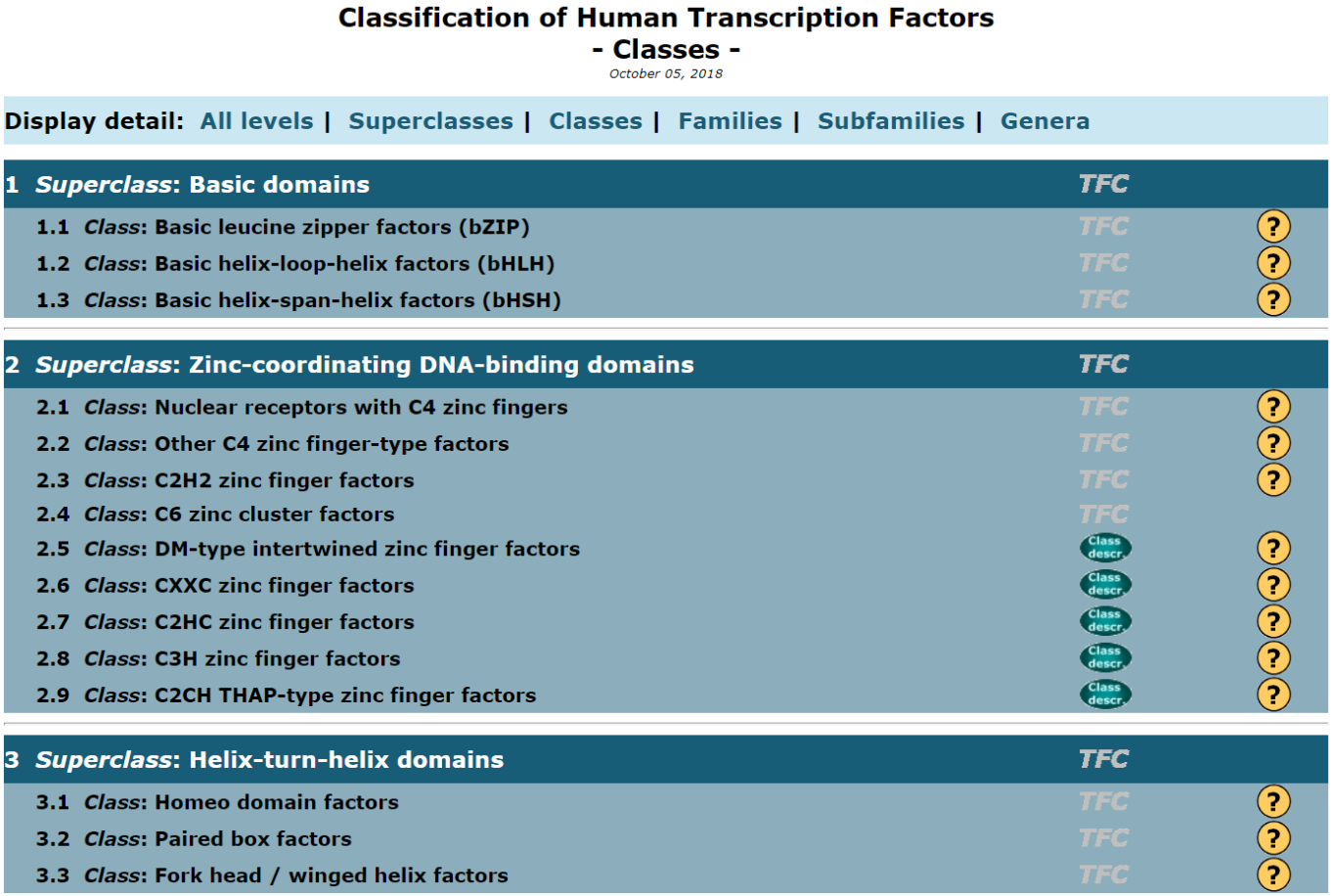
Transcription Factor classification

- **TFClass** is a classification of eukaryotic transcription factors based on the characteristics of their DNA-binding domains (DBDs).
- It comprises **four general levels** (superclass, class, family, subfamily).
- TFClass comprises human transcription factors (TFs) and their mammalia orthologs.

TFClass-descriptions.pdf

http://tfclass.bioinf.med.uni-goettingen.de/

Transcription Factor classification



Classification of Human Transcription Factors
- Classes -
October 05, 2018

Display detail: All levels | Superclasses | Classes | Families | Subfamilies | Genera

1 *Superclass*: Basic domains	TFC	
1.1 *Class*: Basic leucine zipper factors (bZIP)	TFC	?
1.2 *Class*: Basic helix-loop-helix factors (bHLH)	TFC	?
1.3 *Class*: Basic helix-span-helix factors (bHSH)	TFC	?
2 *Superclass*: Zinc-coordinating DNA-binding domains	TFC	
2.1 *Class*: Nuclear receptors with C4 zinc fingers	TFC	?
2.2 *Class*: Other C4 zinc finger-type factors	TFC	?
2.3 *Class*: C2H2 zinc finger factors	TFC	?
2.4 *Class*: C6 zinc cluster factors	TFC	
2.5 *Class*: DM-type intertwined zinc finger factors	Class descr.	?
2.6 *Class*: CXXC zinc finger factors	Class descr.	?
2.7 *Class*: C2HC zinc finger factors	Class descr.	?
2.8 *Class*: C3H zinc finger factors	Class descr.	?
2.9 *Class*: C2CH THAP-type zinc finger factors	Class descr.	?
3 *Superclass*: Helix-turn-helix domains	TFC	
3.1 *Class*: Homeo domain factors	TFC	?
3.2 *Class*: Paired box factors	TFC	?
3.3 *Class*: Fork head / winged helix factors	TFC	?

https://genexplain.com/tfclass/huTF_classification_Classes.html

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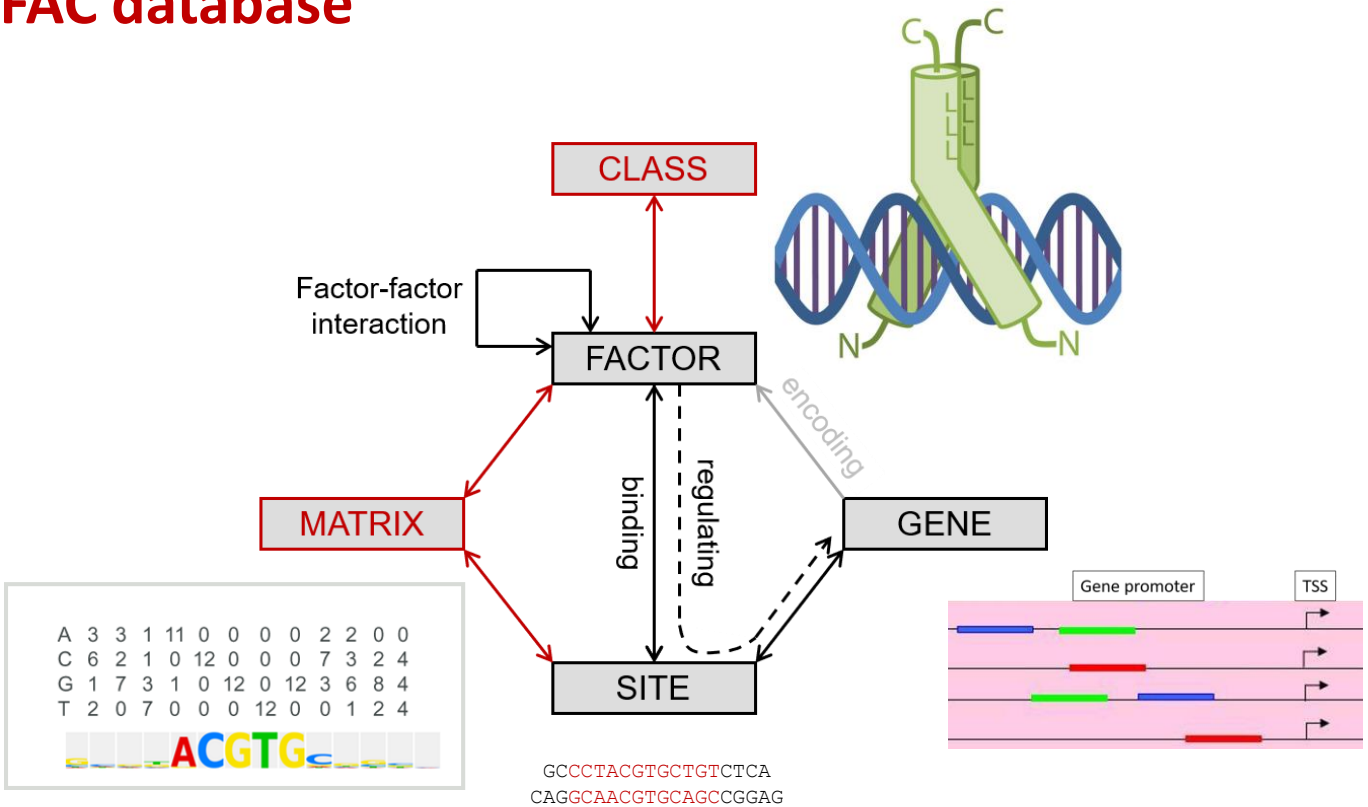
TRANSFAC database



Hands-on training

- Mapping a gene list with TF classification
- Converting Matrices to molecules
- Analyzing ChIP-seq peaks

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