

What is DNA?

Molecular biology Introduction

2 minutes on metacognition: mental models



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Stephen Wiltshire – 18Ft Panorama of NYC Skyline
Memorized after 20 min helicopter ride

2 minutes on metacognition: mental models

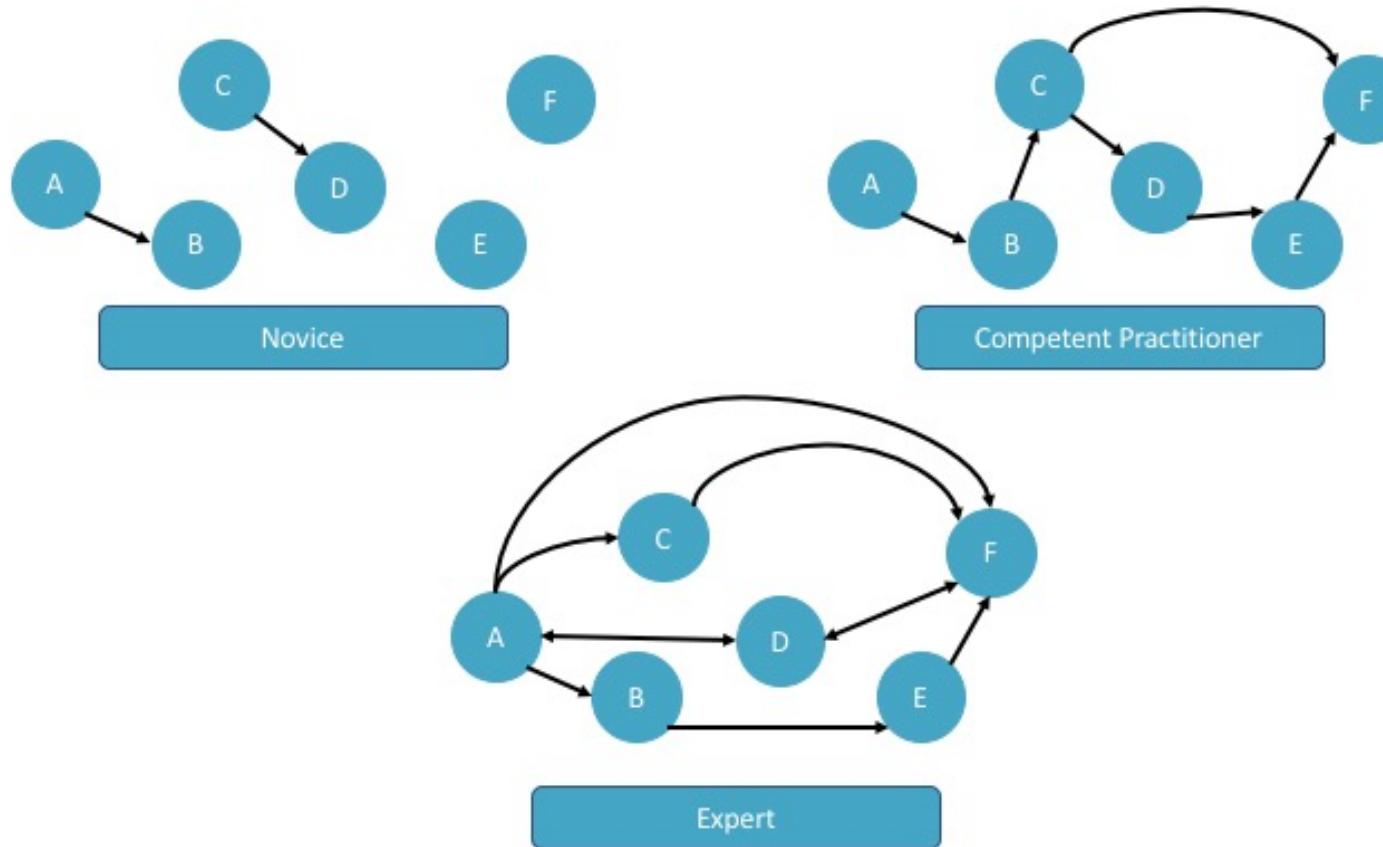


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2 minutes on metacognition: mental models



As we learn, we make new connections

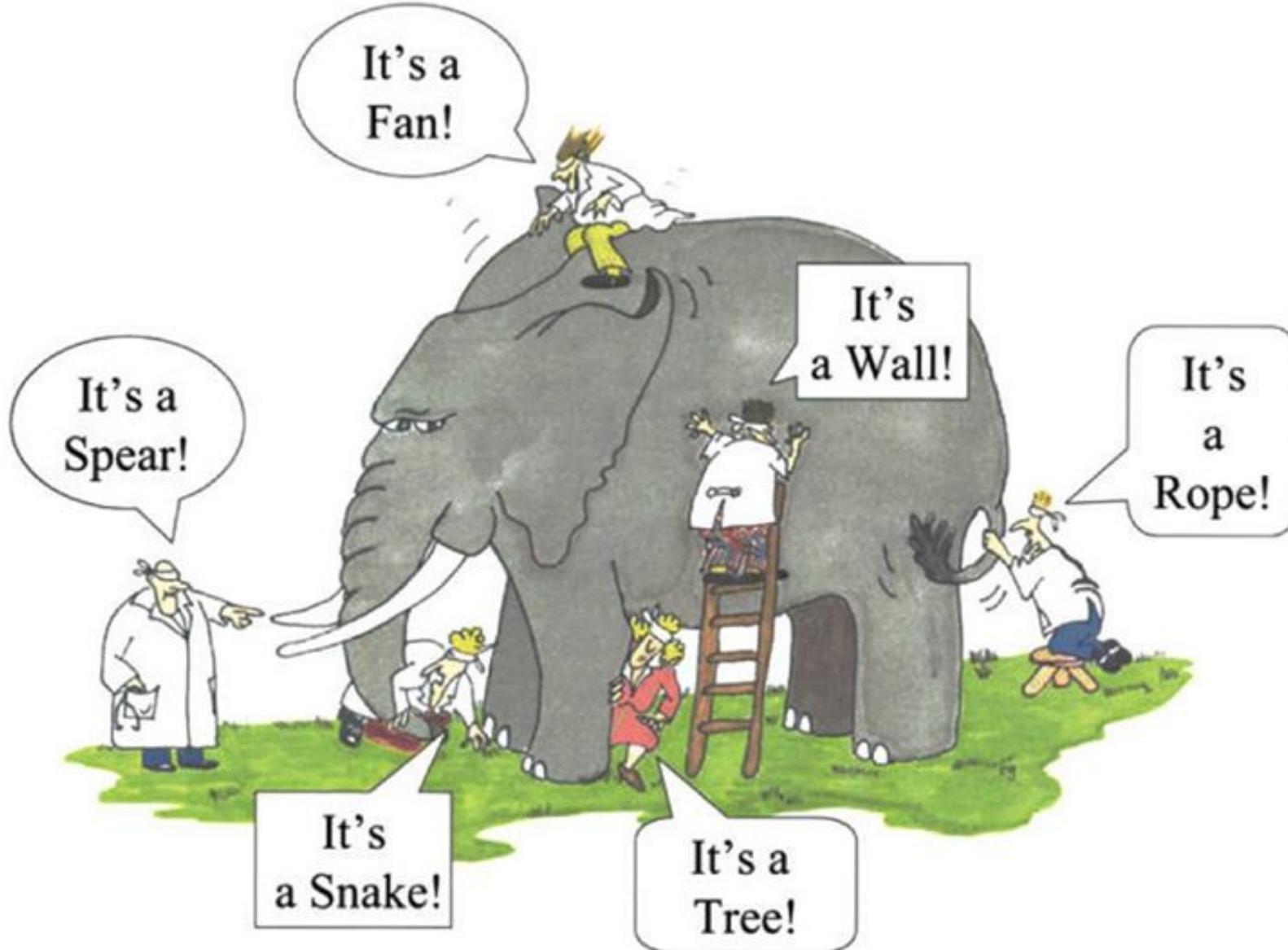
Warning

These slides contain more information than you may need to know

- Don't worry about memorizing details just yet
- For any material that will be on quiz, you will be alerted to review
- Instead see how much you know, try to pick out themes/concepts, what is interesting to you

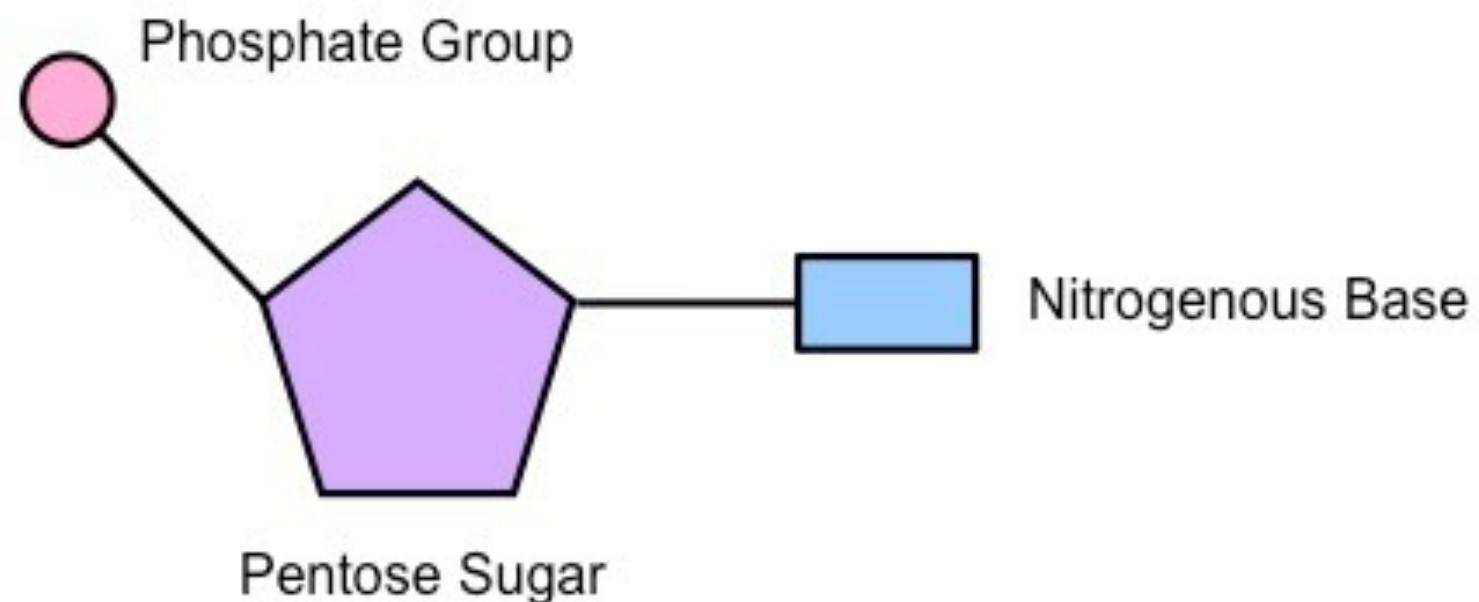
What is DNA?

Like most questions – its all about how you look at it

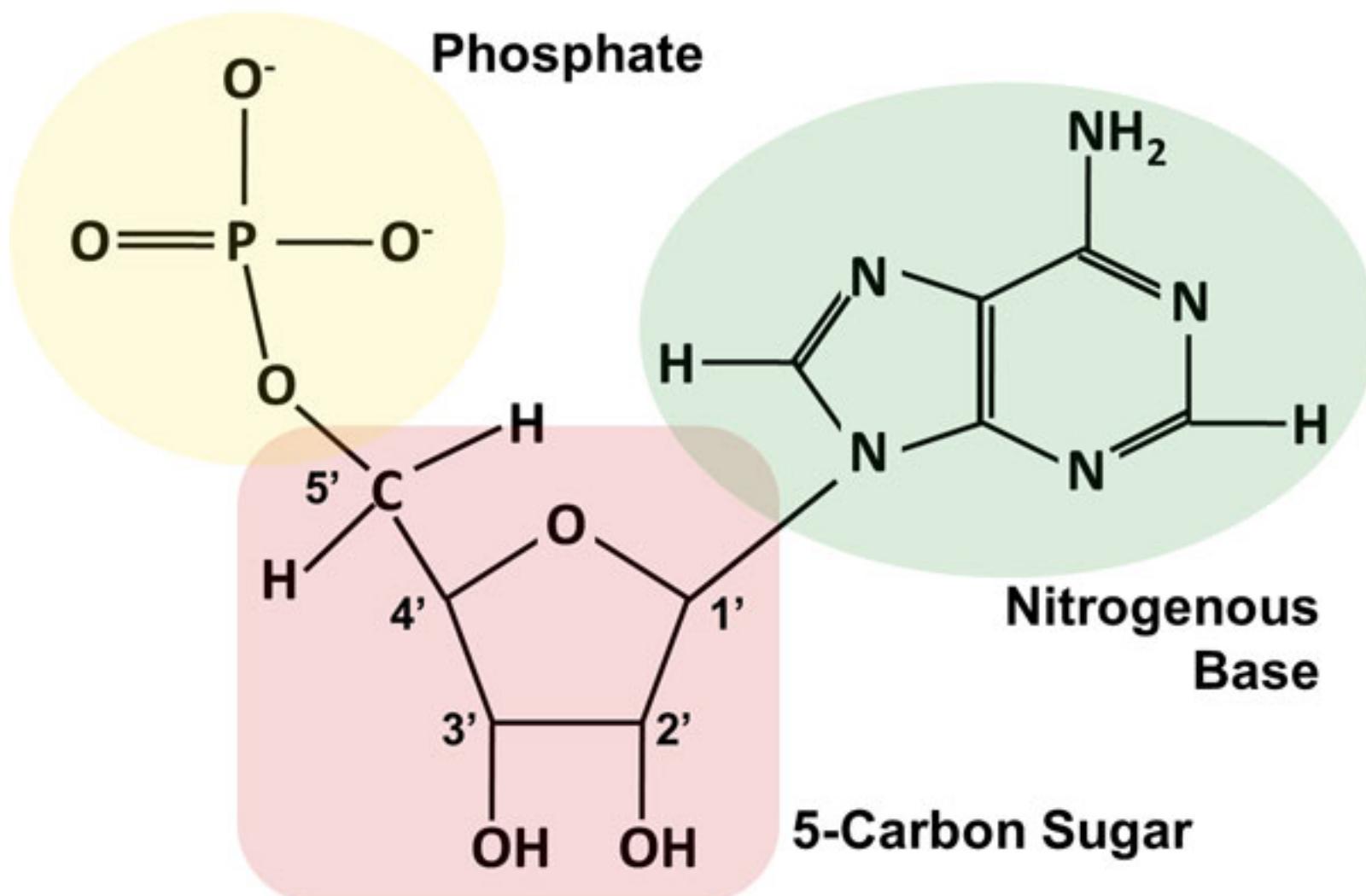


What a Chemist Sees
(atoms/organic chemistry)

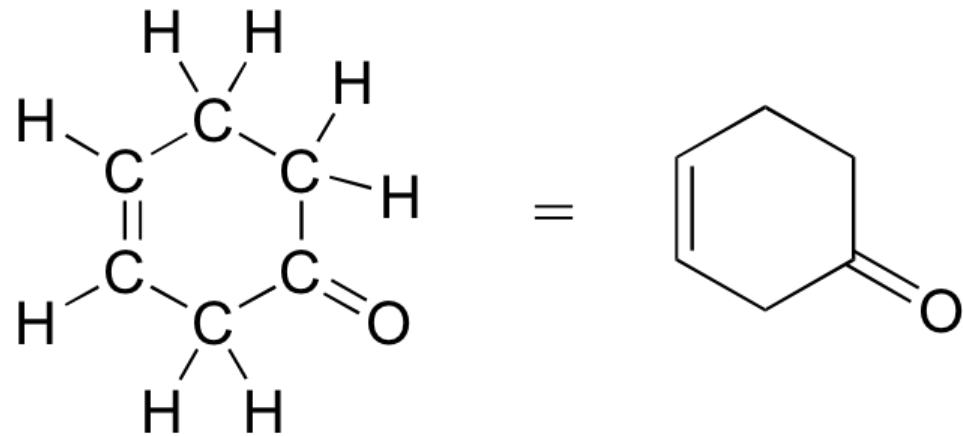
Nucleotide (AKA Base)



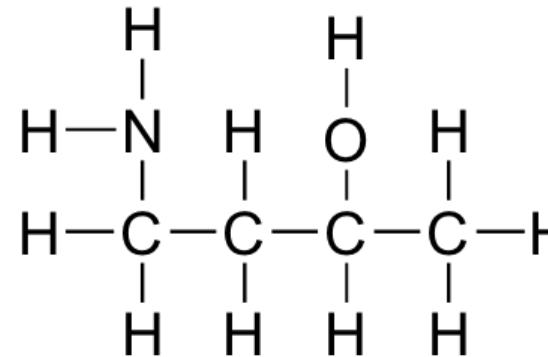
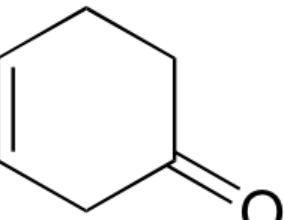
Nucleotide (AKA Base) – Atomic Detail



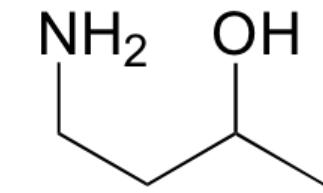
Drawing molecules in organic (carbon-based) chemistry



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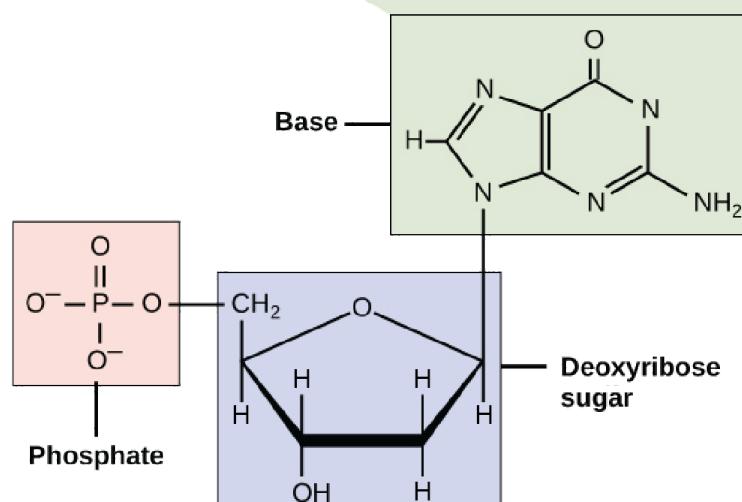
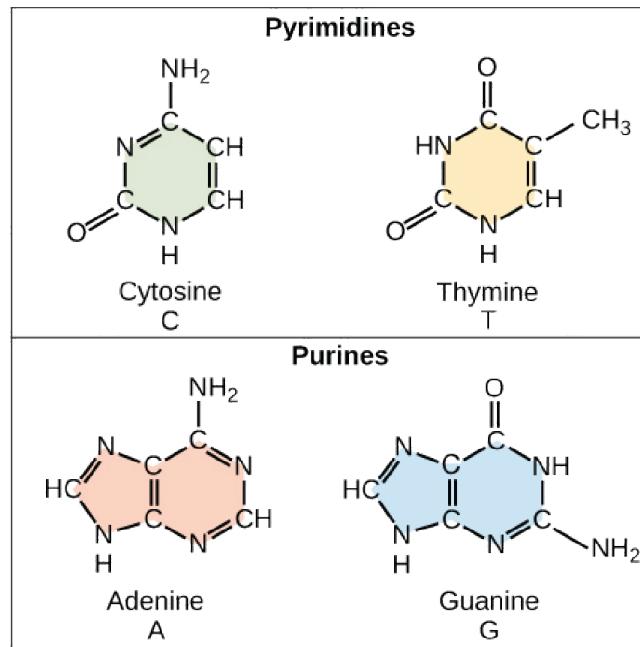


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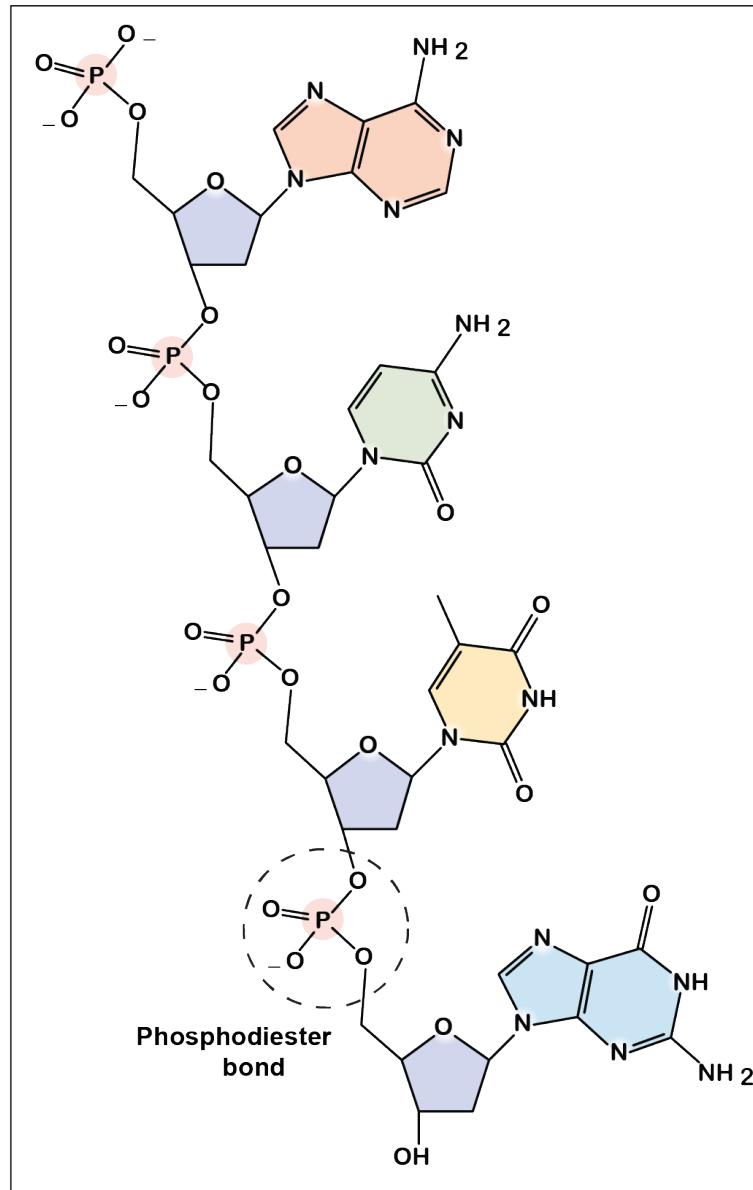


- Every (corner) represents a carbon molecule
- Lines represents bonds (two lines (=) is double bond)
- We don't draw hydrogens (too many)

DNA is made from four bases (A, C, T, G)

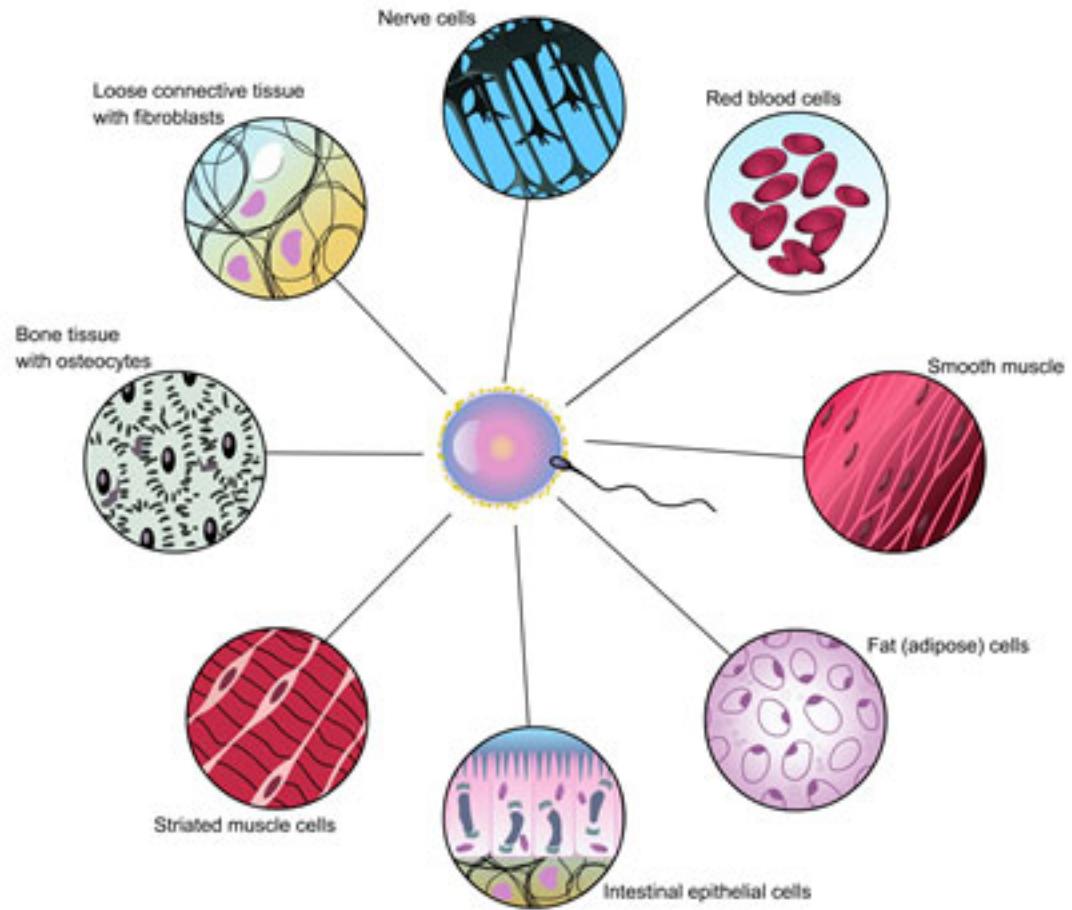
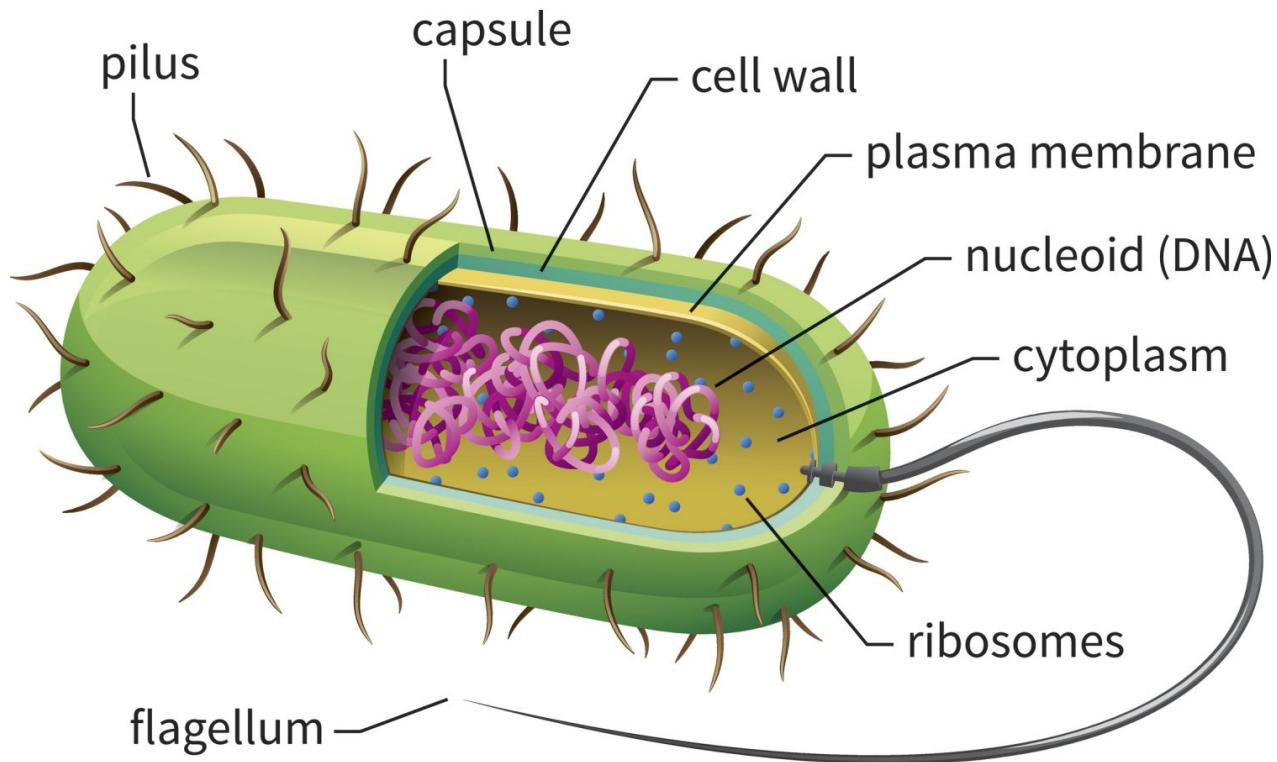


Bases are linked (and ordered)



What an organism sees
(biological function)

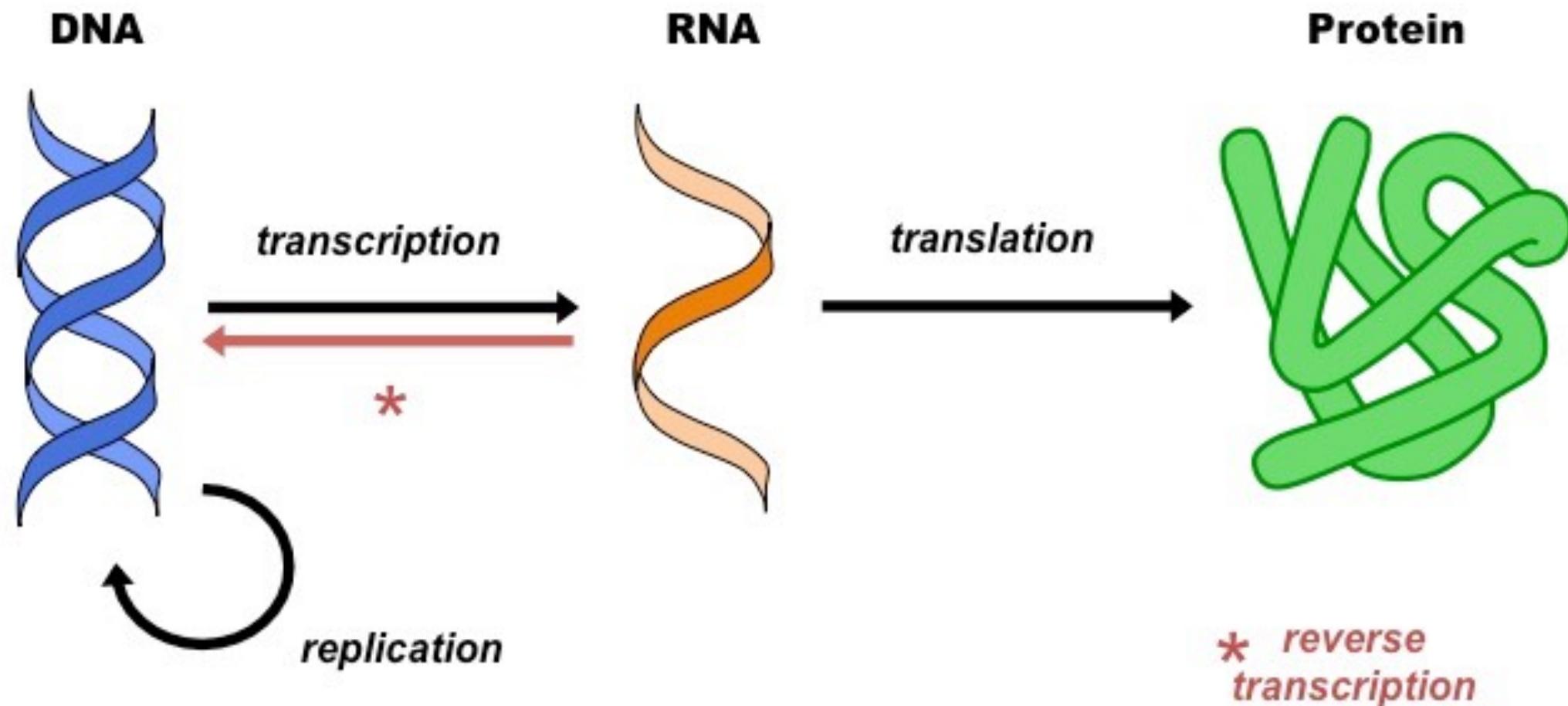
Organisms may be uni or multicellular



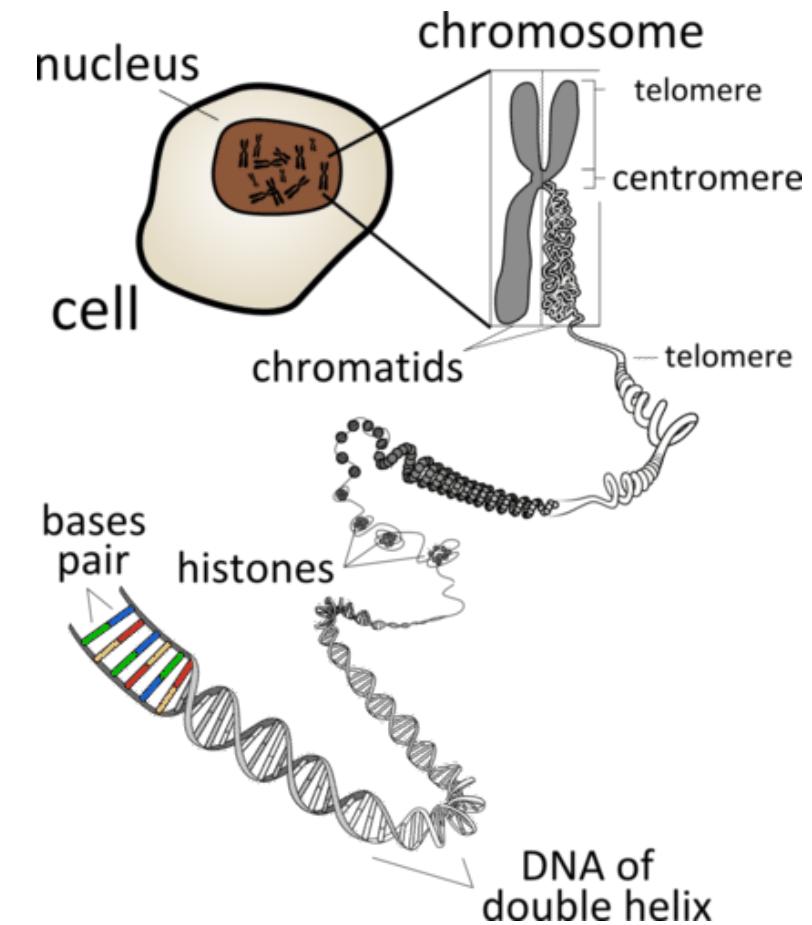
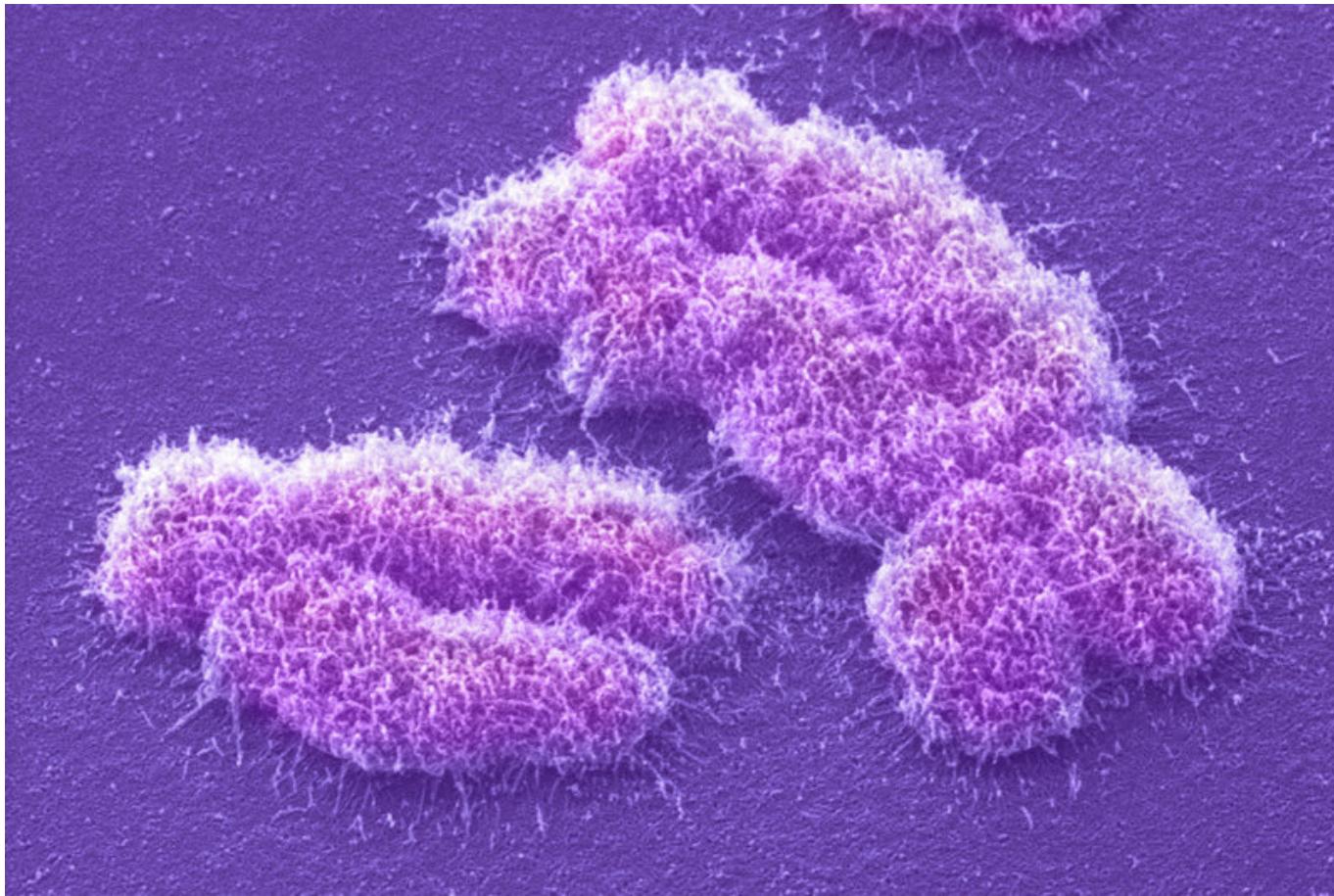
Bacterial cell: <https://www.thoughtco.com/prokaryotes-meaning-373369>

Cell specialization: <https://www.sensebusiness.co.uk/2019/09/gcse-biology-cell-specialization.html>

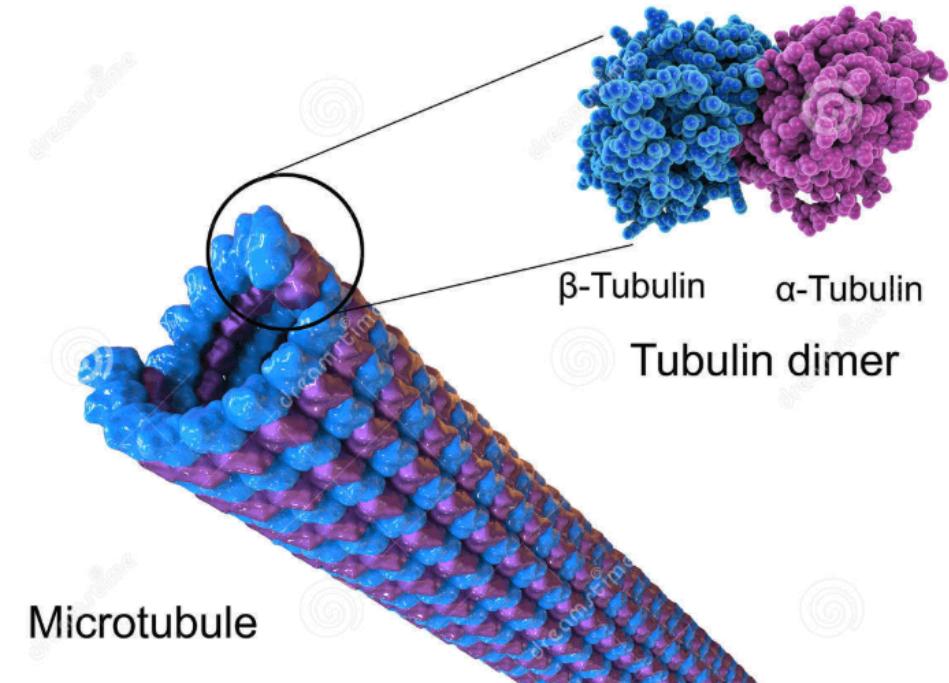
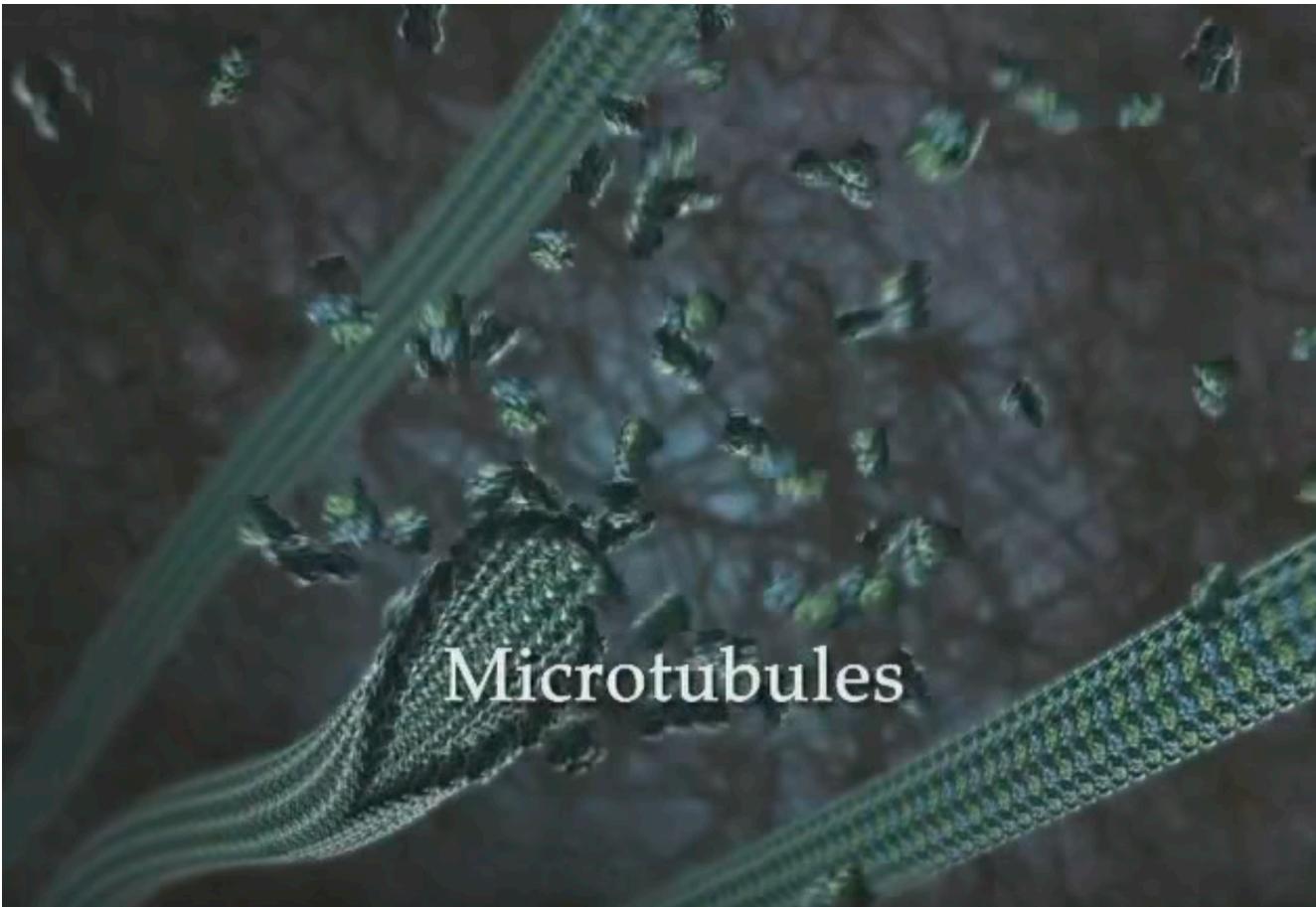
DNA contains instructions for making protein



Chromosomes are tightly packed strands of DNA and proteins



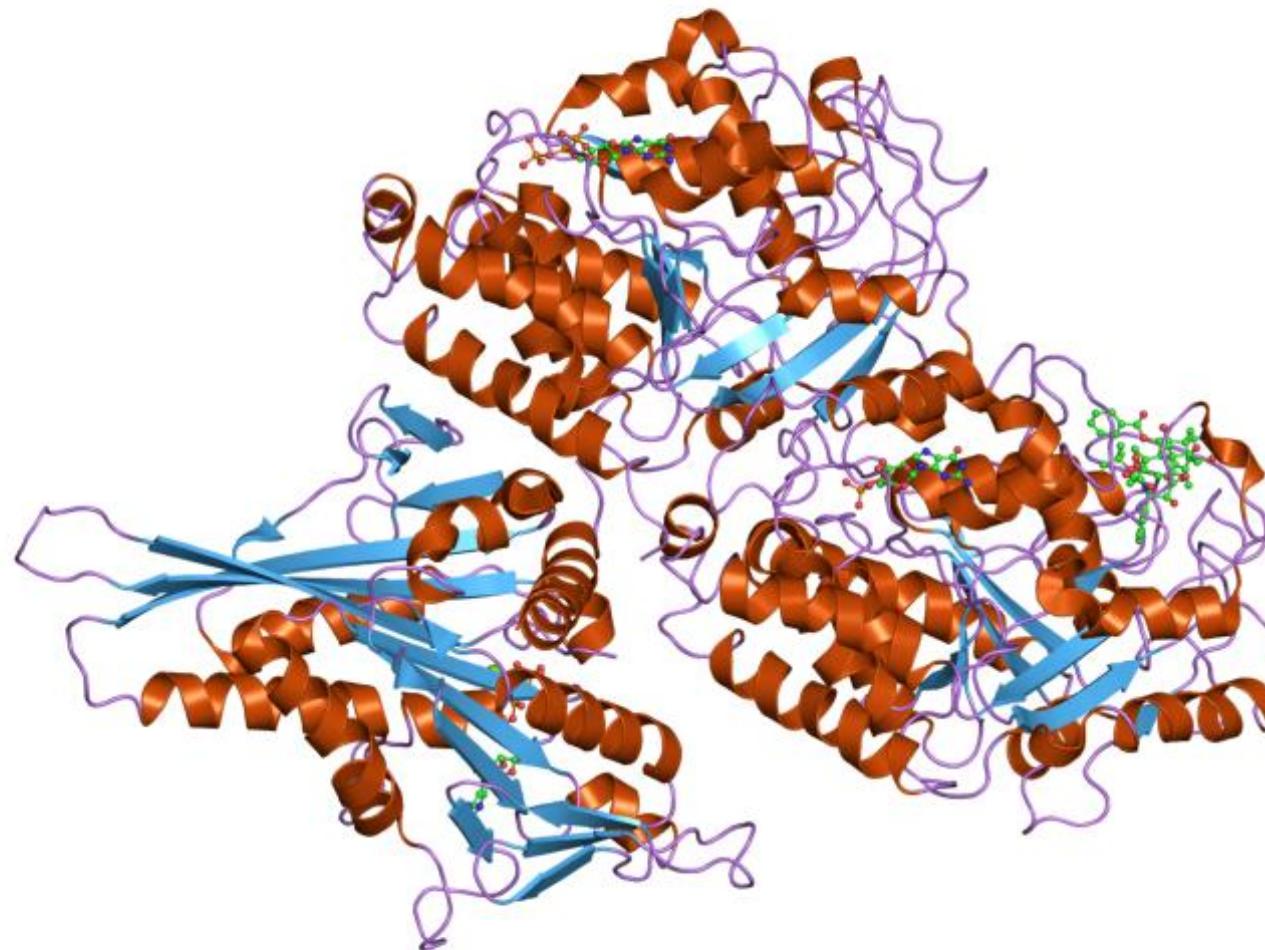
Proteins make up the structures of the cell
And/or perform functions (enzymes)



Tubulin: <https://www.abbkine.com/trakine-pro-live-cell-tubulin-staining-kit/>

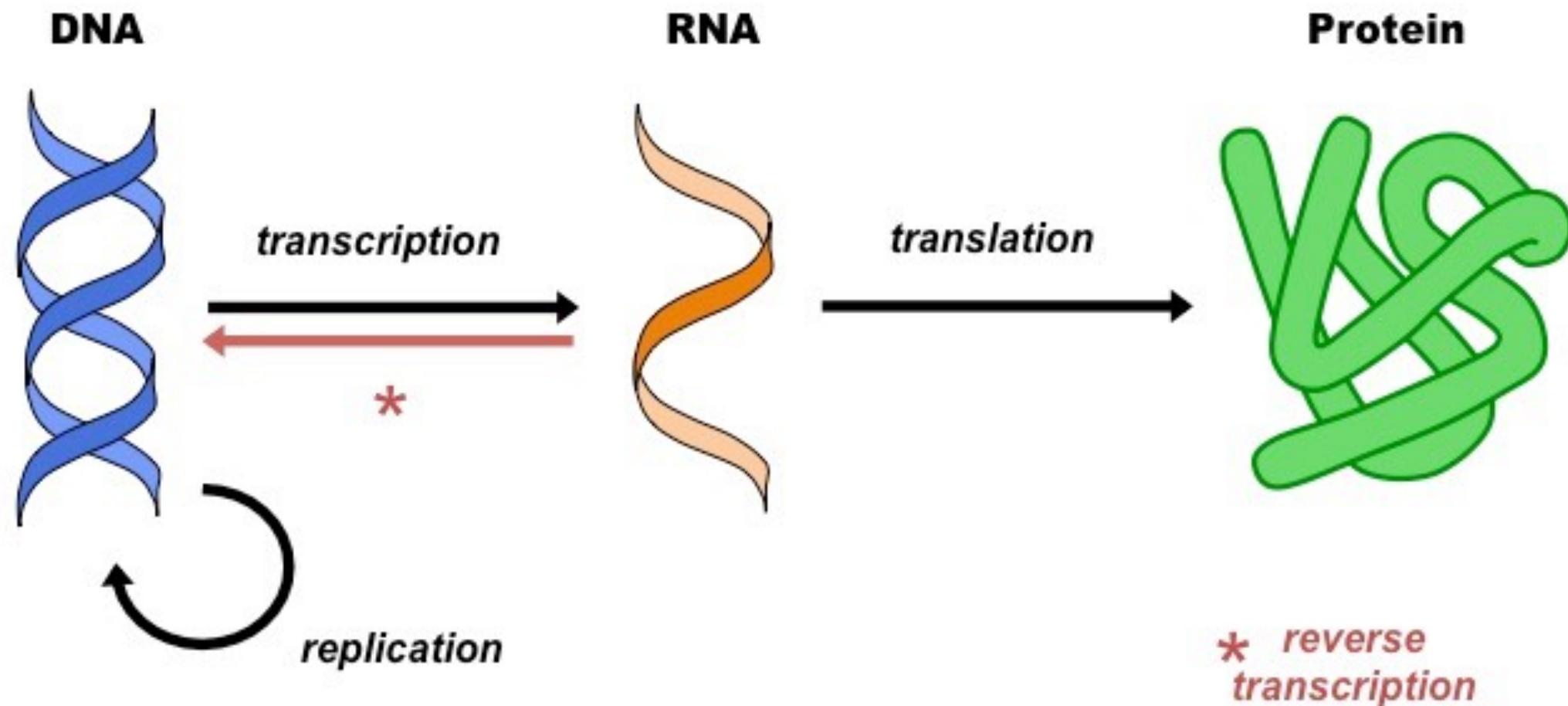
Watch: Inner Life Of A Cell - Full Version
https://www.youtube.com/watch?v=B_zD3NxSsD8

Tubulin “Ribbon” model



What a cell/reader/computer
sees
(information)

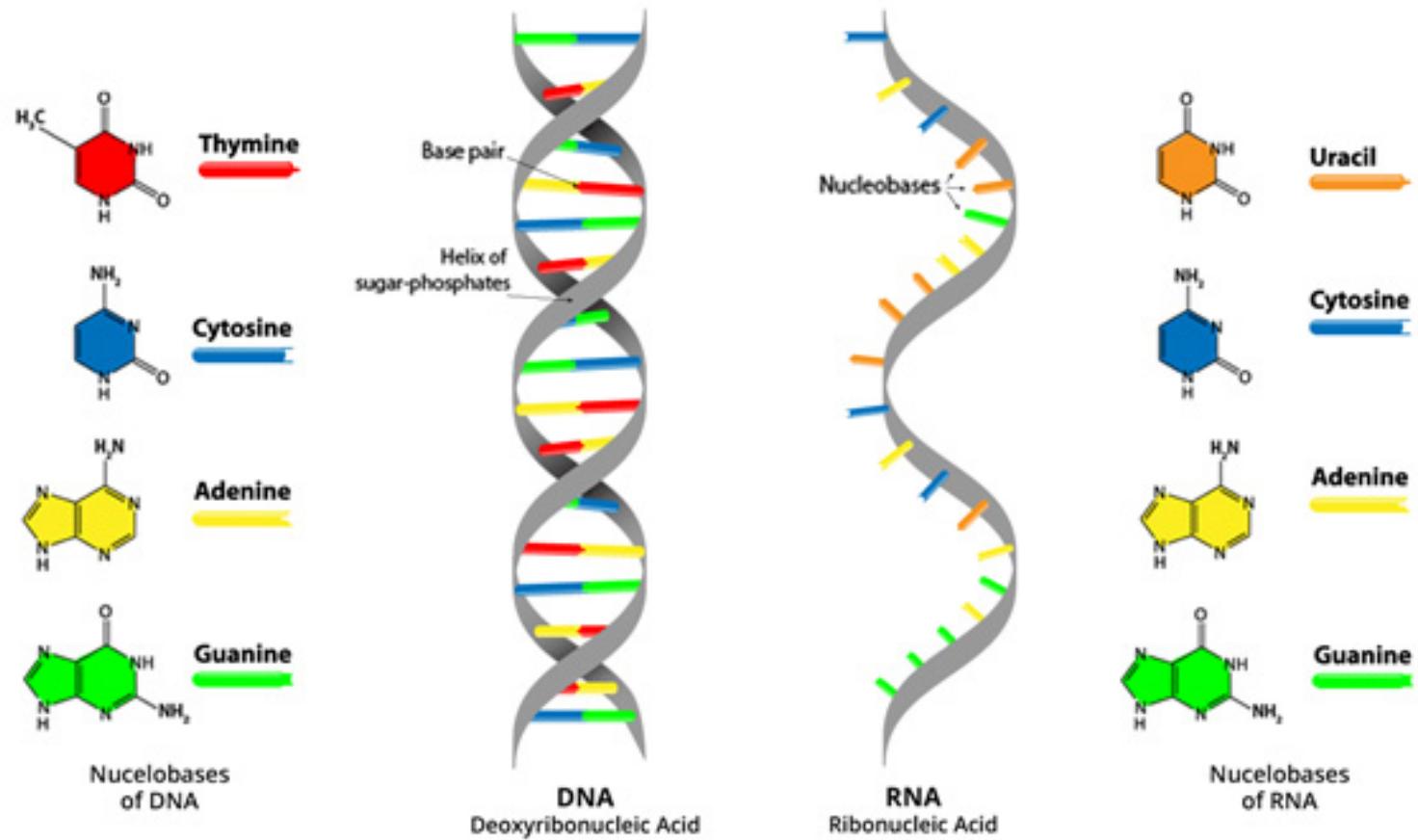
DNA contains instructions for making protein



Tubulin amino acid sequences

>NM_001270399.1 Homo sapiens tubulin alpha 1a (TUBA1A), transcript variant 2, mRNA
ATAATGGATGCTGGCCGACTGCTCTGCACGGTCTTGTCTAAAGGATGCAAACAGTCTACGGATGCTAGAGAAAAAGGGTGGGGAGAGATTACCTCATCCCACGTCGCTTGACCAATCACCAAGTCTCCTGTCATGGCTTCTCTGGGCAGATTGGGGTCTGGACCAACAGAAAAGGCCCGCCATCCCCATGGTGAACGAGTTGTATAGGGAGCCGATCCGCCATGTGCCGAGGTTCTTACATGACCGCTAACAGAGTCGCGCTGTAAGAAGCAACACCTCTCCTCGTCTCCGCCATCAGCTGGCAGTCGCGAAGCAGCAACCAGTGTGAGAATCGGCTCGGCTTTGTGGCGTTGGAGTCAGCGCCCCCAGGCTACTTGGAAAACCTTAAGCTCTTCTTCGTAAGCTCTCTGGCGAGGGTGGTGGTAGTTGTGAGGTTAGCTAGCCCCAATCCTCAAGCCCCGCCGCCAGTGCAGGAAACGGGCCAGTACTGCGCCAGGGCGCAGCAGAGCCTGGGGAGGAACAAAGCGGCCCTAGGCCTGTGGGGCCACTTTCTGTCGCGTTCTCTGGGGACCGGGAGAGGAGGAGGCACCCAAAAAGAGCGGGGGCGTTGGCGAGCTGGGGAGGGGGACGGAAACAAAGCGCAGCCTAGGGTTAGCGTGGGAAGACCCCTCCGCGGTCTTGGCGTTTGGAAAGATACCCACACATTCCCGGAAAACATGCGTAGTGCATCTCCATCCACGTTGGCCAGGCTGGTCCAGATTGCAATGCCGTGGAGCTACTGCCCTGGAACACGGCATCCAGCCCAGTGGCCAGTCCAAGTGACAAGACCACTGGGGAGGAGATGATTCTCAACACCTTCTCAGTGAGACGGGGCTGGCAAGCATGTGCCCGGGCAGTGTAGACTTGAACCCACAGTCATTGATGAAGTTCGCACTGGCACCTACGCCAGCTCTCCACCCCTGAGCACTTATCACAGGCAAAGAAGATGCTCCAATAACTATGCCGAGGGCACTACACCATTGCAAGGAGATCATTGACCTCGTGTGGACCGAATTGCAAGCTGGCCGACCAGTGACGGGTCTCCAGGGCTTCTGGTTTCCACAGCTGTAGTTGAGCCCTACAACCTCATCCTCACCCACACCCACACCCTGGAGCACTCTGATTGTCCTCATGGTAGACAATGAGGCCATCTAGACATCTGCGTAGAAACCTCGATATTGAGCGTCCAACCTATACTAACCTGAATAGGTTAATAGGCTAAATTGTCCTCCATCACTGCTTCCCTGAGATTGATGGAGCCCTGAATGTTGACCTGACAGAATTCCAGACCAACCTGGGCCATCCCCGCACTCCACTTCCCTGGCCACATATGCCCTGTCTGAGAAAAGCCTACCATGAAACAGCTTCTGAGAGATCACCACATGCTGCTTGGCCAGCAACAGATGGTAAATACATGGCTTGCTGCCTGGTACCGTGGTACGTGGTCCAAAGATGTCAATGCTGCCATTGCCACCATCAAGACCAAGCGTACATCCAGTTGTGGATTGGTCCCCACTGGCTCAAGGTTGGCATCAACTACCAGCCTCCACTGTGGTGCCTGGTGGAGACCTGGCCAAGGTACAGAGAGCTGTGTCATGCTGAGCAACACCACAGCATTGCTGAGGCCCTGGCTCGCCTGGGACCAAGTTGACCTGATGTATGCCAAACGTGCCCTTGTTCAGGTACGGTGGGGAGGGGATGGAGGAAGGTGAGTTTCAGAGGCCGTGAGGACATGGCTGCCCTGAGAAGGATTGAGGAGGGTTGGTGGATTCTGTTGAAGGAGAGGGTGAGGAAGAAGGGAGAGGAATACTAAAGTTAAACAGTCACAAAGGTGCTGCTTTACAGGGAAAGCTTAAACATTGAAAAGTTGTGGTCTGATCAGTTAATTGATGTAGCAGTGTATGCTCTCATATAATTACTGACCTATGCTAAACATGAATGCTTGTACAGACCCAAGCTGCCATTCTGTGATGGGTTTGA ATAAAGTATTCCCTGTCTAAATGAAAAAAAAAAAAAA

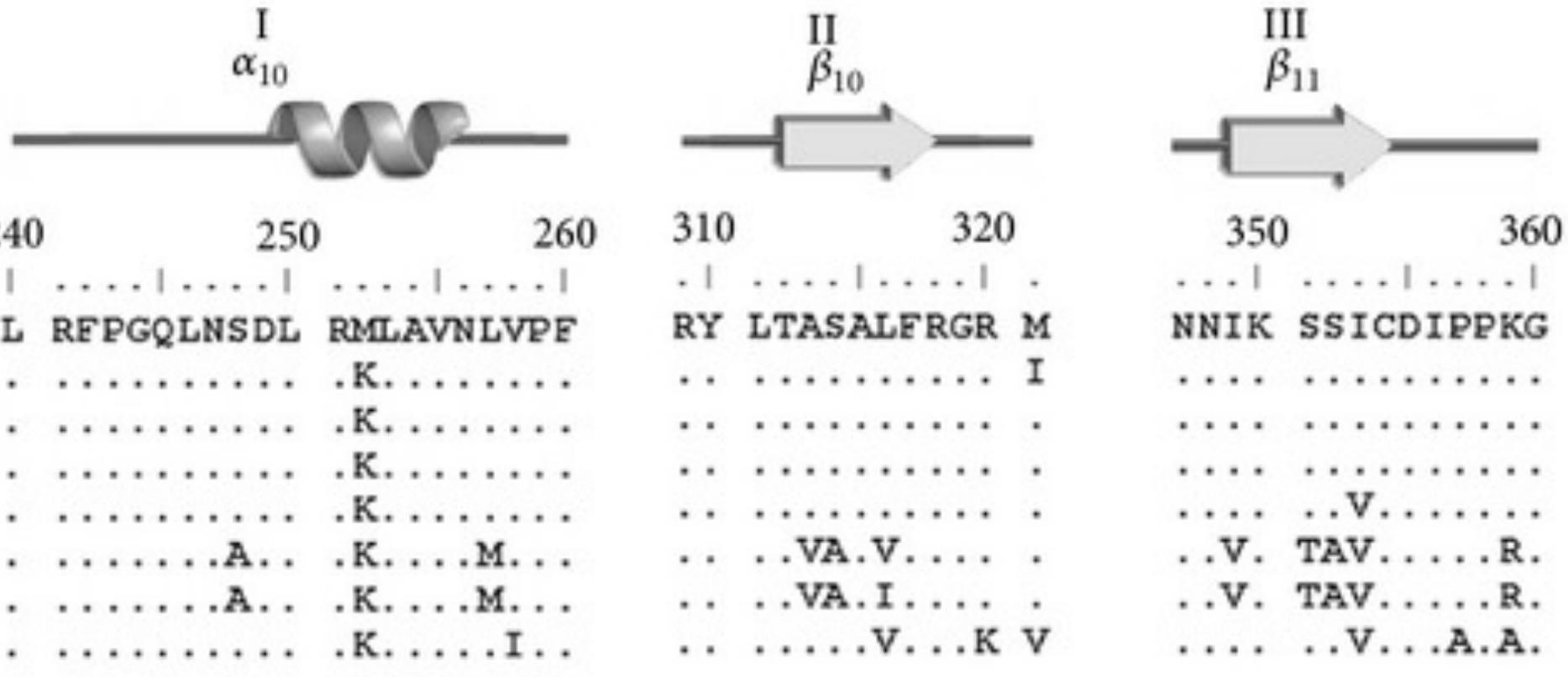
RNA



The Genetic Code

| | | Second letter | | | | | |
|--------------|---|--------------------------|-------------------|--------------------------|---------------------|--------------------------|--------------------|
| | | U | C | A | G | | |
| First letter | U | UUU UUC UUA UUG | Phe Ser Leu | UCU UCC UCA UCG | Tyr STOP STOP | UGU UGC UGA UGG | Cys STOP Trp |
| | C | CUU CUC CUA CUG | Leu | CCU CCC CCA CCG | Pro | CAU CAC CAA CAG | His Gln |
| | A | AUU AUC AUA AUG | Ile Leu | ACU ACC ACA ACG | Thr | AAU AAC AAA AAG | Asn Gln |
| | G | GUU GUC GUA GUG | Val | GCU GCC GCA GCG | Ala | GAU GAC GAA GAG | Asp Glu |
| | | | | | | Third letter | |
| | | U | C | A | G | | |
| | | U C A G | U C A G | U C A G | U C A G | | |

Tubulin amino acid sequences



Our next experiment bacterial genetic engineering

