DNA, RNA, and Proteins

Computational Biology camp for high school students August 21, 2012



MIRCORE

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Values

MIRCORE

Science Compassion Efficiency

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In Computational Genomics Camp

- Focus: Humans
- Hypothesis: diseases are conditions that occur when our body fail to maintain homeostasis.
- Ideal: preventing diseases in a way specific to each person
- Current goal: find potential cure for a disease in the general population by focusing on one gene per camper (or group)

Recap

currently

- Genes: inherited molecules (DNA sequences) that generate functional entities (proteins or RNAs).
- Genome: The sum of genes
- Genomics: The study of all genes at DNA, RNA, or protein levels.
- Diseases: consider multiple genetic networks

Most Diseases



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Central Dogma



http://fig.cox.miami.edu

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Wikipedia: Madeleine Price Ball

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DNA double stranded structures





Attribution: Zephyris at the English language Wikipedia



Fig. 1. Modifications of the histone components of nucleosomes help regulate DNA accessibility by promoting folding or unfolding of chromatin fibers, and by recruiting chromatin remodeling complexes and other factors to specific genomic loci.

http://mcb.illinois.edu/faculty/profile/cmizzen

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Nucleosome core particles



Side view of nucleosome



Widipedia: DNA: Thomas Splettstoesser

DNA to metaphase chromosome



Source:Wikipedia Metaphase chormosomes are duplicated chromosomes for cell division Normal cell chromosomes are not duplicated

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Chromosome band address

Short and Long Arms of a Chromosome



Source: wikipedia

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Human 23 pair chromosomes



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Human 23 pair chromosomes



Source: National Institute of Health

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Number of genes and bases for each chromosome



Source: wikipedia.com

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	Chromosome	Genes	Total base pairs	Sequenced bases
	1	4,220	247,199,719	224,999,719
	2	1,491	242,751,149	237,712,649
	3	1,550	199,446,827	194,704,827
	4	446	191,263,063	187,297,063
	5	609	180,837,866	177,702,766
	6	2,281	170,896,993	167,273,993
	7	2,135	158,821,424	154,952,424
	8	1,106	146,274,826	142,612,826
	9	1,920	140,442,298	120,312,298
	10	1,793	135,374,737	131,624,737
	11	379	134,452,384	131,130,853
	12	1,430	132,289,534	130,303,534
	13	924	114,127,980	95,559,980
	14	1,347	106,360,585	88,290,585
	15	921	100,338,915	81,341,915
	16	909	88,822,254	78,884,754
	17	1,672	78,654,742	77,800,220
	18	519	76,117,153	74,656,155
	19	1,555	63,806,651	55,785,651
	20	1,008	62,435,965	59,505,254
	21	578	46,944,323	34,171,998
	22	1,092	49,528,953	34,893,953
	Х	1,846	154,913,754	151,058,754
Source:	Y	454	57,741,652	25,121,652
wikipedia.o	rg Total	32,185	3,079,843,747	2,857,698,560

RNA



Source: periodni.com

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tRNA



Source: angelfire.com

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Code to Amino Acids

1st		2nd base								
base		U		С	Α		G		base	
U	UUU	(Phe/F)	UCU	 	UAU	(Tyr/Y) Tyrosine	UGU		U	
	UUC	Phenylalanine	UCC		UAC		UGC	(Cys/C) Cysteine	С	
	UUA	(Leu/L) Leucine	UCA	(Ser/S) Serine	UAA	Stop (Ochre)	UGA	Stop (Opal)	Α	
	UUG		UCG		UAG	Stop (Amber)	UGG	(Trp/W) Tryptophan	G	
	CUU		CCU	(Pro/P) Proline	CAU	(Hie/H) Histidina	CGU	(Arg/R) Arginine	U	
с	CUC		ccc		CAC	(nis/n) histidine	CGC		С	
	CUA		CCA		CAA	(GIn/Q) Glutamine	CGA		Α	
	CUG		CCG		CAG		CGG		G	
A	AUU	(Ile/I) Isoleucine	ACU	(Thr/T) Threonine	AAU	(Asn/N) Asparagine	AGU	(Ser/S) Serine	U	
	AUC		ACC		AAC		AGC		С	
	AUA		ACA		AAA	(Lys/K) Lysine	AGA	(Arg/R) Arginine	Α	
	AUG ^[A]	(Met/M) Methionine	ACG		AAG		AGG		G	
G	GUU	(Val/V) Valine	GCU	(Ala/A) Alanine	GAU	(Asp/D) Aspartic acid (Glu/E) Glutamic	GGU	(Gly/G) Glycine	U	
	GUC		GCC		GAC		GGC		С	
	GUA		GCA		GAA		GGA		Α	
	GUG		GCG		GAG	acid	GGG	G		

Source: http://en.wikipedia.org/wiki/Genetic_code

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Amino acids



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Myoglobin



Transcription video

http://www.youtube.com/watch?v=WsofH466lqk

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mRNA processing

 http://www.youtube.com/watch?v=YjWuVrzv ZYA&feature=related



splicing

 http://www.youtube.com/watch?v=FVuAwBG w_pQ&feature=related



Translation

 http://www.youtube.com/watch?v=5bLEDd-PSTQ

