

# PERSONALIZED GENOMICS

**Personal genomics** is a branch of science where **individual** genomes are analyzed and characterized using computer tools.

# TRUE OR FALSE?

1. Evidence shows that mice are attracted to their mates based on genetic diversity. This they can somehow tell from the smell of their urine. There is also currently some weak evidence that humans indirectly do the same thing.
2. According to established data within the senescence field, people who take longer to "sh\*t" arguably should live longer.
3. A transgenic mouse, affectionately known as the "Doogie" mouse has been produced with superior intellect and mental prowess.
4. Research based on psychogenomic analysis have determined genetic sequences involved in your love/hate relationship with brussel sprouts.

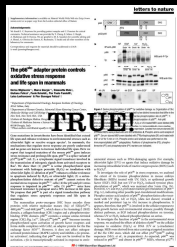
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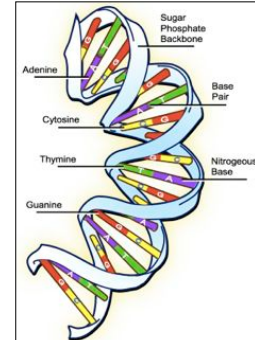


## YOUR GENETISCOPE:

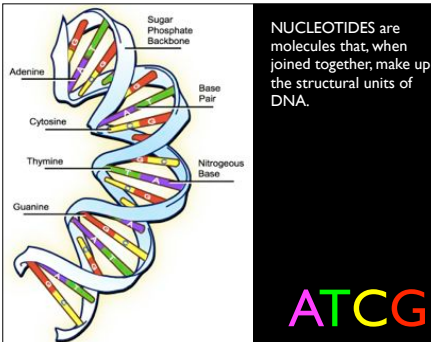
YOUR DNA SEQUENCES ALONG WITH ENVIRONMENTAL PARAMETERS INDICATE THAT YOU WILL HAVE A GENERALLY PLEASANT DAY. WATCH OUT FOR THAT INTERSECTION BETWEEN 4TH AND MAIN, AND NOTE THAT YOU WOULD DO WELL TO AVOID DRIED MANGOES TODAY. ONE OF YOUR COWORKERS WILL PASS ON A WHITE LIE, PROBABLY DURING THE AFTERNOON.

BOWEL MOVEMENTS AT APPROXIMATELY 07:00 AND 18:00 HOURS.

YOUR GENOMIC PROFILE ALSO INDICATES THAT A GREY OR WHITE CAT WILL PISS YOU OFF TODAY.

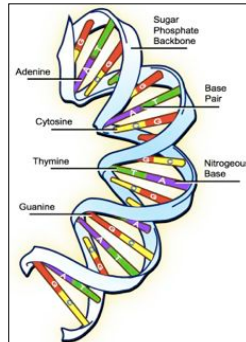


**DEOXYRIBONUCLEIC ACID** or **DNA** is a molecule that contains the genetic instructions used in the development and functioning of (almost) all known living organisms.

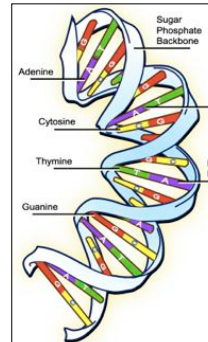


**NUCLEOTIDES** are molecules that, when joined together, make up the structural units of **DNA**.

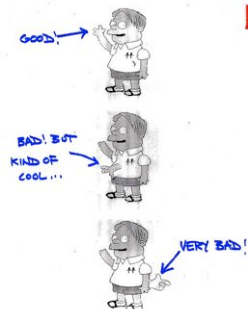
**ATCG**



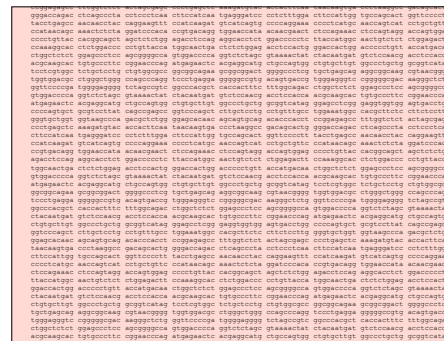
A **GENE** is a unit of heredity in a living organism. It normally resides on some stretches of **DNA** and **RNA** that codes for a type **PROTEIN** that has a **FUNCTION** in the organism.



The **FUNCTION** of a **GENE PRODUCT** can (by itself or in tandem with other **GENE PRODUCTS**) result in an observable **PHENOTYPE** or **TRAIT**.



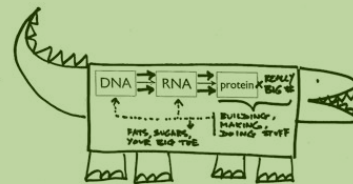
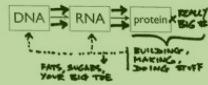
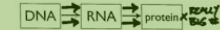
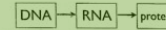
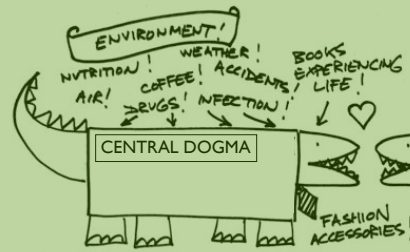
~3,000,000,000!



(code)

(double stranded)

(diploid - two parents)

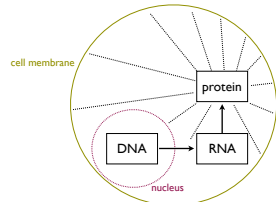
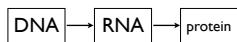


		Second Pair								
		U		C		A		G		
First Pair	U	UUU UUU UUU	Phenylalanine	UUC UUC UUC		UAU UAU UAU	Tyrosine	UGU UGU UGU	Cysteine	Third Pair
	C	UCU UCU UCU	Leucine	UUG UUG UUG	Stutter	UAG UAG UAG	Stop	UGG UGG UGG	Tryptophan	
	A	UAU UAU UAU		CAU CAU CAU	Hisidine	CAU CAU CAU	Glutamine	CGU CGU CGU	Arginine	
	G	UGU UGU UGU		CCU CCU CCU	Proline	CAU CAU CAU	Glutamine	CGU CGU CGU	Arginine	
	U	UUU UUU UUU	Leucine	UUC UUC UUC		UAU UAU UAU	Asparagine	UGU UGU UGU	Stutter	
	C	UCU UCU UCU	Indonine	UUG UUG UUG	Threonine	UAG UAG UAG	Lysine	UGG UGG UGG	Arginine	
	A	UAU UAU UAU	Indonine (right codon)	CAU CAU CAU		CAU CAU CAU	Aspartic acid	CGU CGU CGU	Glycine	
	G	UGU UGU UGU	Valine	CCU CCU CCU	Alanine	CAU CAU CAU	Aspartic acid	CGU CGU CGU	Glycine	

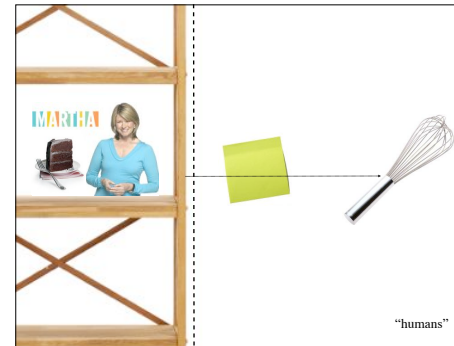
DNA      GCC AGC AGT

RNA      GCC AGC AGU

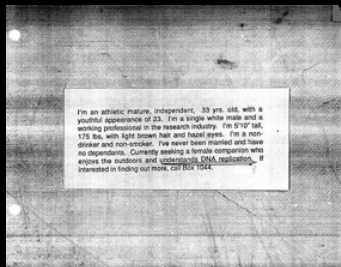
PROTEIN    ALA SER SER



A cell in your earlobe (because earlobes never get the limelight in biology lectures)













# MOLECULAR BIOLOGY



Accession	Gene	Protein	Function
<a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	initiator for bacterial replication (DnaA initiator involved in bacterial replication) (DnaA initiator involved in bacterial replication) (DnaA initiator involved in bacterial replication)
Score: 274 bits (100%), Expect: < .01			
Query: 1 <a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	<a href="#">DnaA</a>
Seqs: 1 <a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	<a href="#">DnaA</a>
<a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	<a href="#">DnaA</a>
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<a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	<a href="#">DnaA</a>
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<a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	<a href="#">DnaA</a>
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<a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	<a href="#">DnaA</a>
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<a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA</a>	<a href="#">DnaA</a>
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<a href="#">U00096.1</a>	<a href="#">dnaA</a>	<a href="#">DnaA&lt;/</a>	

[illegible]

PHENOTYPE	PROTEINS	GENES	DNA SEQ
	 +  + <b>dQ</b> -	 	ATCG TAGC
	 -  - <b>dQ</b> +	 	ATGC TACG

<https://doi.org/10.26434/chemrxiv-2022-12460>



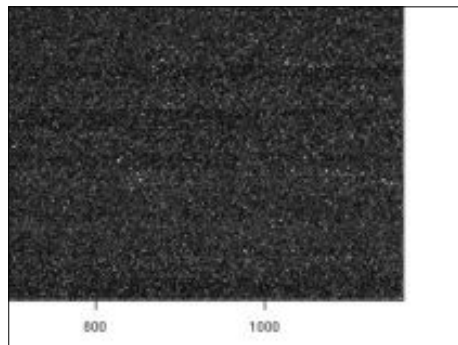
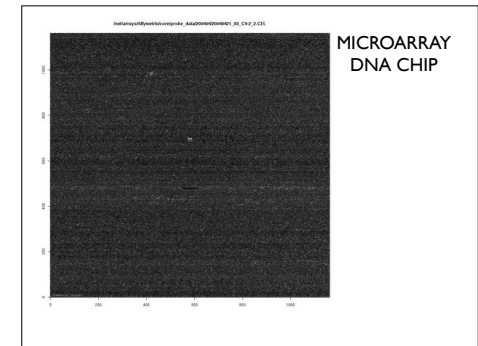
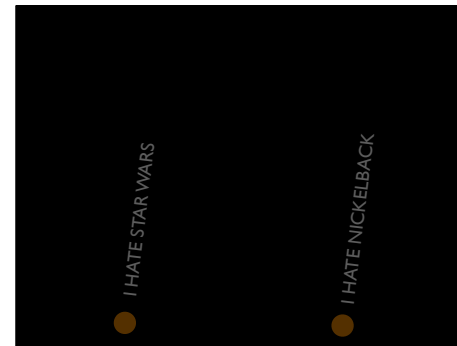
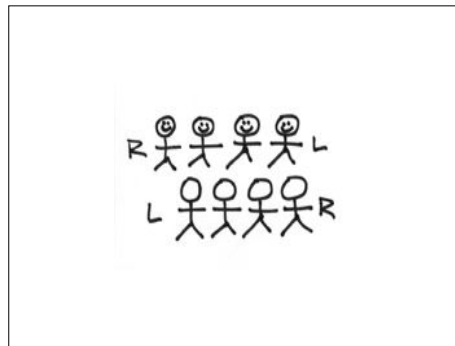
• ~2 million single nucleotide polymorphisms - SNPs (~0.1 to 0.3% of total genome)

is a DNA sequence variation occurring when a single nucleotide — A, T, C, or G — in the genome (or other shared sequence) differs between (human) members.

```

AGCTTAGCGAGTGC CCGGTCAGCTTACGAGATCGAGGACCTTACG
AGCTTAGCGAGTGC CCGGTCAGCTTACGAGATCGAGGACCTTACG
AGCTTAGCGAGTGC CCGGTCAGCTTACGAGATCGAGGACCTTACG
AGCTTAGCGAGTGC CCGGTCAGCTTACGAGATCGAGGACCTTACG
AGCTTAGCGAGTGC CCGGTCAGCTTACGAGATCGAGGACCTTACG
  
```

2 ALLELES A vs C in GENE X      2 ALLELES G vs T in GENE Y



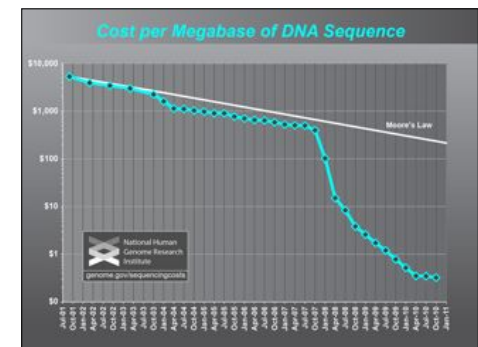
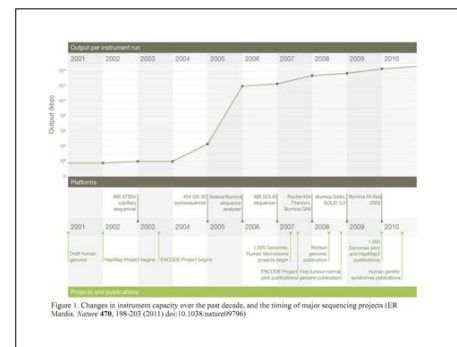
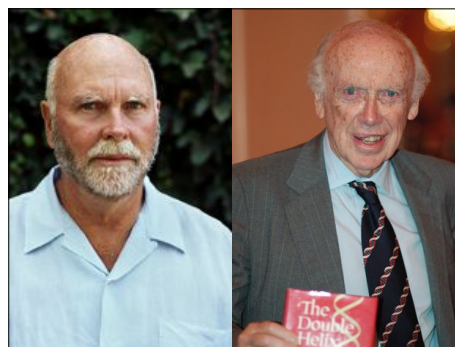
**BETTER WAYS TO JUST  
SEQUENCE THE HECK OUT  
OF A SINGLE SAMPLE**

• Differences between non-related genomes from CNVs is ~ 0.5%

Copy-number variations are alterations of the DNA of a genome that results in the cell having an abnormal number of copies of one or more sections of the DNA

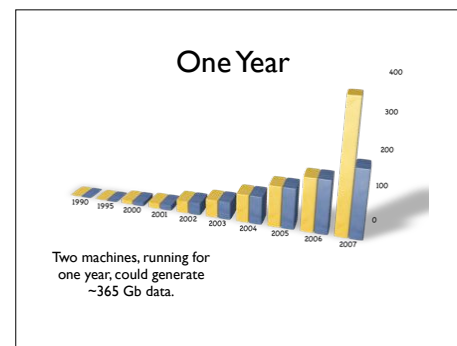
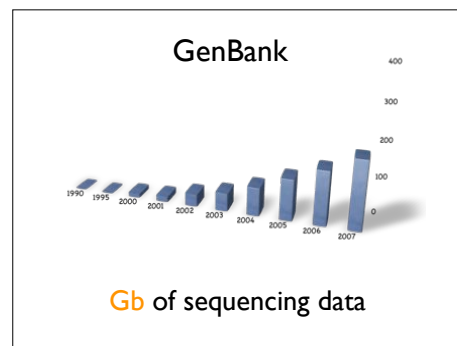
```

AGCTTAGCATCATCATCATAGCT
AGCTTAGCATCATCATCATCATCATAGCT
AGCTTAGCATCATCATCATCATCATAGCT
AGCTTAGCATCATCATCATCATCATAGCT
  
```



**THE PRICE IS RIGHT!**

Illumina MiSeq      Ion Proton      EVE



THESE are what the new technologies are all about! (I'll highlight Illumina's Solexa platform).

THE NET RESULT, is that research is now at a place where getting LOTS of sequencing data for relatively cheap costs is doable. Here are some graphs to show you where we're at now.

GENBANK graph of Gb of sequencing data (per year). Now, see what machines such as Illumina's Solexa technology can do!

Calculating in things like human genome sequencing services. YES, you too can get your genome sequenced for a paltry \$15,500 (March 2011 numbers), or get a group rate - 5 genomes for \$14,500 each.

Here's a general timeline (from Phil Hitter)

BCP reference sequence	(Sanger)	1996-2002	\$100M
J. Craig Venter	(Sanger)	2007	\$1M
Jim Watson	(454)	Spring 2008	\$1M
Tamara Aizawa African		Fall 2008	\$500,000
Cost today	Hito Human	2012	\$5,000

Another striking statistic: Vancouver's Genome Science Center. (from Marco Marra)

4 million bp (1999 - 2010)

173 million bp (2011 to April 2012)

X-PRIZE: >100 genomes, <10 days, <\$10000 each.

OFI MENTIONED CHALLENGE: One machine can sequence an entire genome (with coverage) in less than 15 minutes, for less than \$1000.

In any event, currently biological research is being propelled by these technologies, because ultimately, they allow you to get massive amounts of raw data (DNA, or RNA, code). Much like google algorithms, the trick is correlate this raw data with therapeutic observation, using computer tools, and use statistics to assess potential validity.

But we'll get to this in more detail in the next day...

## TRUE OR FALSE

1. A company called "Genetic Savings and Clone" provides gene banking and genetic services for clients. This also includes the cloning of your favourite pet.
2. The song you are listening to is the title track of a Billboard number one CD. The song and CD are specifically written about and dedicated to the first human clone.
3. The nucleotide code of certain genes when translated into musical notation have been known to have similarities to Chopin compositions.

A company called "Genetic Savings and Clone" provides gene banking and genetic services for clients. This also includes the cloning of your favourite pet.

**Welcome...**

**Our Mission**

Genetic Savings & Clone is dedicated to cloning pet owners, trainers and clients of working dogs...

**News**

Kathleen McNulty speaks about her dog, Billy (video)

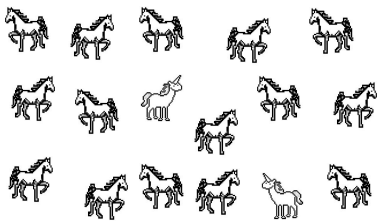
The song you are listening to is the title track of a Billboard number one CD. The song and CD are specifically written about and dedicated to the first human clone.



**KID A**

**TRUE!**

## HYPOTHETICAL EXAMPLE



## UNICORN



## HORSE



## UNICORN



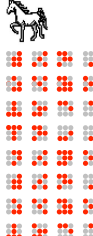
## HORSE



## UNICORN



## HORSE



## UNICORN



## HORSE



## UNICORN



## HORSE



PERSONAL GENOMICS  
PERSONALIZED MEDICINE  
AND THE LIKE...

**AT LAUNCH OF HUMAN GENOME PROJECT (1990)**  
Several machines to sequence the human genome. Est. time and cost: 15 years and \$3 billion

**2 years ago (2012):**  
One machine can sequence an entire genome in about 8 days at a cost of about \$20,000

**1 year ago (2013):**  
One machine can sequence an entire genome in about 3 days at a cost of about \$5,000

**CURRENTLY (as in just announced in January 2014):**  
One machine (the Illumina X-TEN) can sequence an entire genome in less than a day at a cost of about \$1,000

I'm an athletic, mature, independent, 33 yrs. old, with a youthful appearance of 22. I'm a single white male and a working professional in the research industry. I'm 5'10" tall, 175 lbs, with light brown hair and hazel eyes. I'm a non-smoker and non-drinker. I've never been married and have no dependents. Currently seeking a female companion who enjoys the outdoors and understands DNA replication. If interested in finding out more, call 800-123-4567.