Reverse-engineering your family tree with DNA

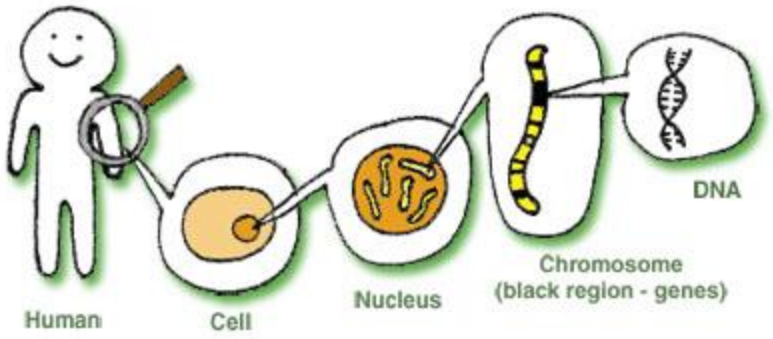
Refresh Annapolis Valley

12 Jun 2018

http://findyourfamilytree.com/p/DNA.pdf

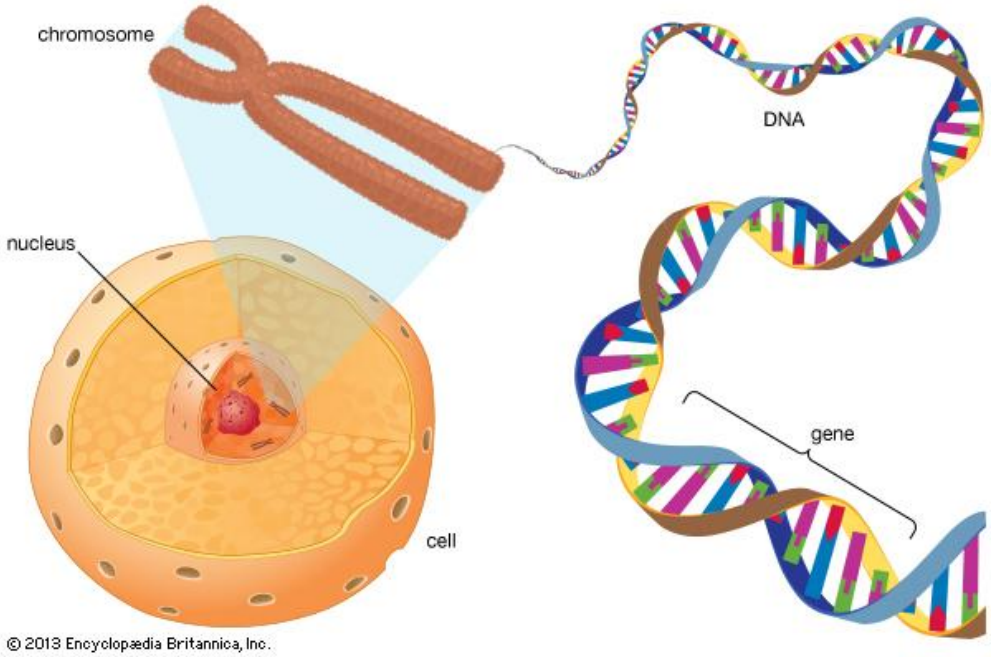
p@pginc.ca

What is DNA?



The body is made of cells
Each cell contains a nucleus

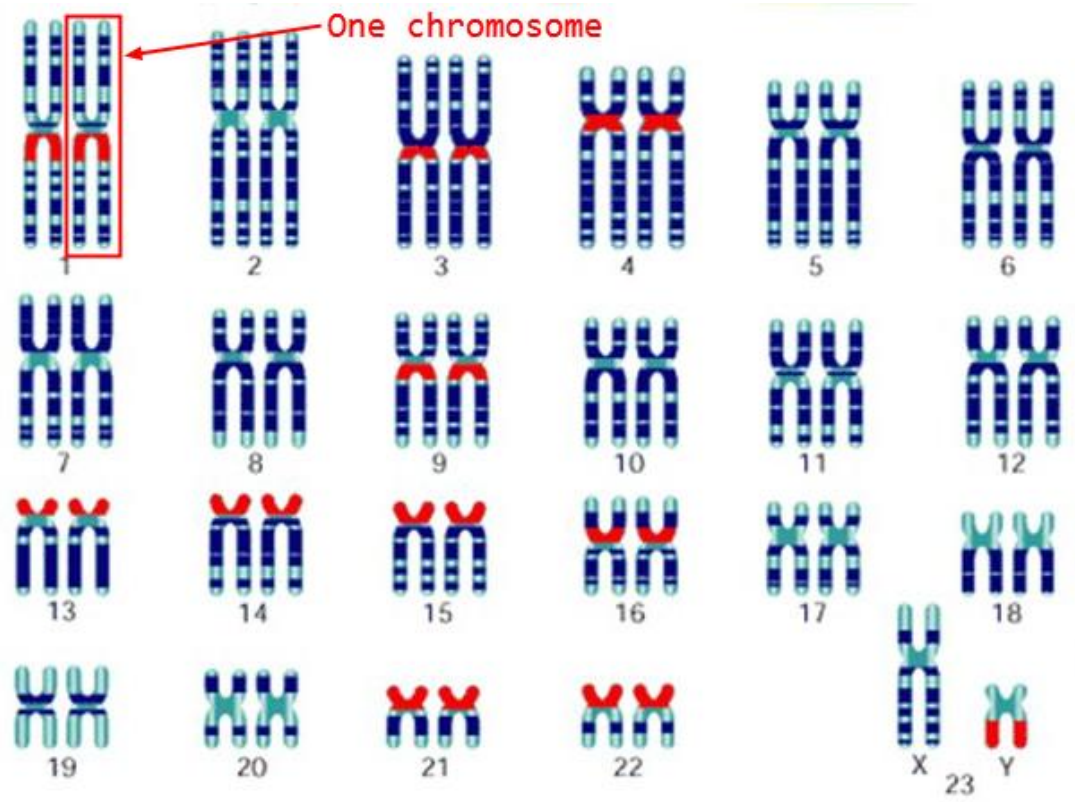
The nucleus contains DNA
DNA is template of life



What is DNA?

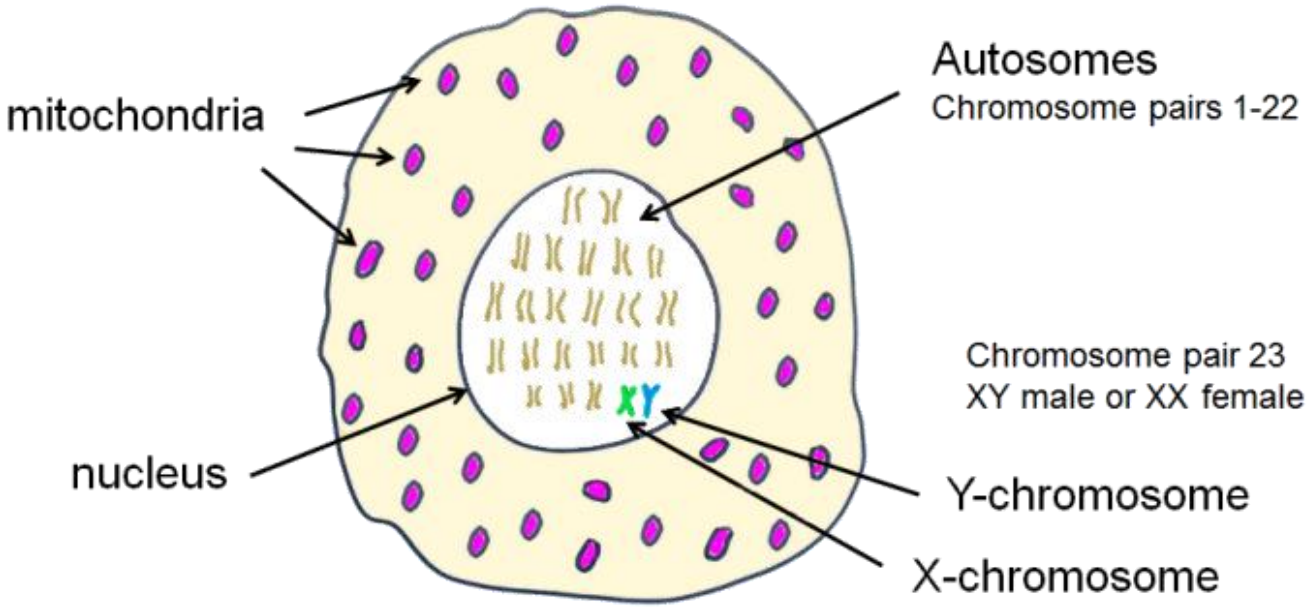
- "Deoxy-ribonucleic acid": 23 pairs

1. Build your body
2. Copy itself
3. Reproduction



Male: #23 is X-Y
Female: #23 is X-X

Types of DNA tests



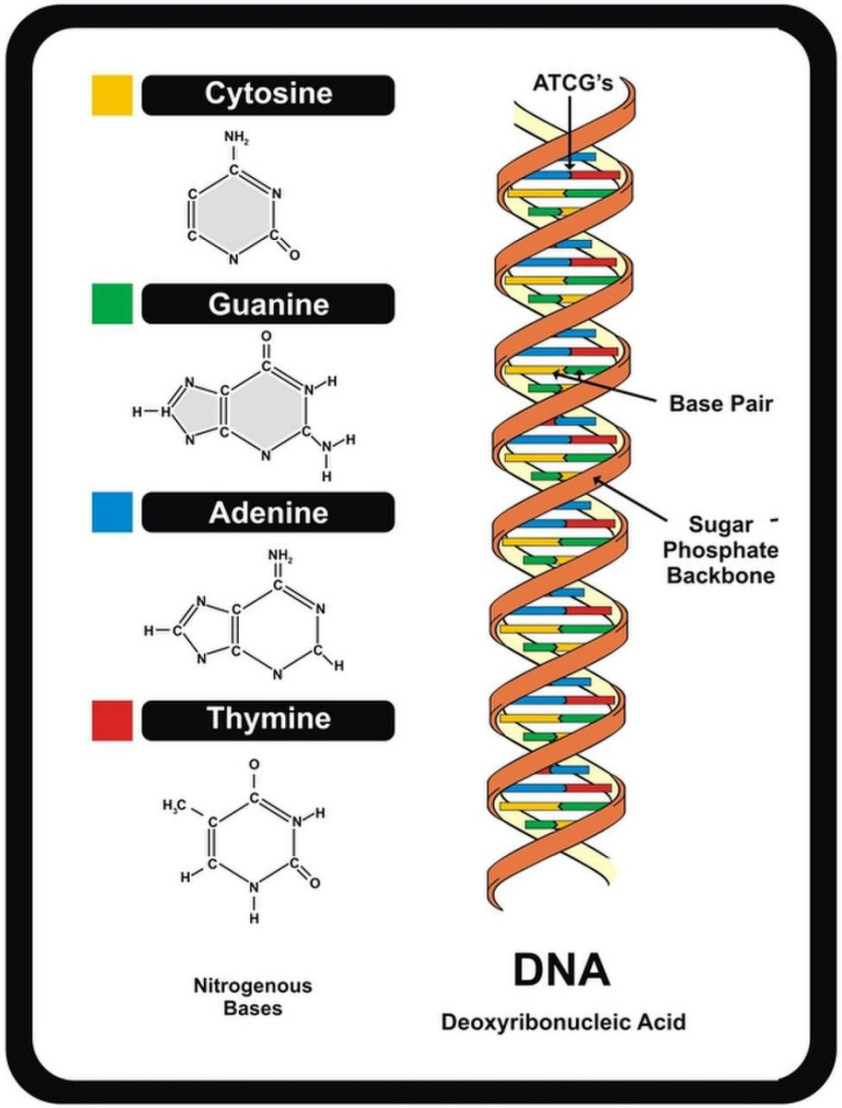
- Y-chromosome: transmitted from father to son
- mtDNA: transmitted from mother to son & daughter; son carries mtDNA, only daughter passes on
- http://www.genie1.com.au/blog/59-dna-test-types-available

Who's got DNA?

- Every living thing

Species	Chromosomes
Ant	2
Fruit Fly	8
Koala, Kangaroo	16
Coffee	44
Humans	46
Goat	60
Dog	78
Hedgehog	90
Crab	208
Atlas Blue butterfly	Bet. 448-452

The Double Helix

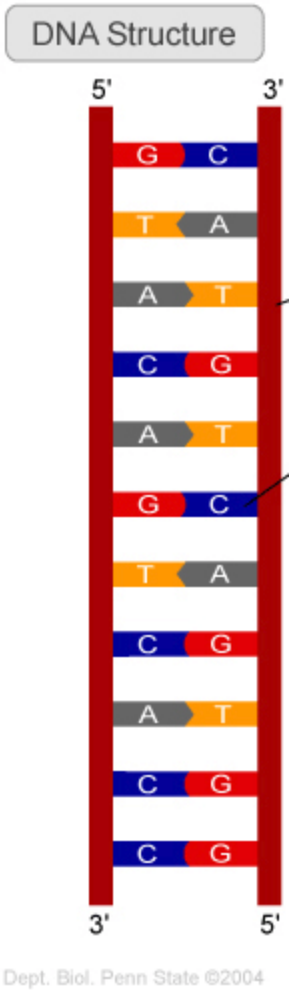


Nucleotide Bases

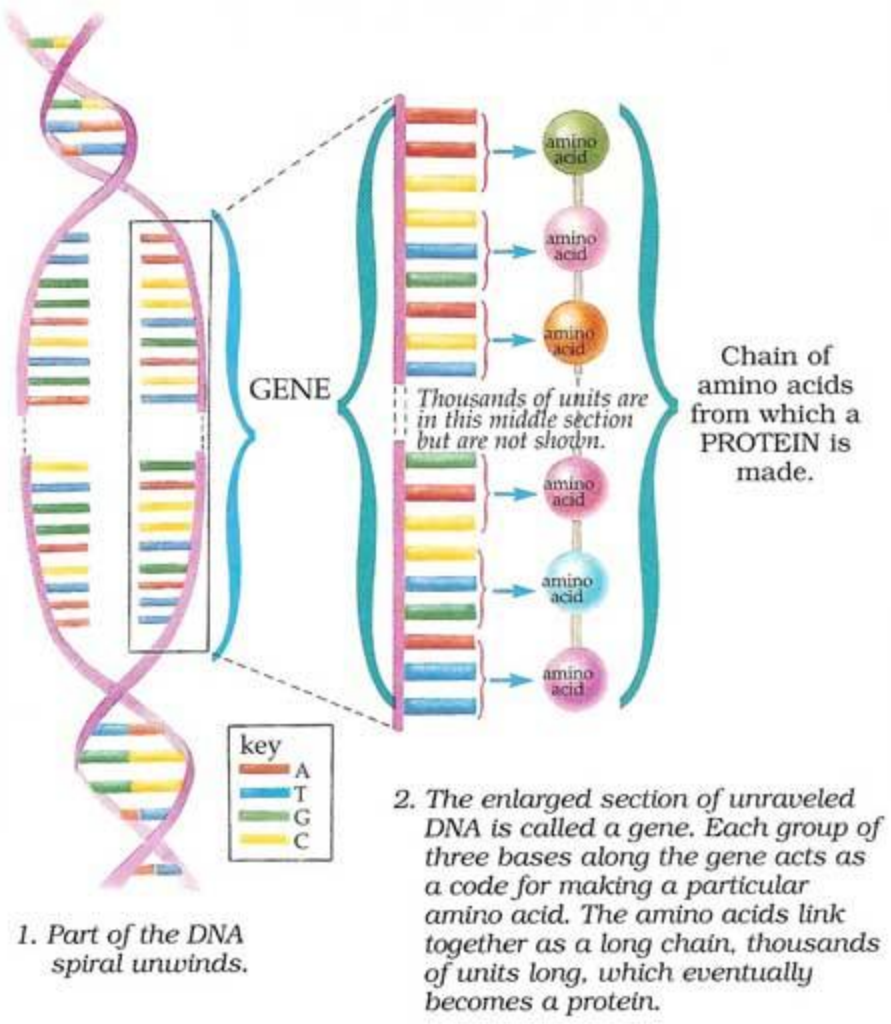
A – T – C – G

A always paired with T

C always paired with G



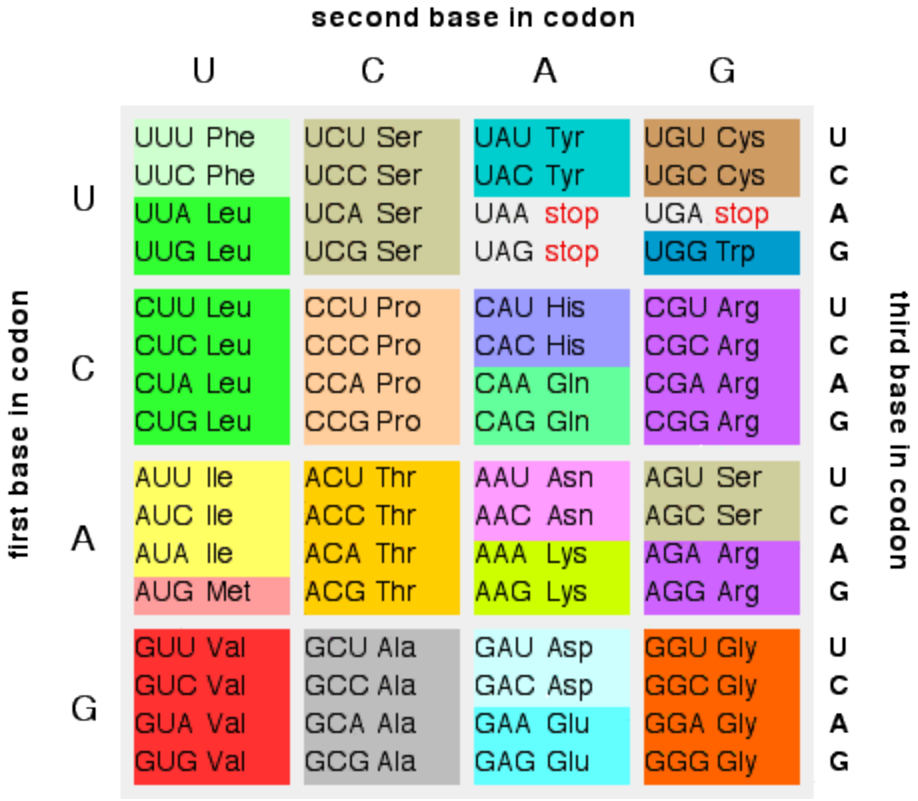
1. Building your body



- The DNA ladder splits up
- Mixes into the nutrient "soup" in the cell, which contains amino acids from digestion
- Three base pairs attach to an amino acid (4x4x4 = 64 different combinations)
- Chain of amino acids make a protein
- Proteins are skin, muscle, brain, liver, etc.

1. Building your body

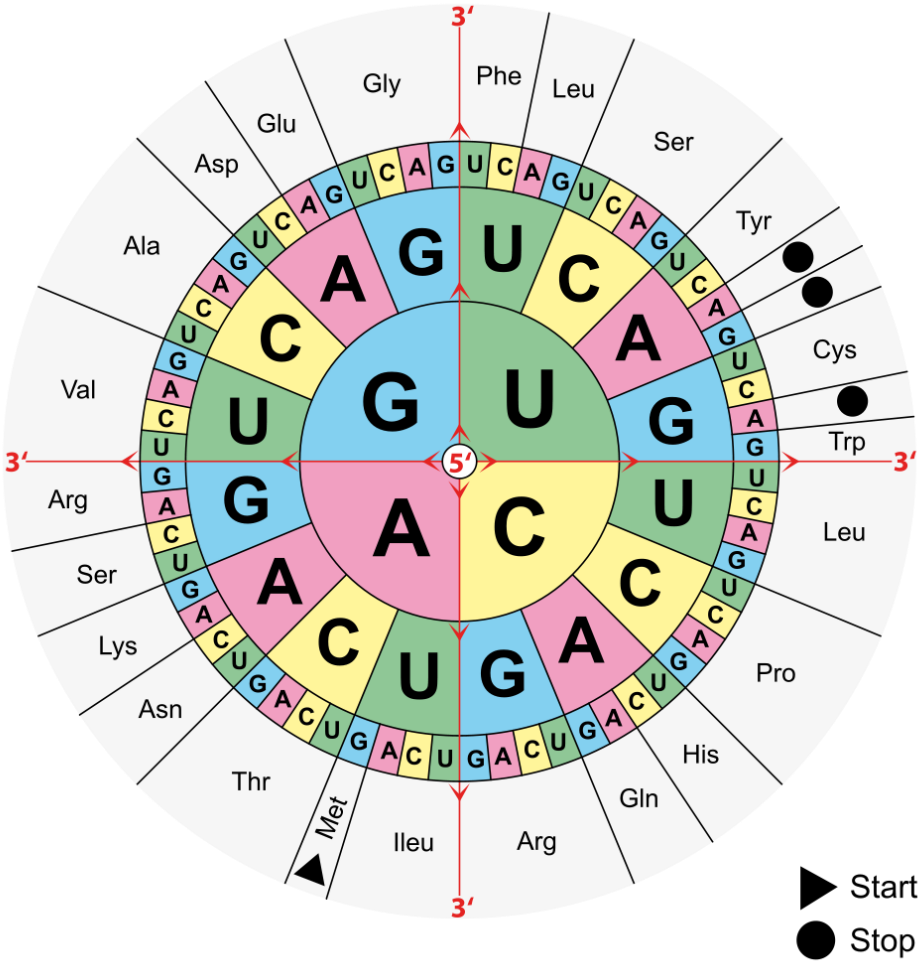
All possible combinations of A-T-C-G ('U' is same as 'T')



All amino acids (used to build proteins)

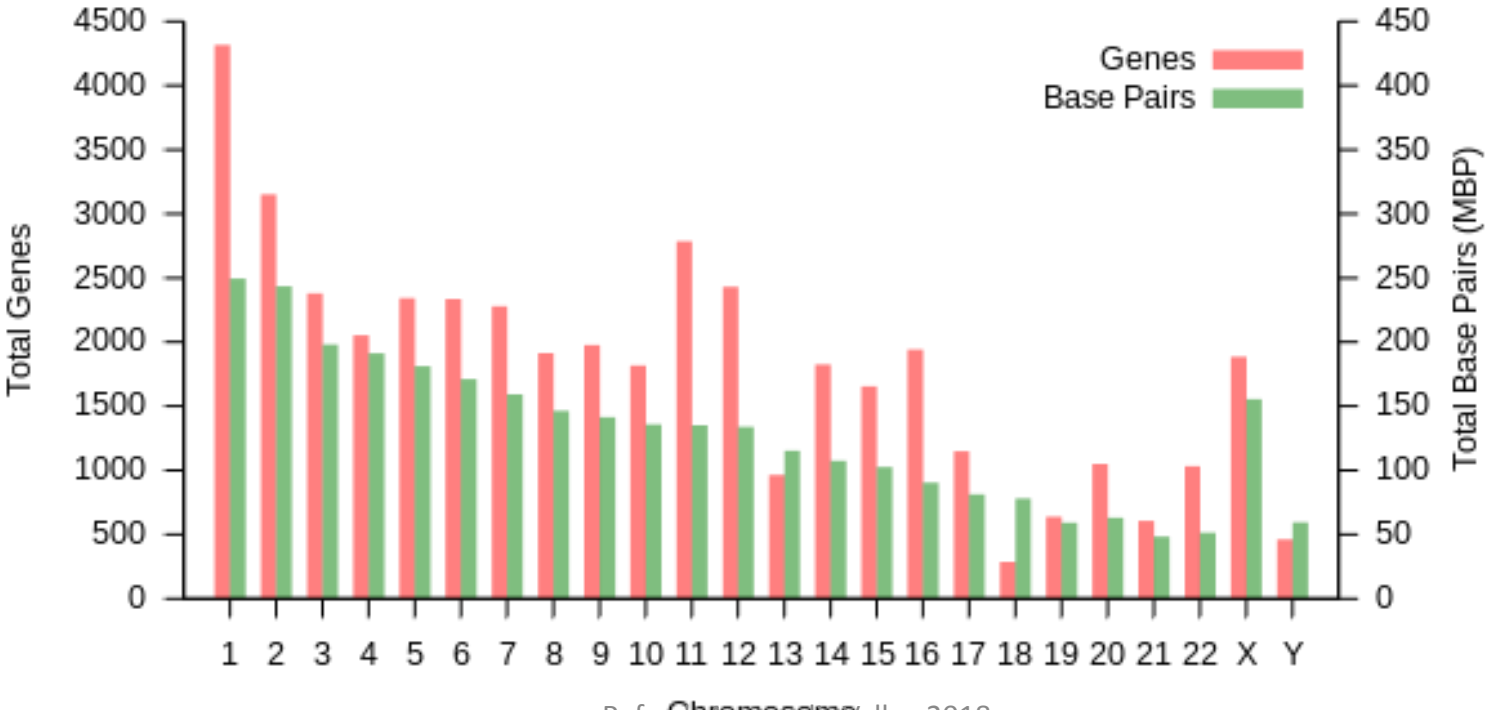
Amino Acid	DNA codons
Isoleucine	ATT, ATC, ATA
Leucine	CTT, CTC, CTA, CTG, TTA, TTG
Valine	GTT, GTC, GTA, GTG
Phenylalanine	TTT, TTC
Methionine	ATG
Cysteine	TGT, TGC
Alanine	GCT, GCC, GCA, GCG
Glycine	GGT, GGC, GGA, GGG
Proline	CCT, CCC, CCA, CCG
Threonine	ACT, ACC, ACA, ACG
Serine	TCT, TCC, TCA, TCG, AGT, AGC
Tyrosine	TAT, TAC
Tryptophan	TGG
Glutamine	CAA, CAG
Asparagine	AAT, AAC
Histidine	CAT, CAC
Glutamic acid	GAA, GAG
Aspartic acid	GAT, GAC
Lysine	AAA, AAG
Arginine	CGT, CGC, CGA, CGG, AGA, AGG
Stop codons	TAA, TAG, TGA

1. Building your body

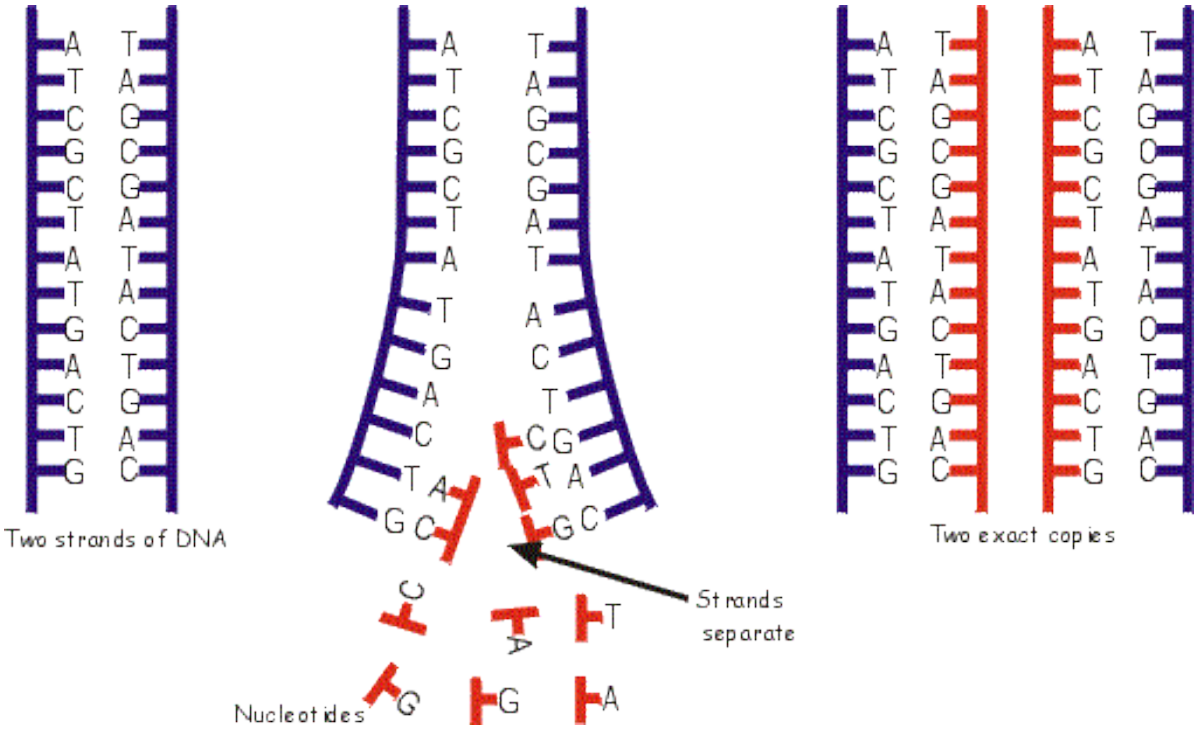


How many genes do we have?

- 3.2 billion base pairs “rungs” (nucleotides)
- 20,412 genes (1.5% of total DNA)
- Average 27,000 base pairs in a gene; shortest gene is 76 base pairs, longest is 2M base pairs
- DNA tests: 700K base pairs (A-C-T-G), 0.02% of genome



Copying itself



1. Opens up like a zipper
2. Each half attracts loose nucleotides (bases)
3. Two new ladders
4. May have errors: mutations

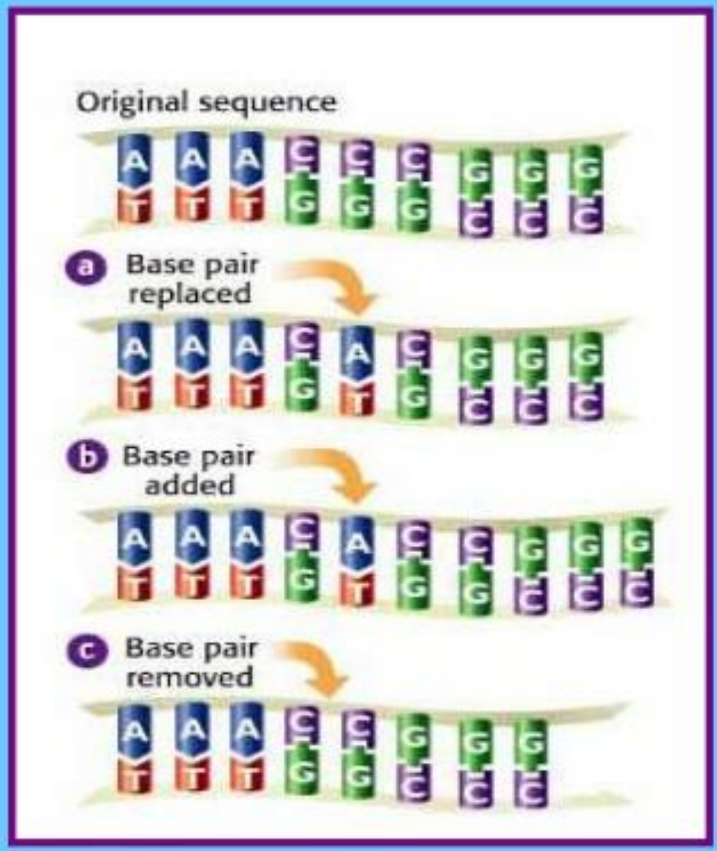
Mutations: good, bad, neutral

- 98% of DNA does not make proteins (non-coding)
- Mutations in genes is (almost always) bad
- Mutations in non-coding is (sort of) harmless
- Mutations are unique “fingerprints”
- SNP (Single Nucleotide Polymorphism)
- STR (Short Tandem Repeat)

How do mutations happen?

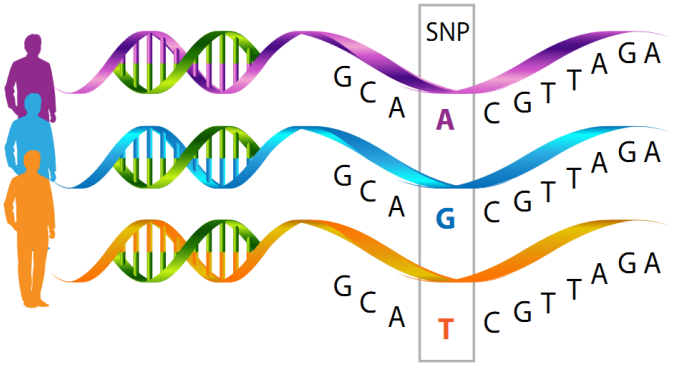
Changes in Genes

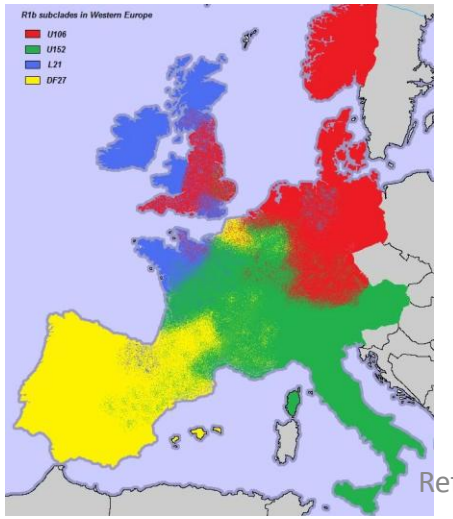
1) **Mutation**: Changes in the number, type, or order of **bases** on a piece of DNA
   1) Deletion: **base is left out**
   2) Insertion: **extra base added**
   3) Substitution: **wrong base is used**

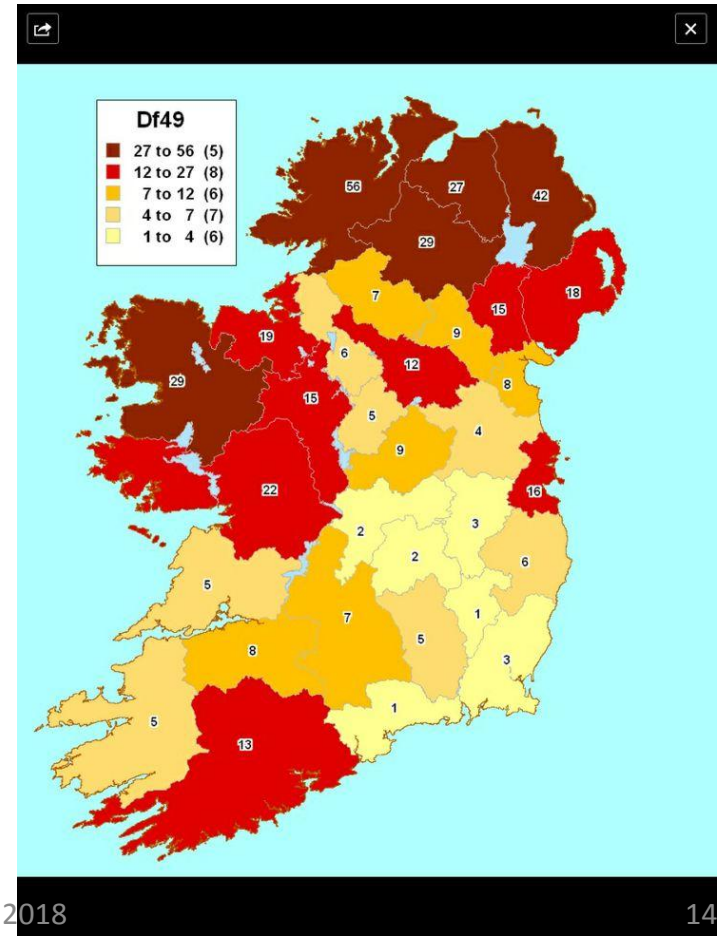


Mutations: Single Nucleotide Polymorphism (SNP)

- When one single base pair is different between individuals
- 85M SNPs, each with different name
- Once it's introduced, gets passed on to descendants
- Distinct by region or population

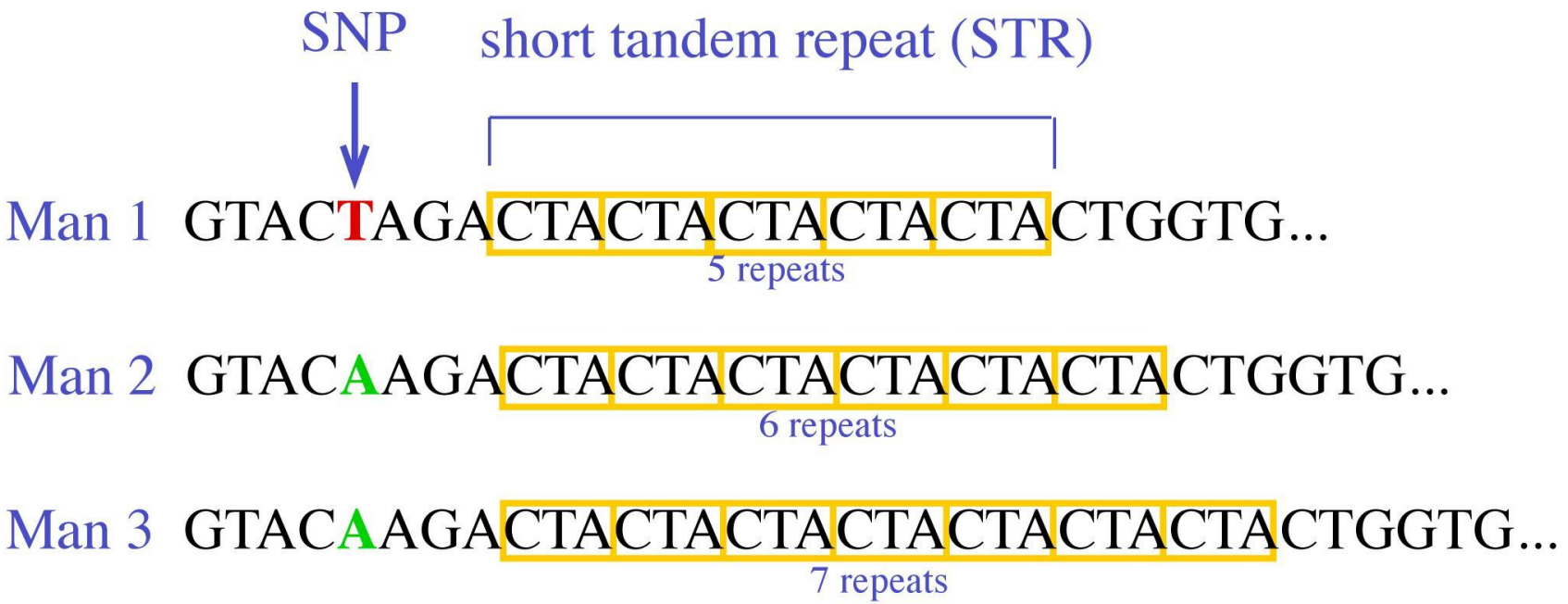






Mutations: Short Tandem Repeat (STR)

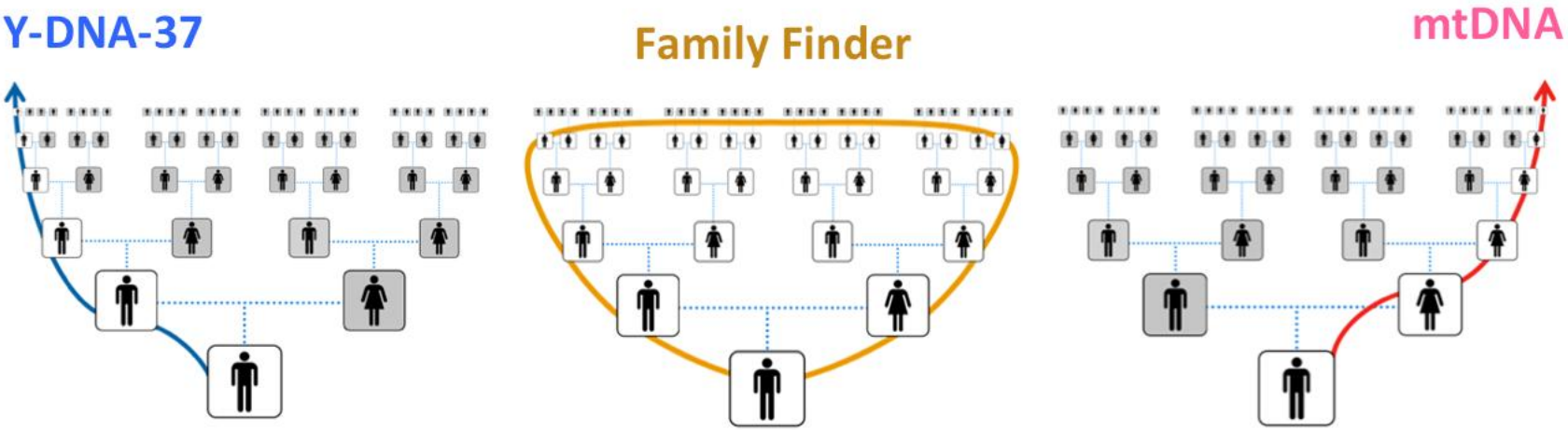
- Same pattern repeated multiple times (harmless non-coding DNA)



DNA testing for genealogy

- Looks for SNPs and STRs to tie you into thousands of ethnic and geographic groups (haploids)
- Autosomal “atDNA” (matches on all lines) Chromosomes 1-22; 6 generations
- Y-chromosome (paternal line) Chromosome #23; 30 generations?
- Mitochondrial “mtDNA” (maternal line); 50 generations
- X-chromosome (women) Chromosome #23

Types of DNA tests



http://gleesongathering.blogspot.ca/

Testing companies

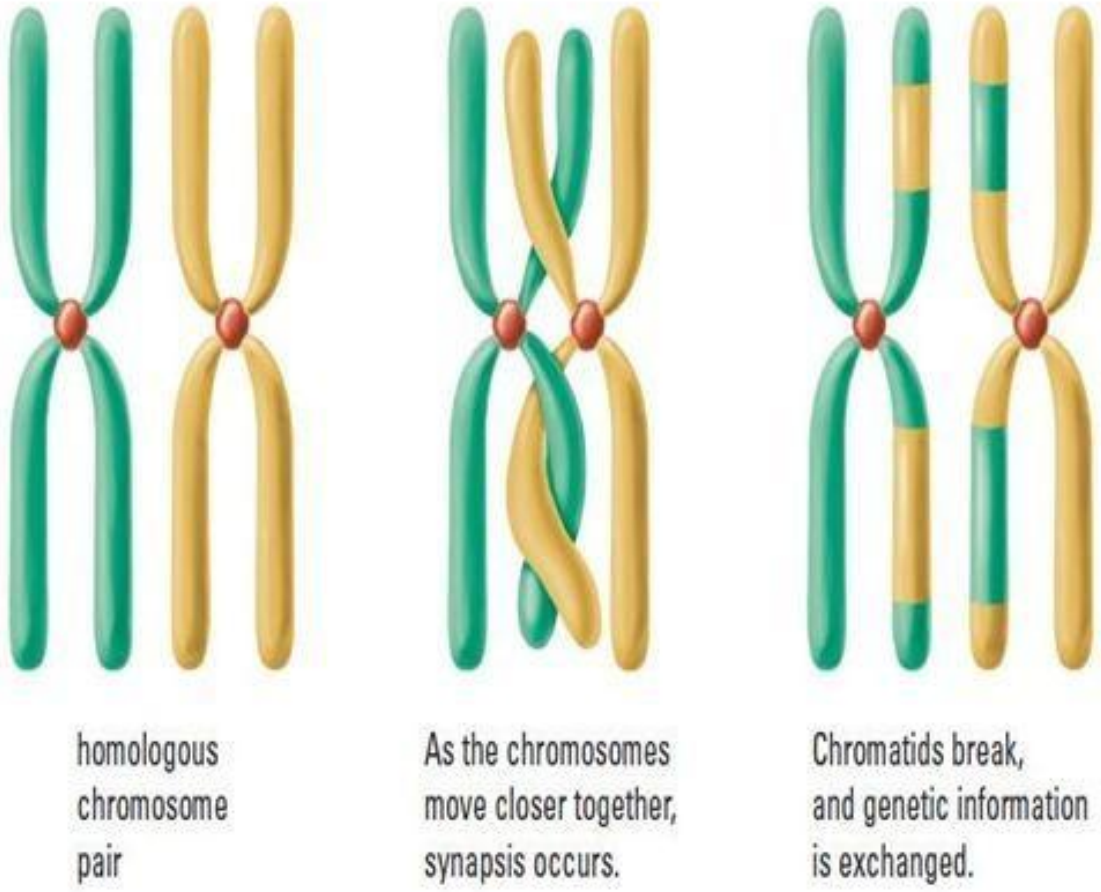
Company	Type of test	Cost
23andMe	Health Ancestry composition (ethnicity) Match relatives (1M) Paternal, Maternal lineage	$249 CAD
Family Tree DNA	Family Finder	$69 USD
	Y-DNA	From $139
	mtDNA	$159
	Match relatives (600K)	
Ancestry	Ethnicity Match relatives (4M)	$129 CAD
MyHeritage	Ethnicity Match relatives (16K)	$69 USD

http://www.legalgenealogist.com/2015/02/02/2015-most-bang-for-the-dna-buck/
https://dna-explained.com/2012/10/01/4-kinds-of-dna-for-genetic-genealogy/
http://thednageek.com/updated-estimates-of-the-genealogical-atdna-databases/

Volunteer?

- Know the surnames of your four grandparents
- Have a sibling

Recombination



Why genetics?

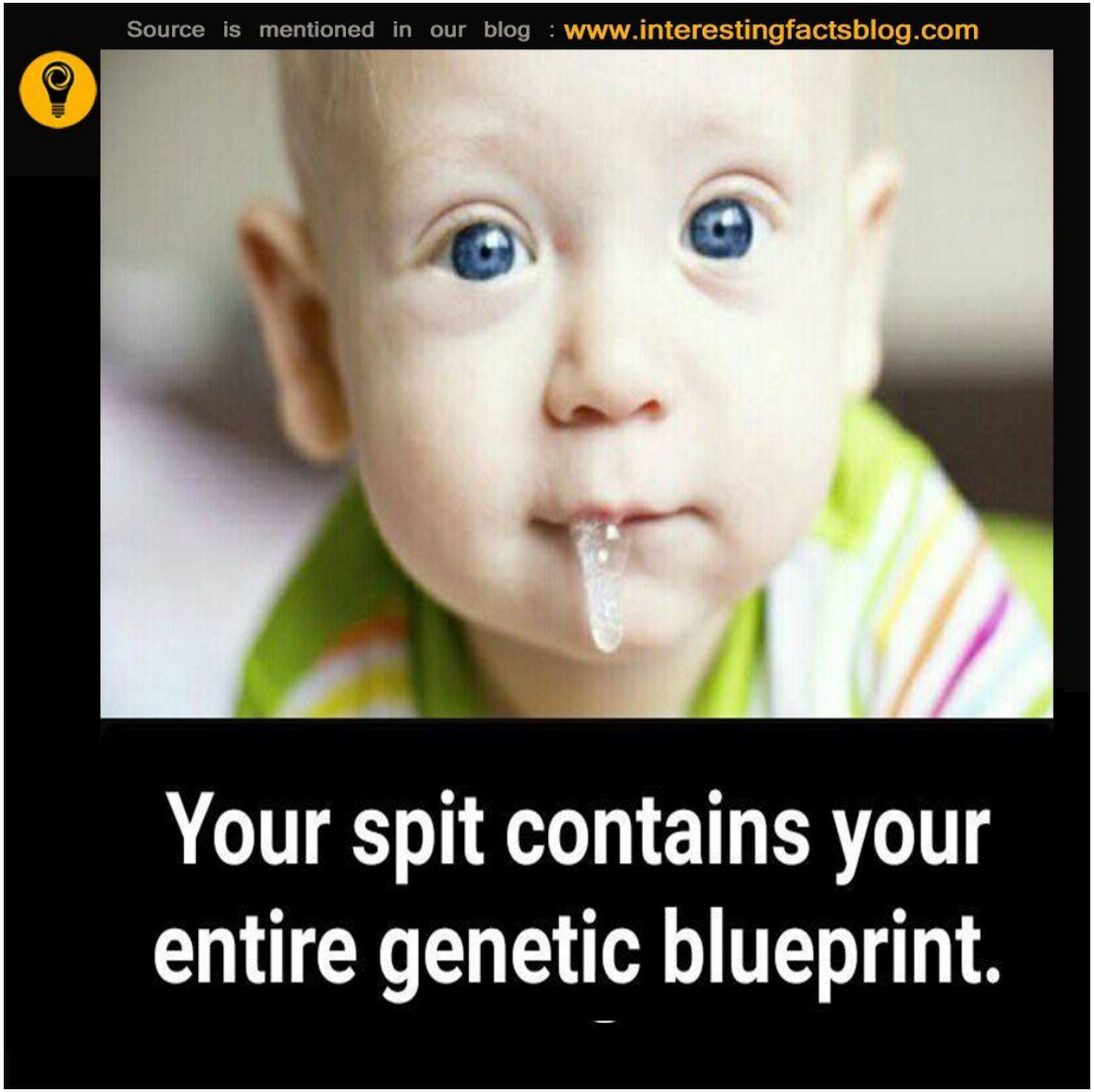
- Confirm genealogical trees
- New relationships when traditional sources not available
- Help break down “brick walls”
- Finding biological parents, relatives
- “Phasing”: reconstituting ancestors’ DNA
- DNA is hot: `dnadoeproject.org`
  ”non-profit humanitarian initiative created to help identify Jane and John Does and return them to their families to bring closure to the unnamed dead.”

How it works

1. Customer sends DNA sample to Ancestry, 23andme, Family Tree DNA, MyHeritage, etc.

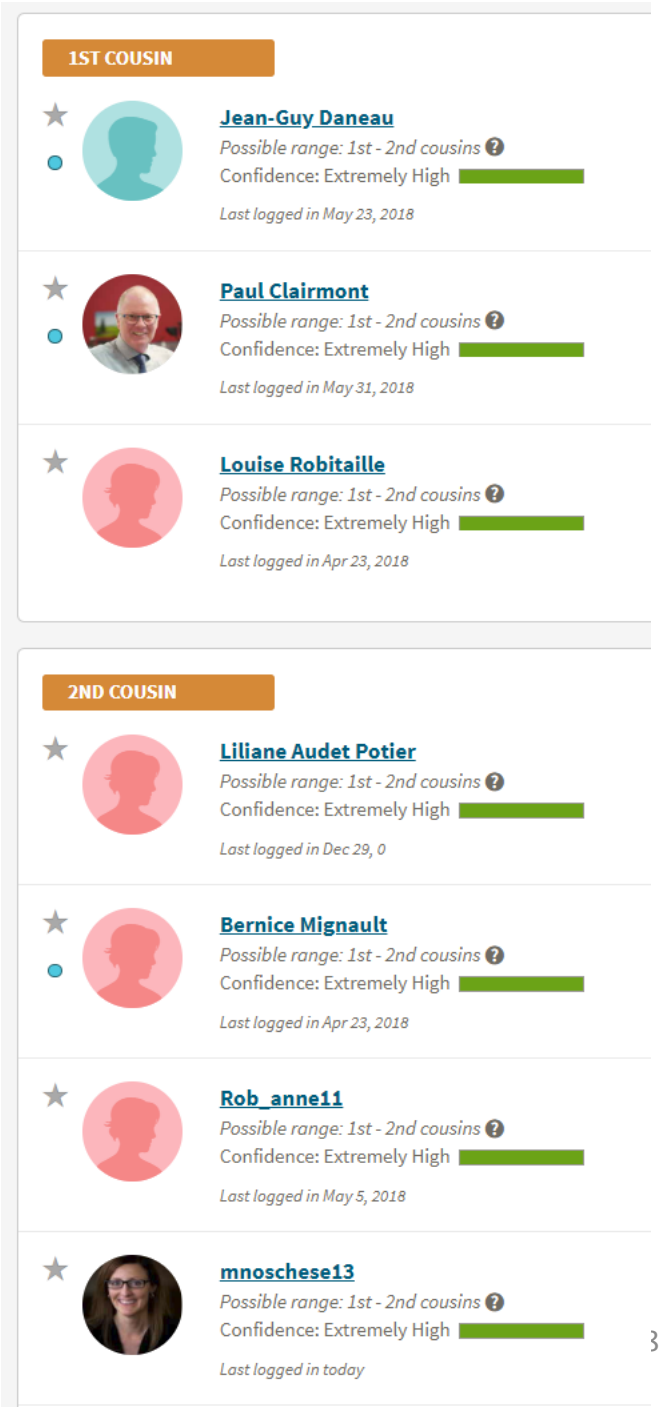


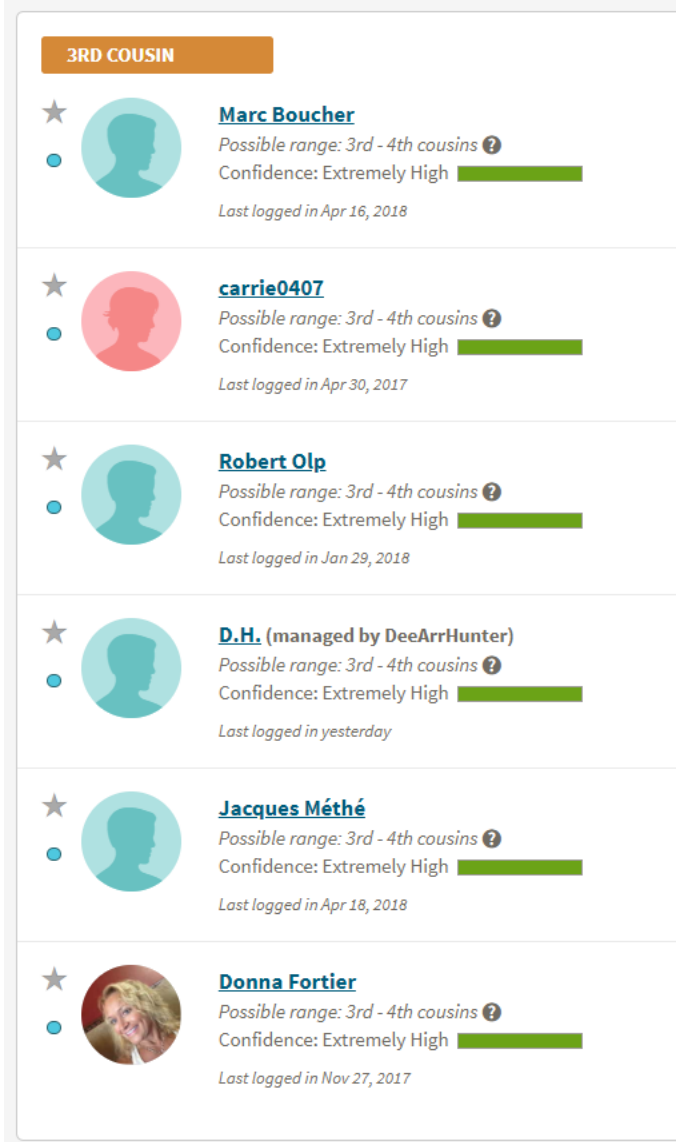



Source is mentioned in our blog : www.interestingfactsblog.com
Your spit contains your entire genetic blueprint.

2. DNA tests

Match results





How it works

3. Customer receives DNA file. *Incomprehensible*.

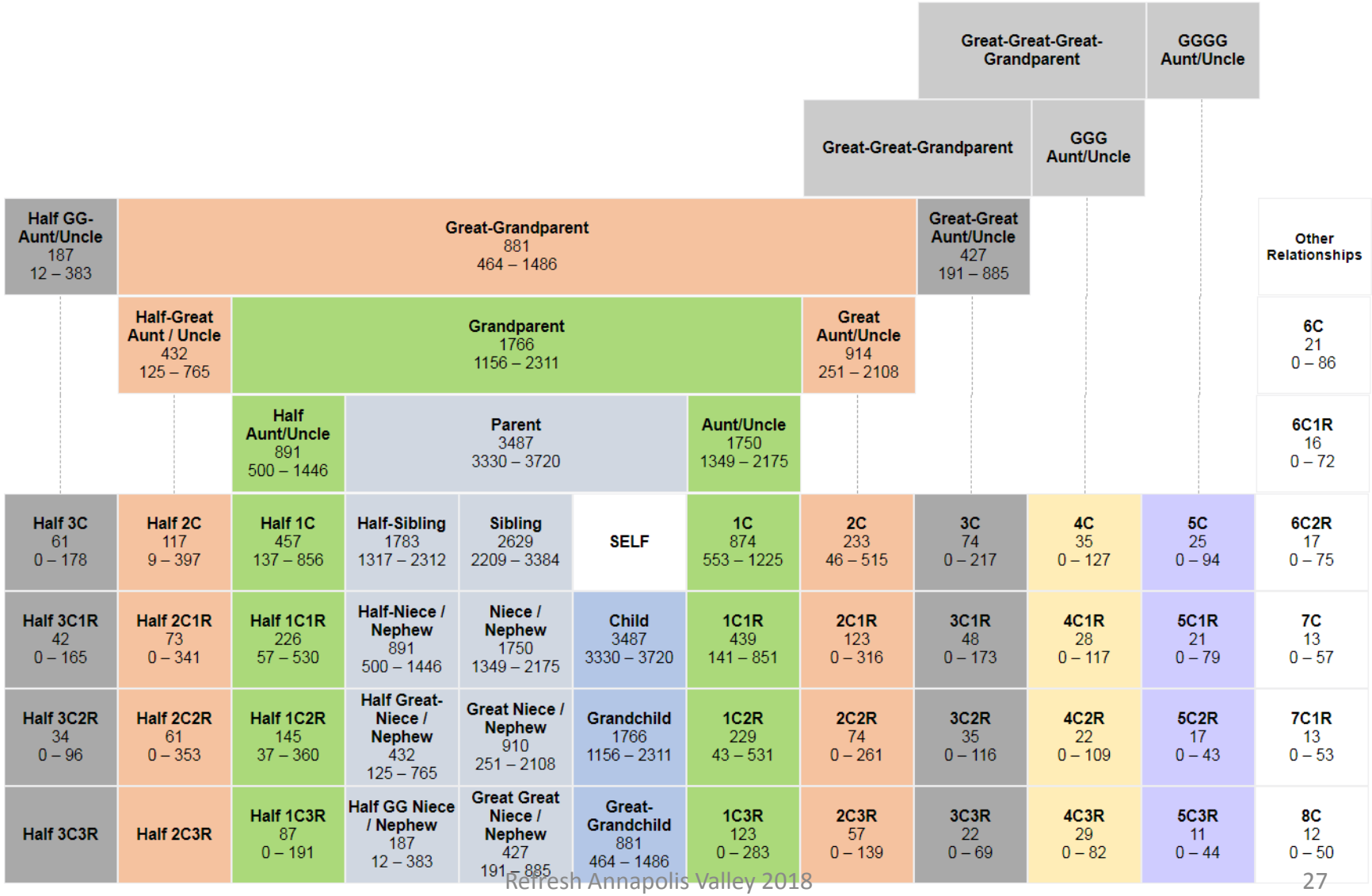
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rs12562034  1   768448  G   G    rs3128126  1   962210  A   G    rs11260542  1   1110019 A   A
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How it works (2)

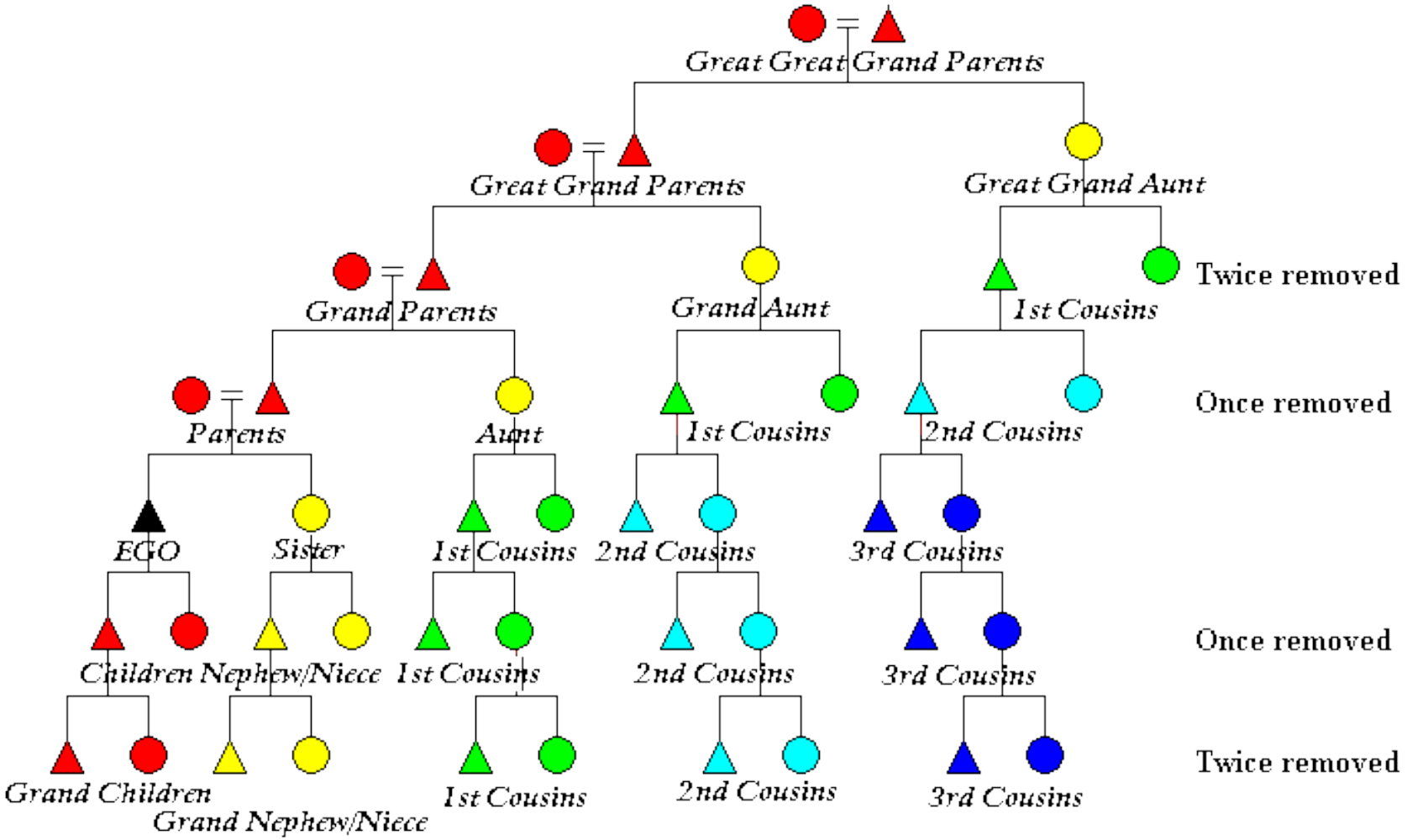
4. Customer uploads DNA file to matching site (GEDmatch, DNAgedcom, FTDNA).
5. Cust. receives CSV match file. *Confusing*.

```
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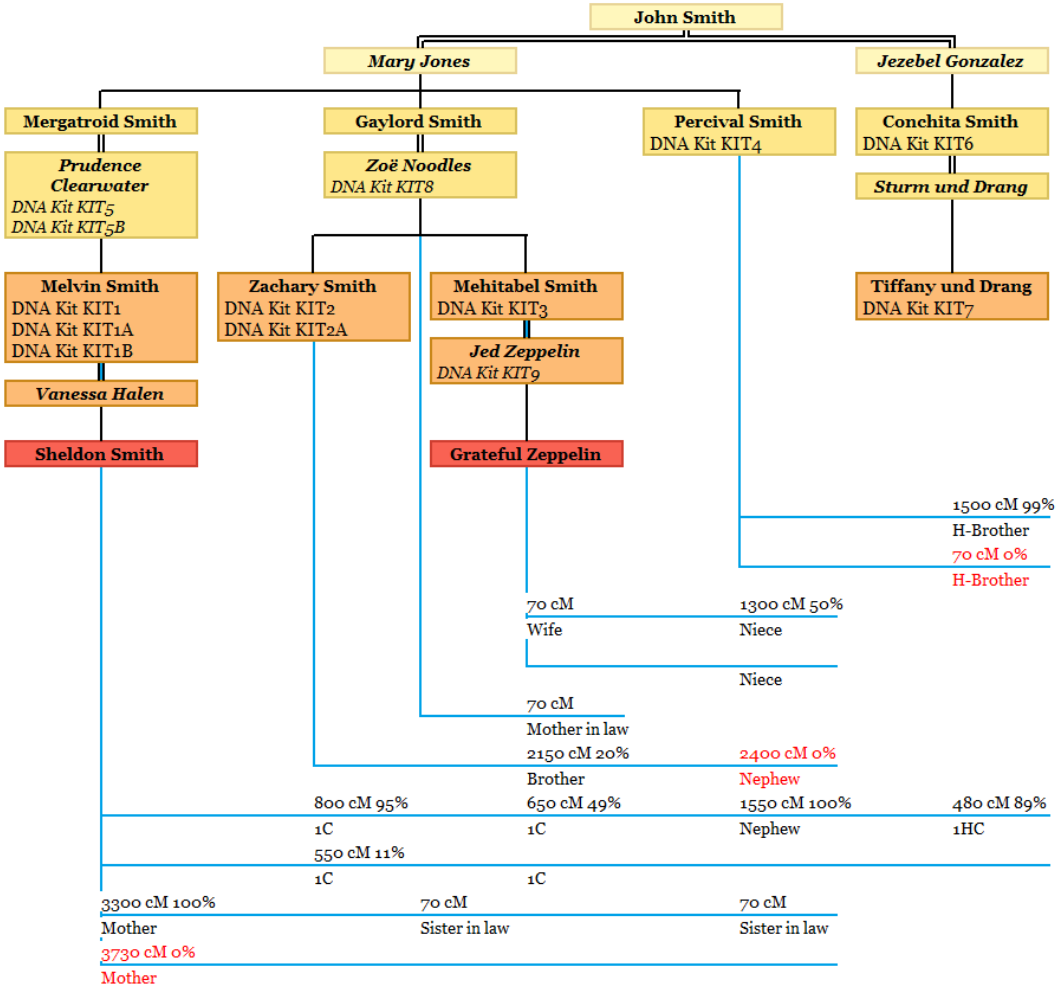
Relationship predicted by DNA match length ("centiMorgans")
1 cM ≈ 1M base pairs



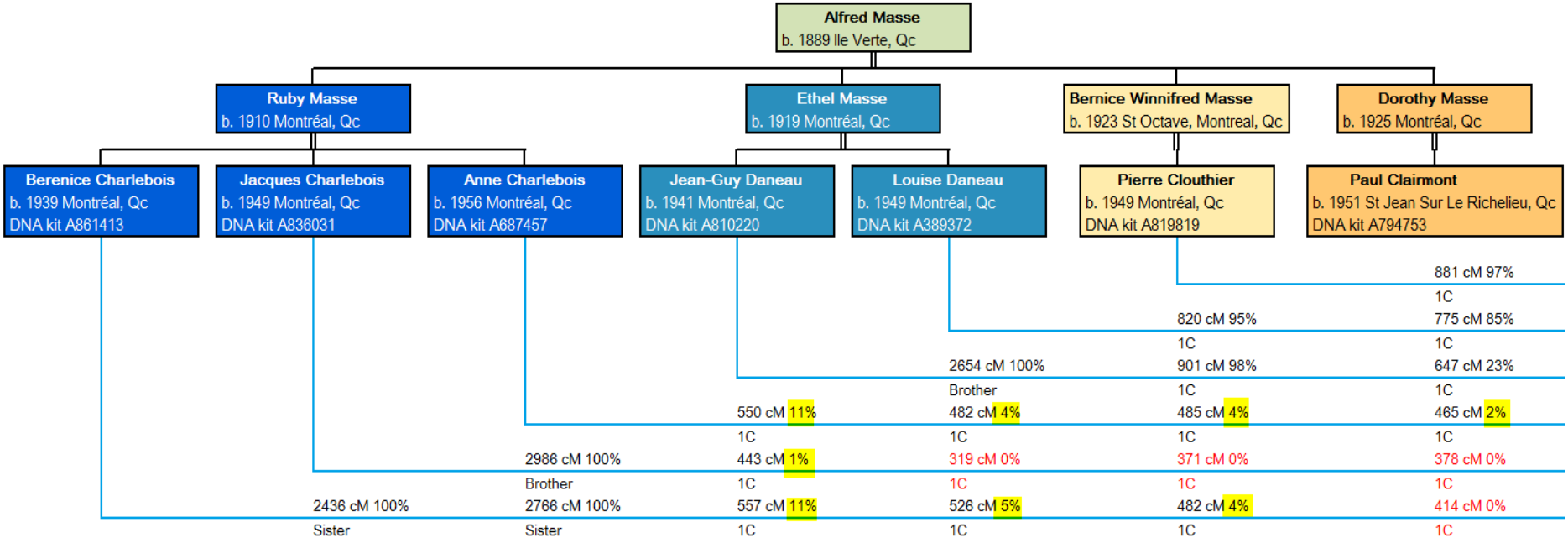
Relationships – What's a removed cousin?



How it works (3)
Display matches in Charting Companion DNA Matrix

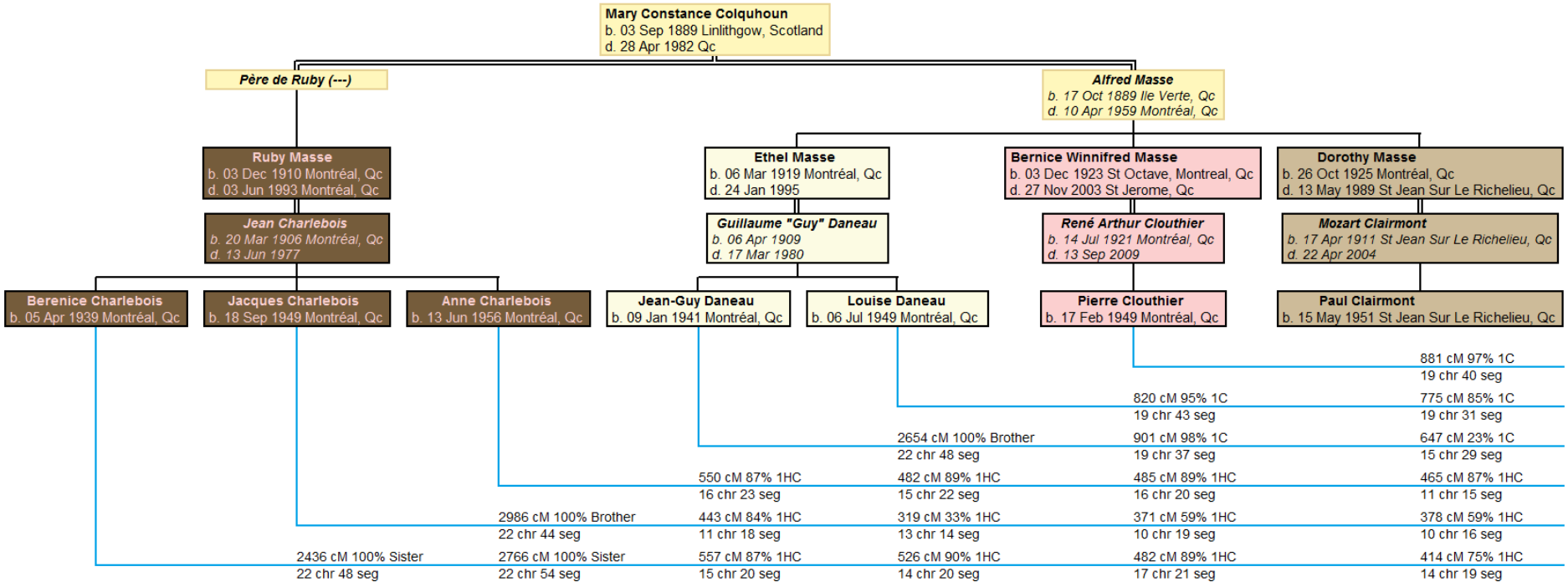


Ruby – daughter of Alfred?



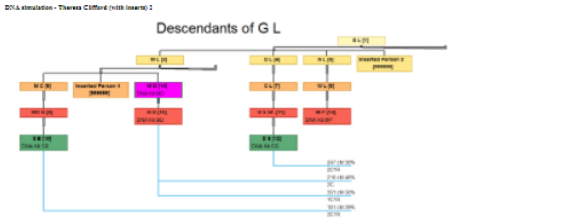
Consistently low probabilities

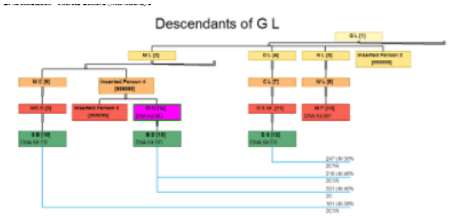
Bombshell! Revelation of a century-old secret

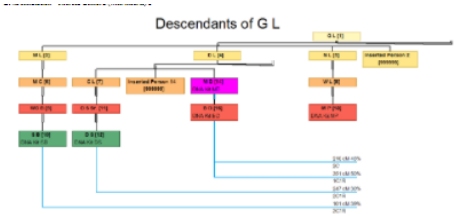


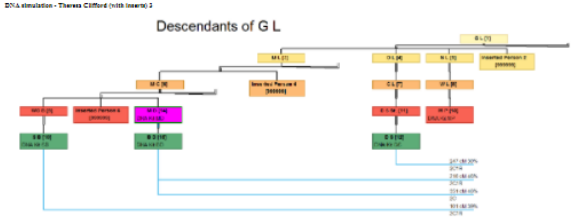
"Half cousins" – more consistent cM

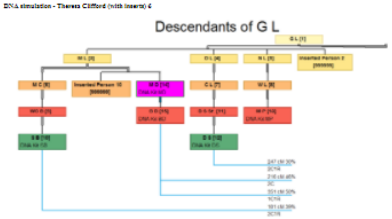
Sample simulations

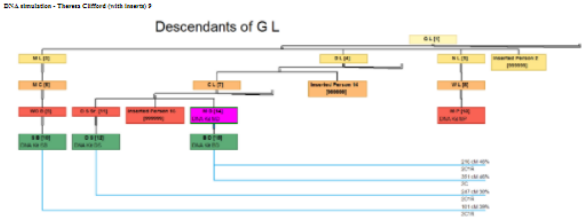


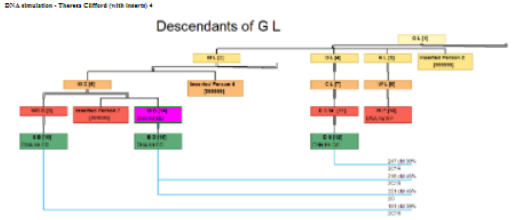


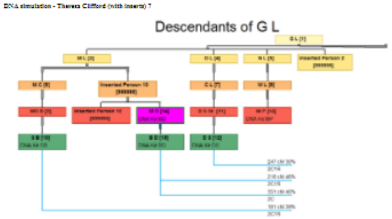


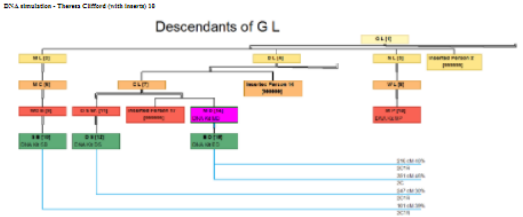








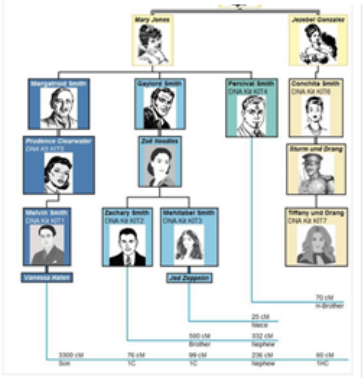




Facebook crowdsourcing

Pierre Clouthier
February 6

Charting Companion 6.7.18 with DNA Matrix ("McGuire Method") is now available. Download a Trial version or purchase a Registration Key here:



96

Terry Mattison It works great, thanks!

Elizabeth Graham-Campbell Question please, How do I tick ALL matches in the "one to all" report please, by the way, how awesome is this..WOW, thank you for sharing

1

Kristal Cravener Thanks for letting me know! It's an awesome program and displays the information beautifully compared to the PowerPoint slides that I've been creating (read: fiddling with). I know programming must be a nightmare with a project like this and it is grea... See More

Jason Cole BTW - Once all the kit numbers were entered (maybe 15 minutes of work to find and enter for the people listed here), this chart took about 2 minutes to adjust to my liking. I've tried making 1 McGuire chart for my grandfather's descendants only, and it took me hours, and I'm fairly tech savvy. Someone with no computer experiences? Probably not worth the time and effort. With this?? A chart is created in seconds, with you having the ability to lay it out how you want with a few clicks. Wow. Completely changed how we can represent our matches, and not just those with computer skills.

Zack Daugherty Awesome, just bought the program. What if most of the "interesting" matches are only at Ancestry and they haven't uploaded to GEDmatch (it is like pulling teeth to get people to do this).

37

Irene Morgan Very helpful again Pierre Clouthier

Like · Reply · 1d

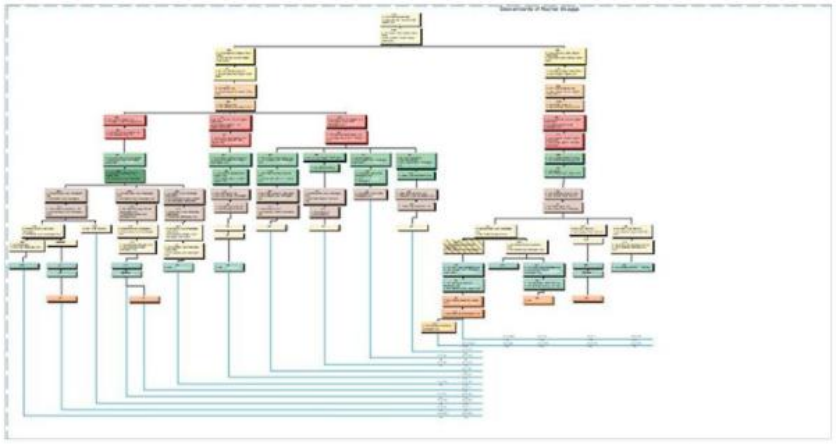
Blaine T. Bettinger Wonderful! I need to play with this ASAP!

Creator of the group

Linda Therkelsen Good idea!

Kristina Lynn Clever I downloaded the trial version to try it out and definitely need to buy this software. What a great charting tool!

Robert Lane added a new photo.
February 25 at 4:55pm



Kathy 'PK' Thompson I've used it for 4 years and made many a chart of all sorts with it.
The DNA McGuire chart is so new and I'm still fully setting up my base database that I've not yet had a fully successful run with it but I can see it will help me a huge amount

Like · Reply · 3w

1

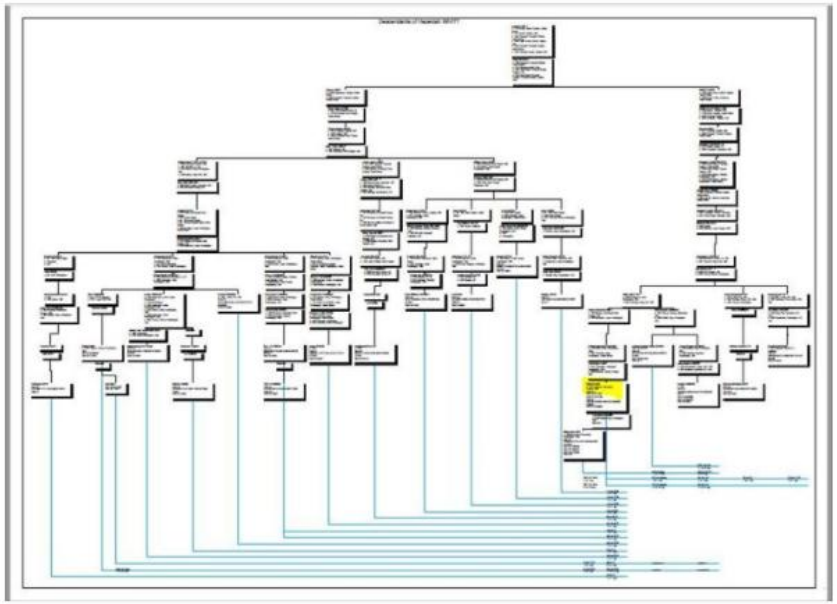
John Fassbender I really enjoy it. I initially got it to print a 50 foot long descendant chart on a plotter. Since then I like how you can batch print family group sheets pkys it can directly access multiple genealogy programs. Those that it can't, it can work directly with a GEDCOM. They keep improving it too. They are very responsive to questions.

Like · Reply · 3w

1

Robert Lane ▸ **Genetic Genealogy Tips & Techniques**
February 21 at 3:09pm ·

Pierre Clouthier has a winner here, amazing.



Like Comment

35