Chromosome Mapping Tips and Techniques

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Chromosome Mapping

Chromosome mapping is an autosomal DNA technique used to assign segments of DNA to an ancestor or ancestral couple based on sharing those segments of DNA with a known relative. In the case of tested ancestors (parents, grandparents, etc.), segments shared with the ancestor are easily mapped as having come from that ancestor. In the case of tested relatives who are not ancestors, segments are mapped to the ancestor or ancestral couple shared with that tested relative. Generally, the closer the relative the greater the number of shared segments.

Chromosome mapping can be complicated by factors such as endogamy, pedigree collapse, and other issues. It can be challenging to map segments for genetic matches that share several different family lines. Small segments (smaller than 7 cM) can also be an issue when chromosome mapping, as small segments may be false.

Testing Relatives

Almost any relative can be used for chromosome mapping. Siblings and children are generally not useful for chromosome mapping, as a full sibling shares both parents, a half-sibling shares one parent, and children inherited your DNA. Beyond that, however, other relatives sharing DNA with you can help you map your segments. For example, segments shared with the following cousins can be mapped as described:

- Full first cousins – segments mapped to shared set of grandparents;
- Half cousins – segments mapped to a set of shared great-grandparents;
- Full second cousins – segments mapped to a set of shared great-grandparents;
- Half second cousin – segments mapped to a set of shared great-great-grandparents;
- And so on!

Segment Data

Chromosome Mapping relies on **segment data**, which is information about the piece(s) of DNA that two people share. Typically, segment data includes a chromosome number, start location, stop location, segment size, and perhaps the number of tested SNPs in the segment.

Name of the Match	Chromosome Number	Starting Position	Ending Position	Size of the Segment	Number of SNPs
Julio G.	3	14,409,980	25,297,332	12 cM	1,437

The main sources of segment data from the following companies or third-party tools:

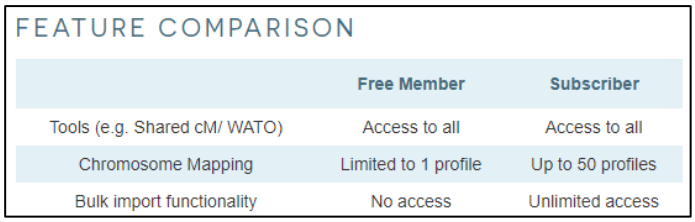
- 23andMe (www.23andMe.com)
- Family Tree DNA (www.FamilyTreeDNA.com)
- GEDmatch (www.GEDmatch.com)
- Living DNA (www.LivingDNA.com)
- MyHeritage (www.MyHeritage.com)

AncestryDNA does not provide segment data to test-takers. However, if both matches transfer to GEDmatch or another testing company, they can obtain that segment data. For the latest information about transfer options, see "What's New in Autosomal DNA Transfers" from Leah Larkin (https://thednageek.com/whats-new-in-autosomal-dna-transfers/).

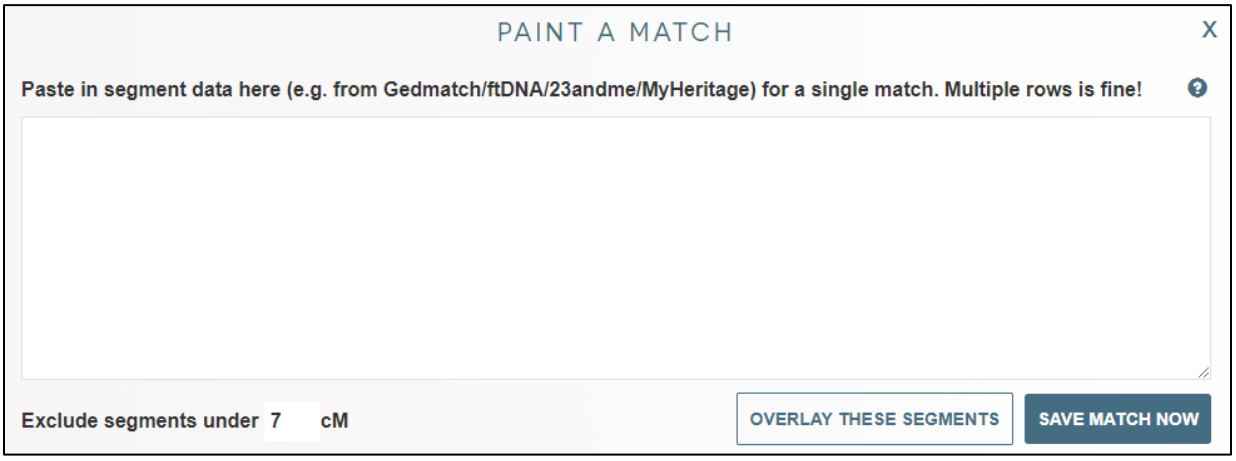
DNA Painter (https://dnapainter.com/)

DNA Painter is a website that allows you to assign shared segments of DNA to a map of your chromosomes. The site also offers powerful tools to estimate your relationships to unknown matches.

The site is created and managed by Jonny Perl of London, a programmer and active member of the genetic genealogy community. DNA Painter has a FREE MEMBER level and a SUBSCRIBER level. Free members have a single DNA map, while Subscribers can have up to 50 DNA maps.

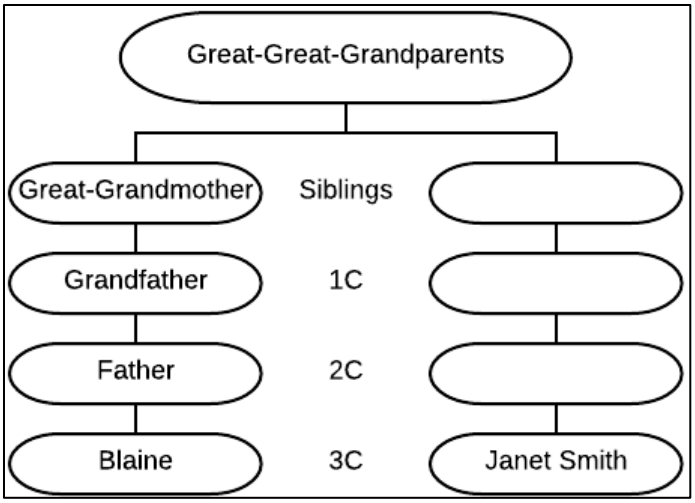


DNA Painter accepts segment data from all the sources listed above (23andMe, Family Tree DNA, GEDmatch, Living DNA, and MyHeritage). To "paint" DNA onto your chromosomes, click on the PAINT A NEW MATCH button, and a pop-up will appear:



I call this the "**FEED ME**!" pop-up. What do we feed this pop-up? We feed it segment data from 23andMe, Family Tree DNA, GEDmatch, Living DNA, or MyHeritage!

Let's use an example from GEDmatch to paint **the segments of DNA I share with a *third cousin* called Janet Smith** who has also transferred her raw data to GEDmatch.



Since Janet Smith and I are third cousins (see the brief family tree to the right), I can hypothesize that all our shared DNA came from our shared ancestors, our great-great-grandparents. Of course, this requires that the shared great-great-grandparents are our only recent connection!

GEDmatch.Com Autosomal Comparison

Comparing Kit A123456 (*B.B.) and M123456 (Janet Smith)

Minimum threshold size to be included in total = 500 SNPs
Mismatch-bunching Limit = 250 SNPs
Minimum segment cM to be included in total = 7.0 cM

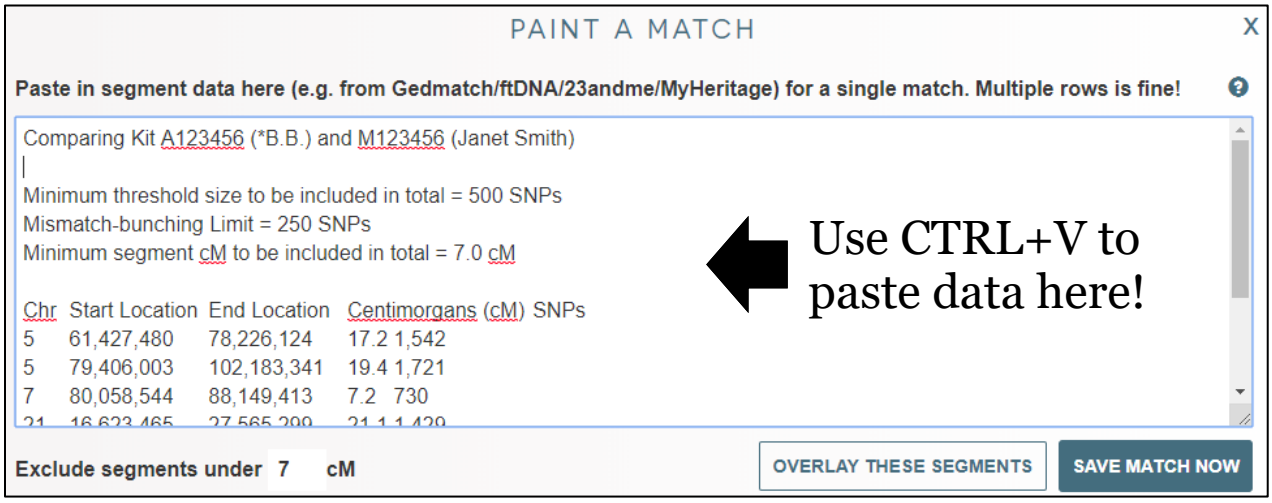
Chr	Start Location	End Location	Centimorgans (cM)	SNPs
5	61,427,480	78,226,124	17.2	1,542
5	79,406,003	102,183,341	19.4	1,721
7	80,058,544	88,149,413	7.2	730
21	16,623,465	27,565,299	21.1	1,429

Largest segment = 21.1 cM
Total of segments > 7 cM = 64.9 cM
4 matching segments
Estimated number of generations to MRCA = 3.9

STEP 1: Obtain the Shared DNA Segment Data. At GEDmatch, the One-to-One Comparison tool reveals that we share four segments of DNA with a total of 64.9 cM of shared DNA. Since I know our shared ancestry (those great-great-grandparents in the family tree above), on MY own DNA map, I can assign ALL of these segments to these shared ancestors.

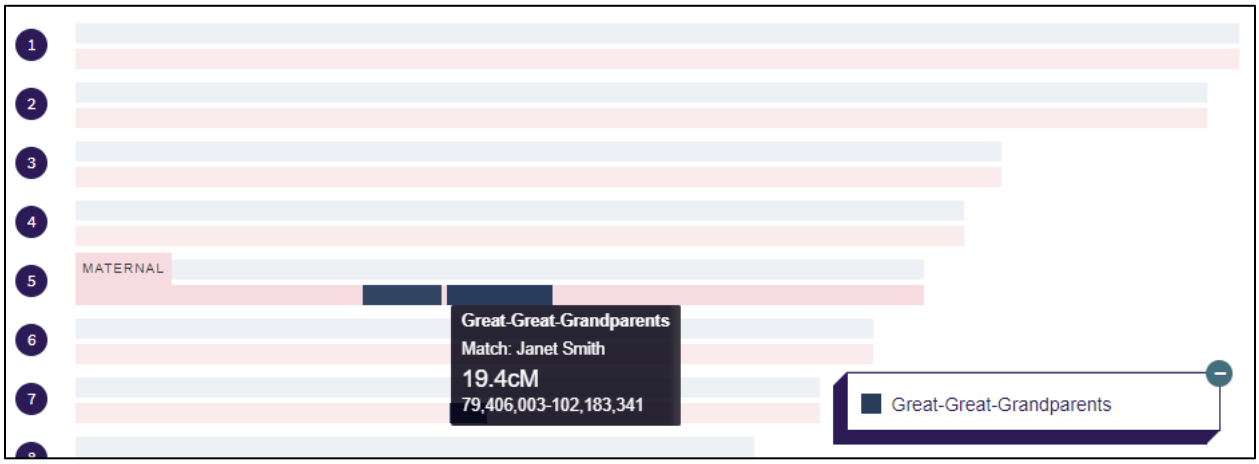
STEP 2: Copy the Shared DNA Segment Data. Now I can copy this segment data. Thankfully, the FEED ME! pop-up from DNA Painter has been designed to accept cut&paste raw data! So I'll just use CTRL+A to highlight the entire page, and then I'll use CTRL+C to copy the entire page.

STEP 3: Paste the copied segment data into the FEED ME! pop-up from DNA Painter:



STEP 4: Provide information about the shared segments. What match did you use to get this information? Who are the common ancestors? What side of the family (Maternal or Paternal)?

Once you provide this information, the segments will be mapped onto your own personal chromosomes! Here we see the two segments on chromosome 5:



During this lecture we will examine some tips for chromosome mapping, including how to find matches to map, which matches are best, and much more!

In addition to the chromosome mapping we discussed above, DNA Painter has several other powerful features that we will examine during this lecture, including the following:

- **Shared cM Project tools** – examine potential relationships based on the total amount of DNA those test takers share in common (based on the Shared cM Project)
- **Bulk Import** – import ALL shared segments from a testing company!

DNA Painter Resources

- The DNA Painter Facebook Group ("DNA Painter User Group"): https://www.facebook.com/groups/127620554606673/
- DNA Painter YouTube Video (Blaine Bettinger): https://youtu.be/wyjcJxywTZI
- The DNA Painter tools: https://dnapainter.com/tools
- DNA Painter Articles from a variety of authors/bloggers/genealogists: https://dnapainter.com/help/articles