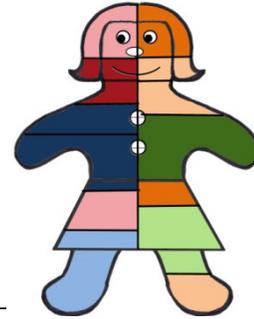


DNA Painter—Part 1: Chromosome Mapping & Analysis Tool

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INTRODUCTION TO DNA PAINTER

DNA Painter is a website created by Jonny Perl of London, England, providing tools to help with autosomal DNA analysis.¹ The site also provides access to tools created by others, with permission of the creator, and sometimes modifies or automates the tool using rights granted through a Creative Commons license.² These additional tools include the Shared cM Project³ by Blaine T. Bettinger and What Are the Odds? (WATO)⁴ by Leah LaPerle Larkin. Access is free for the basic tools. Some useful features require a subscription.

There is an ongoing discussion in the genealogical community about whether genealogical databases should be available to law enforcement investigators and researchers working with law enforcement when no warrant or subpoena compels a company to allow access. At this time, this is not an issue with DNA Painter. Data imported to an account is only available to the account holder unless explicitly shared with another person. Additionally, raw DNA data is not uploaded to DNA Painter; only the

1All URLs accessed on 25 May 2019.

Jonny Perl, *DNA Painter* (<https://dnapainter.com/>) and *Facebook* (<https://www.facebook.com/dnapainter/>).

2 For an explanation of Creative Commons licenses, see “About The Licenses,” Creative Commons (<https://creativecommons.org/licenses/>).

3 Jonny Perl, “The Shared cM Project 3.0 tool v4,” *DNA Painter* (<https://dnapainter.com/tools/sharedcmv4>) based on Blaine T. Bettinger, “Shared cM Project,” *The Genetic Genealogist* (<https://thegeneticgenealogist.com/>). Search Bettinger’s blog posts for the most recent update to the project such as the August 2017 update at <https://thegeneticgenealogist.com/2017/08/26/august-2017-update-to-the-shared-cm-project/>. The project charts are periodically updated with an update expected in 2019.

4 Jonny Perl, “What Are the Odds?,” *DNA Painter* (<https://dnapainter.com/tools/probability>) based on Leah LaPerle Larkin, “Science the Heck Out of Your DNA - Part 7,” *The DNA Geek* (<https://thednageek.com/science-the-heck-out-of-your-dna-part-7/>) with links to parts 1 through 6.

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information about shared matches is needed and aliases can be used in place of real test taker names when privacy is a consideration.

This article gives enough information to get started using DNA Painter to analyze DNA matches and map shared segments. More advanced features may be covered in future articles.

ACCESS AND PROFILES

An account must be created before the site can be used. Access the website (<https://dnapainter.com/>) and click on “Register for a free account.” Enter first and last name with a valid email address. Choose a unique user name and a password for the account, read the “Terms and Conditions” and click the box indicating agreement, then click “Sign me up.” Once the account is setup then login anytime to access the tools and any data entered and saved.

A profile will contain the matching DNA data for one person and any matching test takers for that profile person. Click on “Create a new profile” to create the first profile. Free accounts are allowed only one profile. Subscriber accounts are allowed multiple profiles that can be used for DNA analysis for matches of other relatives, to have one profile for research or speculative analysis and one where only confirmed analysis is entered, or any other use the account holder wishes.

Each profile must be given a name and gender specification. The name can be anything the account holder wishes to use—a real name or an alias. Gender selection determines how many X chromosomes are displayed on the chromosome map. Click “Save and start painting” to display the blank chromosome map for the new profile. Twenty-two chromosome pairs are displayed with the paternal chromosome in blue and the maternal chromosome in pink. The twenty-third chromosome is the X; one chromosome is shown for male gender profiles and a pair is shown for female gender profiles. Click to add a description defining this profile’s use as shown in figure 1—“John’s paternal grandfather Smith.”

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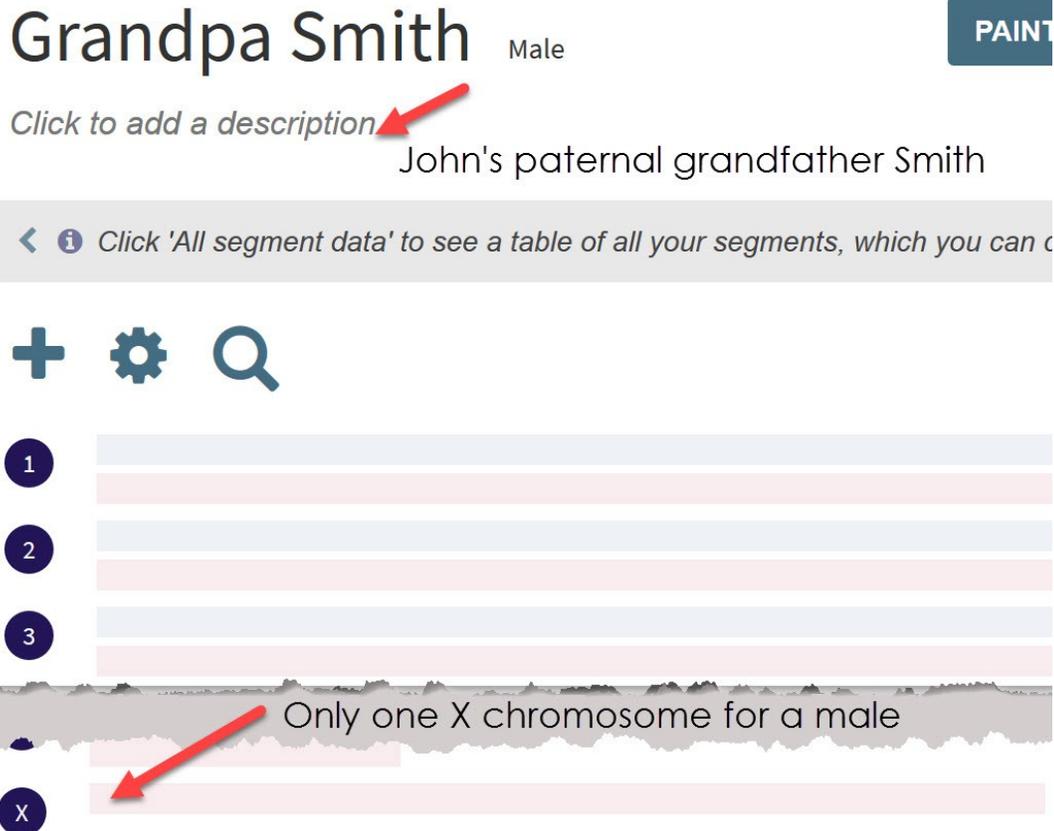


Figure 1. DNA Painter new profile showing profile name (Grandpa Smith), gender (Male), one X chromosome for a male, and a description for the profile (John's paternal grandfather Smith)

GETTING HELP

DNA Painter has online help with a clickable link at the top of the page as shown in figure 2. In addition to the online help, many genealogy bloggers have written about how they use DNA Painter. Those posts can be found using a Google search.



Figure 2. DNA Painter navigation bar

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IMPORTING SEGMENT DATA AND CREATING A CHROMOSOME MAP

In the ensuing discussion, the profile person is the test taker for whom this profile was created. The focus match is one test taker from the profile person's match list.

After creating a profile the DNA segments can be mapped for matches where the common ancestor is known. Start with a focus match—a known cousin who shares only one ancestral line or ancestral couple with the profile person. Mapping is more difficult when test takers share multiple ancestral lines. The match data is the shared segment detail data such as chromosome number, start and stop point of matching segments, and segment length. Users who do not know how to access the segment or match data needed to paint the chromosome map can check out the “Where do you find the match data?” help page.⁵ AncestryDNA does not provide the segment details; AncestryDNA test takers who have uploaded their raw test file to another site should be able to access segment data at the upload site.

Clicking “Paint a New Match” pops up a box into which the user pastes the data on matching segments between the profile person and the focus match. An option is available to specify the size of small segments that should be ignored. Segment size was reduced to 5 cM in figure 3. DNA Painter also ignores extraneous fields pasted into the box; however, edit data with care or an error may cause the import to fail, for example, if invisible field separators are accidentally removed. The profile person and the focus match person share two segments on chromosome 6 and that segment data was pasted into the box as seen in figure 3.

⁵ “Where do you find the match data?” *DNA Painter*
(<https://dnainter.com/help/matchdata>).

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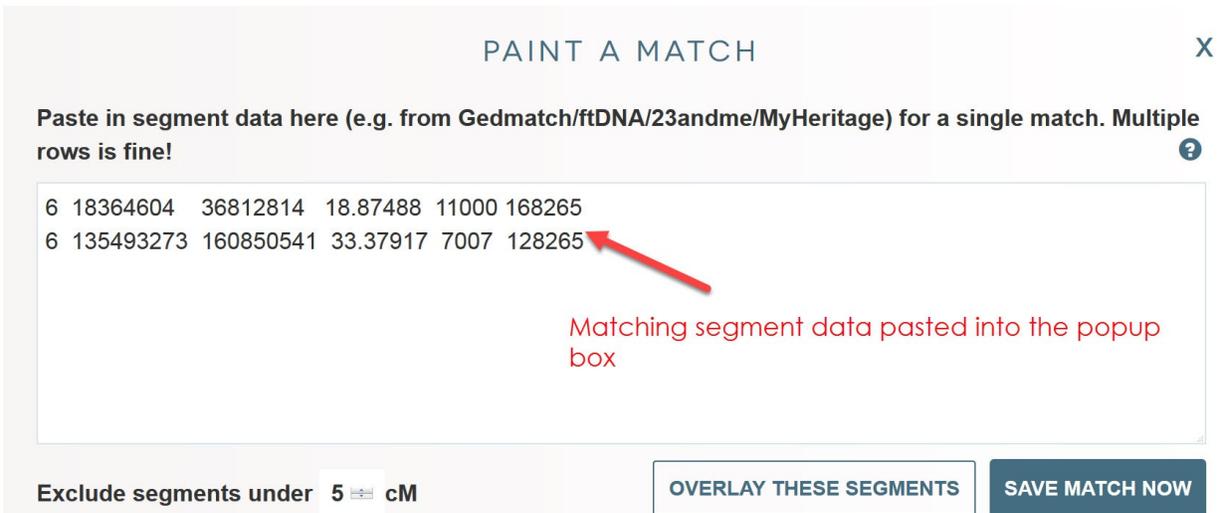


Figure 3. Matching segment data pasted into the “Paint a Match” popup box

Two options are available after pasting in the matching segment data. When additional analysis is needed to be sure of the common ancestor then “Overlay These Segments” can be clicked to analyze and confirm the match before saving the match or discarding it. When the user is certain of the relationship between the profile person and the focus match then “Save Match Now” can be clicked and information about the common ancestors can then be entered.

Figure 4 illustrates adding a match where the relationship or connection between the profile person and the match is known. John Smith is the name (or alias) of the match. A freeform note field indicates “John Smith is descended from Hettie (Parker) Smith, the sister of Henry Parker Jr.” Users can enter any useful information into this field. The bottom of figure 4 shows a slider bar that can be modified to indicate the surety or certainty level of the segments entered for this match. Lesser certainty levels paint the chromosome map in lighter shades of the color selected in figure 5.

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SAVE MATCH

We found **1** segment in your match data (excluding segments under 5cM).

Describe your connection to this match:

I know how I'm connected to this match

I don't yet know how I'm connected to this match.

Enter the name of your DNA match

Optional – This is just so you can identify the source of this segment in future. You could also enter their DNA kit number or username.

John Smith

– Add details about these match segments

Segment / Match Notes

Optional - add notes to describe this match

John Smith is descended from Hettie (Parker) Smith, the sister of Henry Parker Jr.

Adjust the certainty level for these segments

Certain (triangulated or close relative)

Figure 4. Part 1 of Save Match Screen

Scrolling down the screen the user sees, as shown in figure 5, a freeform field for entry of the names of a common ancestor or ancestral couple. In this example, the user enters 04-HParkerJr-NBlack (P), but each user chooses a format that works for his or her research methods. In this case, 04 represents an ancestral couple four generations back from the profile person (second-great-grandparents), HParkerJr is Henry Parker Jr., and NBlack is Henry's first wife Nancy Black. The (P) represents a paternal line; this indicator is not strictly needed, but it is a carryover from this user's organizational method used in other tools.

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Scrolling further down the screen shown in figure 5, the user chooses whether this match is on the profile person's paternal or maternal side, to assign a specific color for mapping segments assigned to this ancestral couple, and optionally, enter data in another freeform notes field that is blank in this example.

If you know how you are connected, you can label these segments with the name of the ancestor you got them from.

+ More info

Enter your ancestor's name (or the name of the couple)

If you have multiple ancestors with the same name, you might like to include their birth year.

04-HParkerJr-NBlack (P)

Is this match on your mother's side or your father's?

*Each pair has one chromosome from your father and one from your mother.
Do these segments look like they're from the maternal or paternal side?
(if you're not sure, you can just select "Not sure")*

Paternal

Colour

Blue

Notes for this group

Optional - add notes to describe this ancestor or group

SAVE MATCH

Figure 5. Part 2 of Save Match Screen

After clicking "Save Match" the chromosome map will show the segments that were just mapped and any segments mapped earlier. Figure 6 shows a map after multiple matches have been mapped, some sharing Henry Parker Jr. and Nancy Black, some sharing the ancestor one generation further back, Henry Parker Sr. and his unnamed wife.

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Figure 6. Chromosome map after saving several matches

Figure 7 illustrates how a popup displays information about a segment when the mouse is hovered over the mapped segment. The top image shows what happens when the mouse hovers over the right side of the segment matching Candy. The bottom image shows what happens when the mouse hovers over the left side of the segment matching Jack. The popup displays shared ancestral line, the name or alias of the match, the total amount of DNA shared between the match and the profile person, and the start and stop points of the shared segment. Figure 7 shows that an overlapping segment may appear to be for one match, but hovering at different locations on the painted segment will display a different popup for each person sharing the segment: Candy shares a longer segment (lighter blue) that overlaps the segment shared with Jack (darker blue). Only a tiny portion of the dark blue can be seen in the top image just left of the arrow.

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Figure 7. Chromosome map showing popup seen when hovering over a segment and how overlapping segments may be displayed

The overlapping segments are more clearly displayed using the “Overlay These Segments” display as shown in figure 8. Each segment is shown on a separate line in this display mode. This makes it easier to see overlapping segments that may lead to triangulated segments with more matches and more analysis.

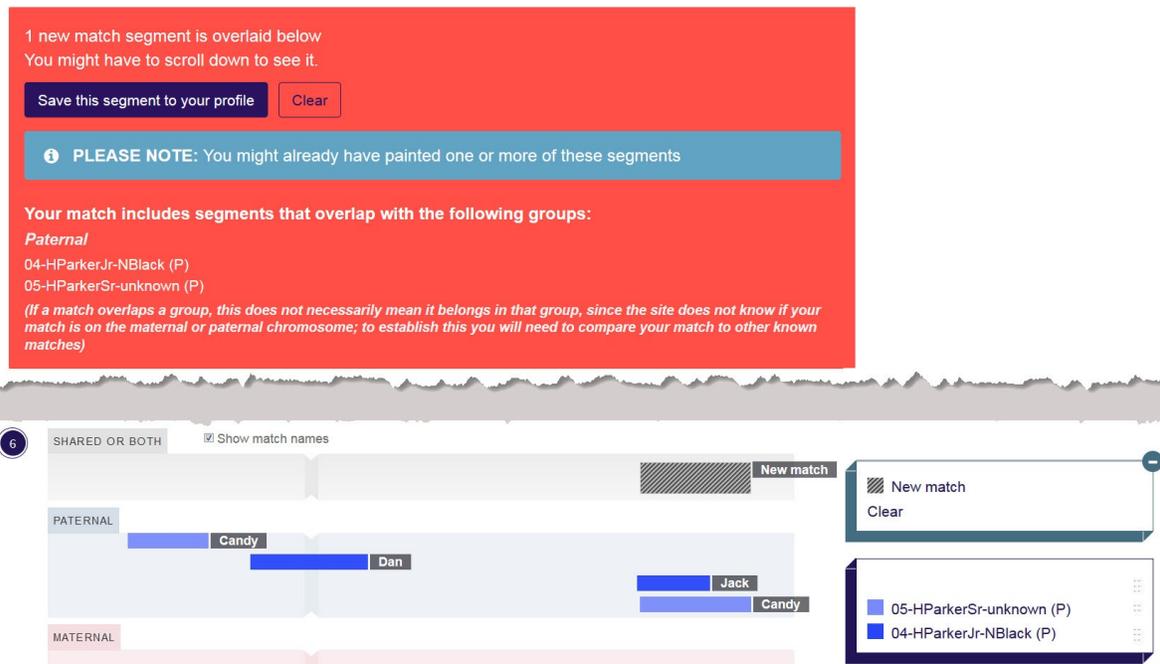


Figure 8. Overlay These Segments display

CONCLUSION

DNA Painter is a powerful tool for X chromosome and autosomal DNA analysis. Powerful tools require an investment in time to learn proper use of all of the features, but DNA Painter should be well-worth that investment. This article introduces DNA Painter accounts, profiles, and basic features to get a researcher started. Use the online help and genealogy blog posts, as well as future articles, to learn more about this exciting and useful tool for DNA analysis by genealogists.

Debbie Parker Wayne, CG, CGL, is a board-certified genealogist experienced using DNA analysis and traditional techniques for family history research. Debbie edited the book and authored one chapter of *Advanced Genetic Genealogy: Techniques and Case Studies*; coauthored the award-winning DNA workbook, *Genetic Genealogy in Practice*; and developed the online, self-paced course *Continuing Genealogical Studies*:

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Autosomal DNA, offered by National Genealogical Society. She is the DNA Project Chair for the Texas State Genealogical Society and the Early Texans DNA Project. Her publications include columns on DNA analysis for several genealogical journals and magazines including the *Stirpes* journal of Texas. Debbie was the course coordinator for the first beginner and intermediate DNA courses offered at four major US genealogy institutes. See <http://debbiewayne.com/> for more information and for archived versions of many of her articles.

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