

DNA Basics

Using DNA for Family History

(presented to CFA 2019 annual meeting)

John F. Chandler

Glossary

- (see <http://edmund-rice.org/dnagloss.htm>)
- DNA = Deoxyribonucleic Acid = blueprint of life
- Base = Nucleotide = smallest unit of DNA, one of four possible units, denoted as A, C, G, or T
- Marker = Locus = any identifiable feature on the DNA chain
- STR = Microsatellite = marker consisting of repeating sequences, characterized by the number of repeats, e.g., 15

Glossary (cont.)

- Mutation = any change in DNA sequence
- Chromosome = major grouping of DNA, visible at certain stages of cell division
- Y Chromosome = determines maleness
- mtDNA = Mitochondrial DNA = DNA found in cell components responsible for energy production (maintained outside the cell nucleus) – *much* slower mutations than Y STRs

Why Y?

- Usable for genealogy
 - Inherited from just one parent, no confusion
 - Inherited from just one grandparent, etc.
 - Traces an entire lineage
- Contrast with the rest of the DNA
 - Comes in pairs, one copy from each parent
 - The pairs are reshuffled and randomly subdivided at each generation -- may have no genes at all from a given distant ancestor

Chandler DNA Project

- 532 members tested as of Sept. 1
 - 505 tested at FTDNA for Y DNA
 - 27 tested elsewhere for Y DNA
- 14 test kits bought, but not distributed
- 16 test kits sent and never returned
- 47 members have also tested mtDNA
- 104 members have also done autosomal

DNA Applications

- Exciting parts
 - Genealogy
 - “Deep Ancestry” (beware!)
- “Scary parts” (not relevant here)
 - Forensics
 - Health screening

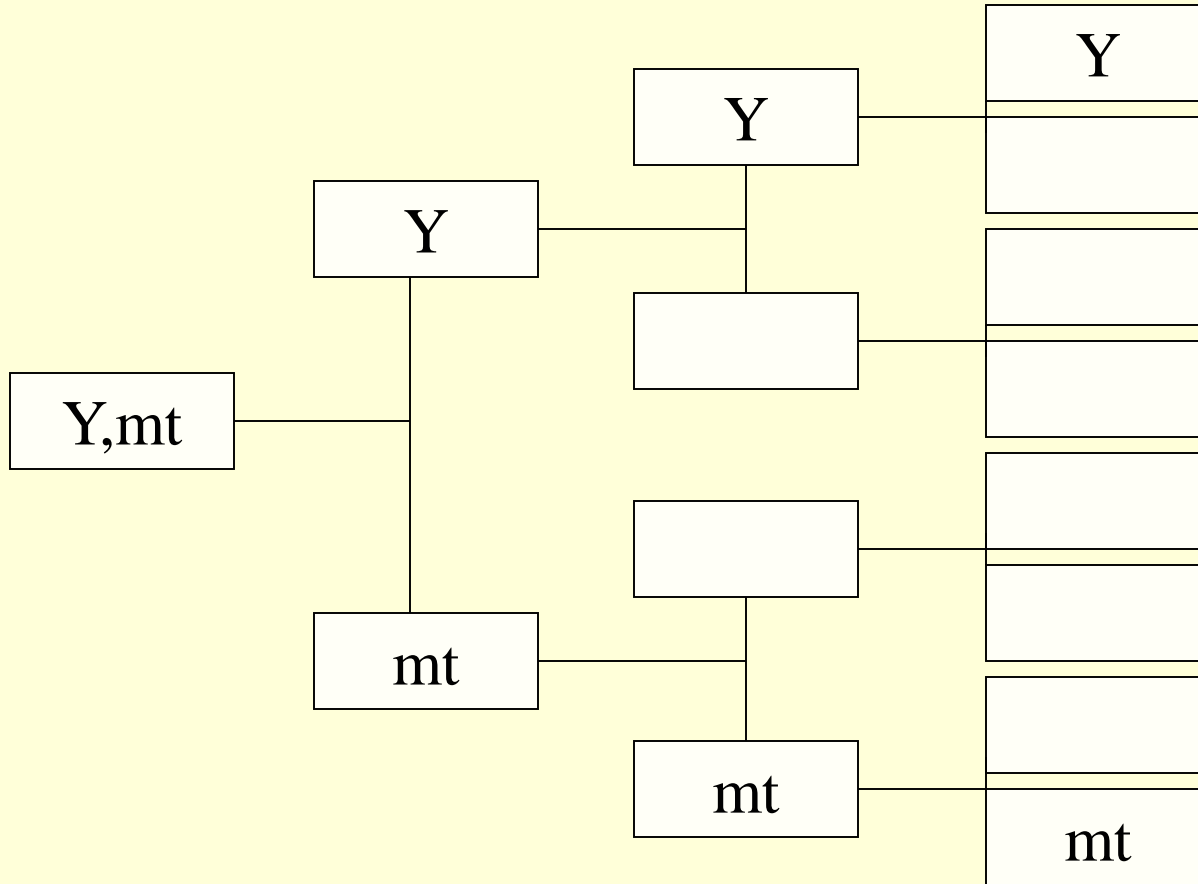
Scary DNA Applications (we don't do these)

- Forensics
 - Criminal identification
 - Paternity and other relationship testing
- Health screening
 - Diagnosis
 - Prediction

Genealogical DNA

- Male lines
 - Y DNA parallels surnames
 - Chandler DNA project, for example
 - Crucial need also for conventional genealogy
- Female lines
 - mtDNA inherited only from the mother
 - Crucial need also for conventional genealogy
- Mixed lines
 - Still under development

DNA on the pedigree



Y DNA Genealogy

There are thousands of active surname projects at FTDNA. At one time, there were six different projects for SMITH, plus two for SCHMIDT (now just 3+1). There are also projects for Allen, Bates, Chandler, Drury, Ewing, Farmer, Grant, Hastings, and so on. Generally, any male with the specified surname, or a variant, is eligible for membership in a project.

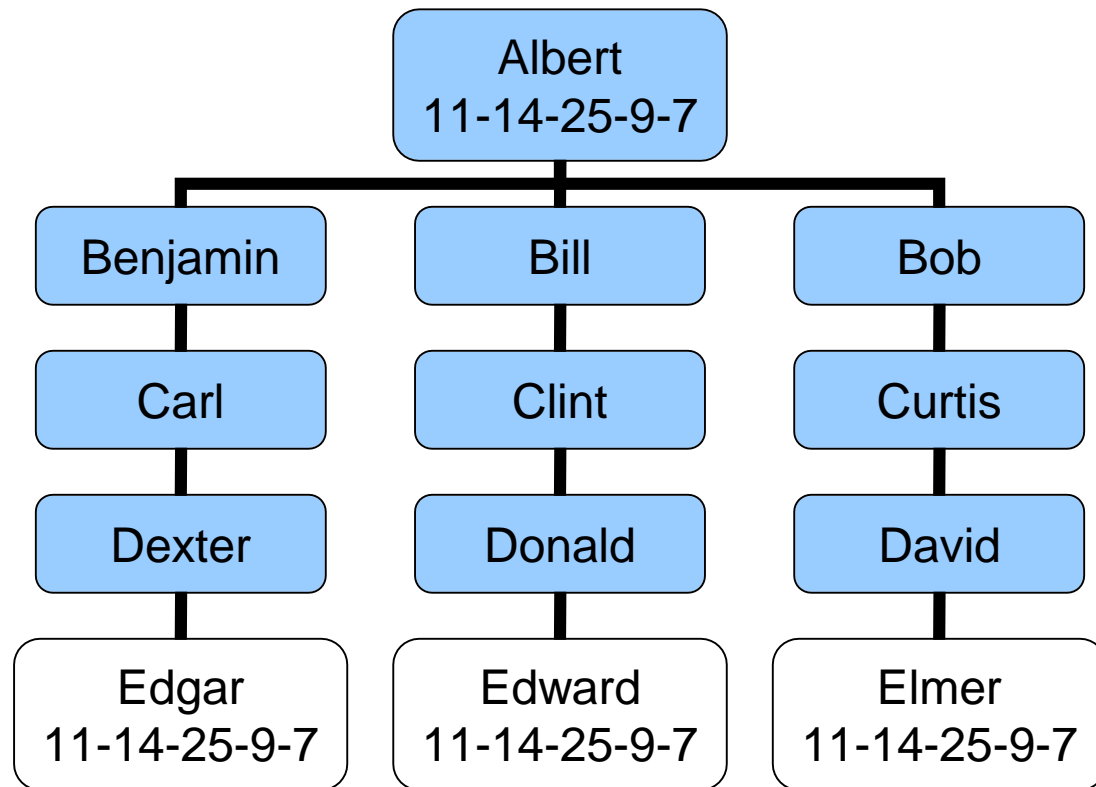
Y DNA Examples

1. Research validation – support or refute connections based on limited evidence
2. Lineage organization – discover at last which families are related
3. Desperately seeking cousins – breaking through “brick walls”
4. Wide-open exploration – all of the above

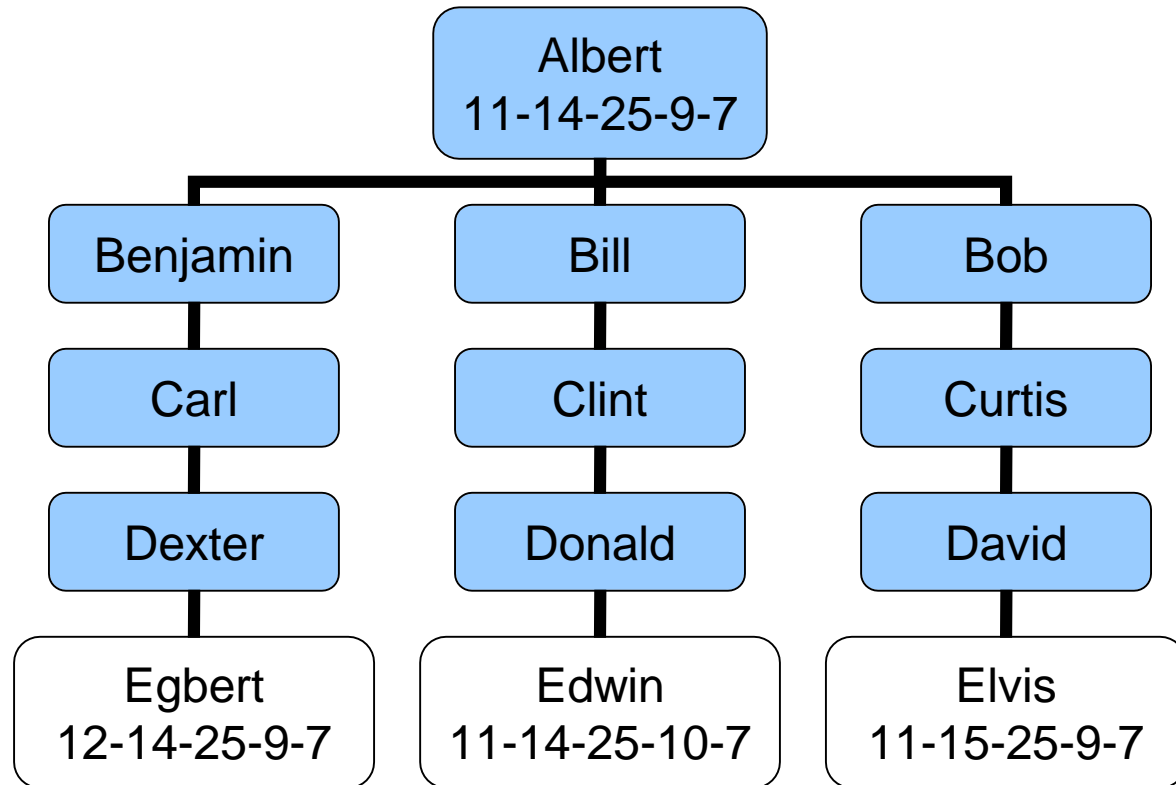
Y DNA Tools I

- Comparison of DNA patterns among testees who are “known” to be related.
- This applies to (1) Research validation.
- Assume, as in our project, that we start with volunteers who have documented lineages back to a common ancestor.
- We examine the numeric results, looking for agreement.
- Need more conventional genealogy if mismatch.

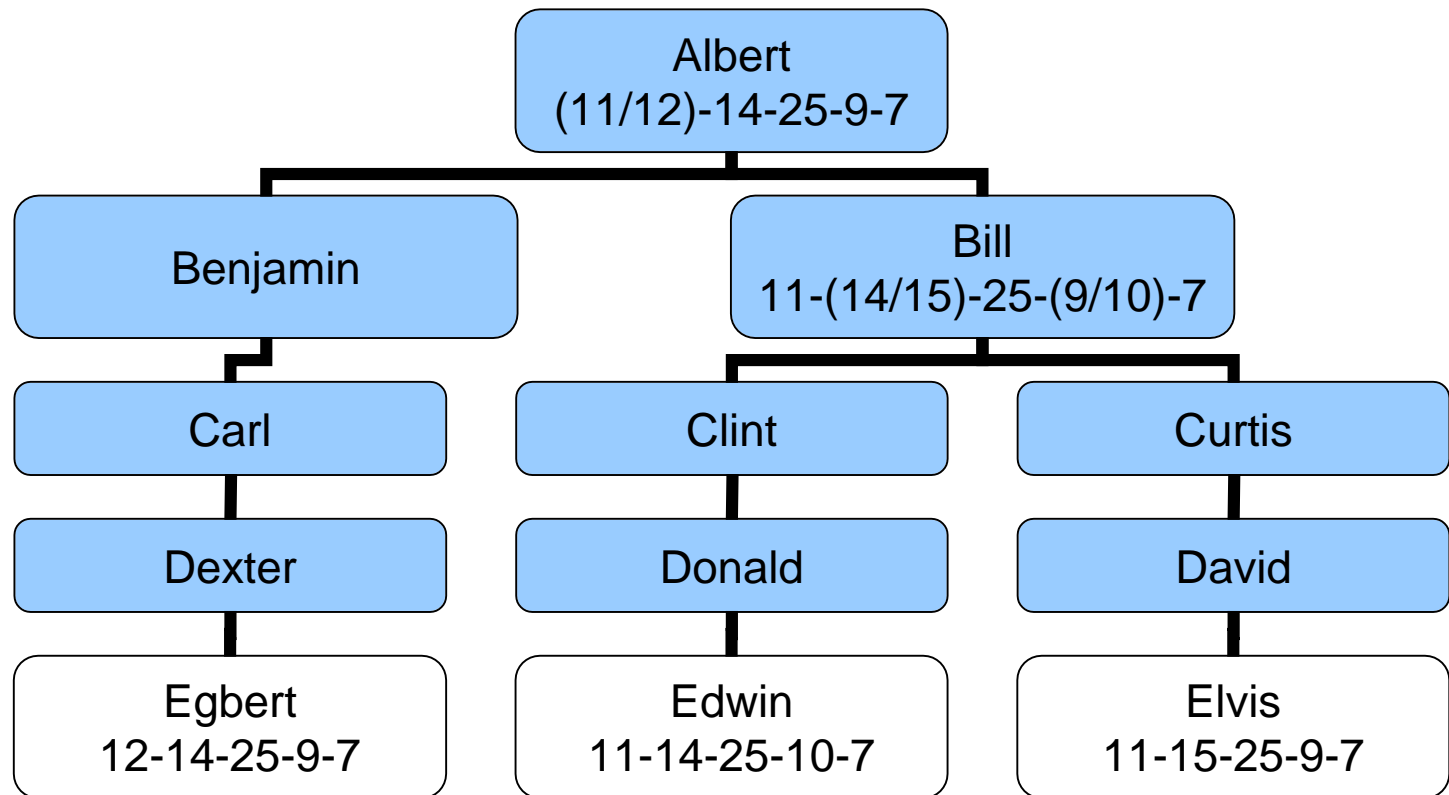
Reconstructed Ancestral Patterns (unanimity)



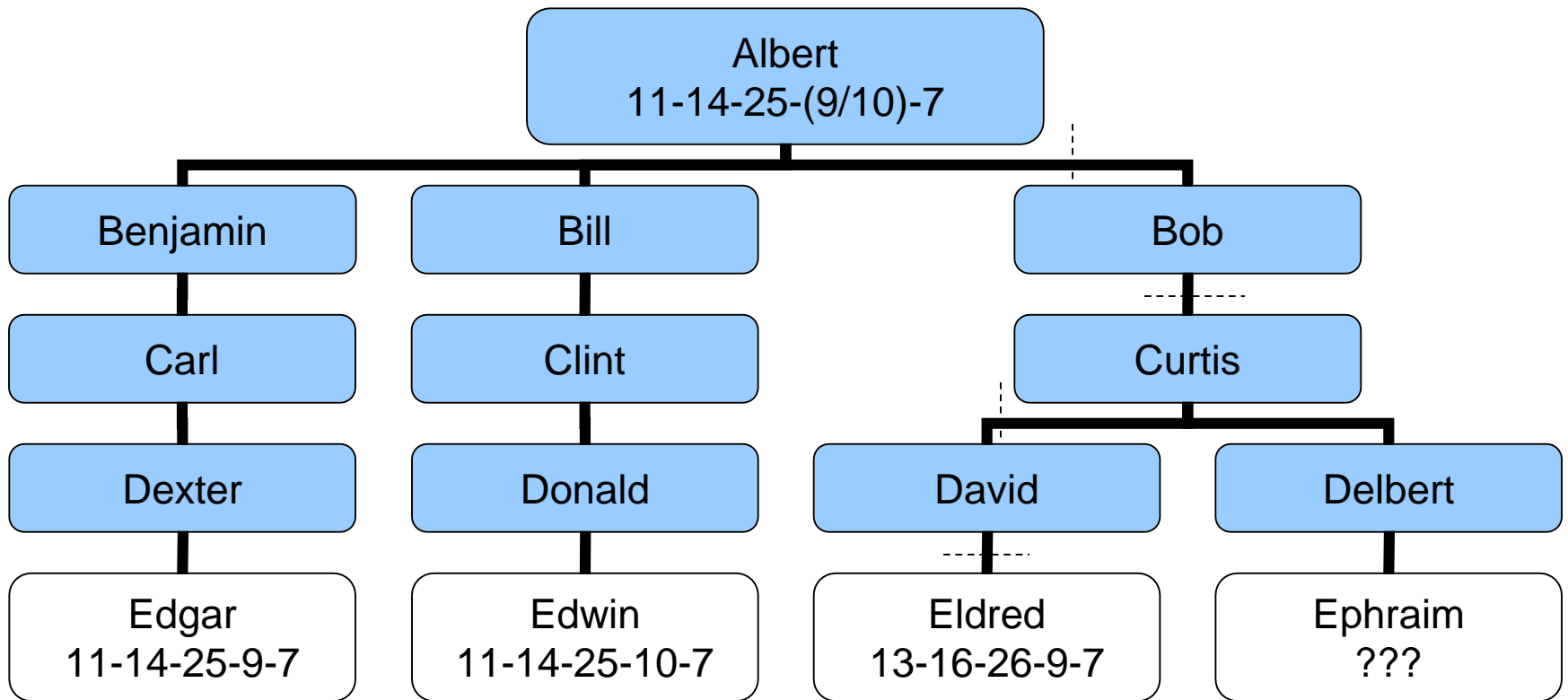
Ancestral Patterns II (majority rule)



Ancestral Patterns III



Ancestral Patterns IV (surprise!)



Summary of dummy DNA results

Edgar	11	14	25	9	7
Edward	11	14	25	9	7
Edwin	11	14	25	10	7
Egbert	12	14	25	9	7
Eldred	13	16	26	9	7
Elmer	11	14	25	9	7
Elvis	11	15	25	9	7
Ezekiel	11	14	25	10	7

Y DNA Tools II

- Comparison of DNA patterns between a known tree and a new testee.
- This applies to (2) Lineage organization, and (3) Desperately seeking cousins.
- Assume that we have a reconstructed ancestral pattern and now test Ezekiel as 11-14-25-10-7.
- We may be able to assign him to a branch.

Y DNA Tools III

- FTDNA supplies the project administrators with reports that list
 - genetic “distances” between any selected participant and all the rest
 - expected dates of all pending test results
 - dates of all past results
 - all participants, including those who haven’t sent their test kits in yet

Y DNA Tools IV

- Upload results to a public database and/or look for matches on-line
- This applies mainly to (3) Desperately seeking cousins, but it works both ways!

Y DNA Tools V

- If you are female, recruit a male relative to take the DNA test on your behalf
- This can apply to any of the DNA examples

mtDNA Genealogy

- Everyone has mtDNA, not just females, but males do not pass mtDNA to children
- Essential to have conventional research done in advance (or be very lucky)
 - no natural gathering places for probable kin
 - lower resolution in mtDNA test results
 - maternal line research is harder

Autosomal Genealogy

- Characterized by short time window
- Can follow male, female, and mixed lines
- Can turn up long-lost cousins