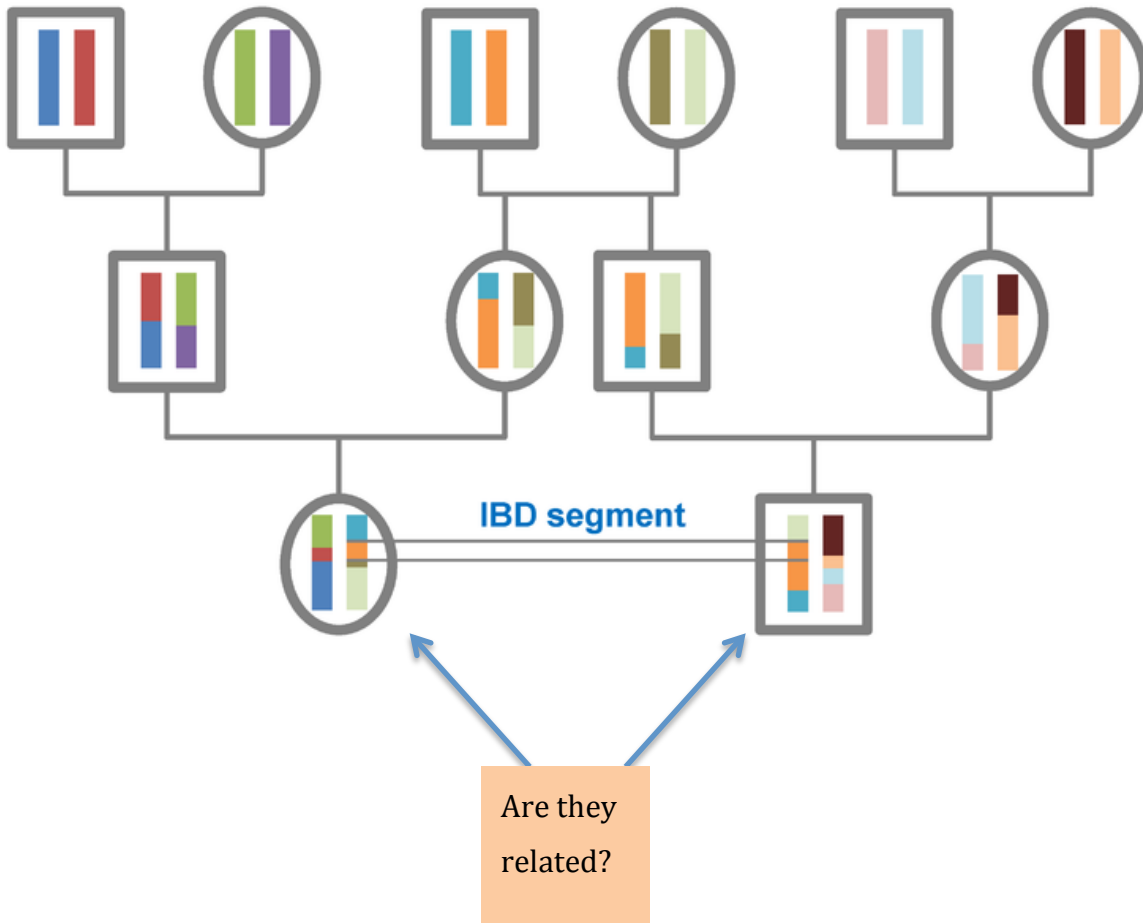


## Identity by Descent & Identity by State

Definition: The phenomenon of that two or more than two individuals who share similar nucleotide sequences is identical by state, meanwhile, if they inherit the similar nucleotide sequences from a common ancestor, IBS is identical by descent (IBD).



The measurement of SNPs by high density microarrays can provide information about the genotypes among many loci. SNP genotypes of two individuals can be compared in terms of IBS, in which two individuals are observed to have identical 0, 1, or 2 alleles at a given location. These alleles could also be IBD if 0, 1, or 2 alleles are inherited from a recent common ancestor, or they may be identical by chance because the allele is very frequent in the population.<sup>22</sup>

Individual 1	Individual 2	IBS State, Z
AA	AA	2
AA	Aa	1
AA	aa	0

Percent identical= $P(Z=1)/2+P(Z=2)$

$$\text{IBS distance} = \frac{(\text{Number of markers with IBS state 2}) + (0.5 * \text{number of IBS state 1})}{\text{Number of non-missing markers}}$$

Number of non-missing markers

Patients	ISLE JE 1	ISLE JE 2	ISLE JE 3	ISLE JE 4	ISLE JE 5	ISLE JE 6	ISLE JE 7	ISLE JE 8	ISLE JE 9	ISLE JE 10
ISLE JE 1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISLE JE 2	0.00	1.00	0.00	0.05	0.19	0.13	0.00	0.14	0.04	0.04
ISLE JE 3	0.00	0.00	1.00	0.00	0.05	0.04	0.00	0.00	0.00	0.07
ISLE JE 4	0.00	0.05	0.00	1.00	0.07	0.07	0.00	0.08	0.00	0.12
ISLE JE 5	0.00	0.19	0.05	0.07	1.00	0.09	0.00	0.14	0.00	0.04
ISLE JE 6	0.00	0.13	0.04	0.07	0.09	1.00	0.34	0.27	0.07	0.30
ISLE JE 7	0.00	0.00	0.00	0.00	0.00	0.34	1.00	0.52	0.00	0.33
ISLE JE 8	0.00	0.14	0.00	0.08	0.14	0.27	0.52	1.00	0.03	0.21
ISLE JE 9	0.00	0.04	0.00	0.00	0.00	0.07	0.00	0.03	1.00	0.03
ISLE JE 10	0.00	0.04	0.07	0.12	0.04	0.30	0.33	0.21	0.03	1.00

**Parent - Offspring = 50%**  
**Full-siblings = 50%**  
**Half-siblings = 25%**

Expected-pedigree

Observed genome

It's the same with itself

### IBD Heat Map and Mating Decision.

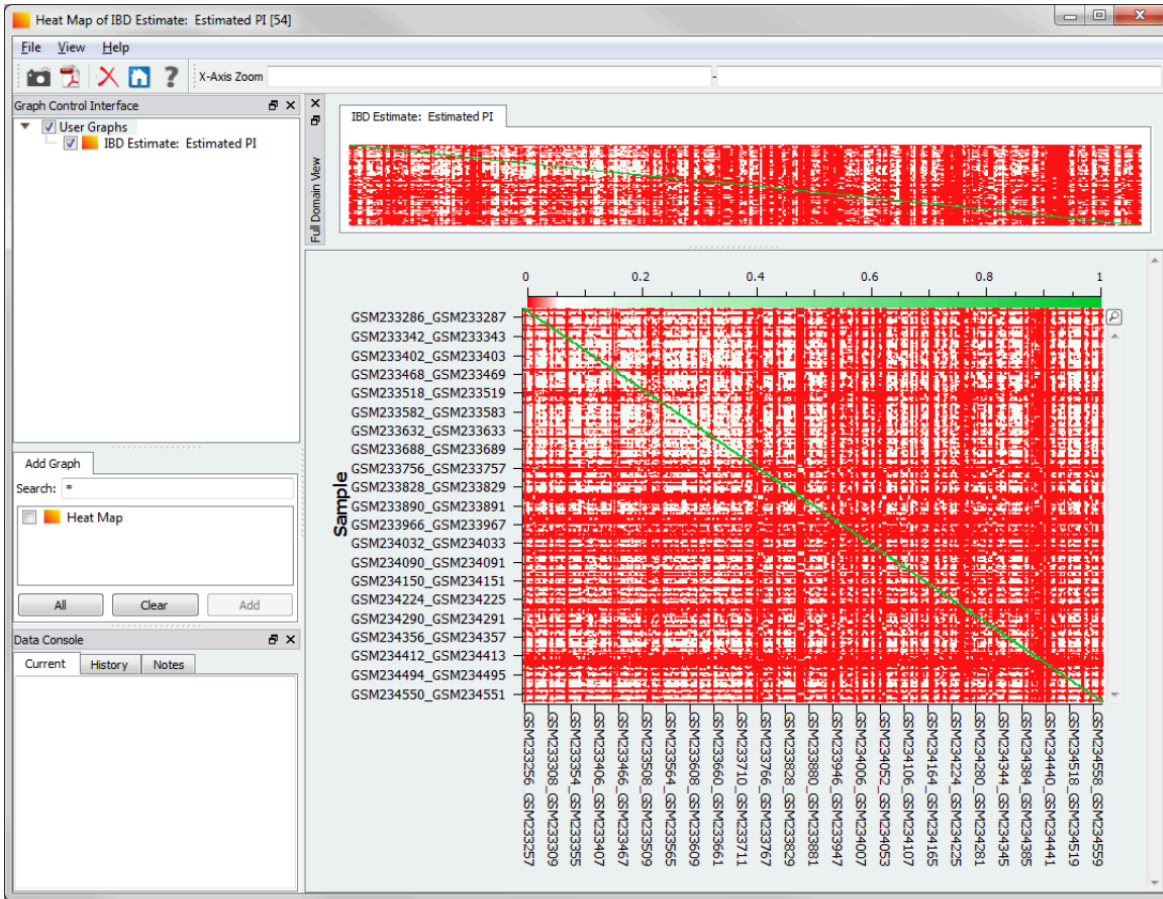


Figure 4-1. Default heat map of IBD PI estimates

