21st. February 1947.

Dear Race,

I enclose a fitting for the Egyptian data with the method written out so that it can be applied to a longer series when you have one. It is applicable so long as phenotypes indicating the rarer gene complexes have not appeared.

You are quite right that R_1 is high in this series, though I should expect R_0 to increase at the expense of R_1 in a negro or Bantu sample. Still, this is only guess work.

I am enclosing a list of your papers so far as we have them in our index. I wonder if you could have the list supplemented by any other papers you would like me to have a record of.

Yours sincerely,

Egyptian Bloods.

~~First~~ Estimate of R_1.

Three phenotypes, namely R_2, R_0 and r, are all cc.
Two phenotypes, namely R_1R_2 and (R_1R_0 and R_1r) are Cc and
One phenotype, namely R_1 is CC.
In the series of 40 these classes contain respectively 10, 21 and 9 persons. Since R_1 is the only gene complex containing C which need be postulated, the gene frequency of R_1 may be found as

$$\frac{2 \times 9 + 21}{80} = \frac{39}{80} = 48.75\%.$$

Similarly R_2 is the only gene complex which need be postulated containing E, so the gene ratio of R_2 may be estimated as

$$\frac{7}{80} \quad \text{or } 9.1705\%.$$

Since R_0 and r are indistinguishable in the presence either of R_1 or R_2, only the cccc phenotypes can throw light on the gene ratio R_0r. In this series one in six is r, so that the residual percentage 42.0795 must be partitioned between R_0 and r in the ratio $\sqrt{6} - 1$ to 1, giving 24.9006 for R_0 and 17.1789 for r.

In this way the gene frequencies can be estimated directly and without any laborious approximation; but this is only true so long as rarer phenotypes do not occur. The comparison of expectations with observation is as follows

Genotype		Phenotype frequency			
Formula	Frequency	Expected	Observed	x^2/m.	
R_2R_2	0.3364				
R_2R_0	1.8268	3.4235	4	.0971	
R_2r	1.2603				
R_0R_0	2.4802	5.9023	5	.1379	
R_0r	3.4221				
$r\ r$		1.1805	1	.0276	
R_1R_2		3.5765	3	.0929	
R_1R_0	9.7112	16.4110	18	.1539	
R_1r	6.6998				
R_1R_1		9.5062	9	.0270	
		40.0000	40	.5364	χ'
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