117. *Probability-theoretic Investigations on Inheritance. XV_3. Detection of Interchange of Infants.*

By Yûsaku KOMATU.
Department of Mathematics, Tokyo Institute of Technology and
Department of Legal Medicine, Tokyo Medical and Dental University.
(Comm. by T. FURUHATA, M.J.A., Nov. 12. 1952.)

5. Main results.

After a preliminary preparation of the preceding section we shall now enter our main discourse. Here it will be convenient, contrary to the agreement in the previous section, to take the order of two members of a mating into account. Since it will be the same whether we classify the types according to a father or to a mother of a mating, we shall prefer the latter.

We now denote by

$$(5.1)\qquad G(ij, hk) \qquad (i, j, h, k=1, \cdots, m)$$

the probability of an event that a triple consisting of a mother A_{ij}, a father A_{hk} and an apparent child is presented and the detection of interchange is possible against another triple; an agreement corresponding to the one immediately subsequent to (3.3) of IV is made here again. The probability $G(ij, hk)$ consists of two parts; the one corresponds to case where the detection of interchange is *possible indifferent to another triple*, and the other to case where it becomes *possible only by taking another triple into account*. These two partial probabilities be denoted by

$$(5.2)\qquad G_0(ij, hk), \qquad \Phi(ij, hk),$$

respectively, the sum being

$$(5.3)\qquad G(ij, hk)=G_0(ij, hk)+\Phi(ij, hk).$$

The symmetry properties will be evident:

$$(5.4)\quad G_0(ij, hk)=G_0(hk, ij),\ \ \Phi(ij, hk)=\Phi(hk, ij);\ \ G(ij, hk)=G(hk, ij).$$

Now, if the first mating can produce only one type of child, then the interchange is detectable by means of the first triple alone, provided it is detectable at any rate. Hence, we get

$$(5.5)\qquad G(ii, ii)=G_0(ii, ii), \qquad \Phi(ii, ii)=0,$$

$$(5.6)\qquad G(ii, hh)=G_0(ii, hh), \qquad \Phi(ii, hh)=0 \qquad (h\neq i).$$

Since the mating $A_{ii}\times A_{ii}$ can produce A_{ii} alone, an apparent child other than A_{ii} is detectable and hence

$$(5.7)\qquad G(ii, ii)=G_0(ii, ii)=\bar{A}_{ii}^2(1-\bar{A}_{ii})=p_i^4(1-p_i^2).$$