

## The Strain Background of the Cardiac Gene

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At the Toronto Symposium in December, 1977, it was suggested that one explanation of the variability of expression of the cardiac (c) mutation might be the presence or absence of a second, uncharacterized, genetic factor in some animals which bear the gene c (1). It was also noted that the cardiac gene was originally described (2,3) in axolotls directly descended from those imported in 1961 by L.E. Delanney, but that it may now be carried in animals of different or mixed strains. I have looked into the extensive set of breeding records kept continuously since 1934 by R.R. Humphrey and A.J. Brothers at the Indiana University Axolotl Colony, in an attempt to precisely describe the general genetic environment, or strain background, which now surrounds the c gene.

As discussed by Humphrey in the first issue of this Newsletter (4), the strains which comprise the Axolotl Colony were brought in at various times. The c gene originated in first-generation offspring of Mexican animals, the DeLanney strain, mentioned above. The Tompkins strain is descended from animals sent to R. Tompkins from Mexico in 1968. Most animals bearing c which the Axolotl Colony has distributed in recent years have as one grandparent an axolotl sent to Humphrey by J.B. Armstrong, who, in turn, obtained it from H.Clark Dalton. Delanney sent some of his Mexican stock to Dalton who may have combined it with stocks previously in his possession; thus I will term this line DeLanney-Dalton. In addition to these three recently-imported strains, the Holtfreter and Wistar lines,

whose backgrounds are in European laboratories (4), also contribute to some present-day cardiacs. There is also a very small component deriving from an Ambystoma opacum from Brown County, Indiana, which was used for an artificial insemination in the late 1950's.

The genetic background, by strain, of cardiac spawnings investigated by Humphrey and others is shown in Table 1. A summarized family tree of these spawnings is shown in Figure 1. All the cardiac spawnings listed have a large component-- at least 30%-- derived from the Delanney or Delanney-Dalton strains. But it is immediately clear that a major shift has taken place in the remainder of the genome since 1967. The Tompkins strain now makes up 40 to 65% of the background of cardiac spawnings, and there are additional small contributions from the Wistar and Holtfreter strains.

It is possible, then, that the original cardiac phenotype was caused by the c gene acting in animals lacking some trait or factor which is now supplied by the Tompkins or other lines. Less likely is that a second trait whose presence is essential for the original phenotype has been bred out as the Delanney line has been diluted with other strains.

The Axolotl Colony does not now possess any cardiac spawnings without a large Tompkins component. However, we do have a limited number of non-cardiacs whose background is 55% Wistar, 37% DeLanney, 5% A. opacum, and 3% Holtfreter. This may be useful for future tests of the "strain variation hypothesis."

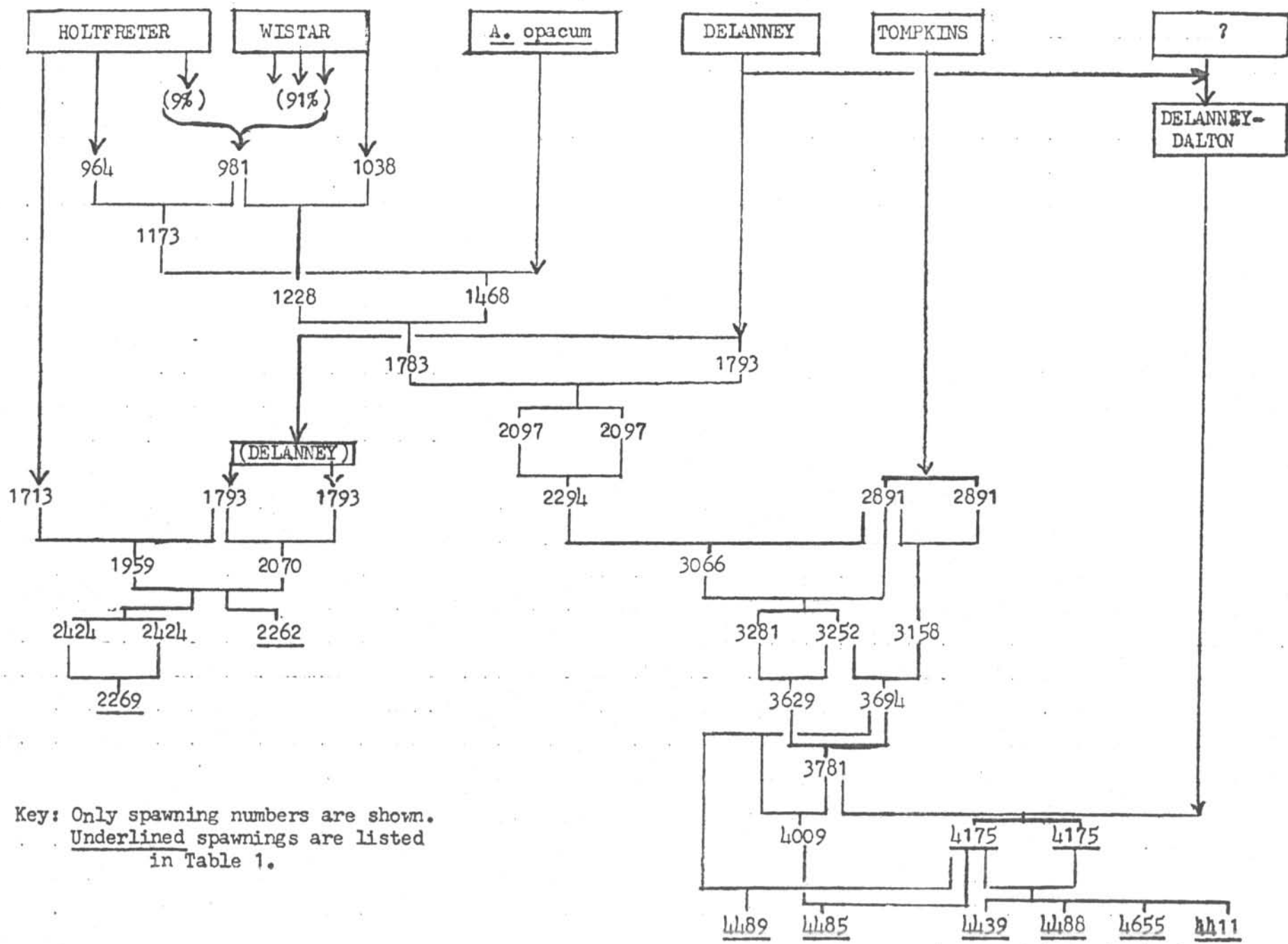
References

1. Kulikowski, R.R. and F.J. Manasek, Axolotl Newsletter, number 4 (1977).  
See also forthcoming symposium papers by several authors (Amer. Zool. 18: in press).
2. Humphrey, R.R., Anat. Rec. 160:475 (1968).
3. Humphrey, R.R., Dev. Biol. 27:365-375 (1972).
4. Humphrey, R.R., Axolotl Newsletter, number 1 (1976). See also forthcoming paper by Malacinski, G.M. (Amer. Zool. 18: in press).

Spawning number	Studied by	MEXICAN STRAINS		Delaney-Dalton	Holtfreter	Wistar	<u>A.</u> <u>opacum</u>
		DeLanney	Tompkins				
2262	Humphrey (1968/1972)	75	0	0	25	0	0
2669	Justus (1967)	75	0	0	25	0	0
4175, 4411, 4439, 4488, 4655	Manasek, Kulikowski, Justus, Lemanski (1977)	5	41	50	1	2	1
4485	Manasek (1977)	7	63	25	1	3	1
4489	Lemanski, Manasek (1977)	6	65	25	1	2	1

Table 1

Genetic Background of Cardiac Spawnings (in percent)



Key: Only spawning numbers are shown.  
Underlined spawnings are listed  
 in Table 1.

Table 1. Family Tree of Cardiac Spawnings