

XY Females Caused by X-Irradiation

There have been many attempts to influence the sex ratio in the offspring of organisms whose sex is determined by an XY mechanism. We should like to report some new results which we have obtained from experiments with the wild livebearing fish *Platypoecilus maculatus* from the Jamapa River in Mexico¹. These animals have a distinct sexual dimorphism. The sex of an animal can be easily determined by observing the structure of its anal fin. In the female, this fin is normally constructed, whereas in the male it is transformed into a gonopodium. In addition, the ovaries can be seen in the female because of the transparency of the fish.

Sex determination has been proved to be of the XY type². The sex chromosomes are distinctly heteromorphic³. In our stock the X chromosome carries either the genes *Sd* (Spotted dorsal) and *Dr* (Dorsal red) or *Sp* (Spotted). The Y chromosome carries *Sr* (Stripe-sided) and *Ar* (Anal red). Both male and female animals have in addition a homozygous autosomal gene *Sh* (Shoulder spot), which only manifests itself in the absence of the Y chromosome⁴. The gonosomal constitution can be identified as easily as the functional sex simply by observing these distinctive characteristics. Under normal conditions functional sex and gonosomal constitution never differ, indicating that the XY mechanism of sex determination in the wild *P. maculatus* is a very stable one.

With regard to these facts, it is surprising that functional females with the heterosomal male constitution XY appear after irradiation (1000–2500 R) of embryos with X-rays. The greatest percentage of XY females was obtained after irradiation with a dosis of 2000 R. In this series of experiments, all irradiated pregnant females ($n = 12$) gave birth to young with different numbers of XY females. In all, 54.4% of the XY offspring were females. Irradiation of pregnant females ($n = 13$) with 1500 R produced 33.1% XY females (see Table). In one group of young of this series, all XY offspring ($n = 12$) became females.

All of these XY females are normal individuals, displaying normal sex characteristics and functions. When these females are mated with nonirradiated XY males, XX females and XY and YY males in the expected ratio of 1:2:1 are produced. From these results, we can con-

clude that the occurrence of XY females after X-irradiation seems to be physiologically rather than genetically determined.

Determination of XY embryos to females by X-rays

Dose	No. of irradiated pregnant females	Offspring irradiated in the embryonic stage				
		Total No.	XX ♀♀	XY ♂♂	XY ♀♀	% of XY ♀♀ offspring
1500 R	13	233	103	87	43	33.1
2000 R	12	111	54	26	31	54.4
	25	344	157	113	74	

Zusammenfassung. Bei *P. maculatus* werden XY-Embryonen durch Röntgenstrahlenbehandlung (1000 bis 2500 R) physiologisch zu normalen Weibchen umdeterminiert.

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¹ The strain used in this investigation was derived from a collection made in 1939 by MYRON GORDON. Some years later it was introduced into the laboratories of CURT KOSSWIG, and it has been cultured in our laboratory for 10 years.

² M. GORDON, *Fishes as Laboratory Animals* (Ed. E. FARRIS, New York 1950), p. 345.

³ W. FÖRSTER, Dissertation Giessen (1969); A. ANDERS, F. ANDERS, K. KLINKE, W. FÖRSTER and S. RASE, *Verhandl. Zool. Ges. in Würzburg*, in print (1969).

⁴ P. MACINTYRE, *Genetics* 46, 575 (1961).

Amino Acids as Stimulating Agents of DNA-Replication in Melanomas¹

I. Stimulation in Explants

As we know from the work of KOSSWIG², GORDON³ and HÄUSSLER⁴, certain platy-fishswordtail hybrids (Poeciliidae) develop tumours. Two years ago⁵ this was interpreted as misled regulation of genes controlling production of pterinophores and melanophores (colour genes). We would like here to present some new evidence for this interpretation.

Colour genes. The genes investigated in this research, the pterinophore gene *Dr* (dorsal red) and the macromelanophore gene *Sd* (spotted dorsal), are closely linked on the X-chromosome of the wild species *Platypoecilus maculatus* from Mexico. This linkage is reflected by the participation of certain pterines as cofactors in melanophore differentiation and melanin synthesis^{5,6}. In the pure-bred species, these 2 genes are phenotypically responsible for a specific

colour pattern, in which small black spots (*Sd*) appear in a reddish background (*Dr*) on the dorsal fin.

Repression and derepression. Crossing wild *P. maculatus* of *Dr-Sd* genotype with wild *Xiphophorus helleri*, which

¹ This publication is dedicated to Dr. CURT KOSSWIG on his 65th birthday.

² C. KOSSWIG, *Z. indukt. Abstamm.- u. VererbLehre* 44, 253 (1927); 59, 61 (1931); *Copeia* 1964, 65 (1964).

³ M. GORDON, *Genetics* 12, 253 (1927); *Pigment Cell Biology* (Academic Press, New York 1959), p. 215.

⁴ G. HÄUSSLER, *Klin. Wschr.* 27, 1561 (1928).

⁵ F. ANDERS, *Experientia* 23, 1 (1967).

⁶ Compare I. ZIEGLER, *Ergebn. Physiol.* 56, 1 (1965); N. KOKOLIS and I. ZIEGLER, *Z. Naturf.* 23b, 860 (1968).