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Sex linked genes

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- ✓ Qualitative phenotypes may also be controlled by genes located on one of the sex chromosomes and the genes are called **sex-linked genes**
- ✓ Sex-linked phenotypes have been discovered in relatively few species of fish and most of the information came from the two species guppy and platy.



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- ✓ The sex-linked inheritance in fish was first described by Johannes Schmidt in 1920 in guppy, *Poecilia reticulata*.
- ✓ all sex-linked phenotypes that are known in fish are controlled by genes that are located on the X and / or Y chromosome
- ✓ No genes restricted to the W or Z chromosomes have been discovered.



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1. Y-Linked Genes

Only one copy of a Y-linked gene exists on the single Y chromosome of a normal male.

- ✓ Y-linked phenotypes cannot be fixed in normal females, which do not possess Y chromosome
- ✓ The Y-linked inheritance of colour patterns in male *P. reticulata* was reported by Winge.



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Genes located on the Y–chromosomes are transmitted from father to son, and

- ✓ unless they cross over to the X chromosome, they will never exist in normal females (XX).
- ✓ Thus Y-linked phenotypes are seen in only one sex, males.



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2. X-linked Genes

Sex-linked genes can also be located on X-chromosome

- ✓ X-linked genes are expressed differently in normal males (single copy in XY) and normal females (two copies in XX).
- ✓ In females, most X-linked genes exhibit complete dominance



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3. Sex-limited traits

X-linked alleles follow definite genetic patterns, but the phenotypes do not always follow the expected ratios

- ✓ This is because many X-linked phenotypes (some autosomal phenotypes too) are sex-limited in that the phenotype is expressed in only one sex



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Sex-linked inheritance in the Platy- WZ/ZZ system

The black strain 'Nigra' is inherited as a dominant sex linked allele.

- ✓ a cross between a 'Nigra' female and a lightly pigmented male 'white' produced 'Nigra' sons and 'white' daughters and
- ✓ F_2 produced approximately equal frequencies of 'Nigra' and 'white' individuals of each sex.



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Sex linked inheritance in platy

Wo Zn x Zw Zw

Nigra ♀ White ♂



Wo Zw

Zn Zw

White ♀

Nigra ♂



Wo Zn : Wo Zw : Zn Zw : Zw Zw

Nigra ♀

White ♀

Nigra ♂

White ♂