AP Bio FRQ Fridays

2018 #7
Punnett Squares & Fitness

FRQ Friday #14

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In the tongue sole fish (*Cynoglossus semilaevis*), sex is determined by a combination of genetics and environmental temperature. Genetically male fish have two Z chromosomes (ZZ), and genetically female fish have one Z chromosome and one W chromosome (ZW). When fish are raised at 22°C, ZZ fish develop into phenotypic males and ZW fish develop into phenotypic females. However, when fish are raised at 28°C, the Z chromosome is modified (denoted as Z*). Z*W individuals develop as phenotypic males that are fertile and can pass on the Z* chromosome to their offspring even when the offspring are raised at 22°C. A cross between a ZW female and a Z*Z male is shown in the Punnett square below.

	Z	W
Z*	Z* Z	Z* W
Z	Z Z	Z W

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(a) **Predict** the percent of phenotypic males among the F_1 offspring of the cross shown in the Punnett square if the offspring are raised at 22°C.

@22°C

ZZ = male
ZW = female
Z*Z = male
Z*W = male

	Z	W
Z*	Z* Z — M	Z* W — M
Z	Z Z — M	Z W — F

@28°C

Z*Z = male
Z*W = male

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(a) **Predict** the percent of phenotypic males among the F_1 offspring of the cross shown in the Punnett square if the offspring are raised at 22°C.

(a) The percent of phenotypic males among the F_1 offspring of the cross shown in the Punnett square if the offspring are raised at 22°C is about 75%.

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(b) At least one Z or Z* chromosome is necessary for survival of the fish. A researcher crossed two fish and observed a 2:1 ratio of males to females among the offspring. Based on the information, **identify** the genotype of the male parent in the cross. **Describe** ONE fitness cost to the female of mating with this particular male.

@22°C

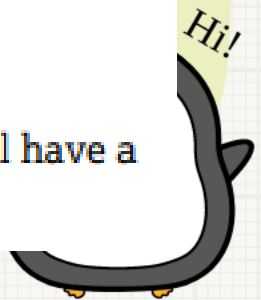
ZZ = male
ZW = female
Z*Z = male
Z*W = male

	Z*	W
Z	Z*Z Male	ZW Female
W	Z*W Male	WW Did Not Survive

Identification (1 point)
Z* W

Description (1 point)

- Fewer offspring will develop/survive.
- 1/4 of the offspring are predicted to die.
- Some of her offspring will have the Z* chromosome/all of her male offspring will have a Z* chromosome.



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(b) At least one Z or Z* chromosome is necessary for survival of the fish. A researcher crossed two fish and observed a 2:1 ratio of males to females among the offspring. Based on the information, **identify** the genotype of the male parent in the cross. **Describe** ONE fitness cost to the female of mating with this particular male.

(b) The genotypic of the male parent in the cross is Z*W. A fitness cost of the female of mating with this particular male would be that only 75% of the offspring will survive, as 25% percent of the offspring will have a genotype of WW, which in turn since the reduction of offspring survival.

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