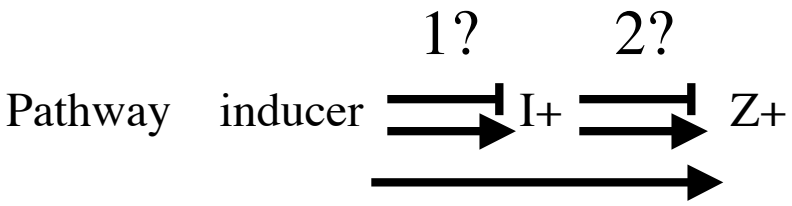
An Explanation of Bars and Arrows Sept 24, 2003

Key:

1. Is mutation recessive or dominant?
2. Draw pathway with known genes and bars and arrows
3. Use the following logic

Example 1: for LacI

Genotype	Phenotype (lacZ) no inducer	inducer	
1. I+	-	+	
2. I-1 (mutant)	+	+	
3. I-1/I+	-	+	**I-1 recessive**
4. I-2	-	-	
5. I-2/I+	-	-	**I-2 dominant**



Analysis- Bar or Arrow?:

I-1 is recessive- lost I+'s normal function.

I-1 therefore does not do something that I+ normally does

Since I-1 yields Z+, then I+ must normally inhibit Z. **BAR is right!**

(Also, imagine if I+ were activator, and I-1 does not do that..then I-1 would not make Z - which is not the phenotype of I-1!)

I-2 is dominant: I-2 does the same as I+, yet I-2 does it when I+ doesn't

I-2- activator of Z+ when I+ is not activating?? NO, in I-2 no Z made

I-2 is inhibitor of Z+ when I+ is not an inhibitor? YES, in I-2 no Z.

Bar is right again!

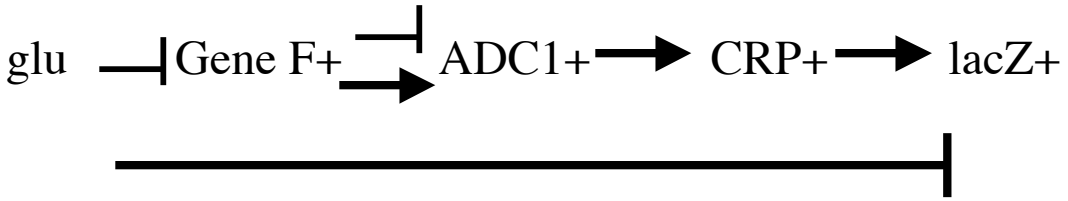
Gene F-1 problem revisited

Example 2: glu ⊣ ADC1+ → CRP+ → lacZ+

Genotype	Phenotype (lactose present)	
	no glucose	glucose
1.Gene F+ (wildtype)	+	-
2. Gene F-1	+	+
3. Gene F-1/Gene F+	+	+
4. ADC1-	-	-
5. ADC1-, Gene F-1	-	-

Line 5 says that ADC1 is epistatic/downstream of Gene F because double mutant has phenotype of ADC1- single mutant

Bar or Arrow?



Analysis:

Gene F-1 is dominant, so gene F-1 does something that Gene F+ normally does, yet Gene F-1 does it when Gene F+ does not.

Since in Gene F-1 lacZ is made, (and all are arrows downstream of ADC1), Gene F+ must also be an activator.

To maintain overall negative from glucose, then bar is needed between glu and Gene F+.

Note: With Bars and arrows, start with most downstream gene first, then work your way to front.

One more time on phage mutants: