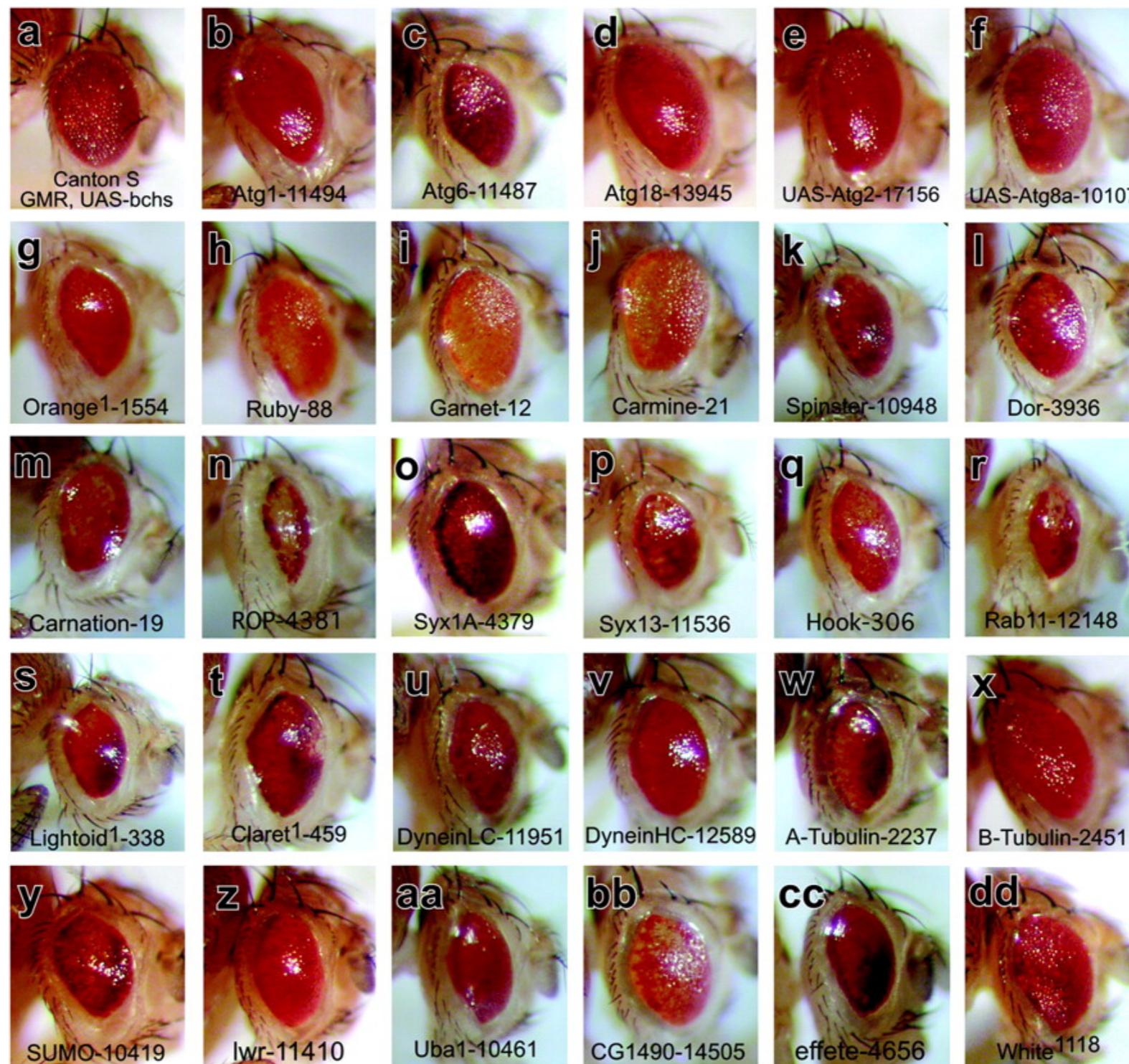
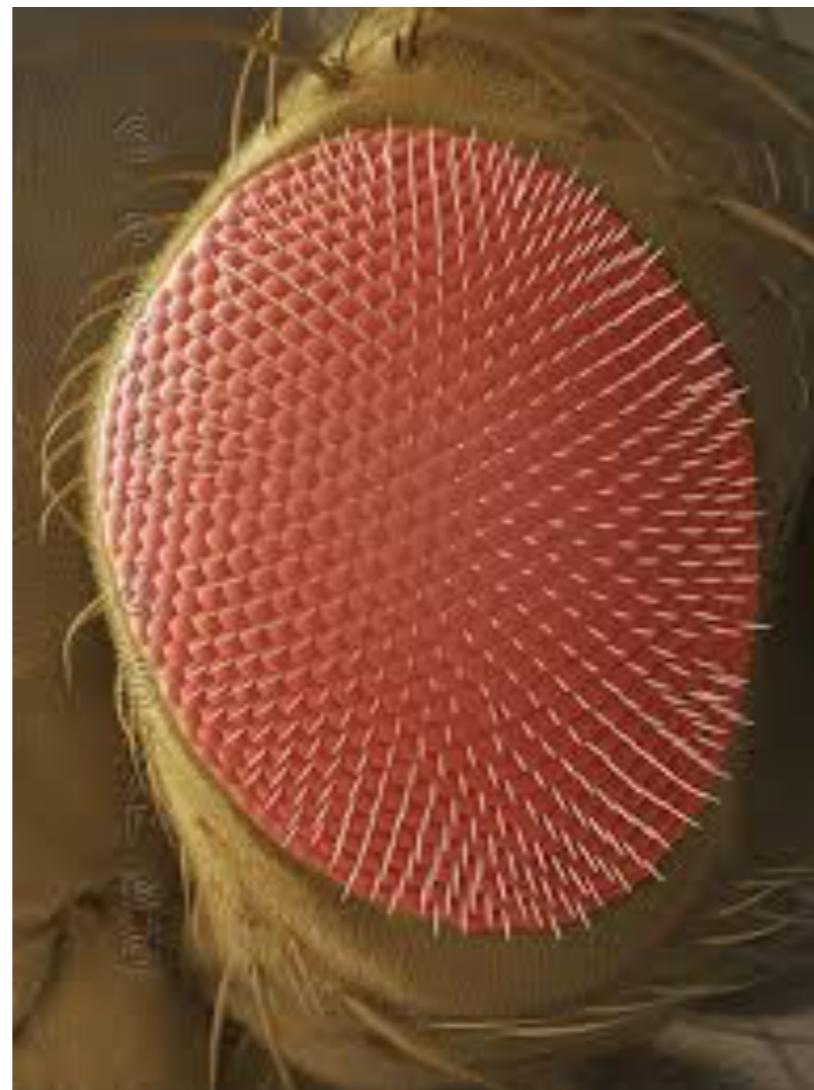


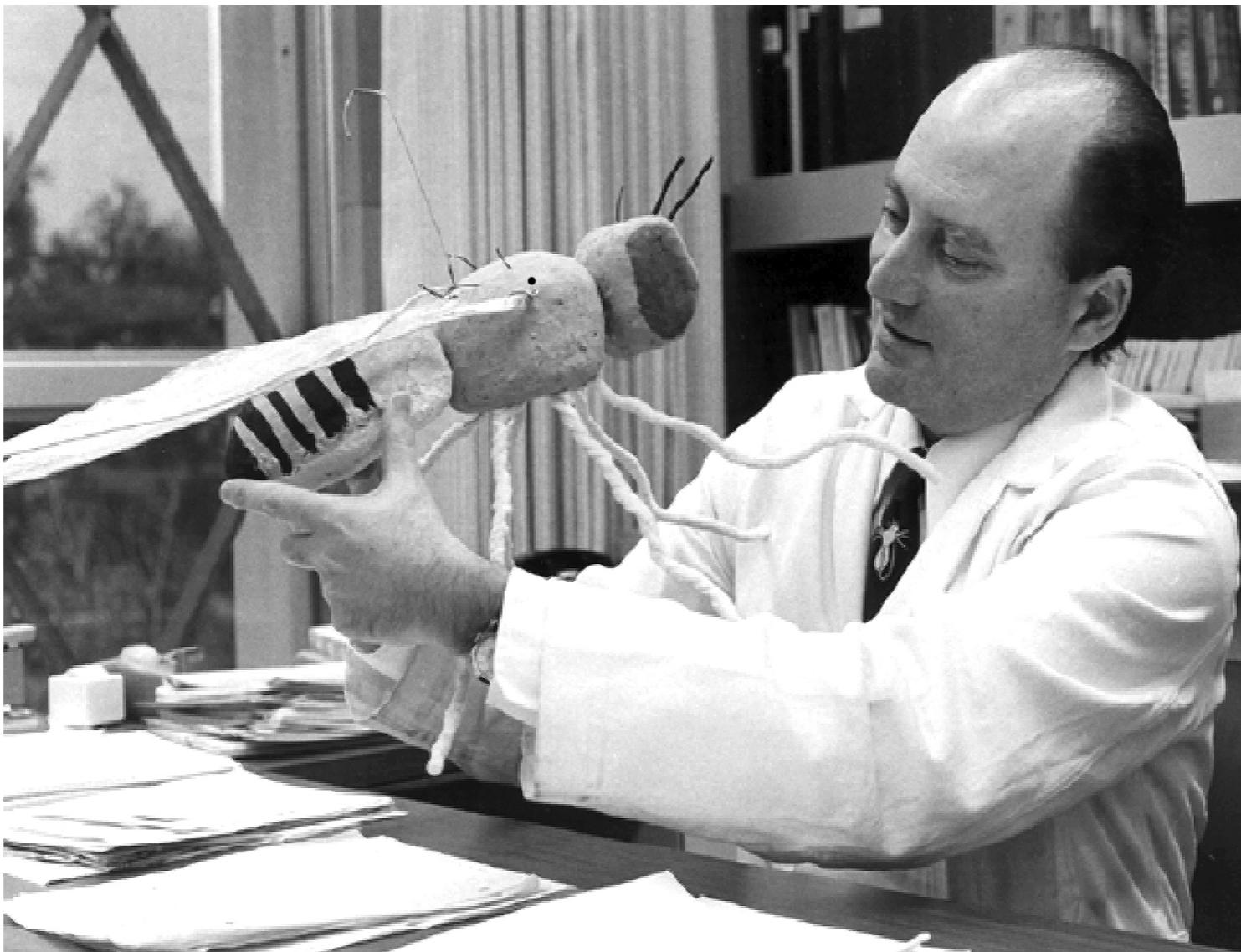
Bio393: Genetic Analysis

Developmental genetics II

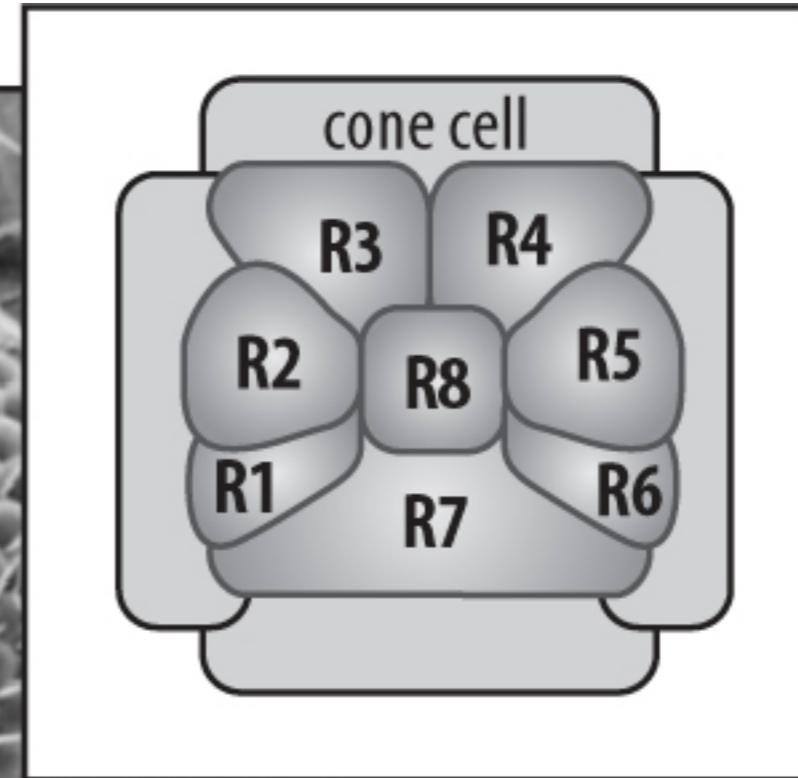
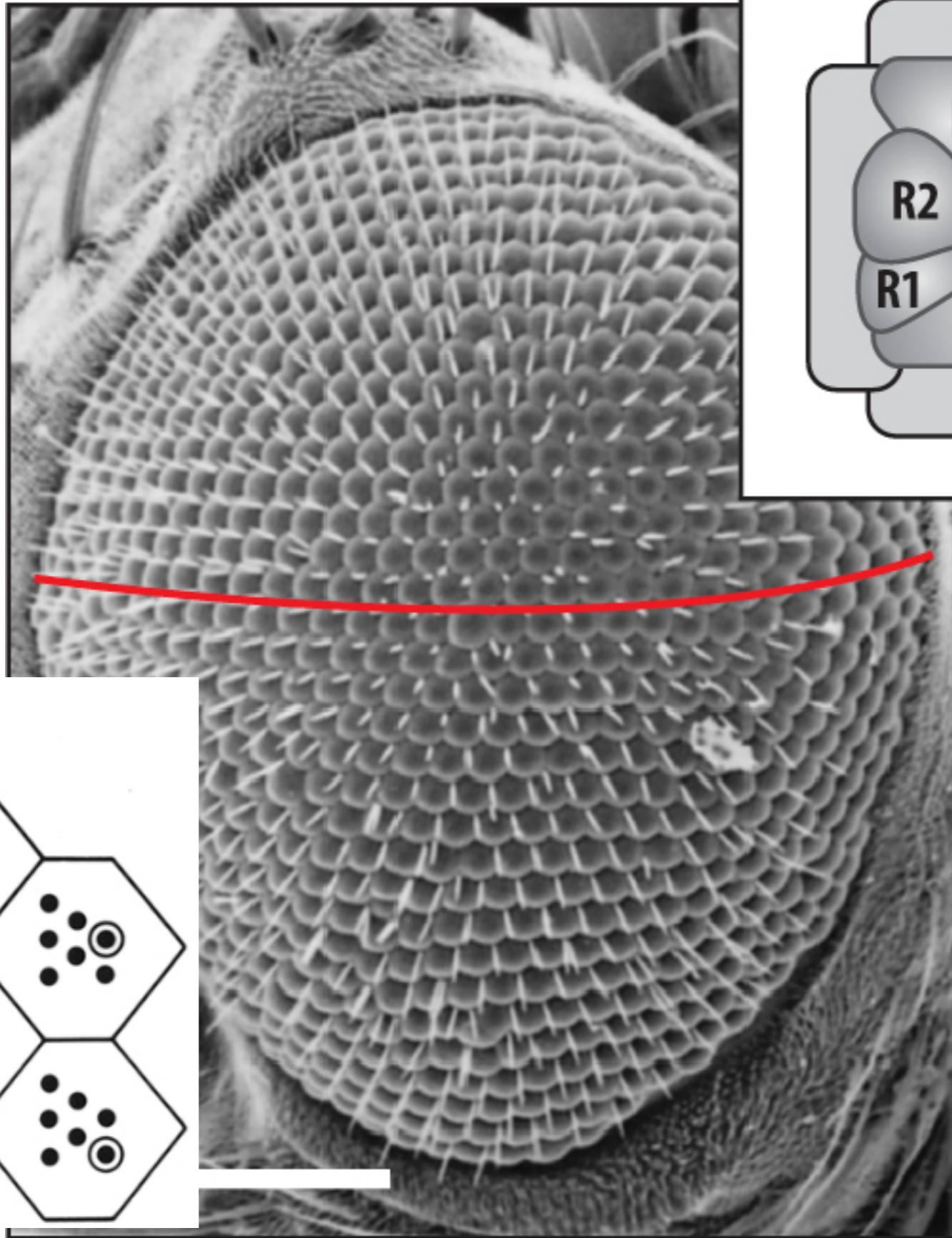
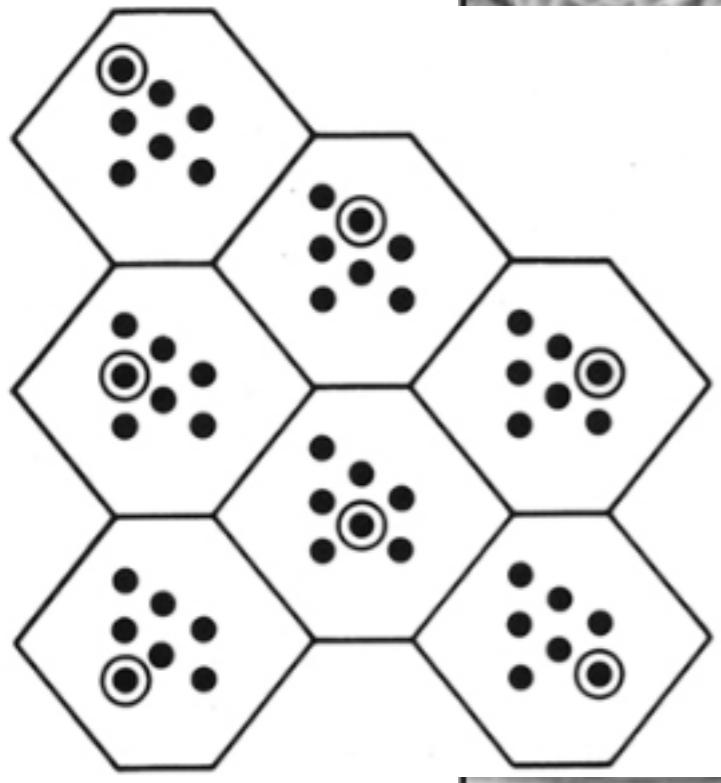




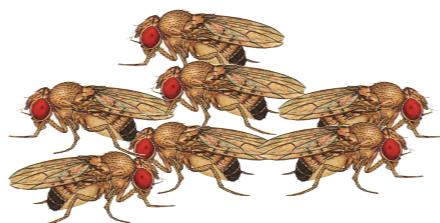
The *Drosophila* eye



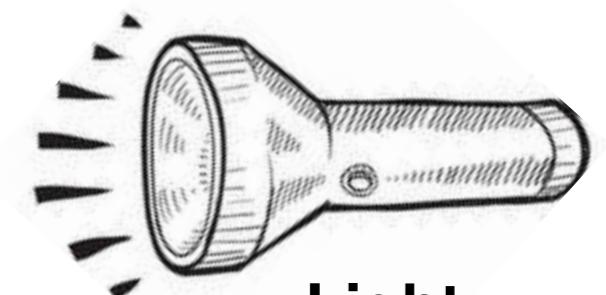
Seymour Benzer



A simple behavioral selection

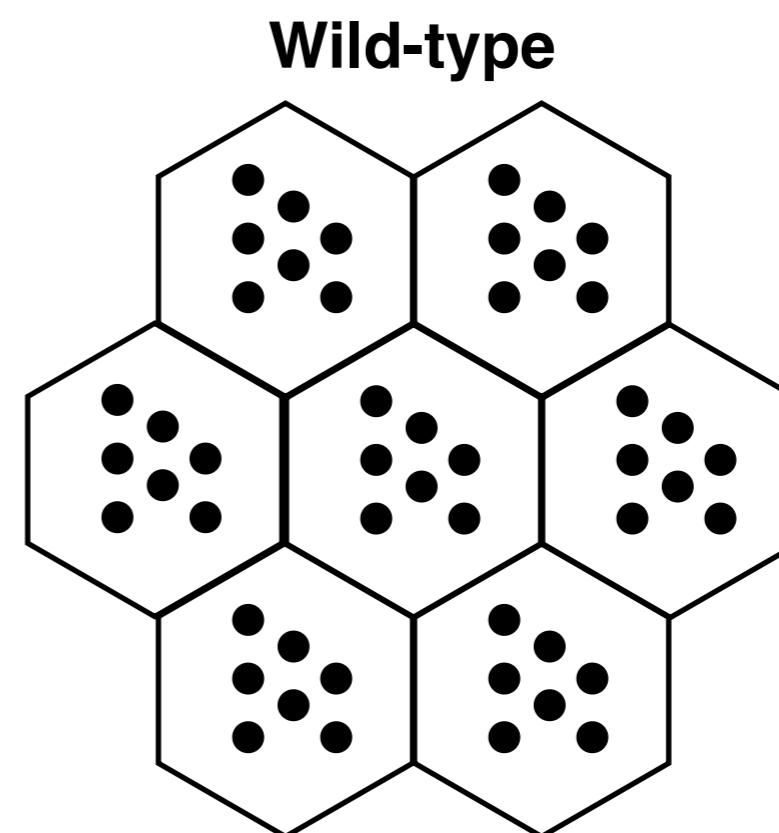
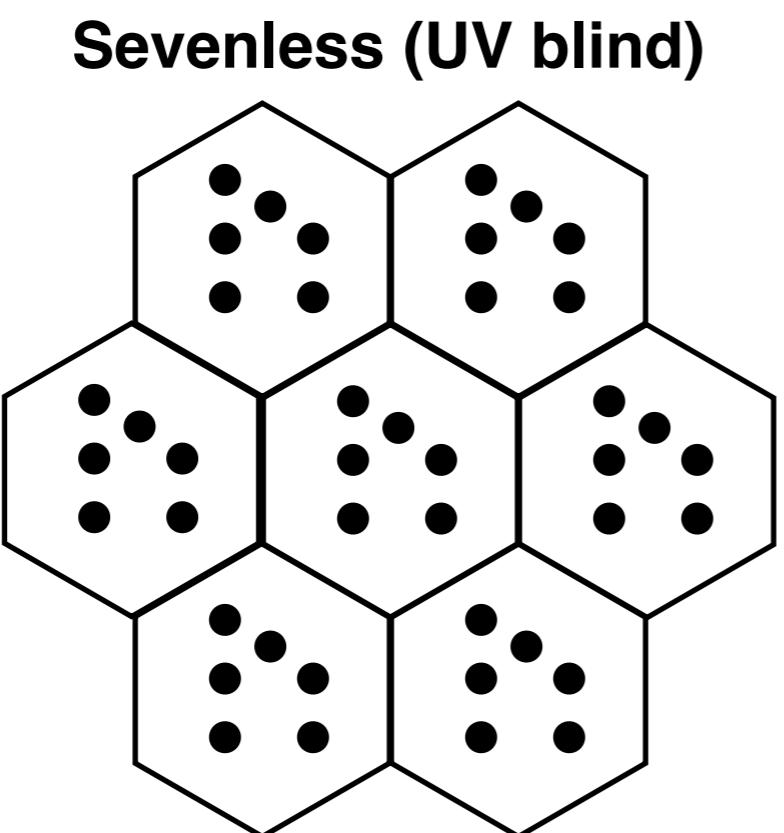
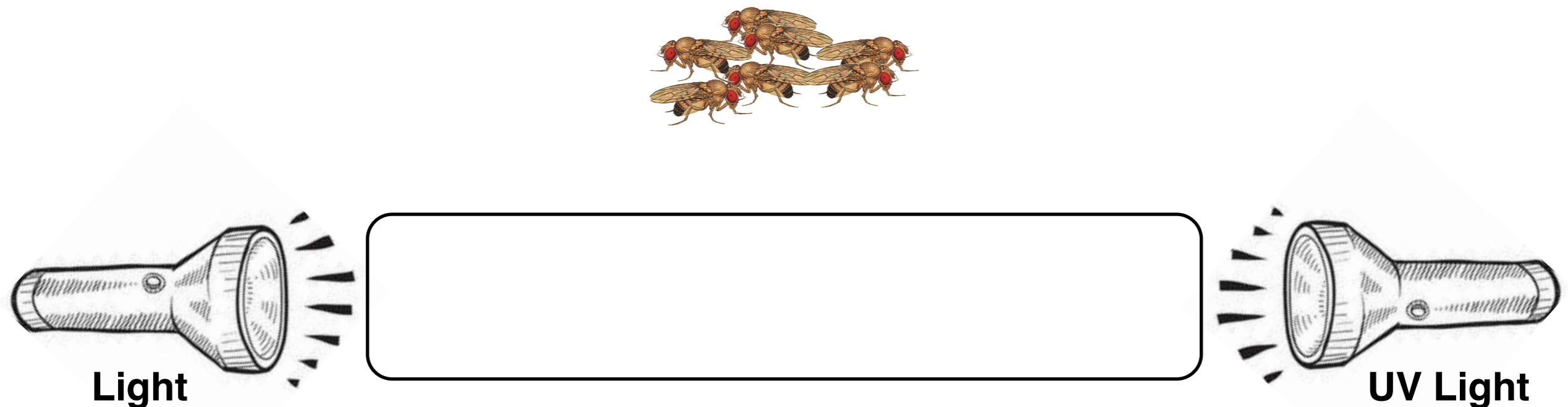


Dark



Light

A simple behavioral selection

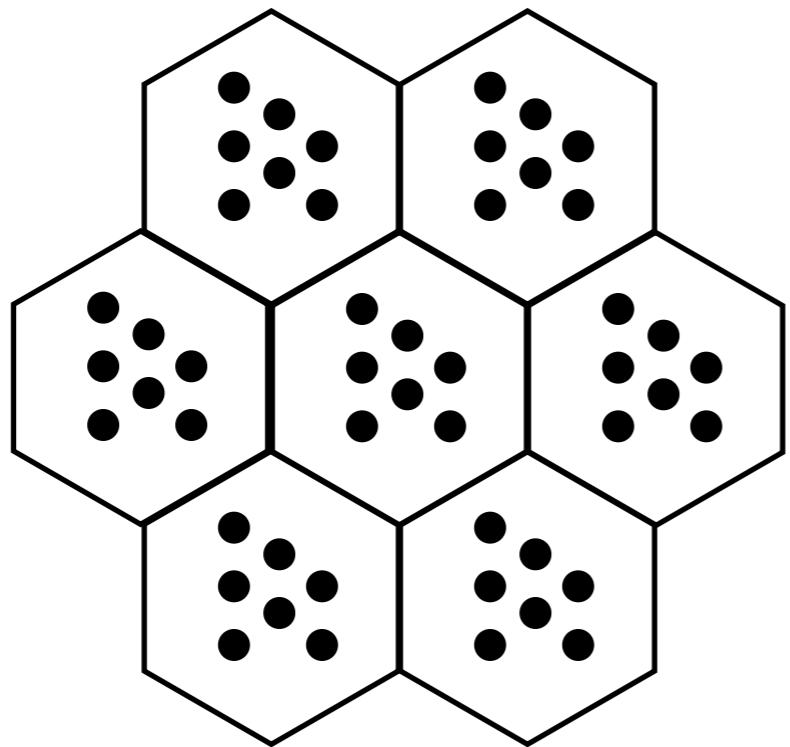




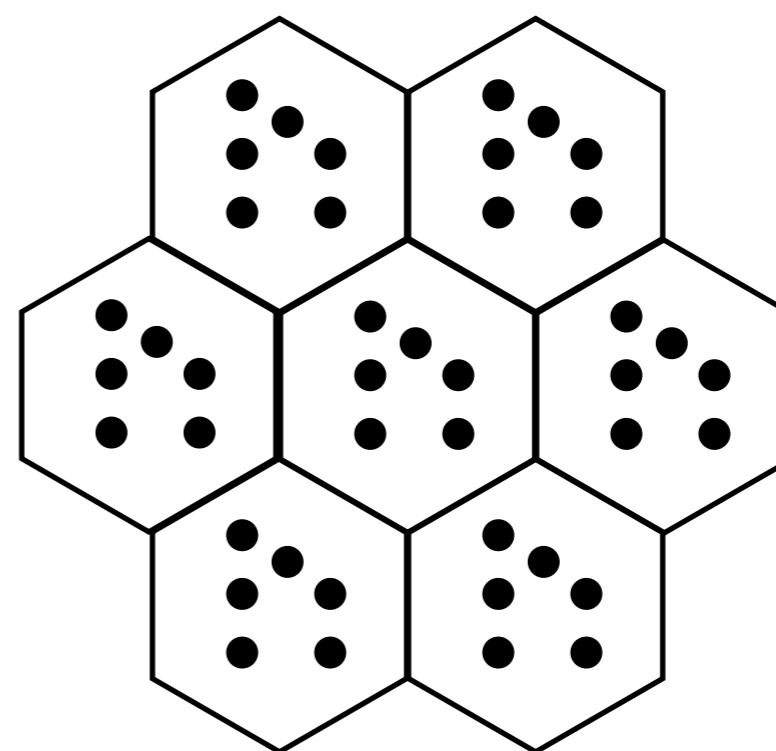
Gerry Rubin

Other UV blind mutants

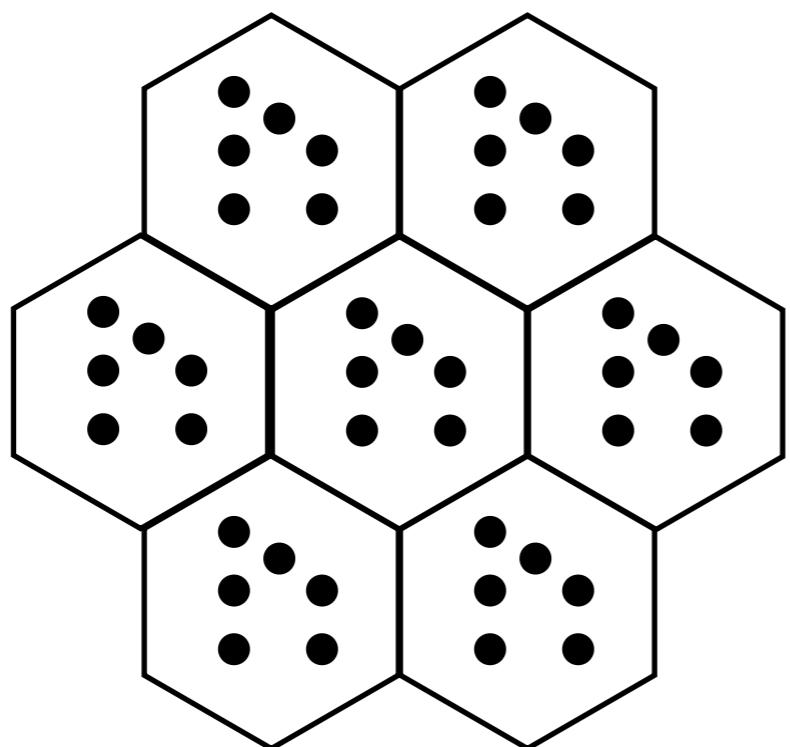
Wild-type



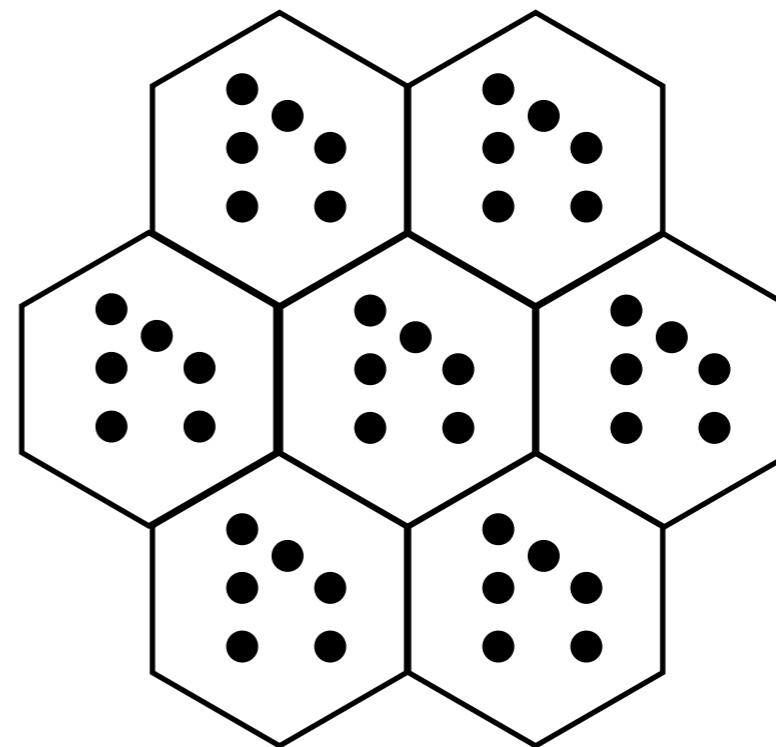
Sevenless (UV blind)



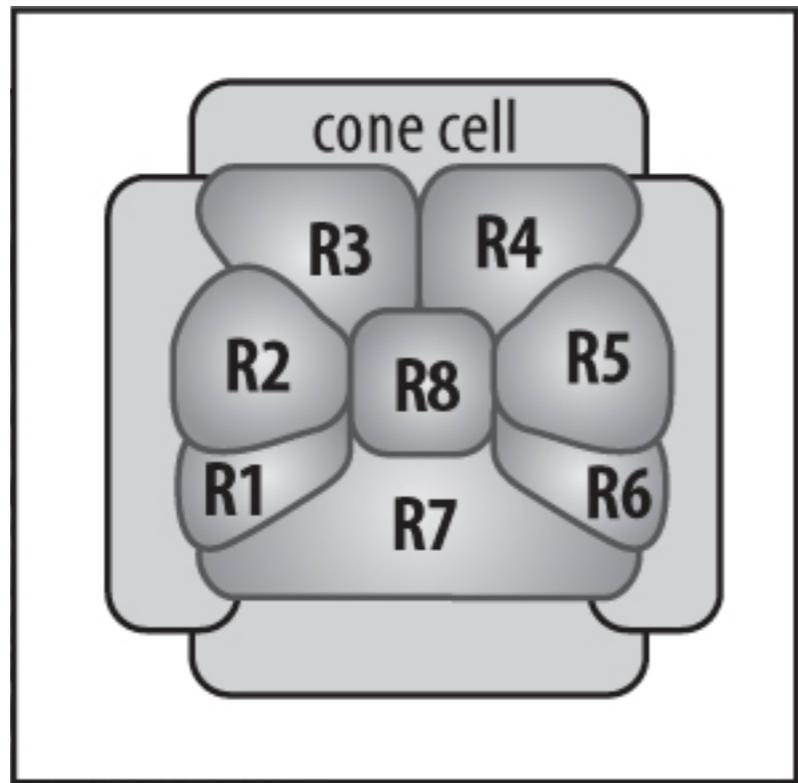
Bride of sevenless (UV blind)



Seven-in-absentia (UV blind)



Development of an ommatidium

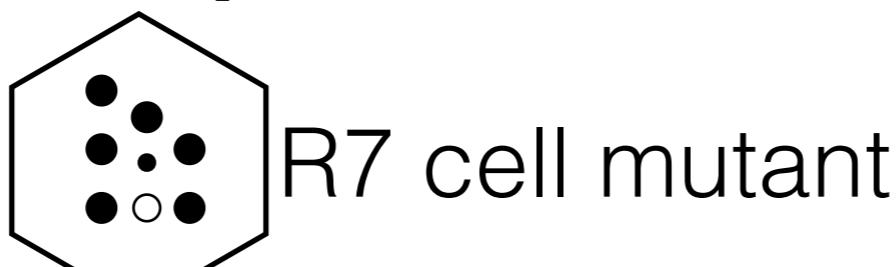


R8 born first

R1-R6 born after

R7 last to be born

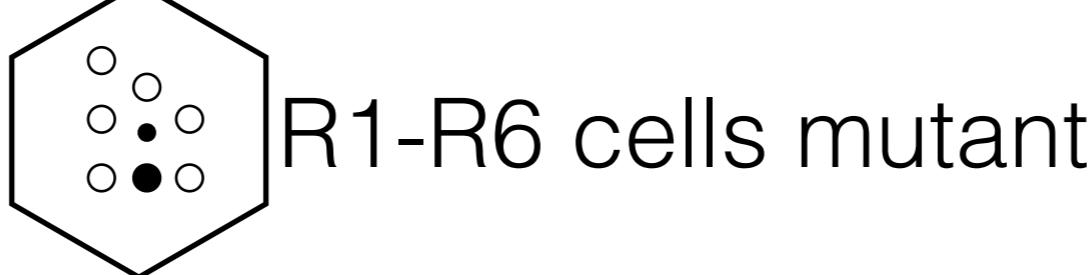
***boss* and *sev* are required in different R cells for R7 fate**



R7 cell mutant

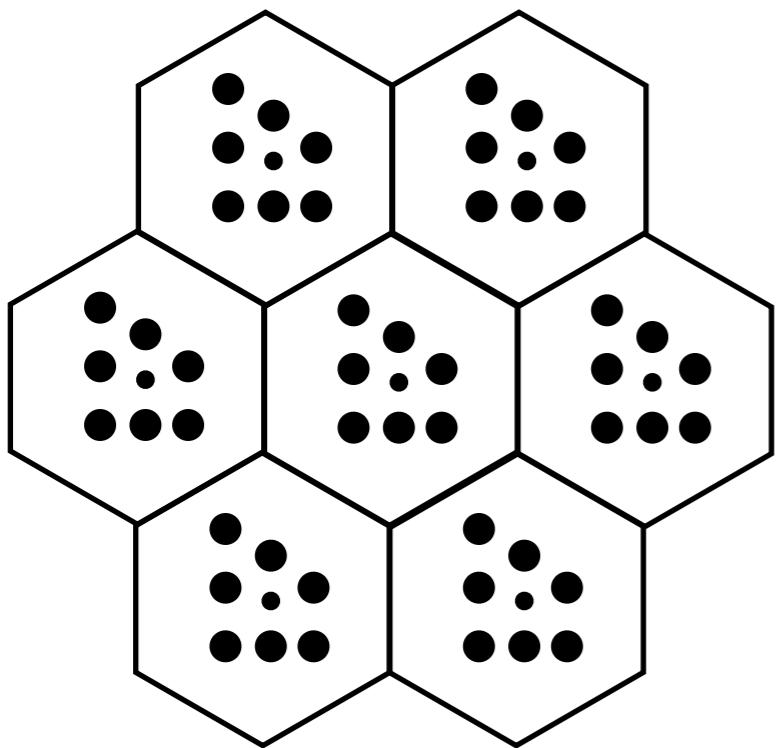


R8 cell mutant

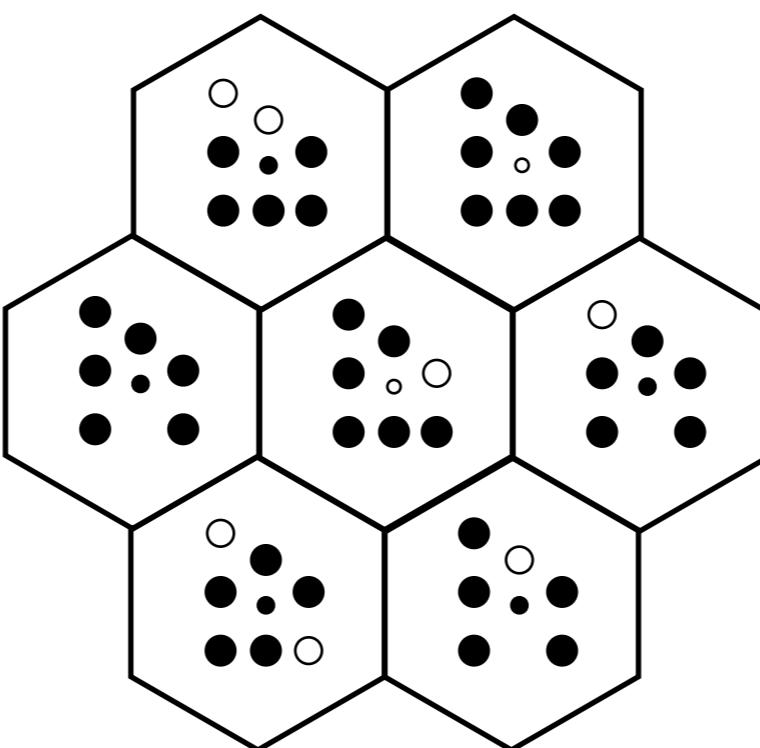


R1-R6 cells mutant

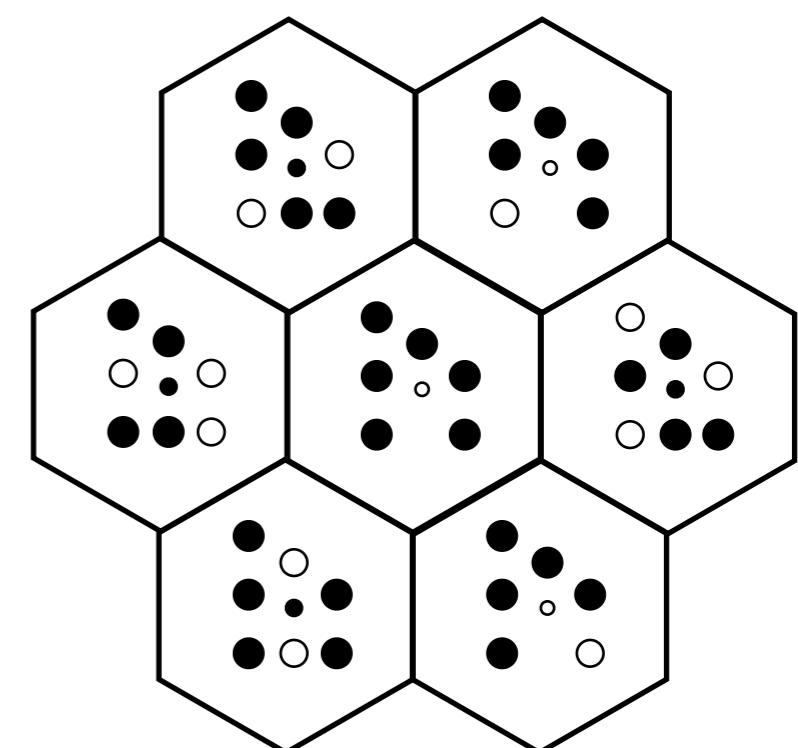
Wild-type



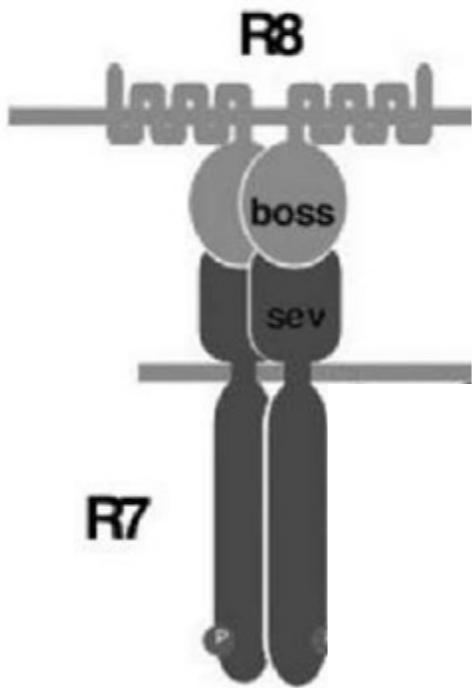
sev mutant



boss mutant

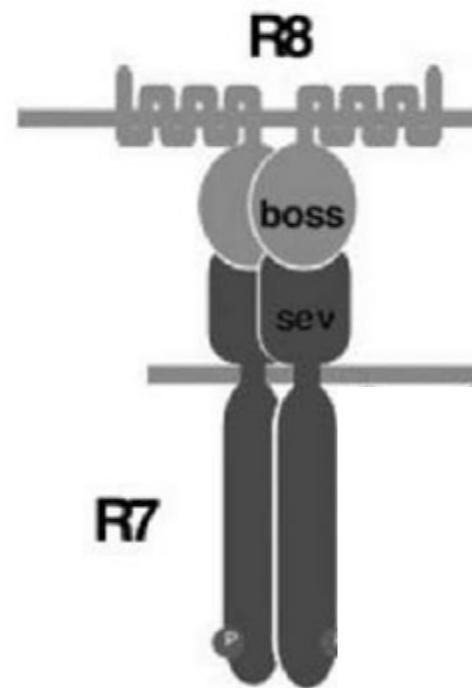
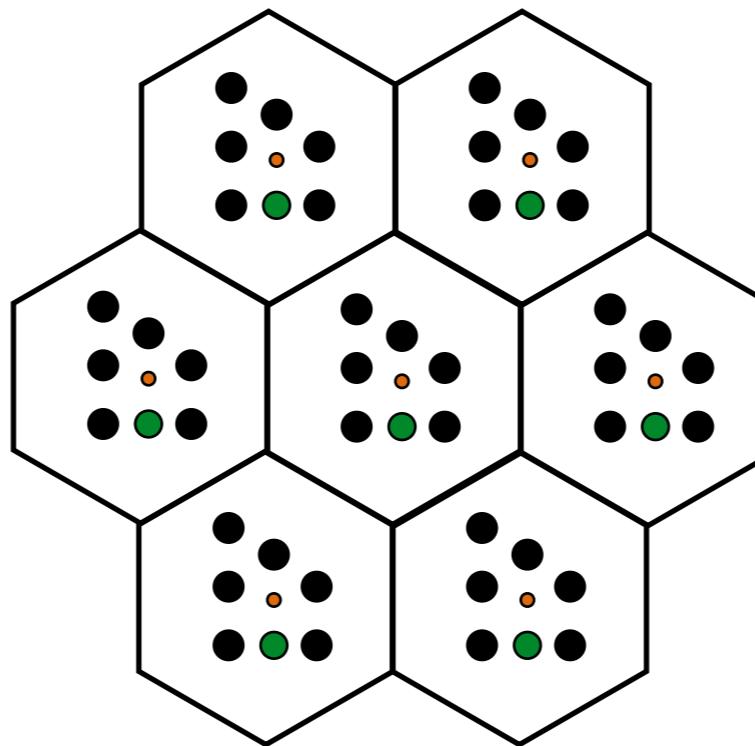


boss encodes
a membrane-bound protein



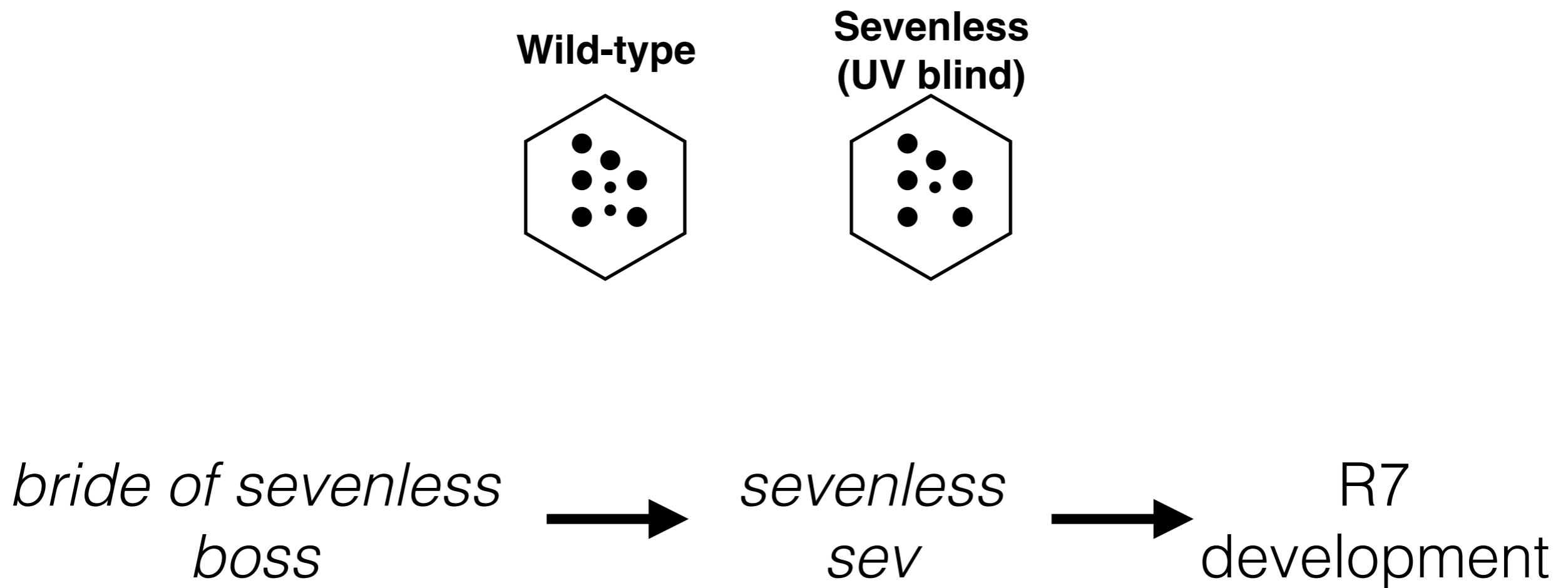
sev encodes
a membrane receptor tyrosine kinase

Expression of *sev* and *boss*



boss internalized into R7

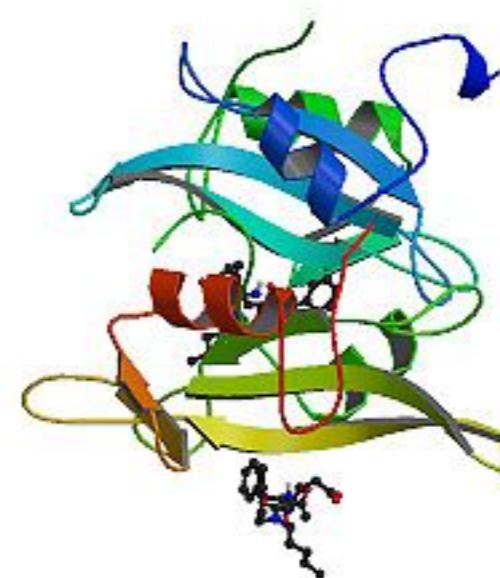
UV blind mutants led to elements of signaling pathway



Virus gene mutant from chicken to *Drosophila*



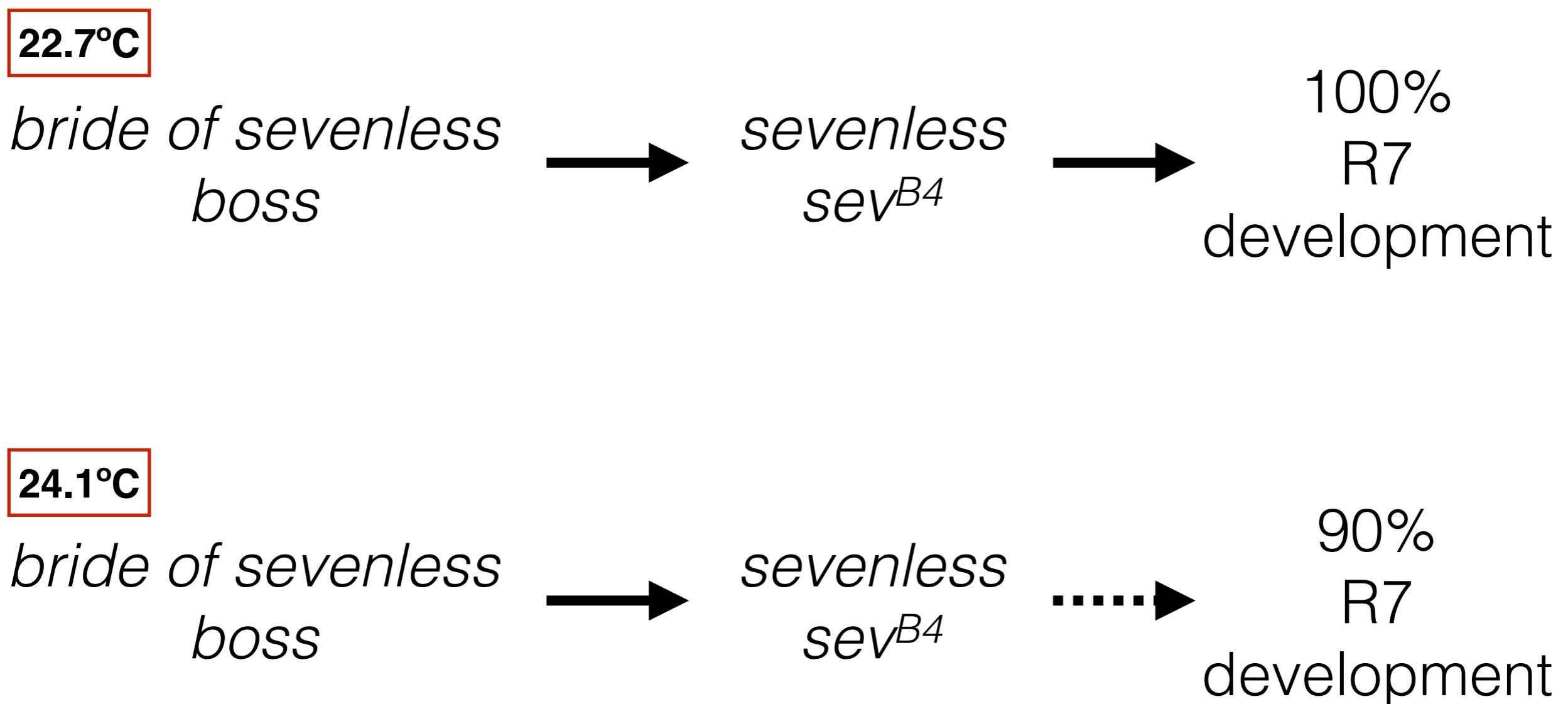
Peyton Rous discovered the first oncogenic virus in chicken



The virus expressed v-src (a tyrosine kinase) to control cell cycle

Mutagenesis of v-src led to temperature-sensitive alleles

A sensitized enhancer screen for the *sevenless* pathway



Strains used for the sensitized screen

$sev^{d2}; TM3\ ry / CxD$

sev^{d2} = complete loss of sev

$TM3$ = third chromosome balancer

ry = allele conferring recessive rosy eye phenotype

CxD = third chromosome balancer

$P[ry^+ sev^{B4}]$

sev^{B4} = temperature-sensitive sev hypomorph

Screen for dominant enhancers of sensitized phenotype

$sev^{d2}; TM3\ Sb\ ry\ P[ry^+ sev^{B4}]/\text{CxD}$

22.7°C

*bride of sevenless
boss*



*sevenless
sev^{B4}*



100%
R7
development

24.1°C

*bride of sevenless
boss*



*sevenless
sev^{B4}*



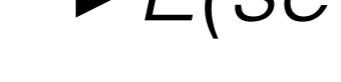
90%
R7
development

22.7°C

*bride of sevenless
boss*



*sevenless
sev^{B4}*

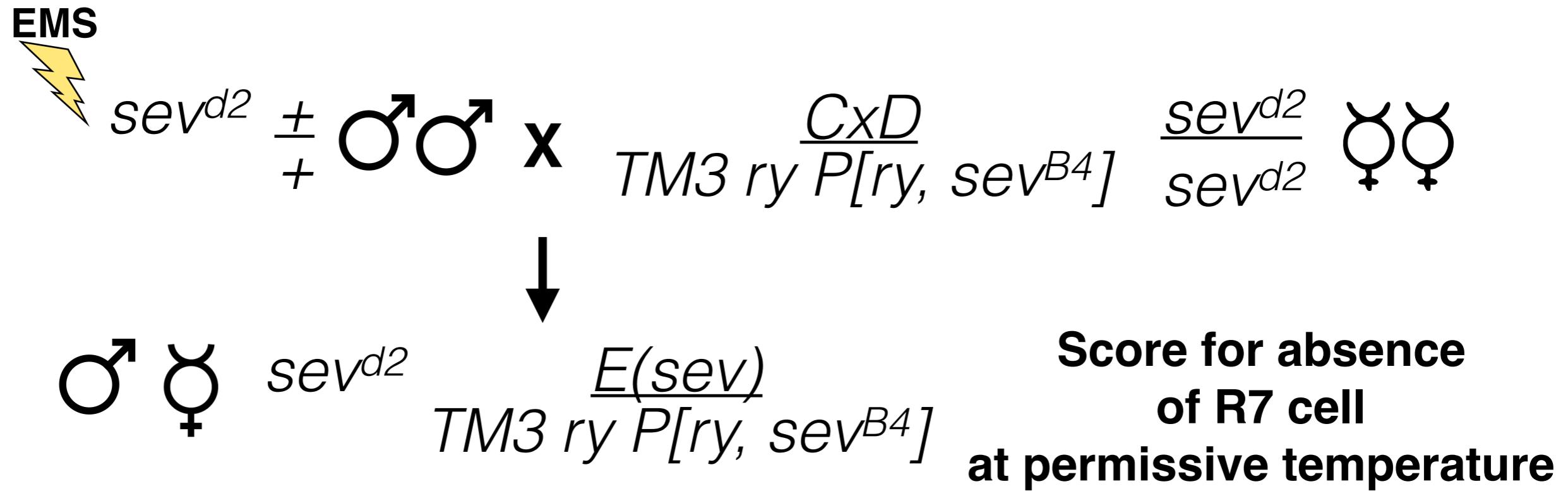


~10%

R7

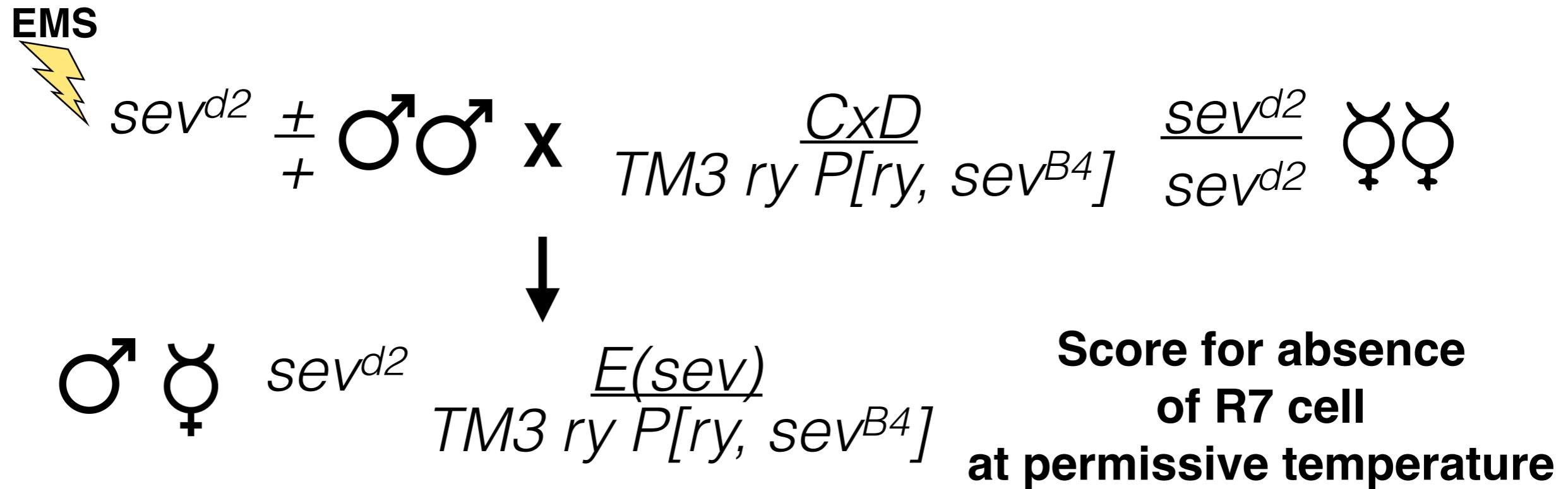
development

Screen for dominant enhancers of sensitized mutant R7 phenotype



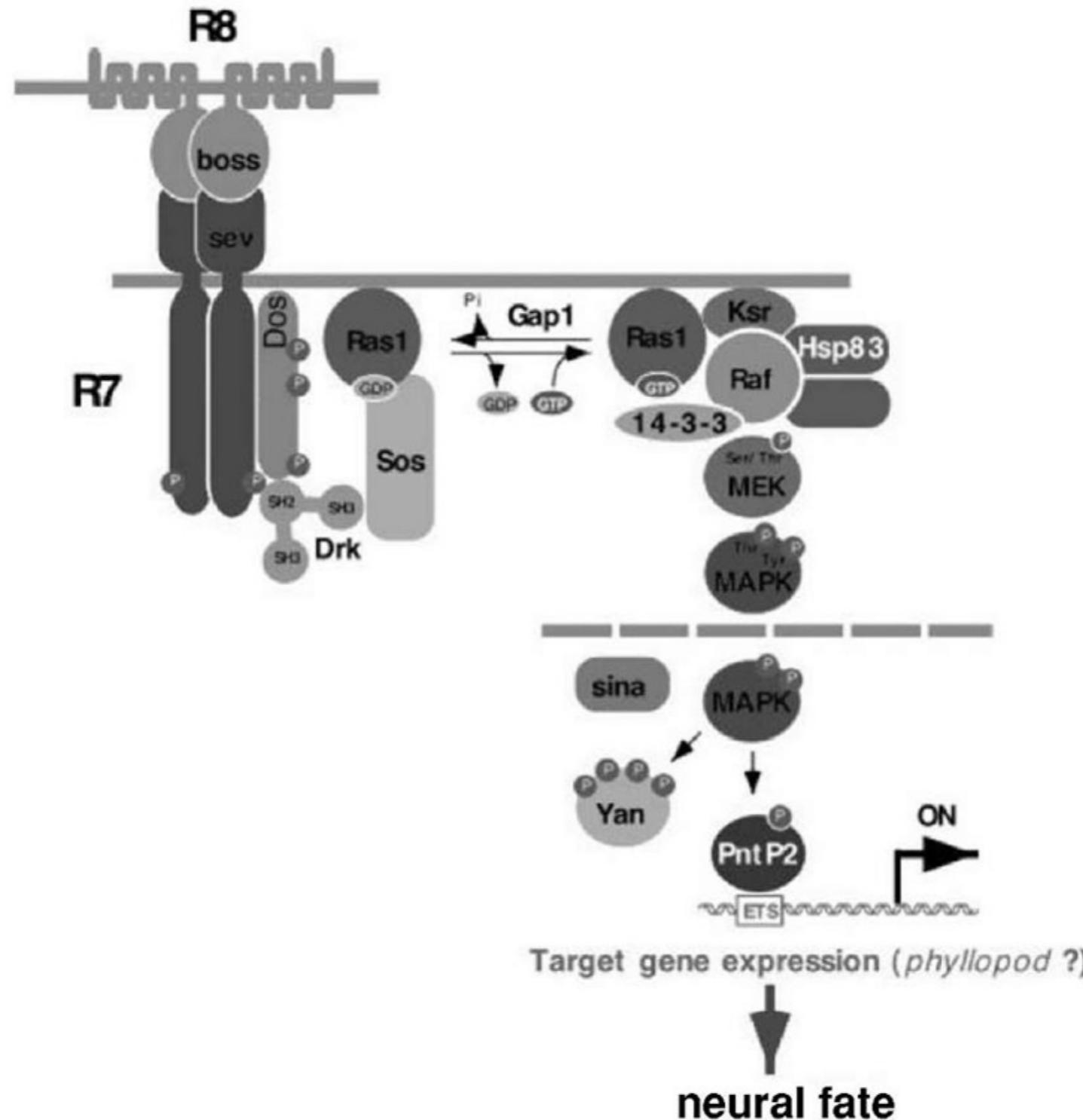
Assumptions: (1) Mutations in downstream genes required for viability and R7 fate
(2) Most genes are not haploinsufficient

Screen for dominant enhancers of sensitized mutant R7 phenotype



Screened 30,000 flies using pseudopupil technique
Got 20 $E(sev)$ in seven complementation groups

R7 fate is determined through a Ras pathway



What cells require *E(sev)* for function?

Mitotic recombination

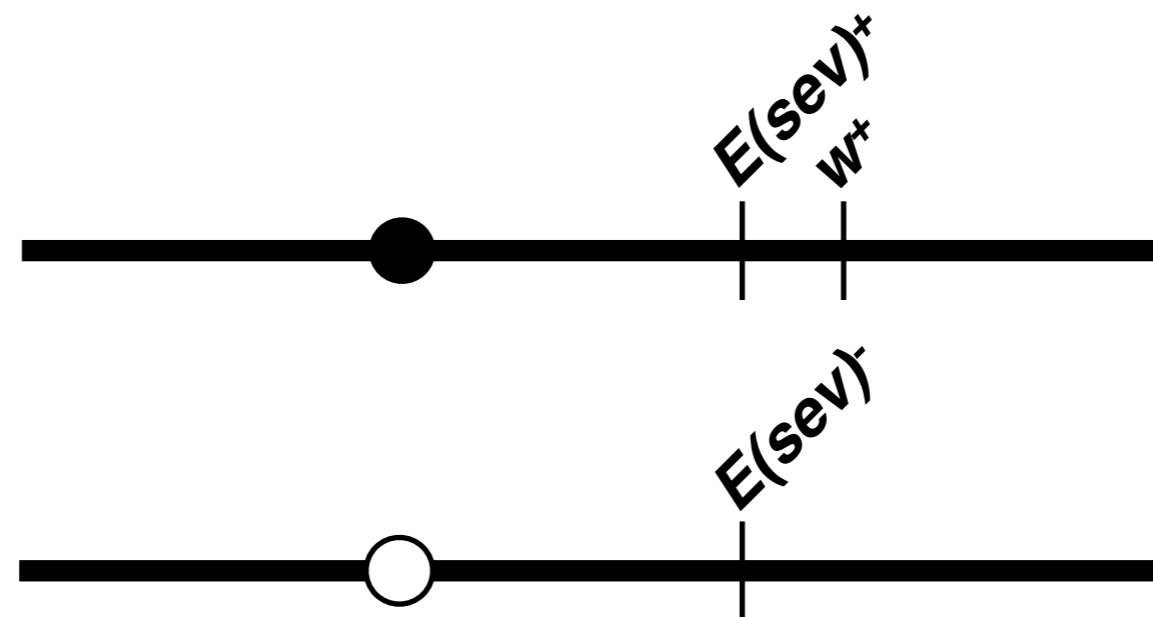
Lecture 11

Are genes required in ommatidia for cell viability?

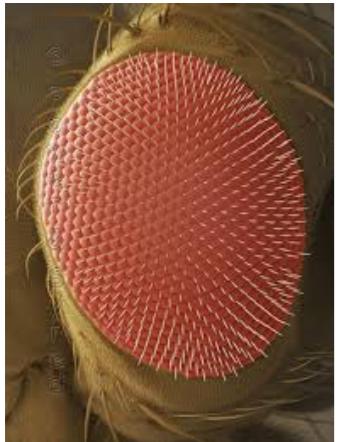
We want to make flies that lack the *E(sev)* gene in certain cells

1.  $\underline{E(sev)}^- ; \underline{w}$
+
 w

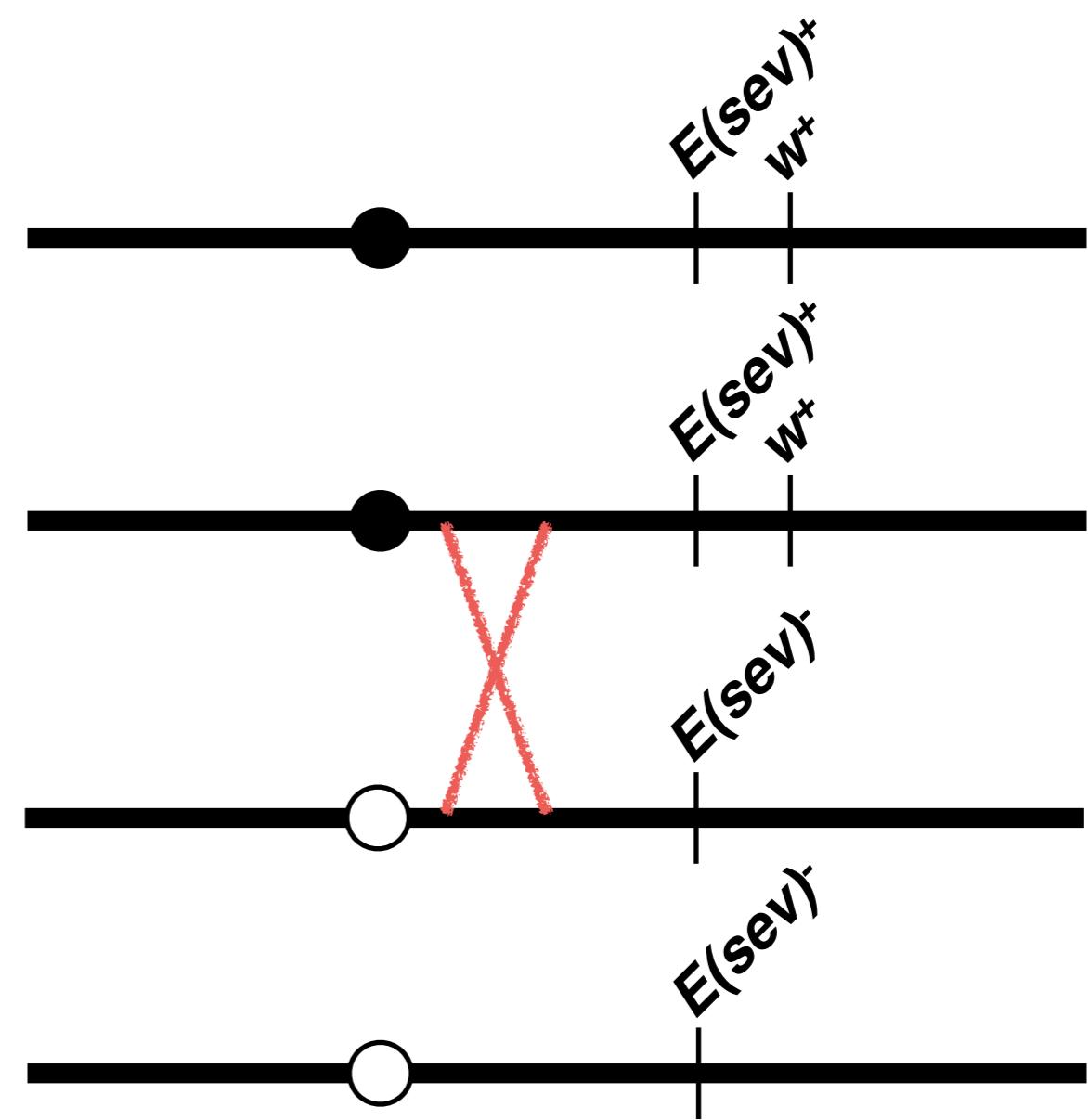
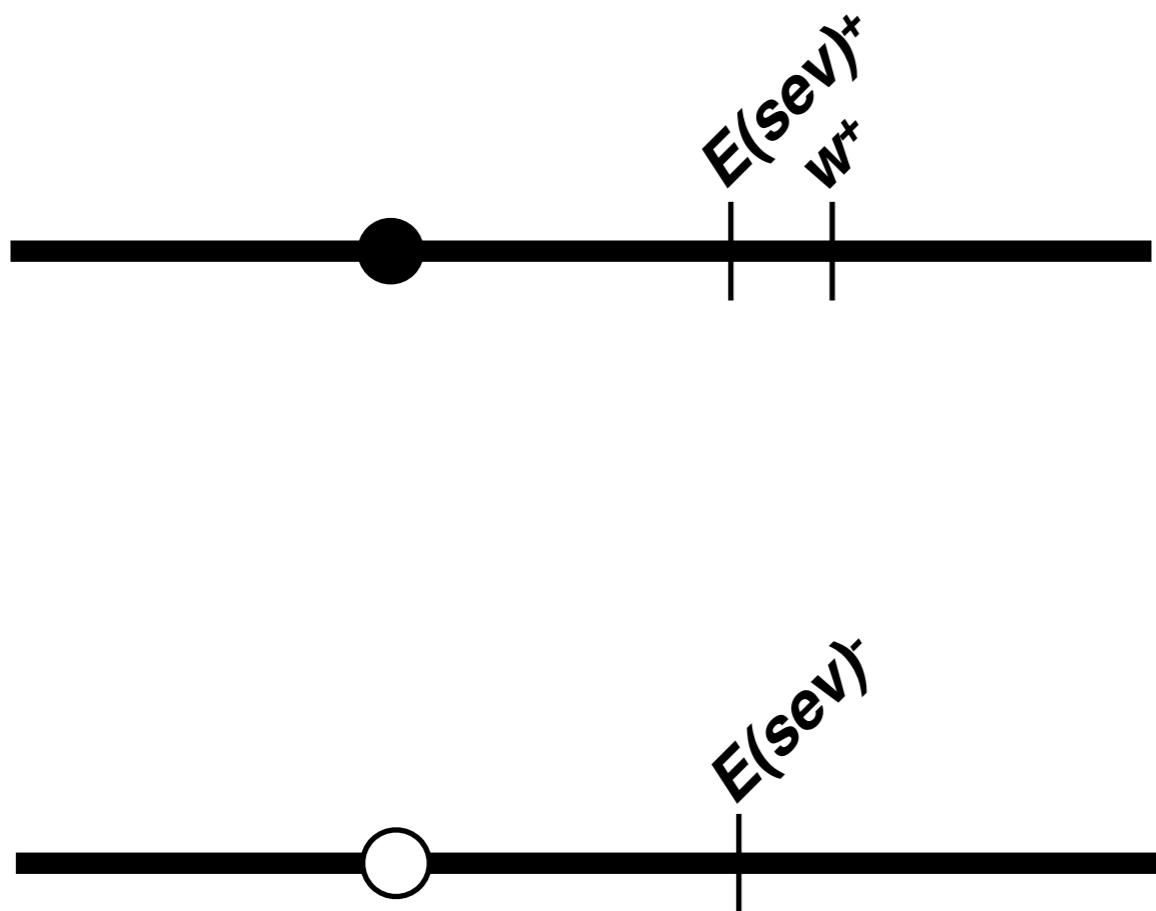
2. Use a P element with w^+ distal
to the wild-type *E(sev)* gene



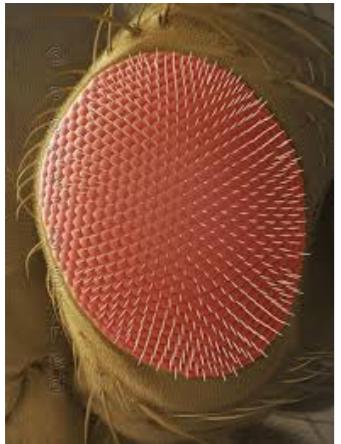
Are genes required in ommatidia for cell viability?



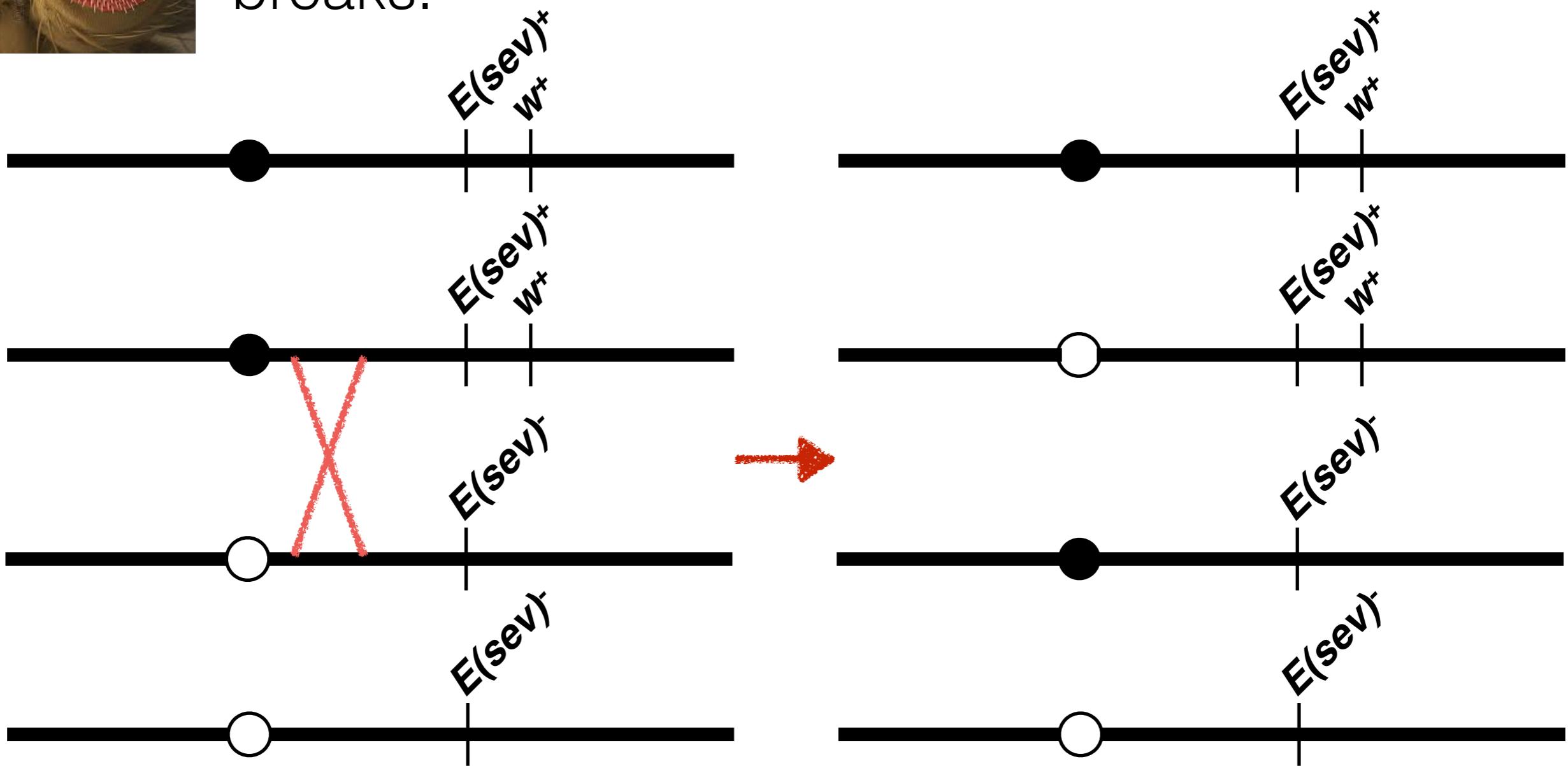
During mitosis for the cells that make up the eye, recombination can occur to repair double-strand breaks.



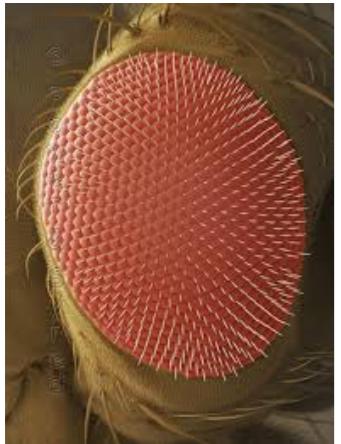
Are genes required in ommatidia for cell viability?



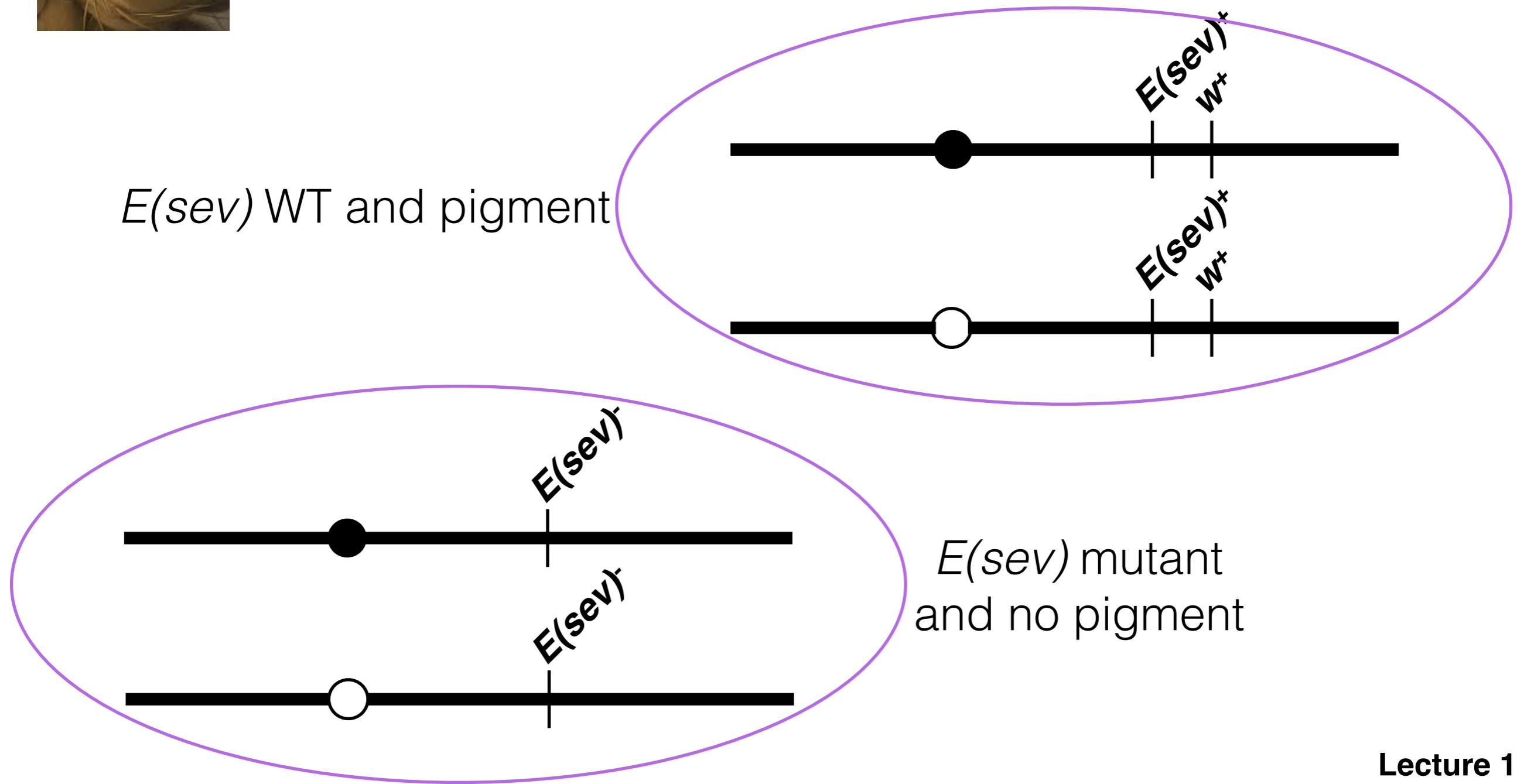
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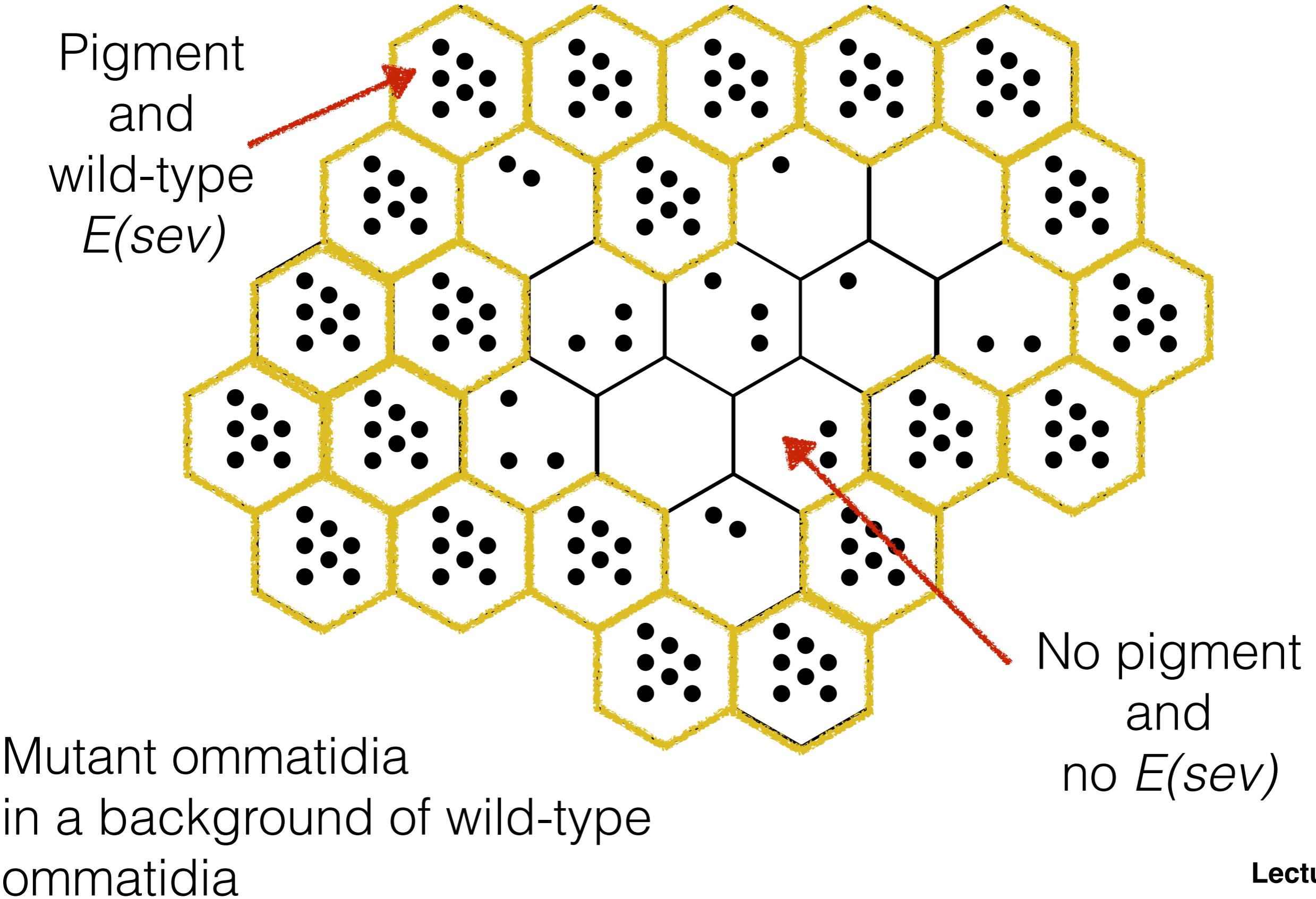
Are genes required in ommatidia for cell viability?



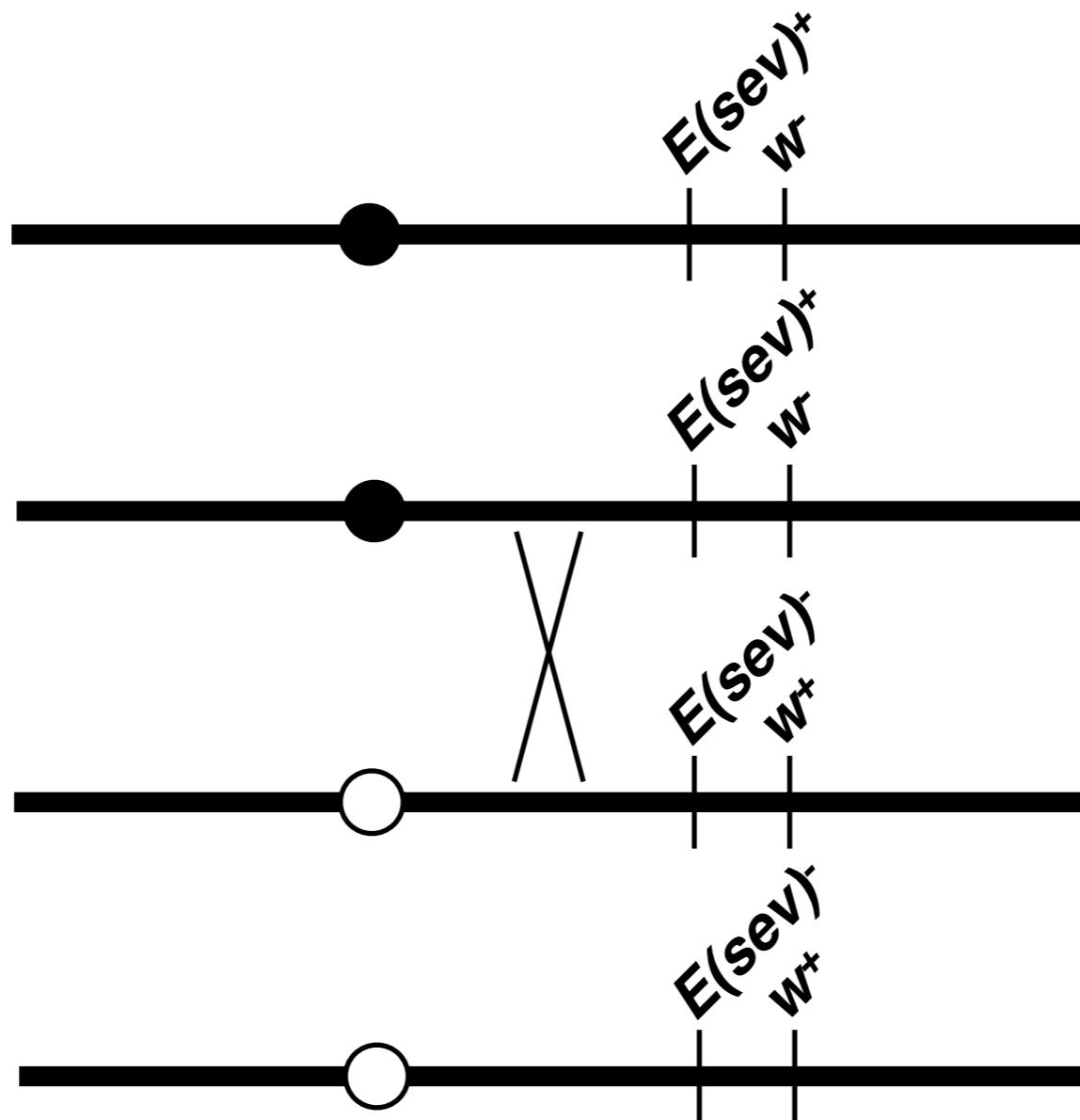
During mitosis for the cells that make up the eye, recombination can occur to repair double-strand breaks.



Are genes required in ommatidia for cell viability?

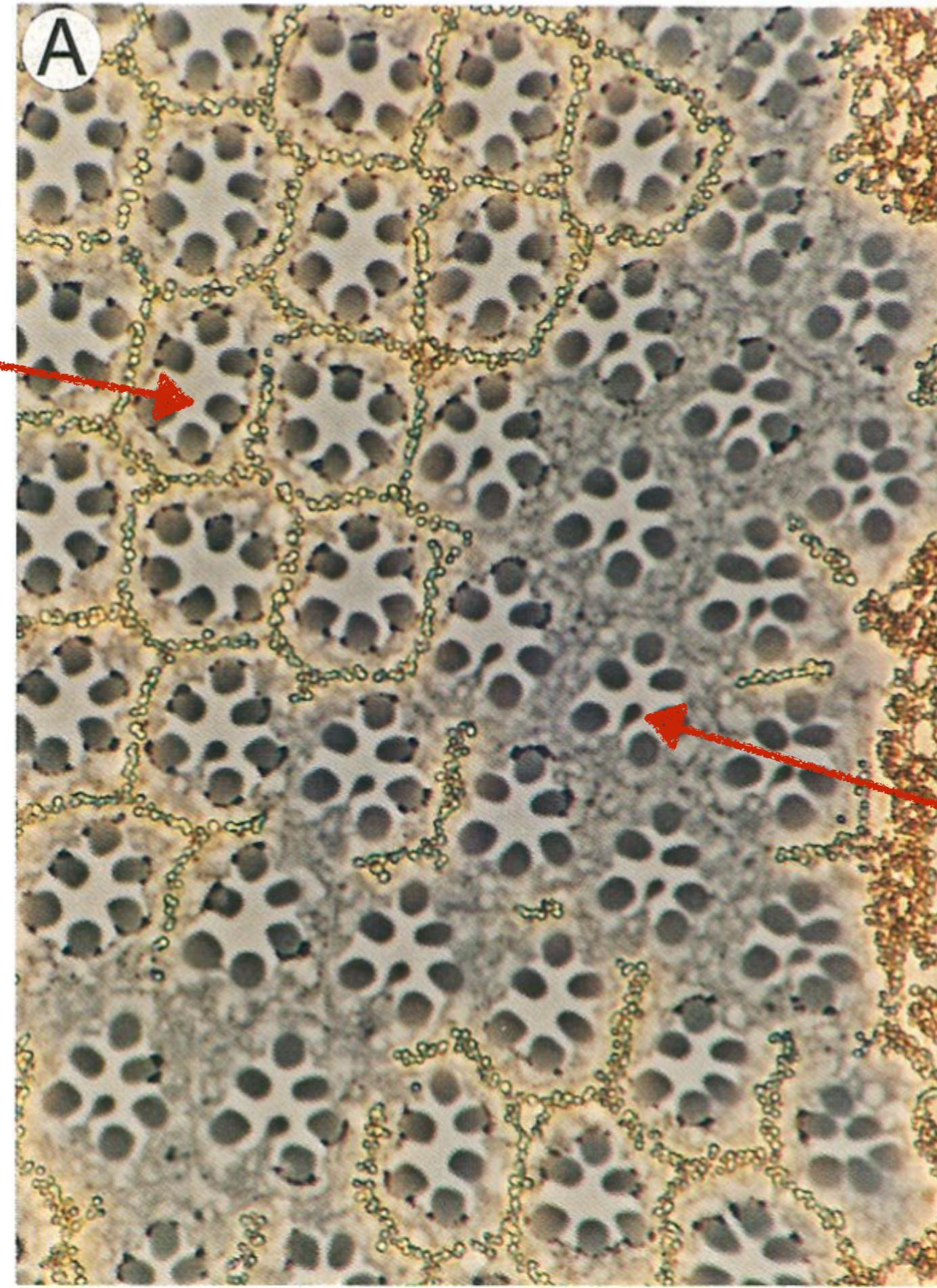


Are genes required in the R7 cell for controlling R7 cell fate?



Wild-type
ommatidia
in a
background
of mutant
ommatidia

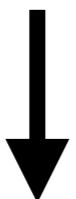
Pigment
and
E(sev)
mutant



No pigment
and
wild-type
E(sev)

Screen for dominant enhancers of sensitized phenotype led to the Ras pathway controlling R7 fate

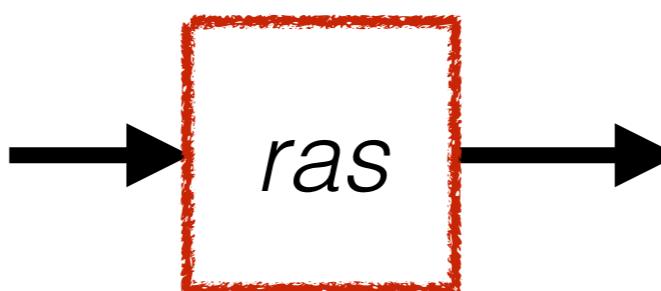
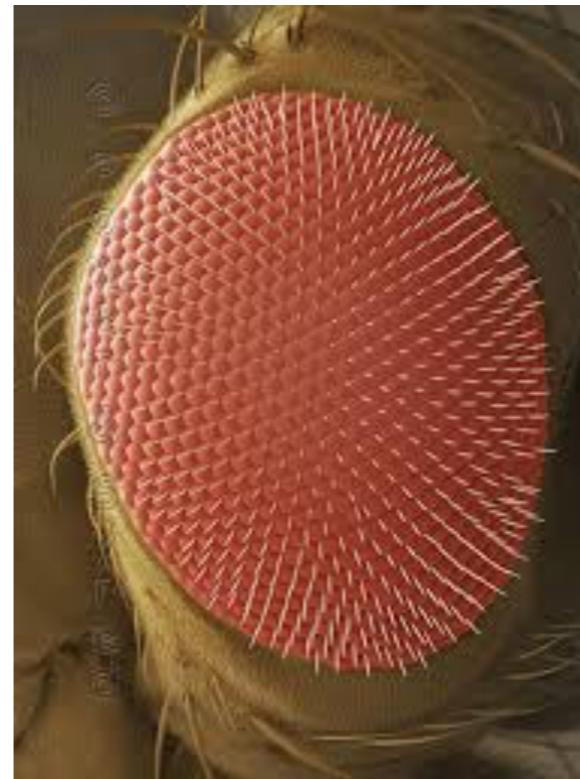
bride of sevenless
boss



sevenless
sev

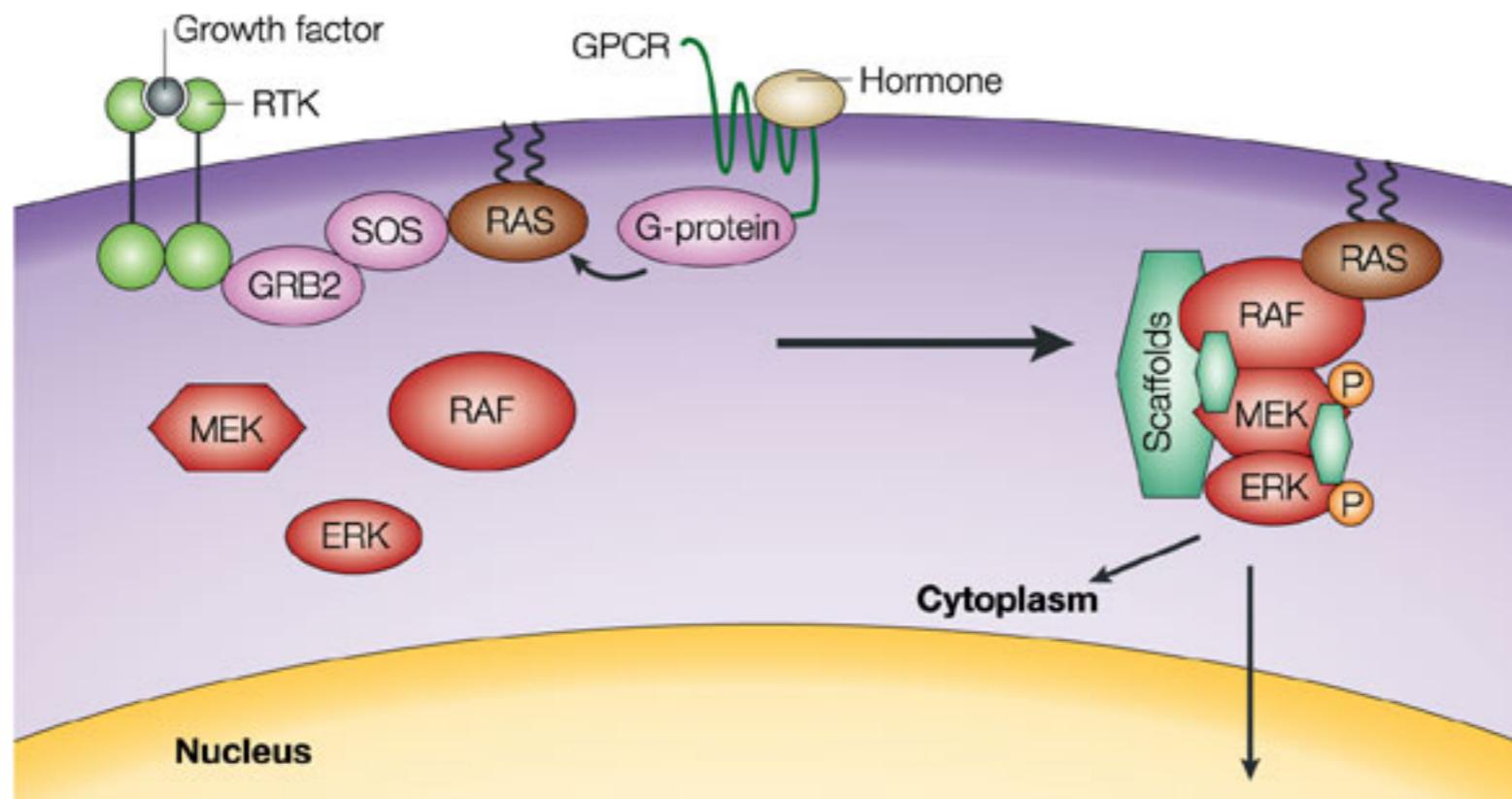


son of sevenless
sos



R7
development

Two decades of research in *Drosophila* and *C. elegans* led to these pathways



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