The key to understanding heredity is to understand how cells divide and pass DNA information to the newly produced cells. Gregor Mendel, a 19th century amateur geneticist, was able to explain many characteristics of heredity that had mystified the professional biologists of his time. In this chapter, you will learn how to predict patterns of inheritance and how organisms pass their genetic information to future generations. Cell division processes are different between eukaryotes, prokaryotes (bacteria) and, haploid gametes (eggs and sperm). Adults produce haploid gametes, with half the diploid-amount of DNA, in a slightly different way than they produce diploid cells. Yet all these cell division processes use similar proteins, as would be expected given their common evolutionary history. {*Connections: the Big Idea of Evolution is discussed explicitly in six chapters.*} The five sections of Chapter 3 focus on information at the organismal level.

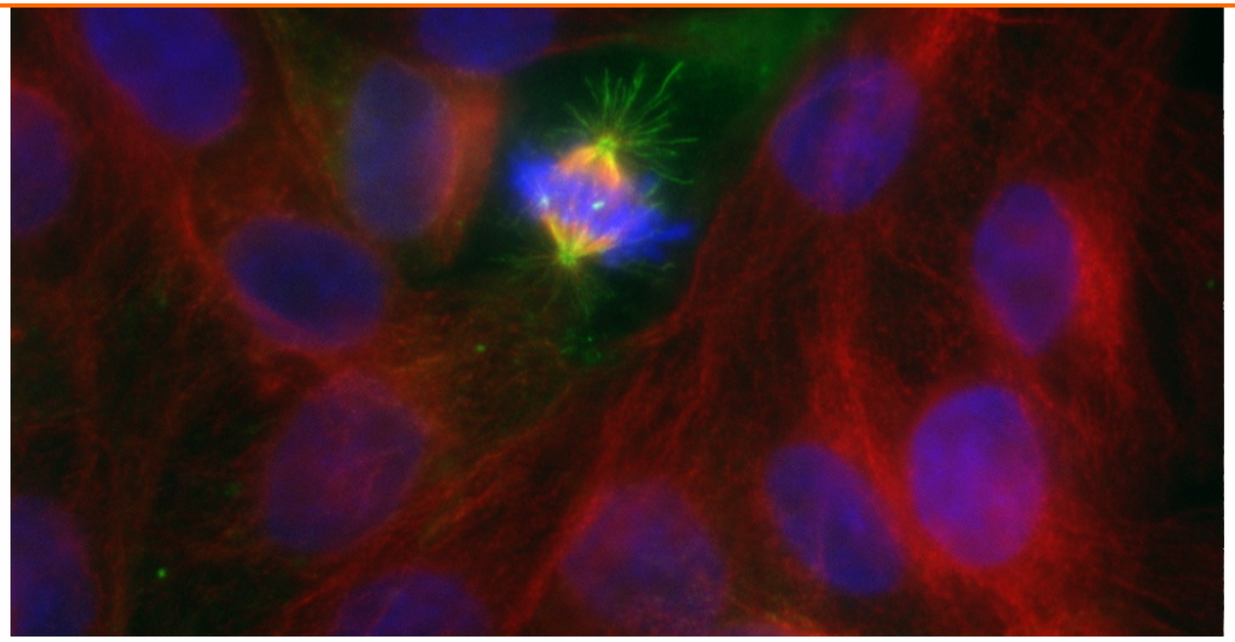


Photo courtesy of John Kogoy, Davidson, NC.

you are here		Big Ideas of biology				
		Information	Evolution	Cells	Homeostasis	Emergent Properties
levels of the biological hierarchy	molecules	1	4	7	10	13
	cells	2	5	8	11	14
	organisms I	3	6	9	12	15
	organisms II	16	19	22	28	25
	populations	17	20	23	29	26
	ecological systems	18	21	24	30	27

Biology Learning Objectives

1. Restate the major rules and laws discovered by Gregor Mendel.
2. Analyze genetic data to demonstrate your comprehension of inheritance patterns.
3. Use diagrams to illustrate how prokaryotes reproduce through cellular fission.
4. Explain how mitosis works and its genetic outcomes.

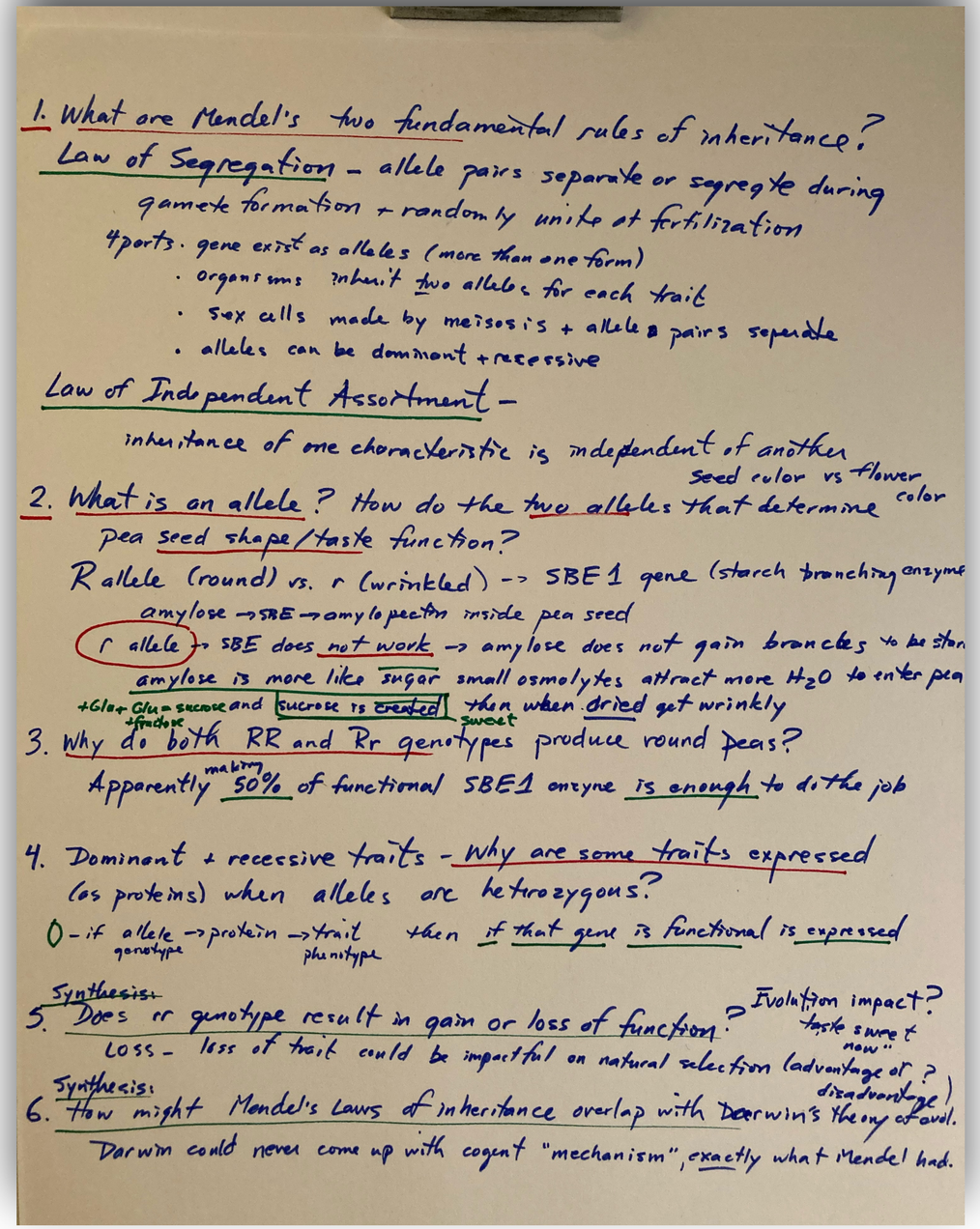
Lecture12 - (Preparing for) **The LIVE in-person lecture**

Budgeting homework time (60 min): Read and prepare for a case study on the SBE1 gene (evo-ed.org).

SBE1 case:
Read and take notes from the http://evo-ed.com/ website in the "Pea Taste" sections: Mendel to Molecules, Cell Biol, Molecular Genet, Population Genetics. *Direct link*-> http://evo-ed.com/Pages/Peas/

Use that website as well as section 3.1 on Mendel in your textbook as resources to answer these questions. Write out your answers in your paper notebook so you can photograph and turn in one copy but keep the second one for class.

Integrating Questions
1. What are Mendel's two fundamental rules of inheritance?
2. What is an allele? How do the two alleles that determine pea seed shape/taste function?
3. Why do both the RR and Rr genotypes produce round peas?
4. We call some traits dominant and others recessive, and we relate this to their respective alleles. Explain, in terms of protein function, why some traits are expressed when alleles are heterozygous.
5. Synthesis question: Does the rr genotype result in a gain or loss of function? How could either a loss or gain of function be evolutionarily important?
6. Synthesis question: Mendel and Darwin were contemporaries, although they did not know one another. How might the principles of Mendel's laws of inheritance overlap with Darwin's theory of evolution?



Integrating Questions

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Why is R dominant over r?

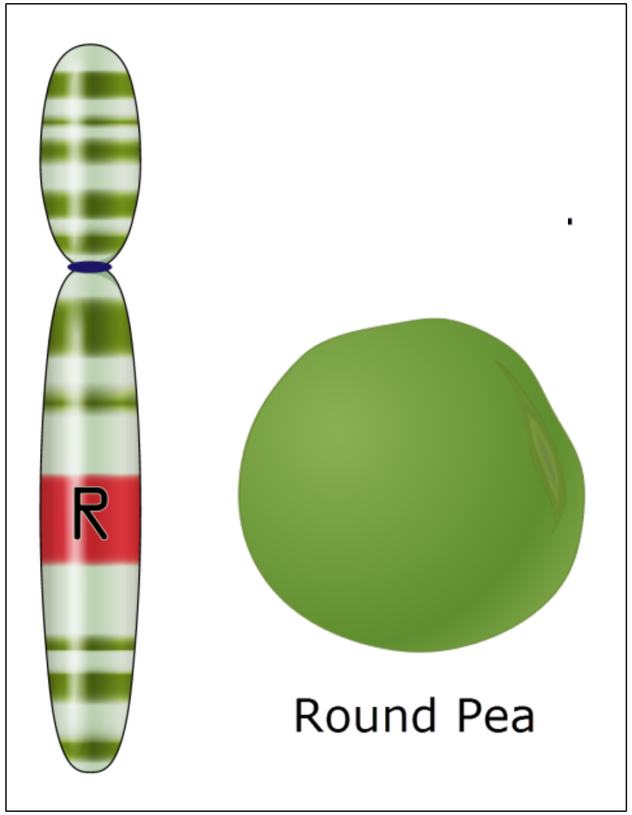
Why do both the RR and Rr genotypes produce round peas?

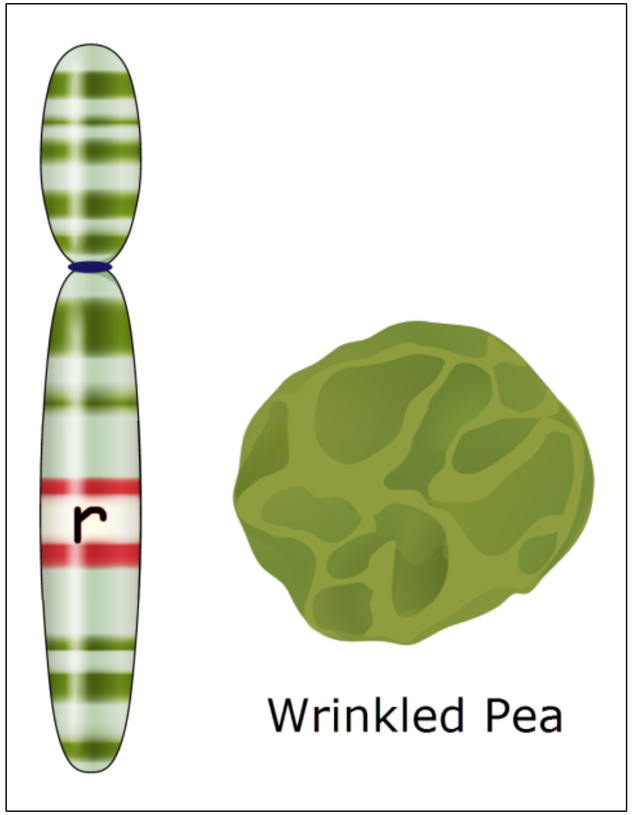
Discuss…

At the molecular level (DNA->RNA->protein) why is that pea wrinkled?

(what might a molecular biologist predict?)

?

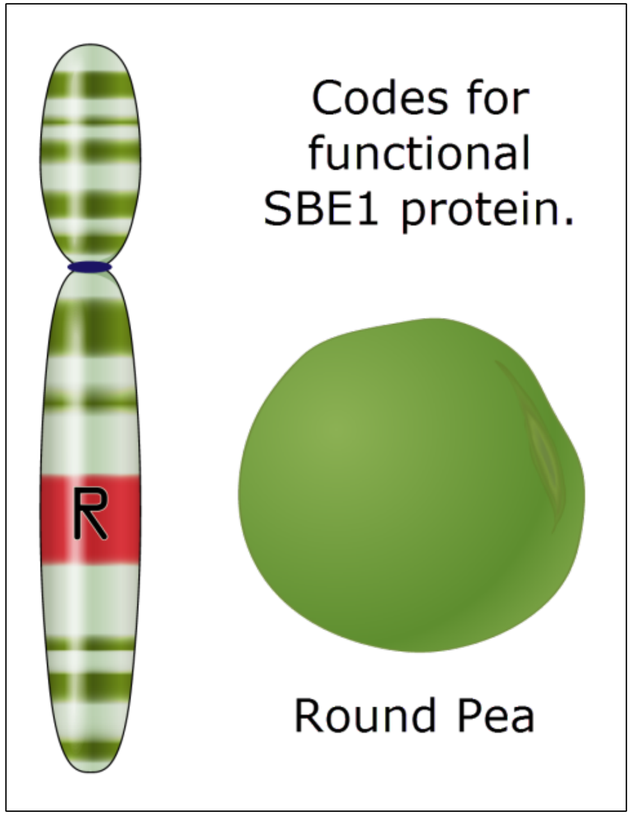


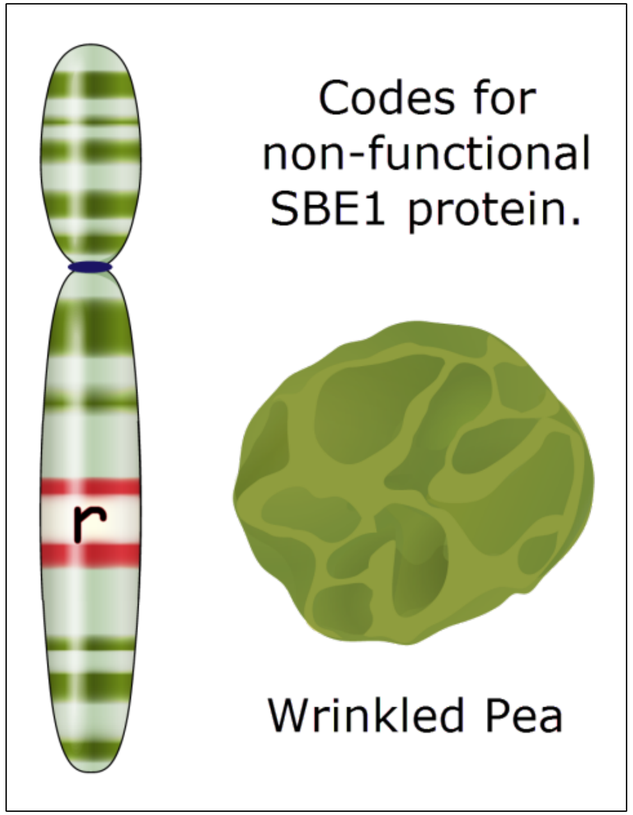


R= sbe1 gene

SBE= Starch Branching Enzyme

?

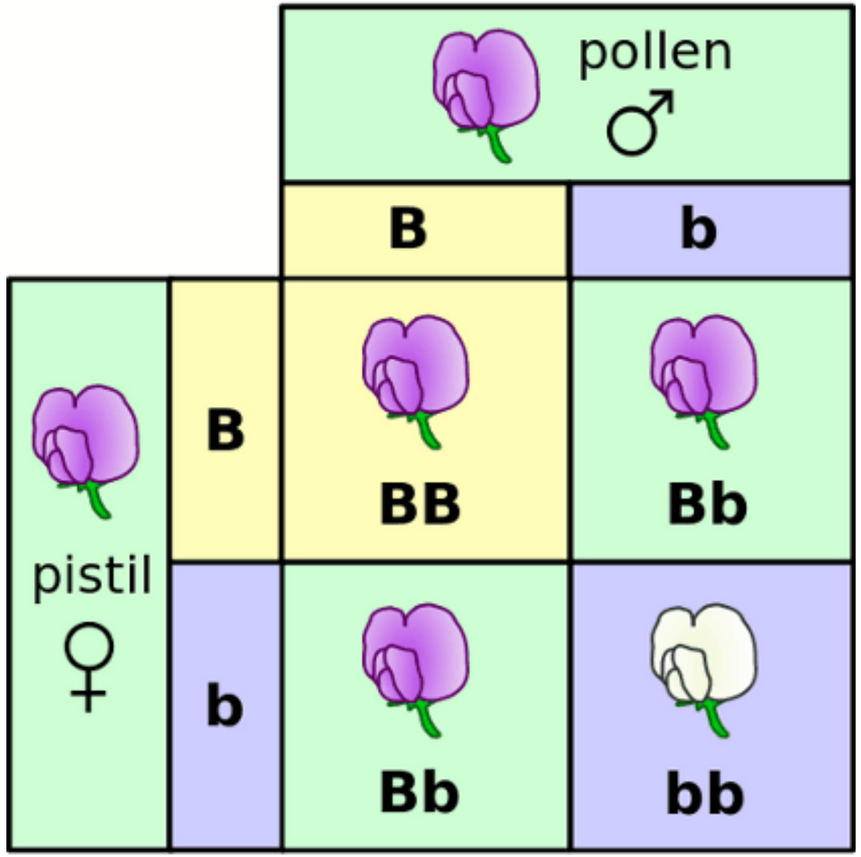




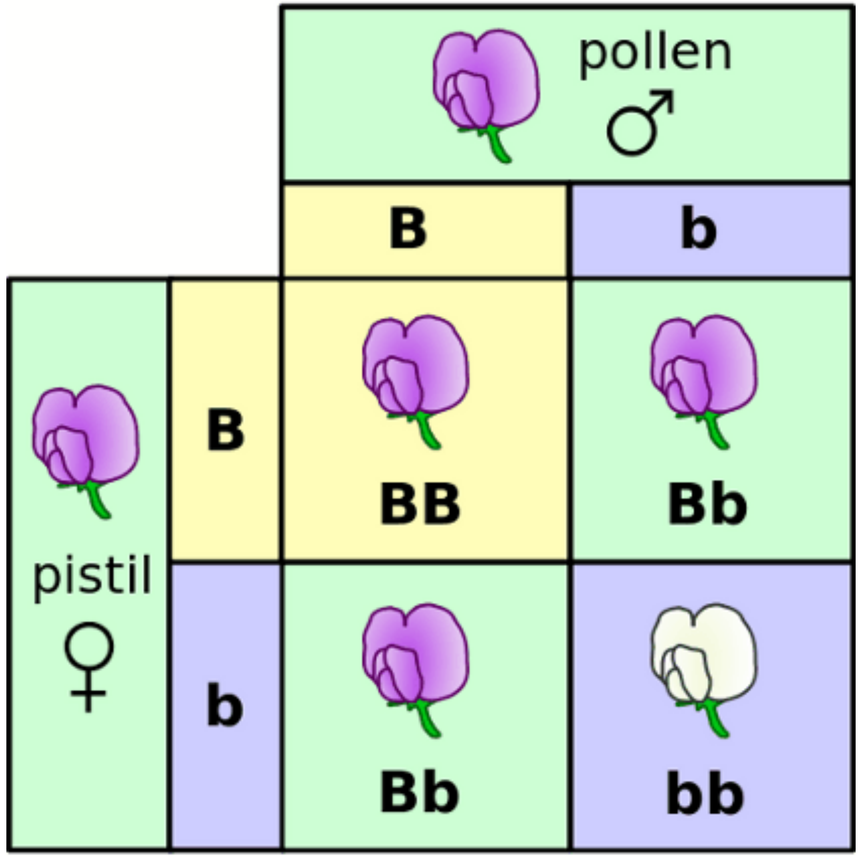
At the molecular level (DNA->RNA->protein) why is one pea flower white?

(what might a molecular biologist *predict*?)

?

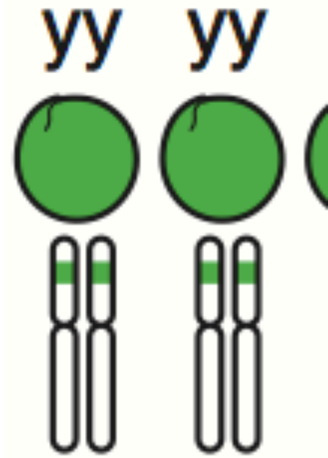


Q: If B allele produces a purple pigment, **WHY** isn't Bb light pink (would that be blended)?



What's the GENOTYPE?

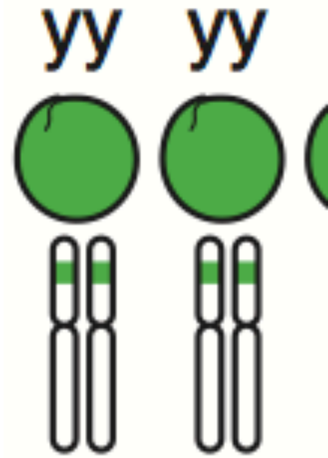
?



At the molecular level (DNA->RNA->protein) why is that pea yellow?

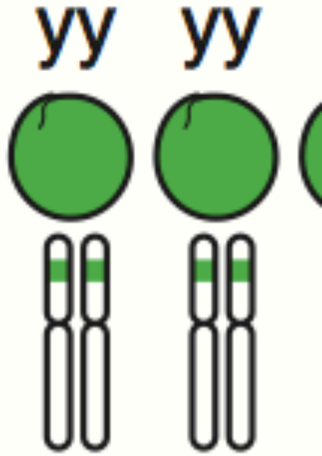
(what might a molecular biologist *predict*?)

?



I talked to a colleague from my old university and he said “yes, well, kinda”

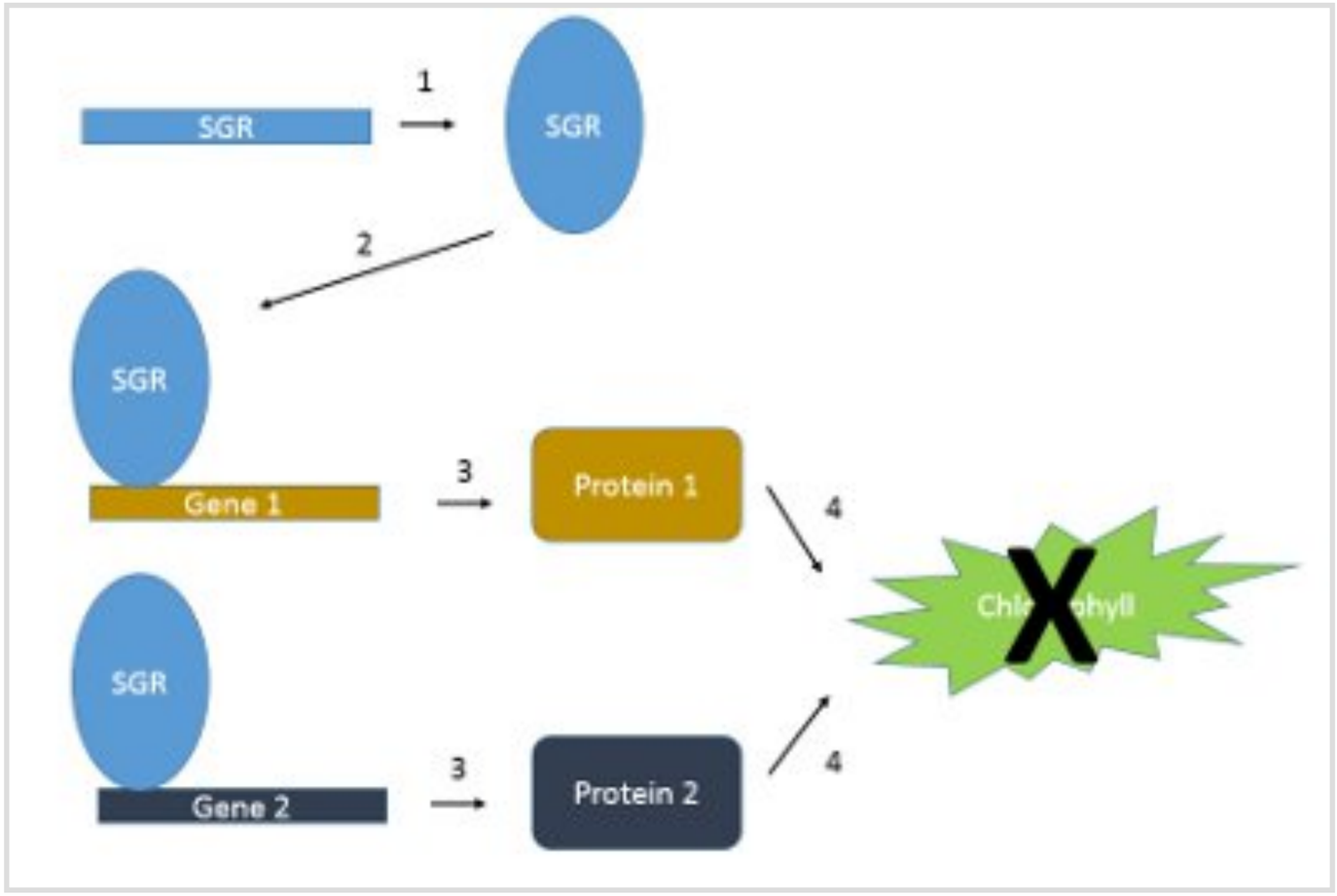
Dr. Barry Starr, [Stanford University]

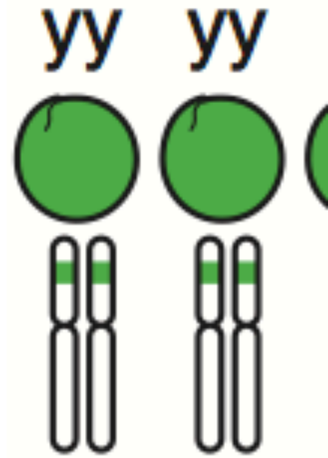


Y =SGR gene

SGR gene [blue rectangle] -makes-> SGR protein (blue oval)

?





Protein **Protein STAY-GREEN, chloroplastic**

Gene **SGR**

Organism *Pisum sativum (Garden pea)*

Status Reviewed - Annotation score: ●●●○○ - Experimental evidence at transcript level[i]

Function[i]

Probably involved in the disassembling mechanism of the intact light-harvesting complex of photosystem II (LHCII) in the thylakoid membranes. Required for the chlorophyll breakdown pathway. Acts independent and upstream of pheophorbide a oxygenase (PAO). 2 Publications

Miscellaneous

Corresponds to one of the seven genes studied by Gregor Mendel in 1866 (PubMed:17204643). The green cotyledon (i) line JI2775 used in the original work has a non-functional SGR protein (AC A7VLV2) due to the presence of a two amino acids insertion (PubMed:17709752 and PubMed:18301989). 1 Publication

Sequence[i]

Sequence status[i]: Complete.
Sequence processing[i]: The displayed sequence is further processed into a mature form.

A7VLV1-1 [UniParc] FASTA | Add to basket

« Hide

```
         10          20          30          40          50
MDTLTSAPLL TTKFKPSFSP QQKPCFPHRR RFENGKKNQS IVPVARLFGP
         60          70          80          90         100
AIFEASKLKV LFLGIDENKH PGNLPRTYTL THSDVTSKLT LAISQTINNS
        110         120         130         140         150
```

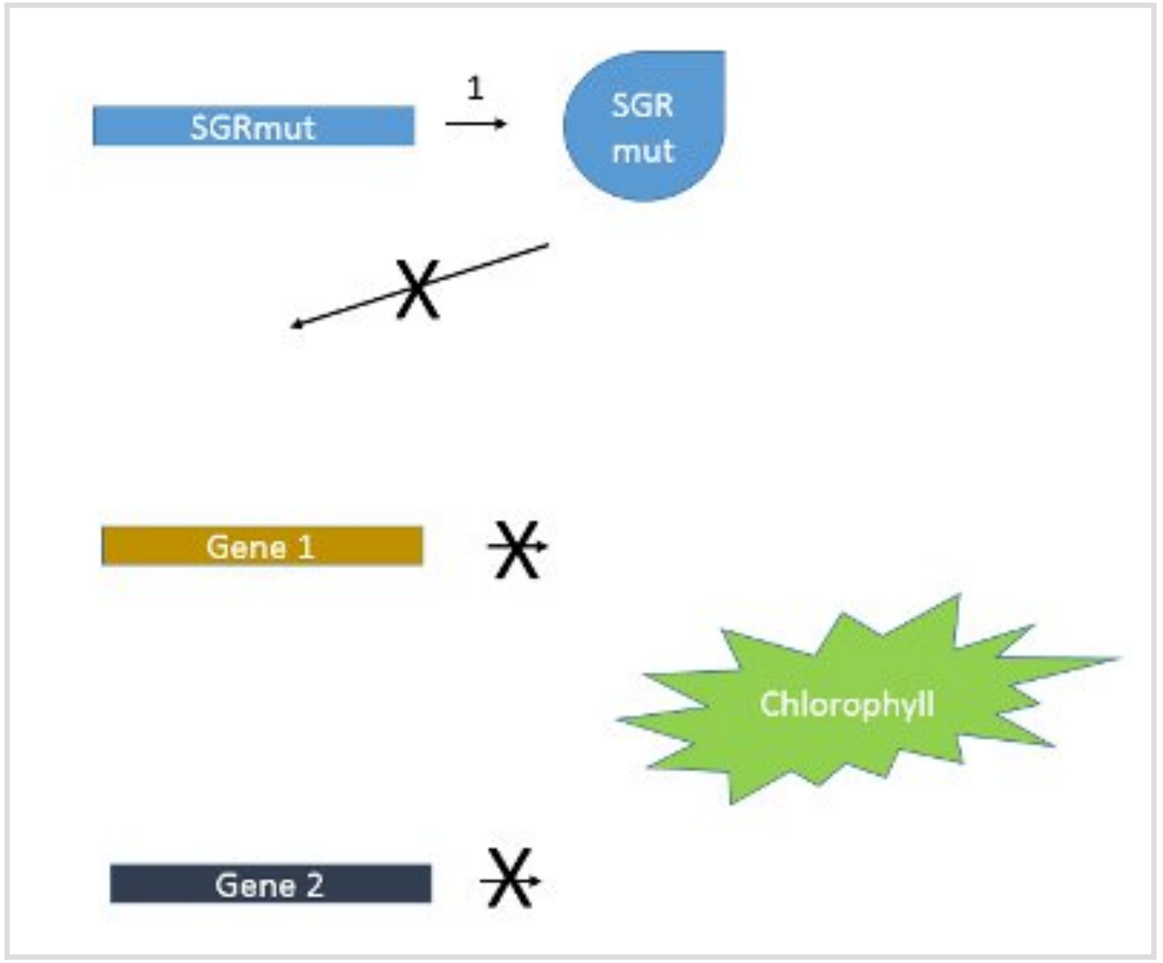
Length: 261
Mass (Da): 29,651
Last modified: October 23, 2007 - v1
Checksum:[i] 224749FD8714AF82

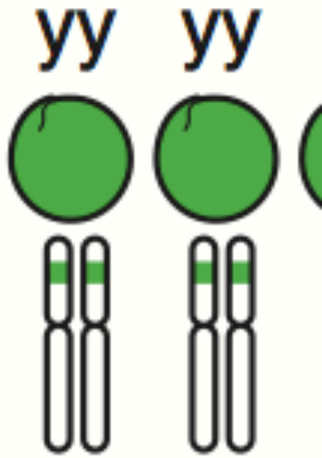
BLAST GO

Y =SGR gene

"SGRmut"= mutated SGR gene

?





Y =SGR gene

SGR="STAY-GREEN" Regulator

?

genotype

phenotype