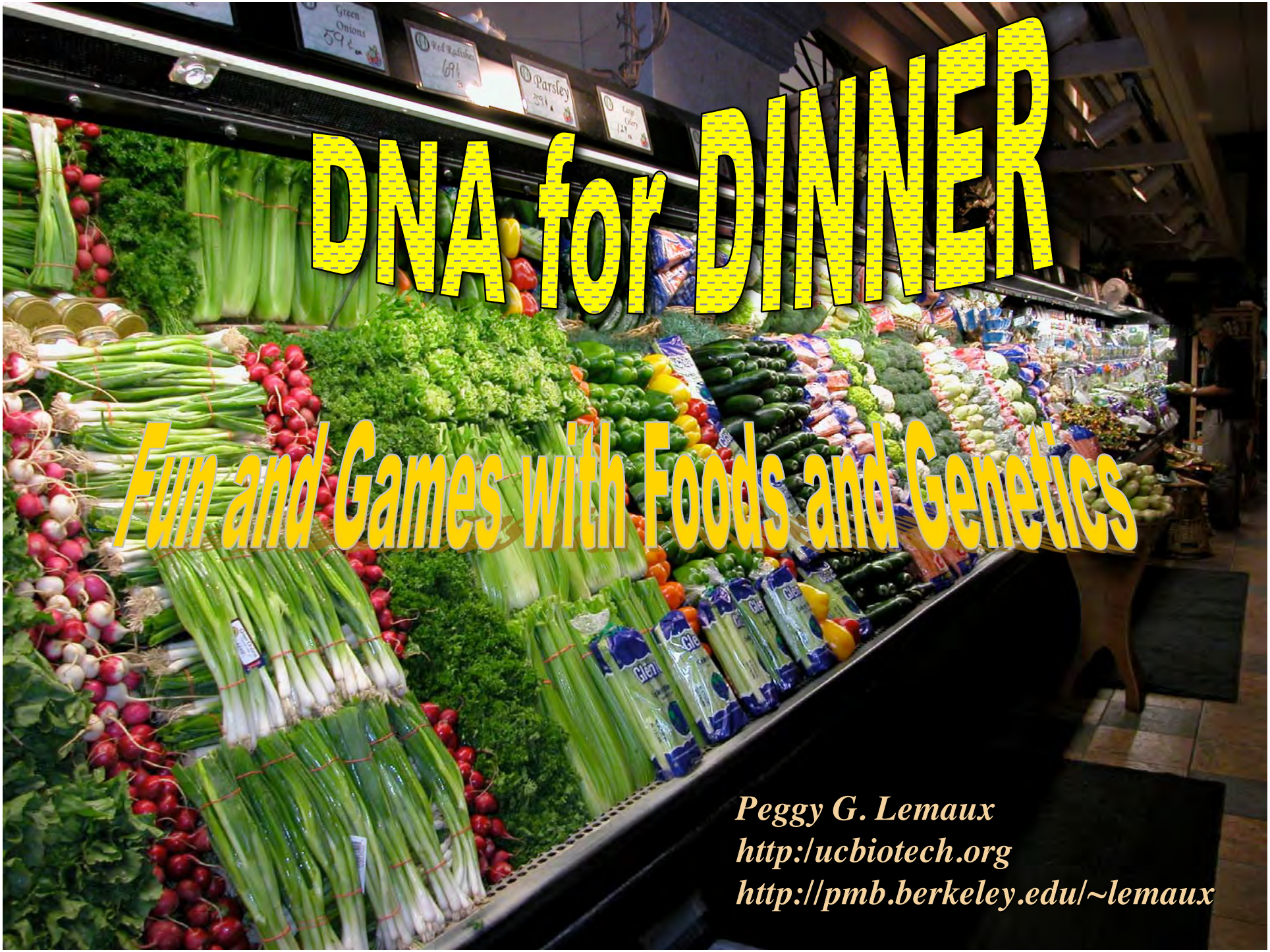
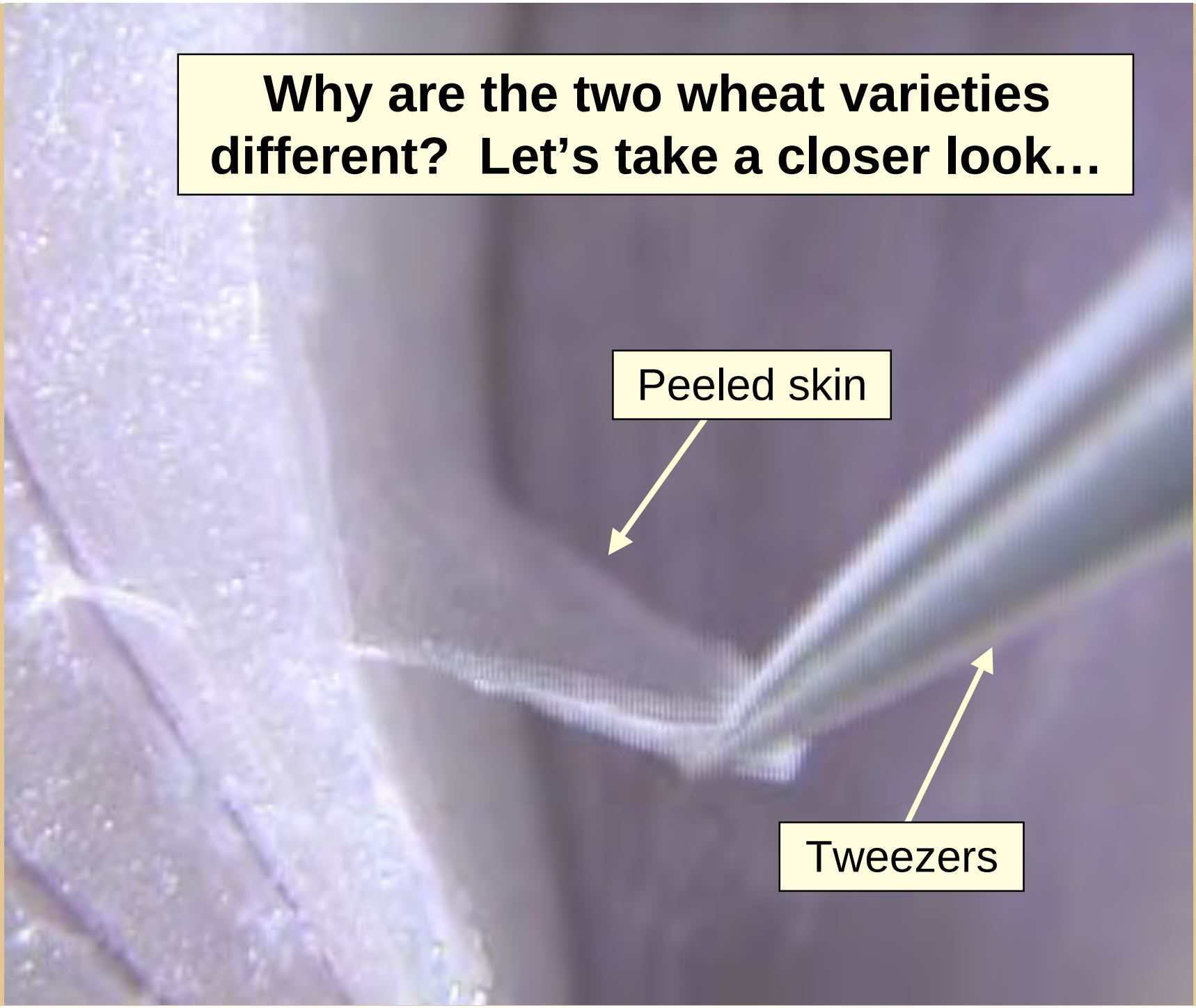
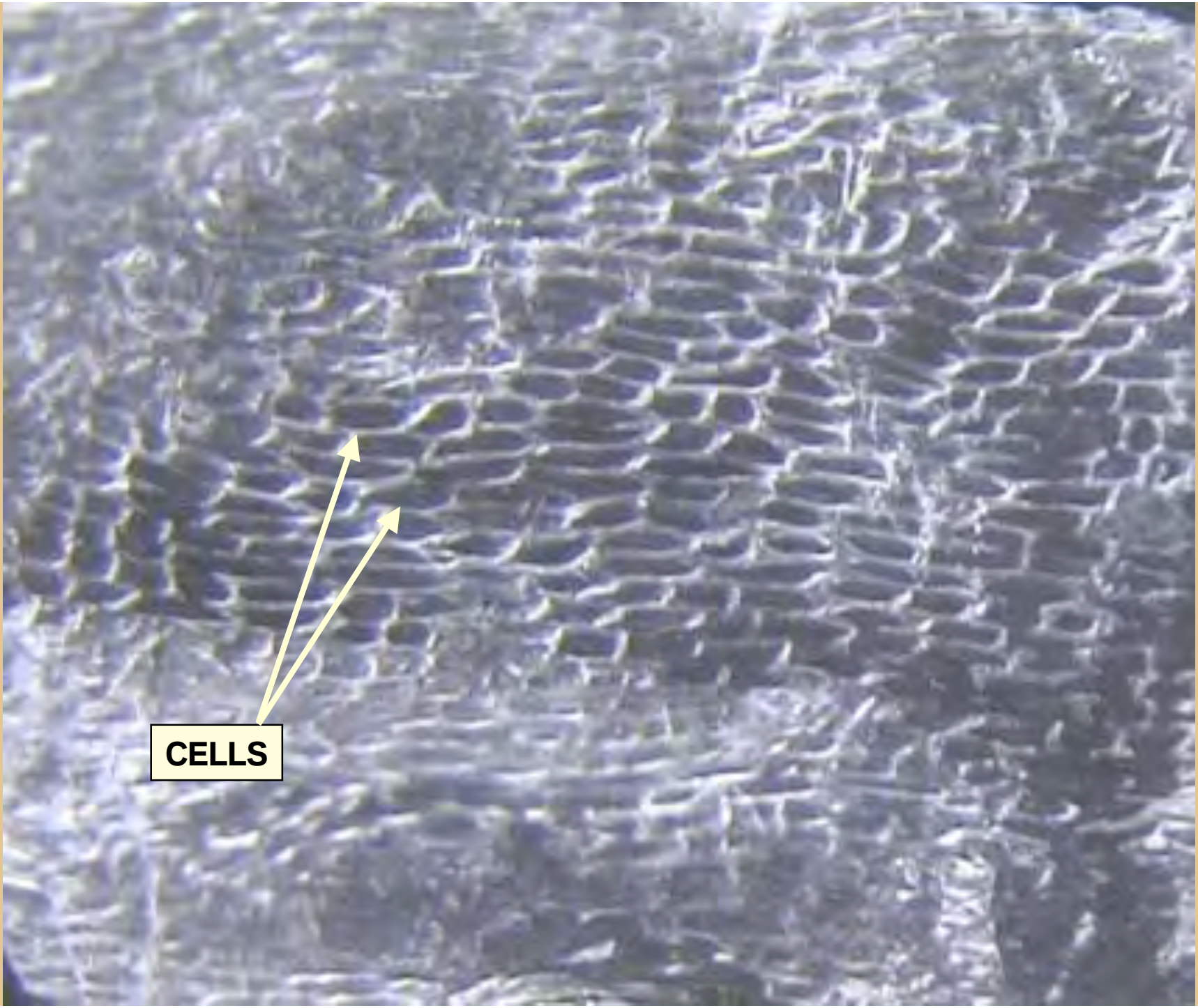
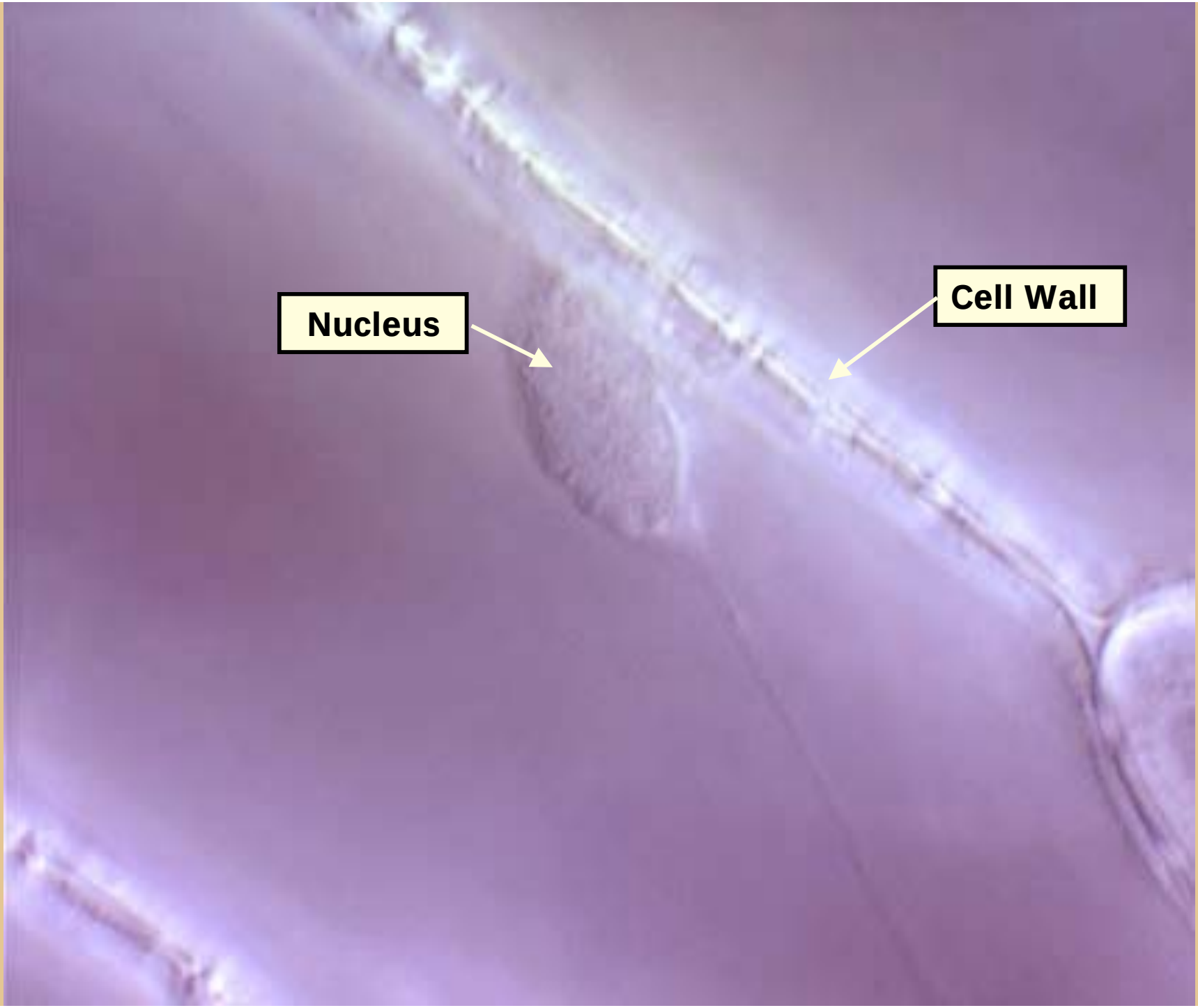
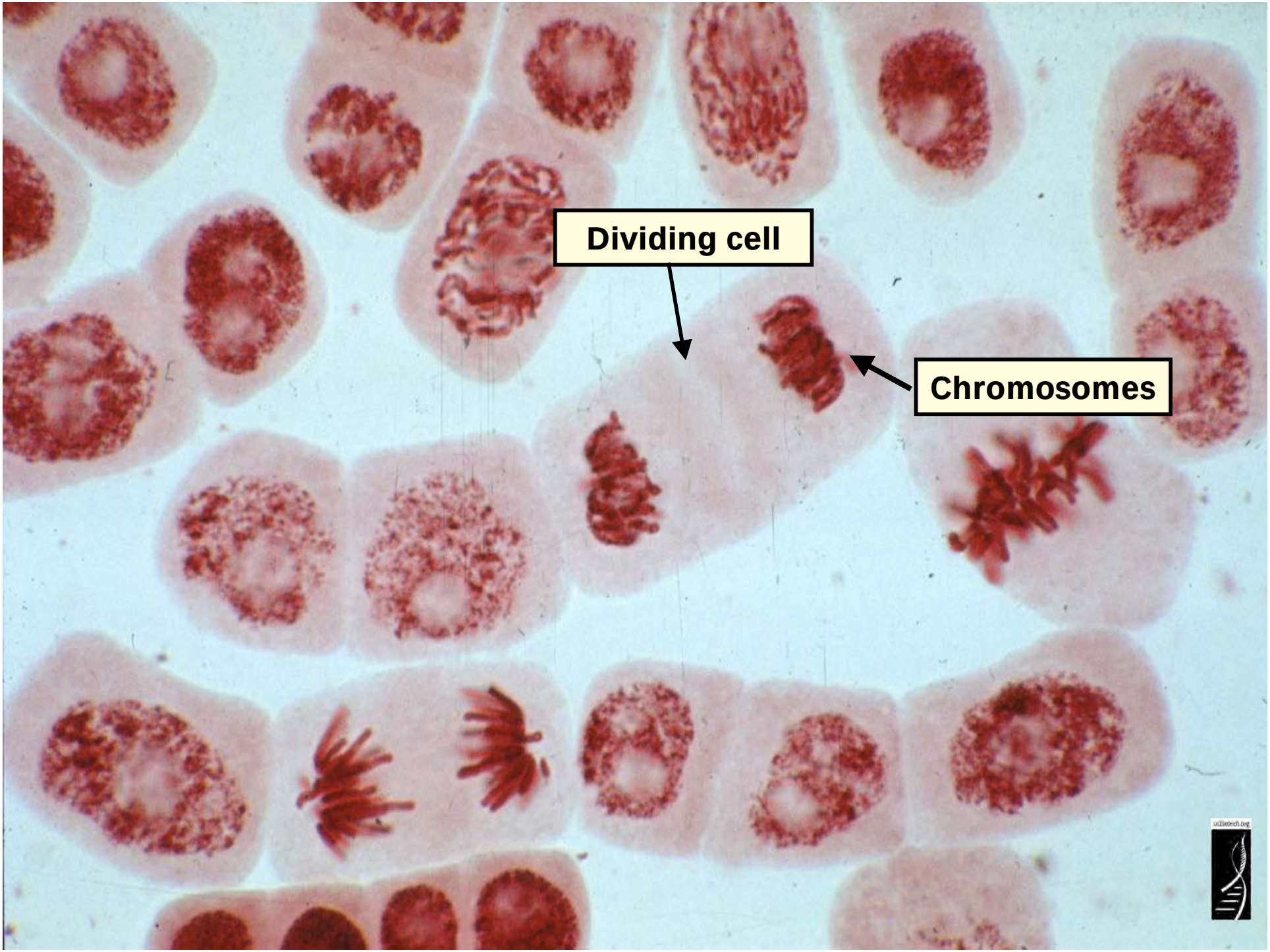

DNA for DINNER
Fun and Games with Foods and Genetics
Peggy G. Lemaux
http:/ucbiotech.org
http://pmb.berkeley.edu/~lemaux

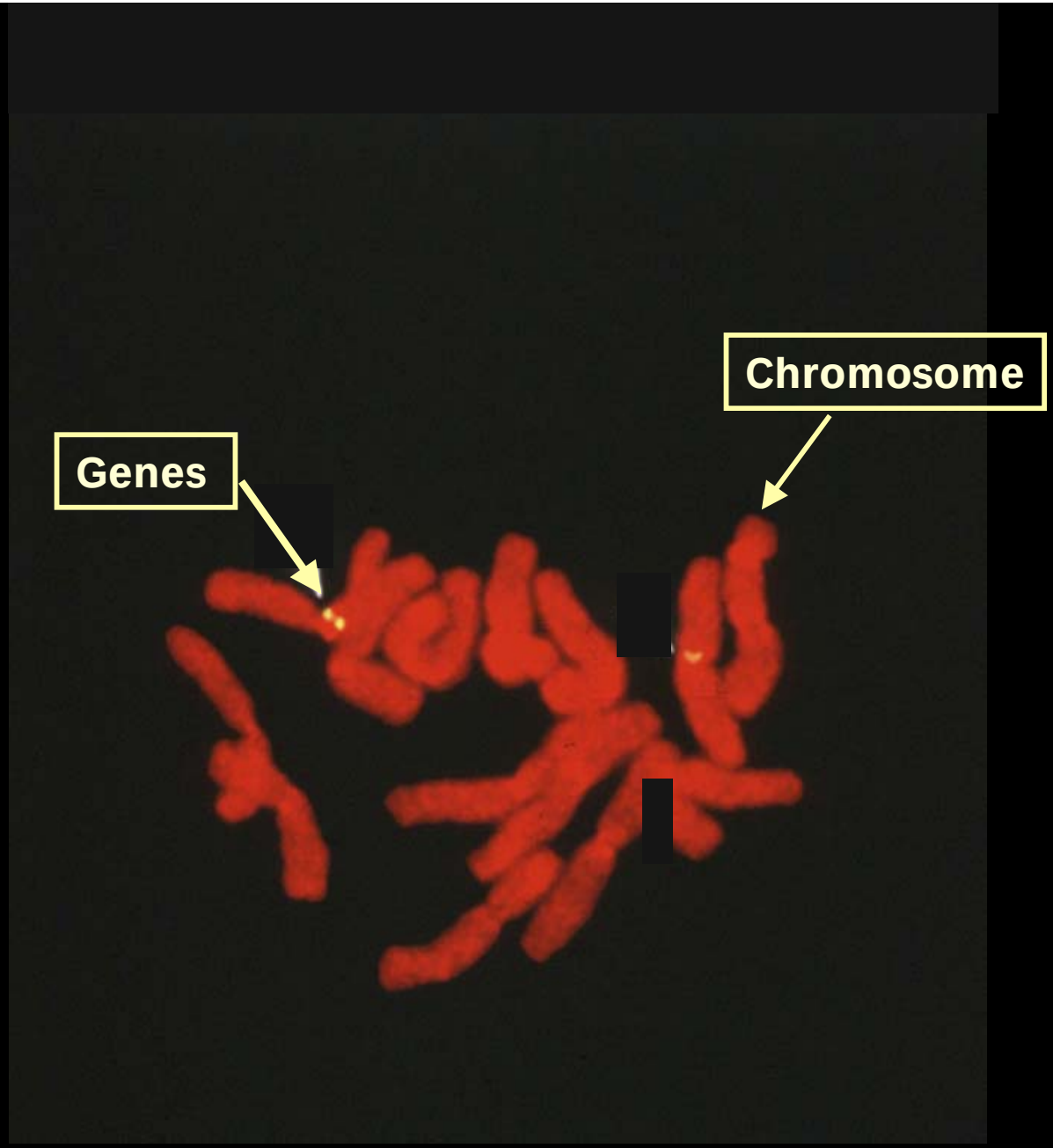
Tour d'Onion


Why are the two wheat varieties different? Let's take a closer look…
Peeled skin
Tweezers


CELLS


Nucleus
Cell Wall


Dividing cell
Chromosomes


Chromosome
Genes

What if an ancient variety of wheat had a trait, like disease resistance, that is needed in the modern variety?

Triticum aestivum
Modern bread variety

Triticum monococcum
Ancient variety

How can the genetic information in the cells of the wheat plant be modified to create the new variety?

Information in the wheat genome

Chemical units represented by alphabetic letters

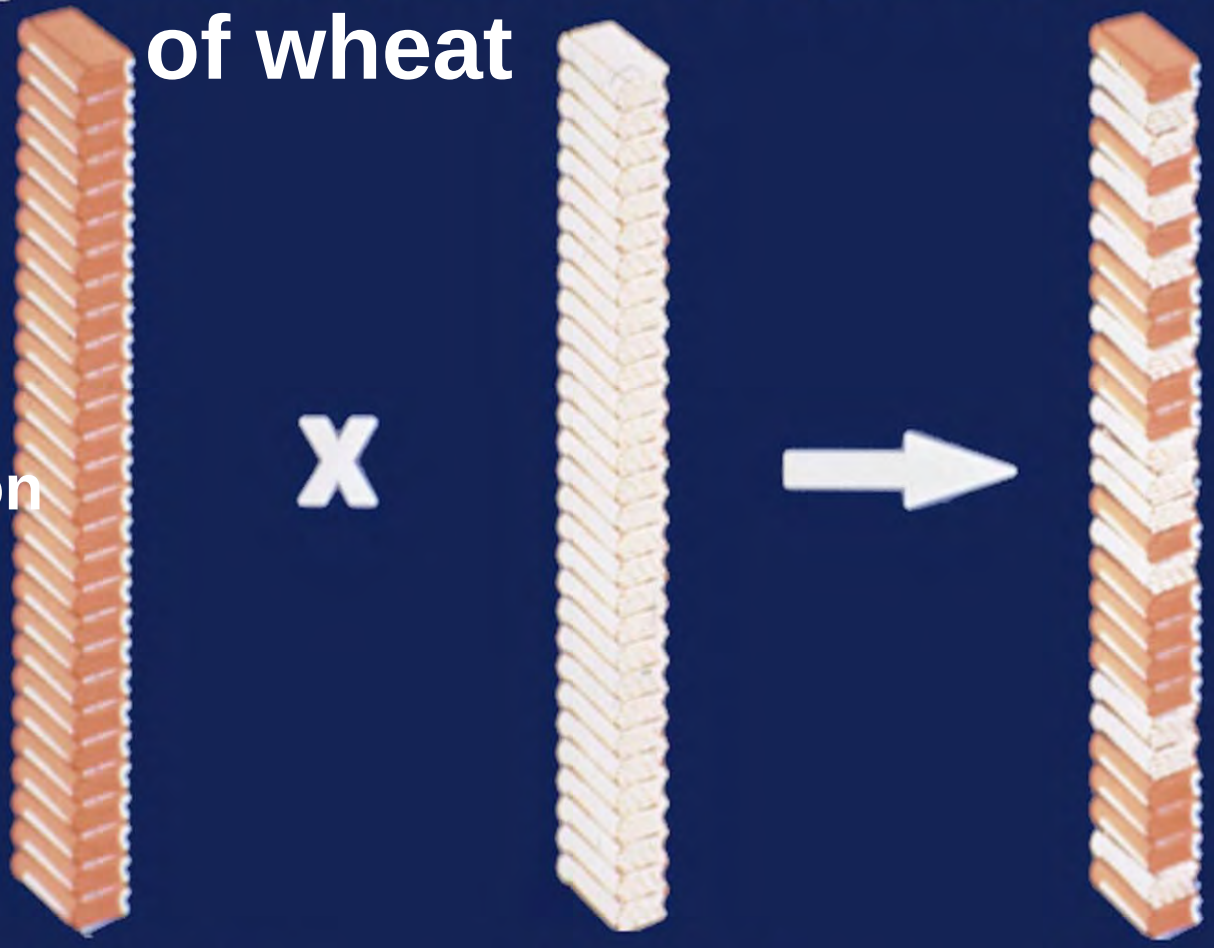
...CTGACCTAATGCCGTA...

1700 books
1000 pages each

1700 books
(or 1.7 milion pages)

Hybridization or cross breeding of wheat

Two varieties have different information contained in their books

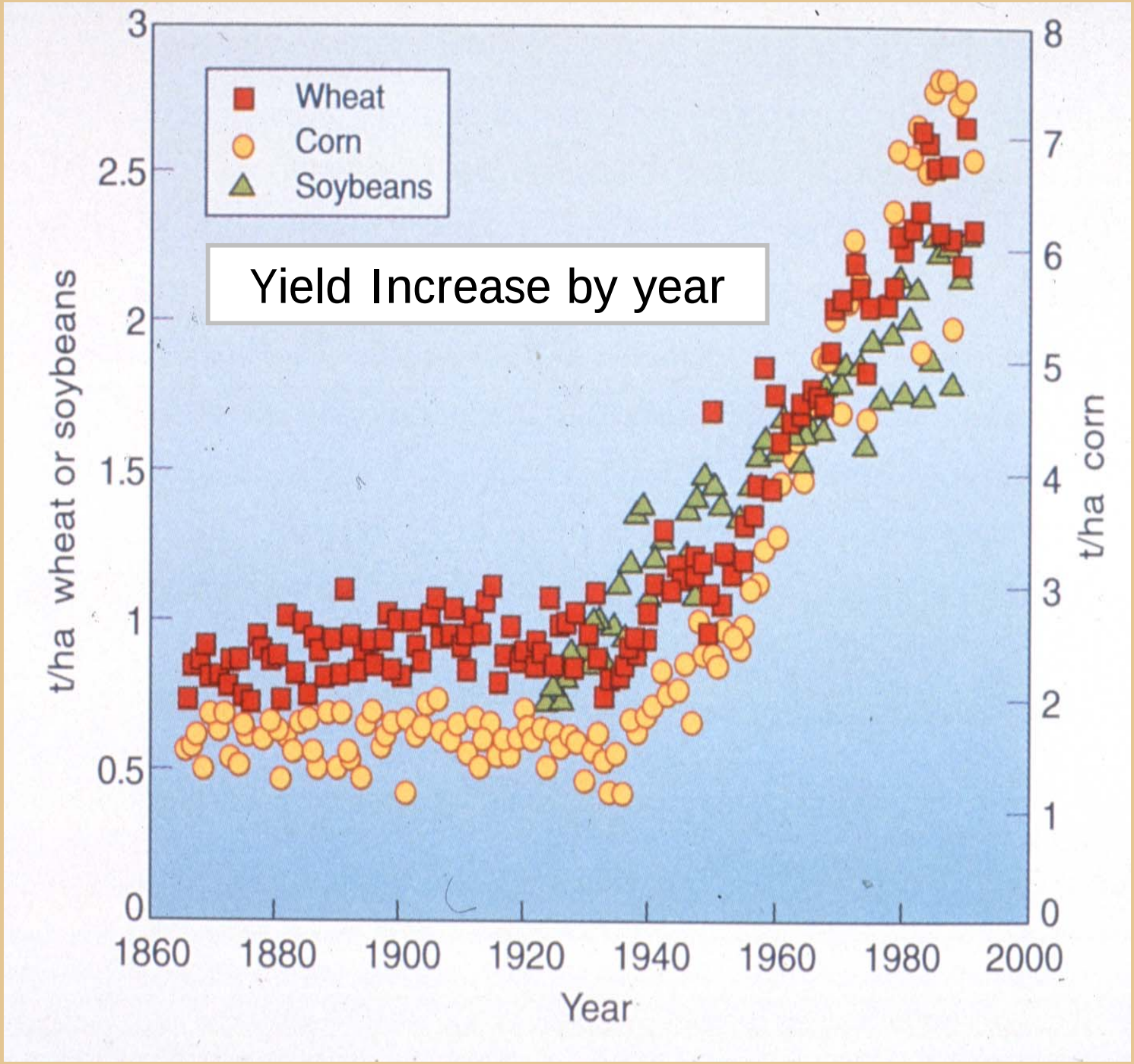


Random retention of information from each parent

1700 books (or 1.7 million pages)

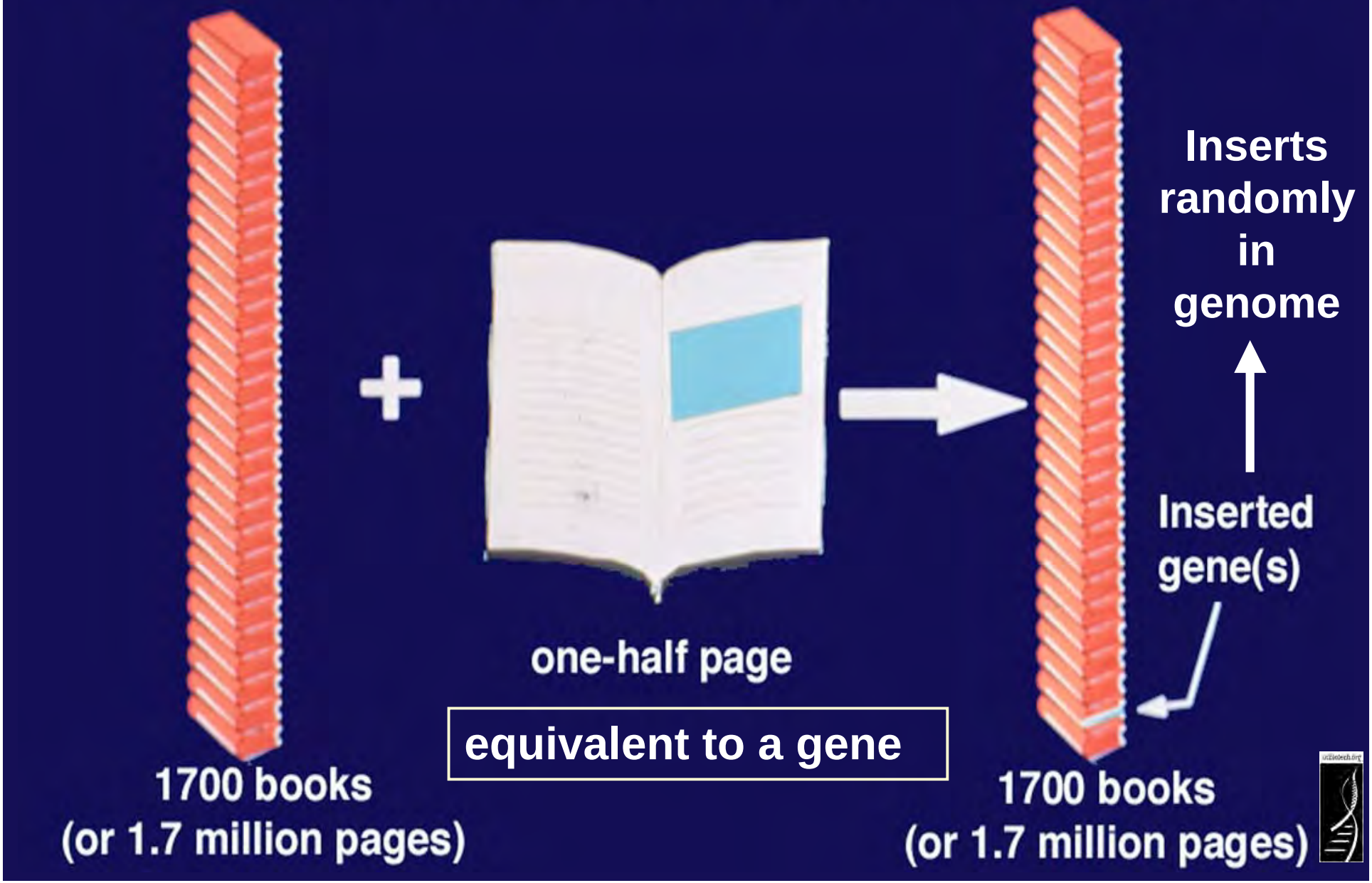
1700 books (or 1.7 million pages)

1700 books (or 1.7 million pages)


Wheat
Corn
Soybeans
Yield Increase by year
t/ha wheat or soybeans
t/ha corn
Year
0
0.5
1
1.5
2
2.5
3
0
1
2
3
4
5
6
7
8
1860
1880
1900
1920
1940
1960
1980
2000

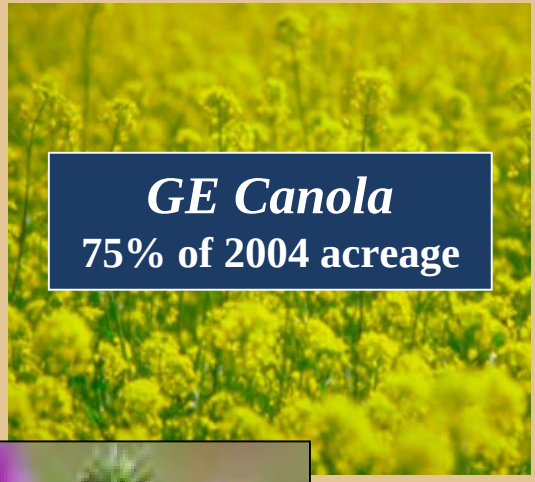
But there are other ways to create new varieties using the modern tools of genetics

Genetic Engineering Methods

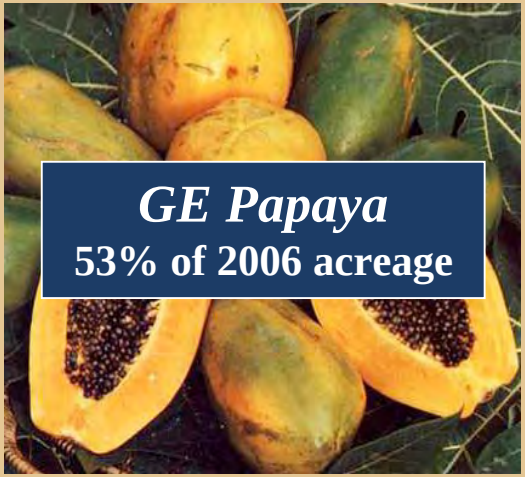


GE Corn
61% of 2006 acreage

(Insect Resistant: 25% Herbicide resistant: 21% Stacked gene: 15%)
1% of corn with Bt (ECB) + Bt (rootworm) + herbicide



GE Canola
75% of 2004 acreage

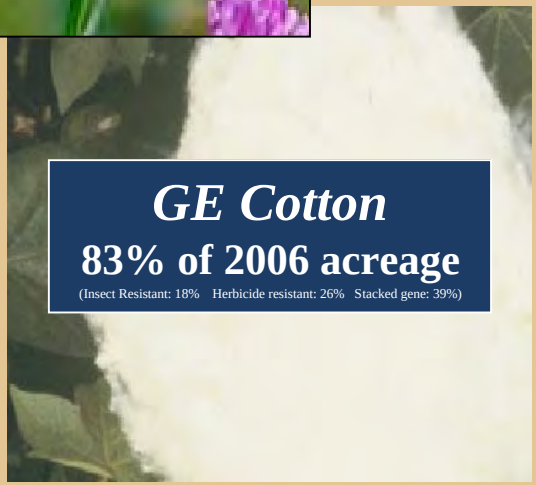


GE Papaya
53% of 2006 acreage

GE Alfalfa
<0.5% of 2005 acreage

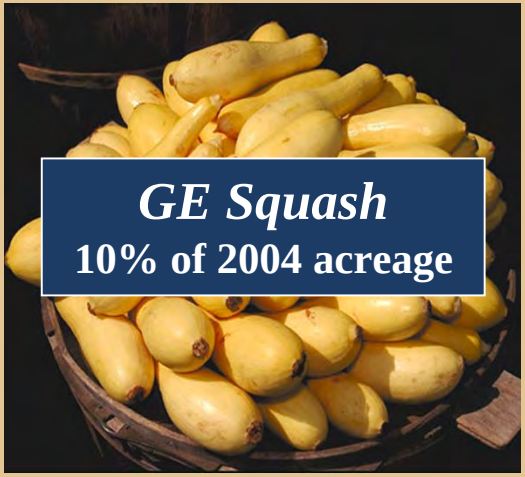
GE Soybean
89% of 2006 acreage

(Herbicide resistant: 89%)



GE Cotton
83% of 2006 acreage

(Insect Resistant: 18% Herbicide resistant: 26% Stacked gene: 39%)



GE Squash
10% of 2004 acreage

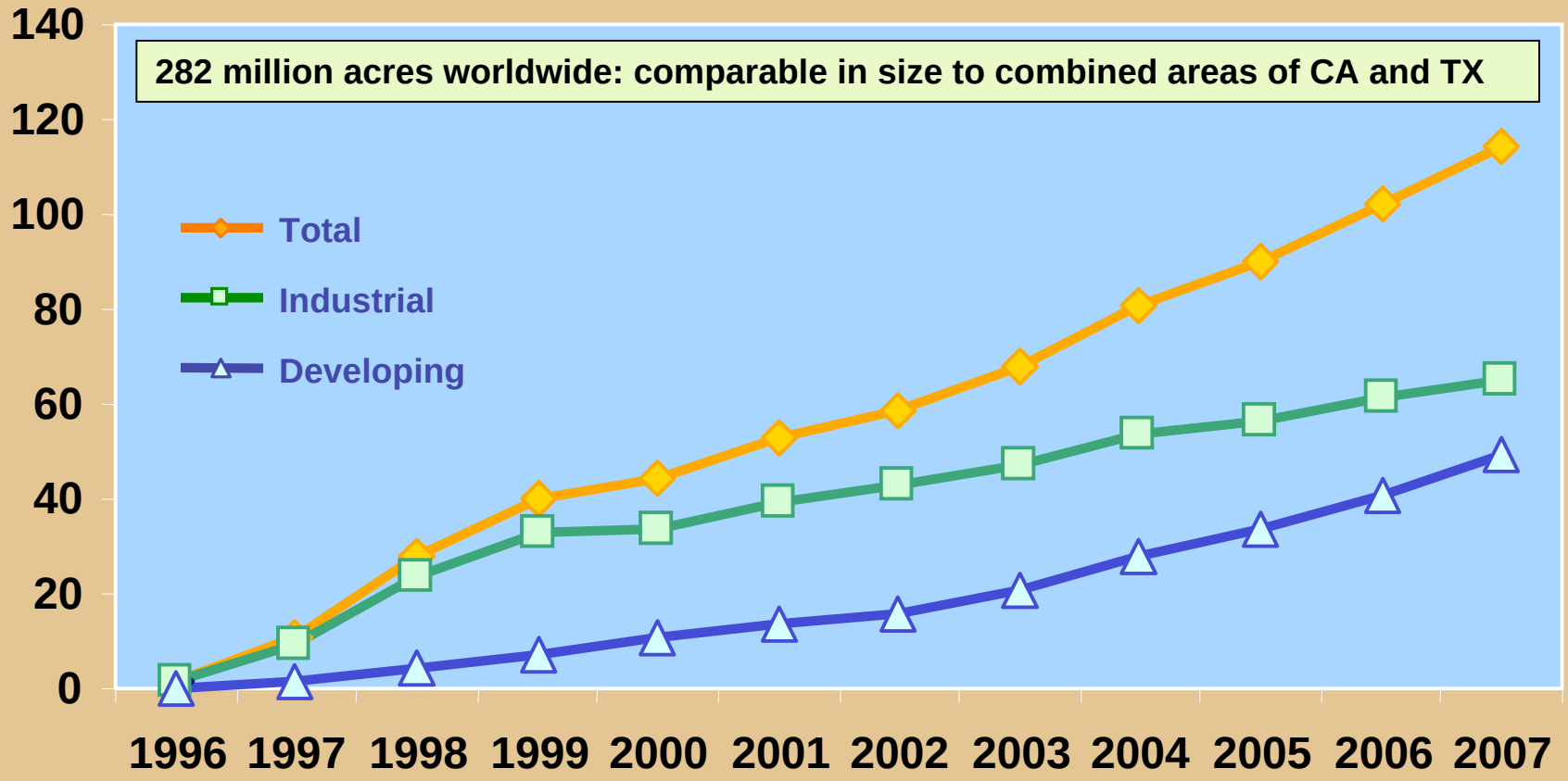
SOURCE: NCFAP; USD

Bollgard Cotton™
Engineered for insect resistance using gene from naturally occurring bacterium

Roundup Ready Soybean™

Engineered with bacterial gene to tolerate herbicide application

Global Area of Biotech Crops, 1996 to 2007: Industrial and Developing Countries (Million Hectares)



23 industrial and developing countries in order of acreage: US, Argentina, Brazil, Canada, India, China, Paraguay, South Africa, Uruguay, Philippines, Australia, Spain, Mexico, Colombia, Chile, France, Honduras, Czech Republic, Portugal, Germany, Slovakia. Romania, Poland.