The Central Dogma & DNA

HW1 Part 1

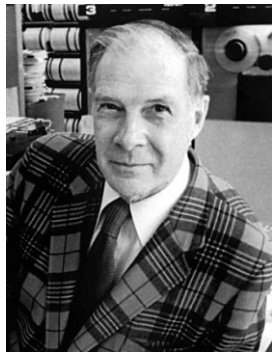
Working with Numbers

variable x:	3
variable y:	-2
x+y=	1
x-y=	5
y-x=	-5
x*y=	-6
x/y=	-1.5
y/x=	-0.6666667

Working with Strings

- "Gluing" Strings:
  - If A=`Hi` and B=`There`, A+B=`HiThere`
- Functions are case-sensitive:
  - If A=`Hi` and c=`H`, occur(c,A)=`1`
  - If A=`Hi` and c=`h`, occur(c,A)=`0`

HW1 Part 2



Richard Hamming (1950)

Hamming Distance

One definition: Given two strings of equal length, how many characters are different?

```
PEAR
PAIR
```
2

```
PEAR
PARE
```
3

```
PEAR
KIWI
```
4

Another definition: Given two strings of equal length, how many single-character substitutions are required to convert one string to the other?

Alignment: shift the top string to the left or right. A character matched with nothing has a distance of 0. At least one character must overlap.

```
PEAR
EARS
```
4

```
PEAR-
-EARS
```
0

Lab Leftovers

Running Python

- On the Macs in ETC: `python3.4` instead of `python3`
- On Windows: `py` or email Anna for other instructions

Lab Section Sizes

- Monday 1:10-3pm: 16
- Tuesday 3:10-5pm: 7

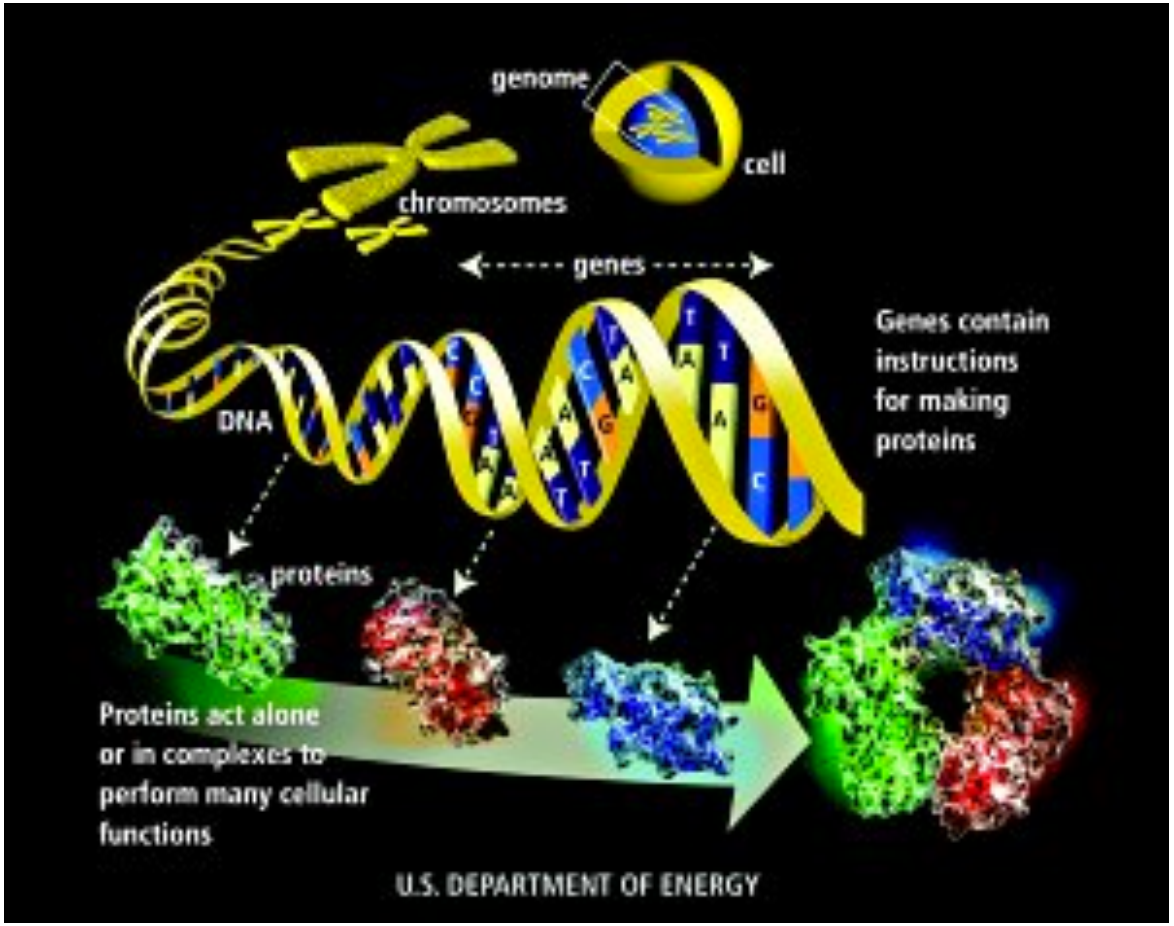
Benefits of Tuesday Lab

- Fewer people = more help / get a head start on HWs
- Second round of lab = Anna's better prepared

Topic 1: How do Cells "Read" the Genome?

3.72×10^{13} cells =
37,200,000,000,000
= 37.2 **trillion** cells

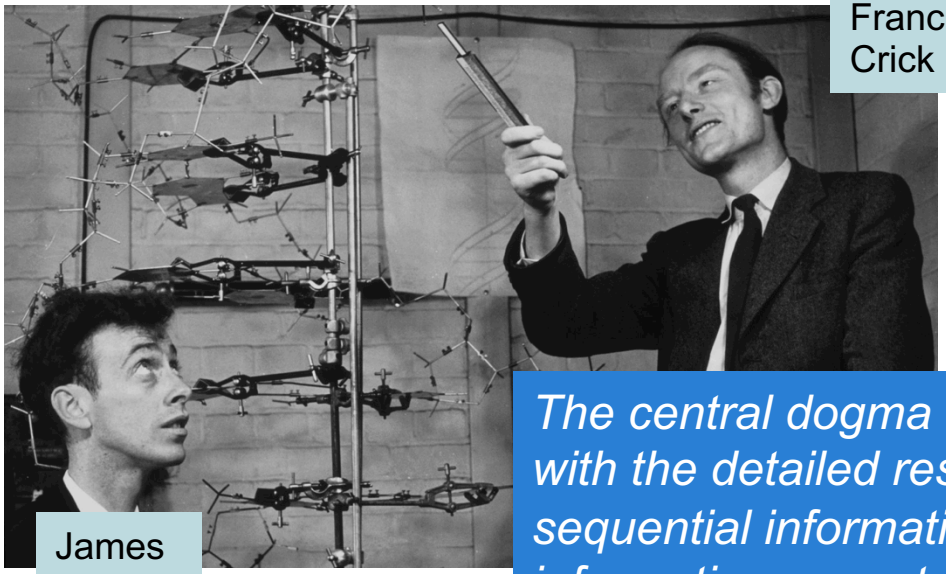
Each **cell** has the same genome with 3 **billion** bases
= 3,000,000,000



http://www.ncbi.nlm.nih.gov/pubmed/23829164

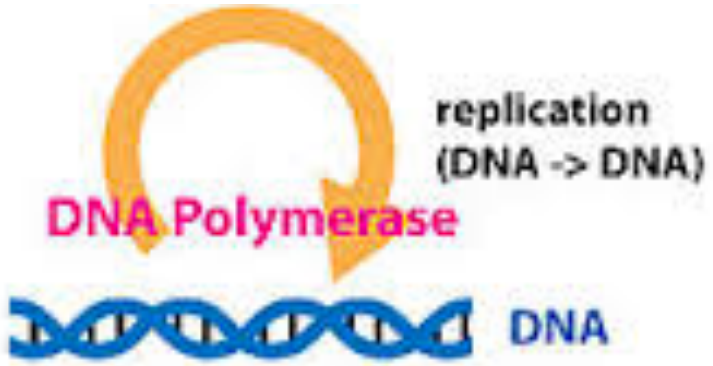
http://science.kqed.org/quest/2007/07/09/a-wonderful-mess/

The Central Dogma of Molecular Biology



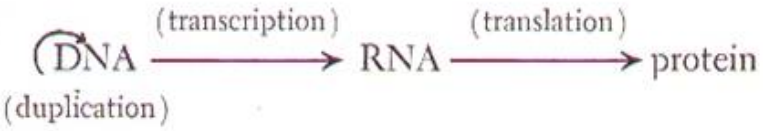
Francis Crick

James Watson

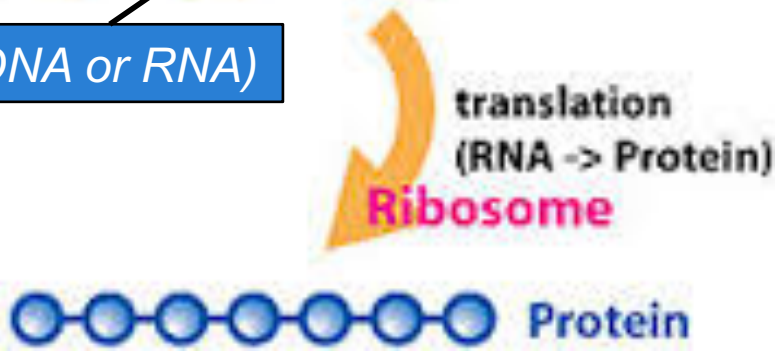


The central dogma of molecular biology deals with the detailed residue-by-residue transfer of sequential information. It states that such information cannot be transferred from protein to either protein or nucleic acid. (F.H.C. Crick, 1970)

DNA makes RNA makes protein.
(paraphrased from Watson, 1965)



(DNA or RNA)



http://all-len-all.com/wp-content/uploads/2015/04/Watson-Crick.jpg
http://sandwalk.blogspot.com/2007/01/central-dogma-of-molecular-biology.html
http://www.junkdna.com/fig6/, wikipedia

The Central Dogma of Molecular Biology

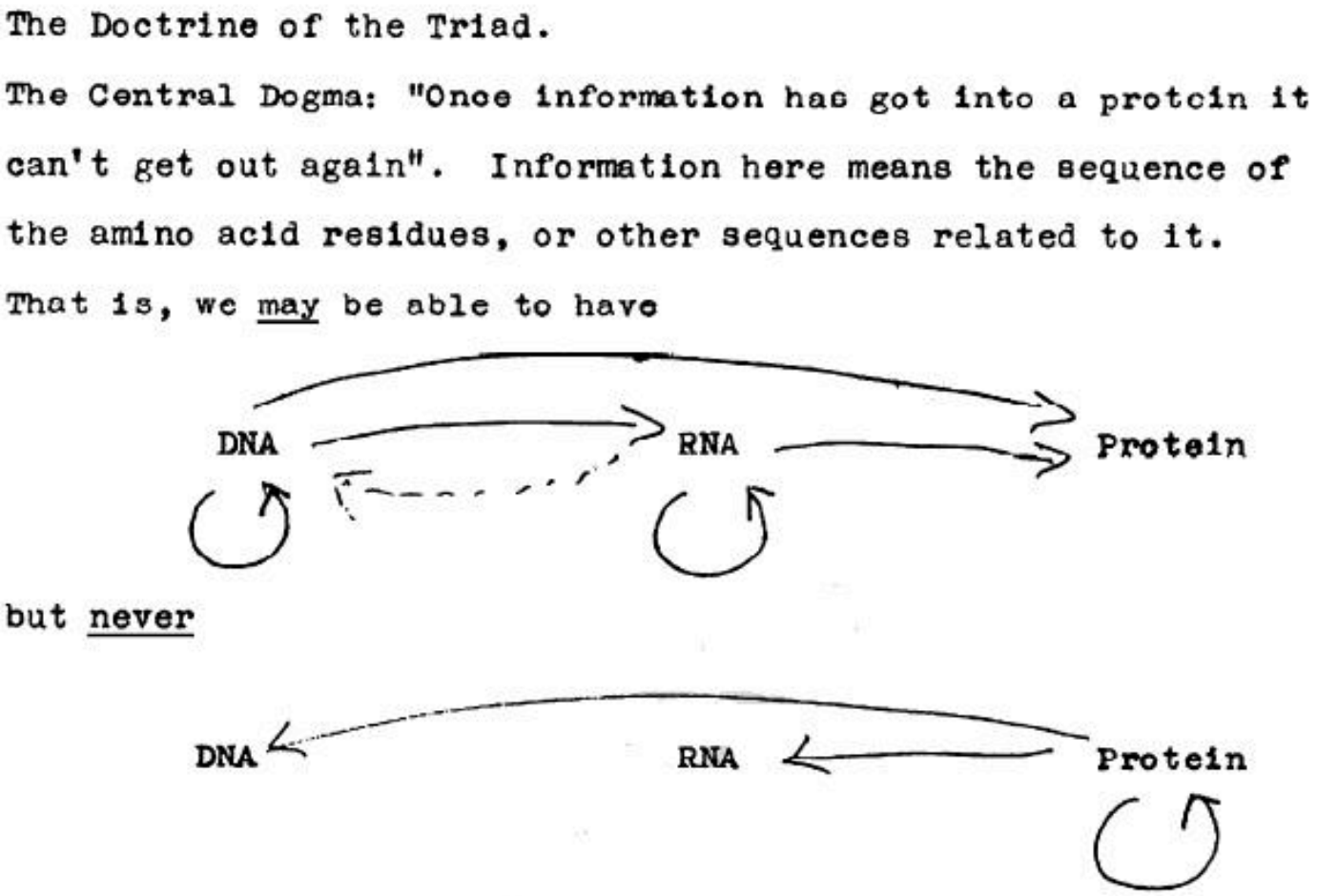
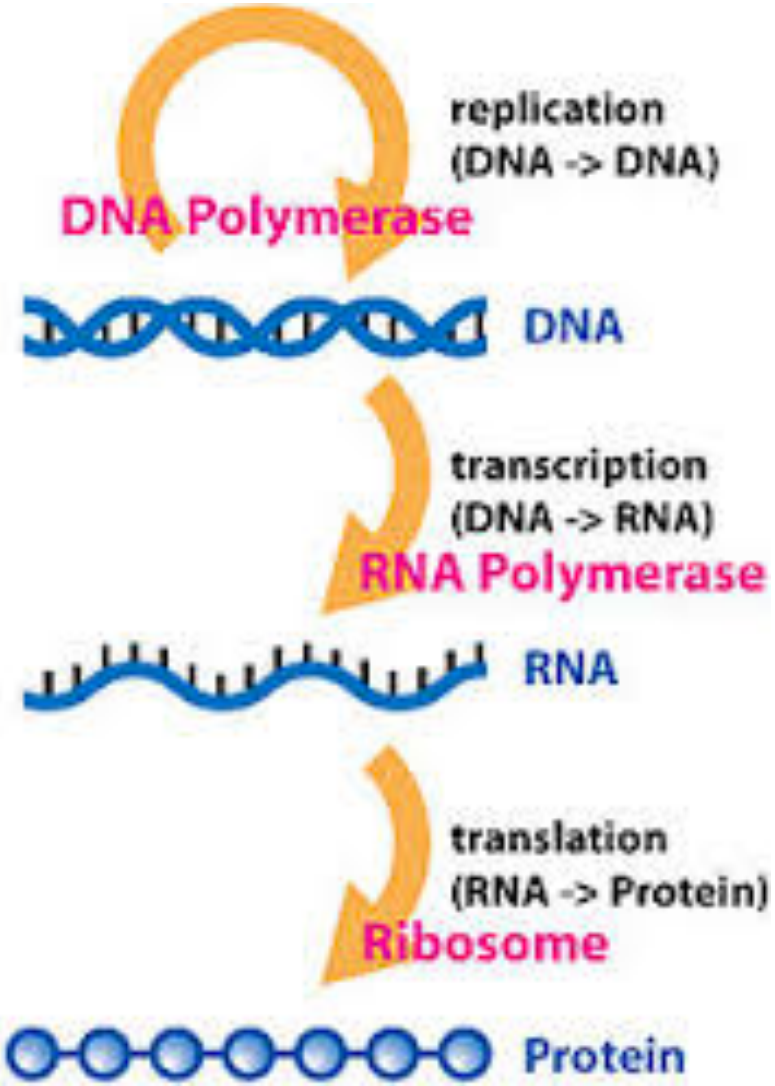


Fig. 1. Nascence of the "Central Dogma of Molecular Biology"; the original concept diagram by Francis Crick in 1956. (Unpublished but acknowledged by Crick in 1958)

http://www.junkdna.com/fig6/

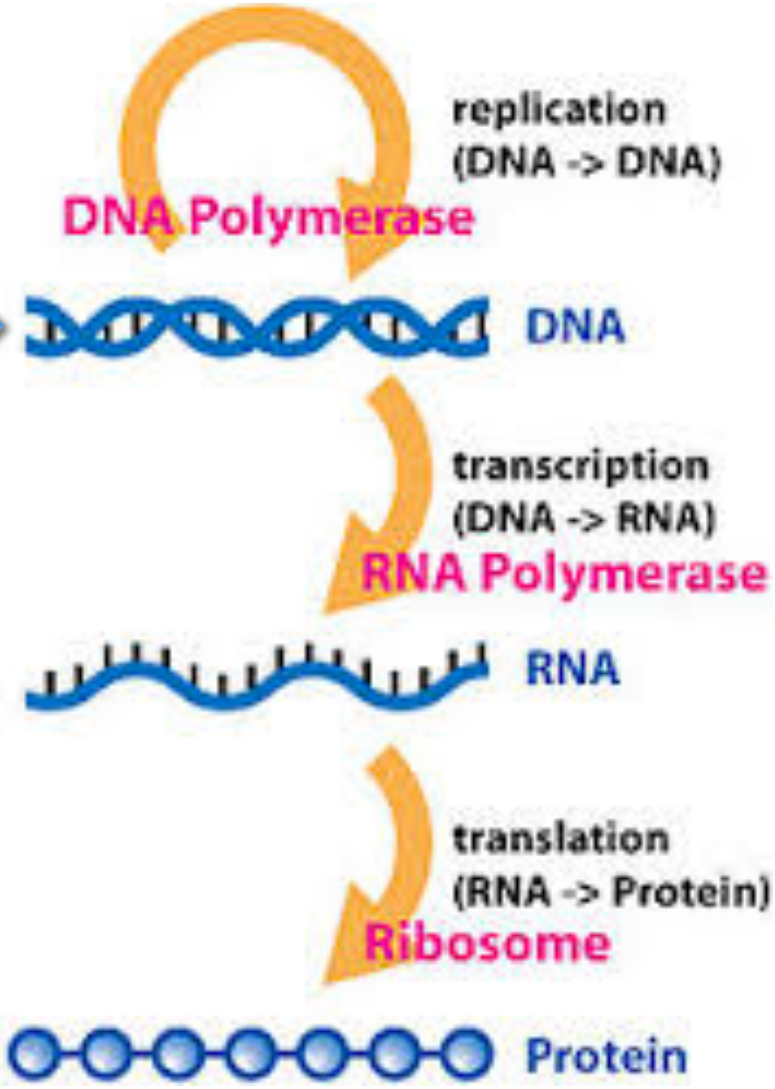
The Central Dogma of Molecular Biology



The Central Dogma of Molecular Biology

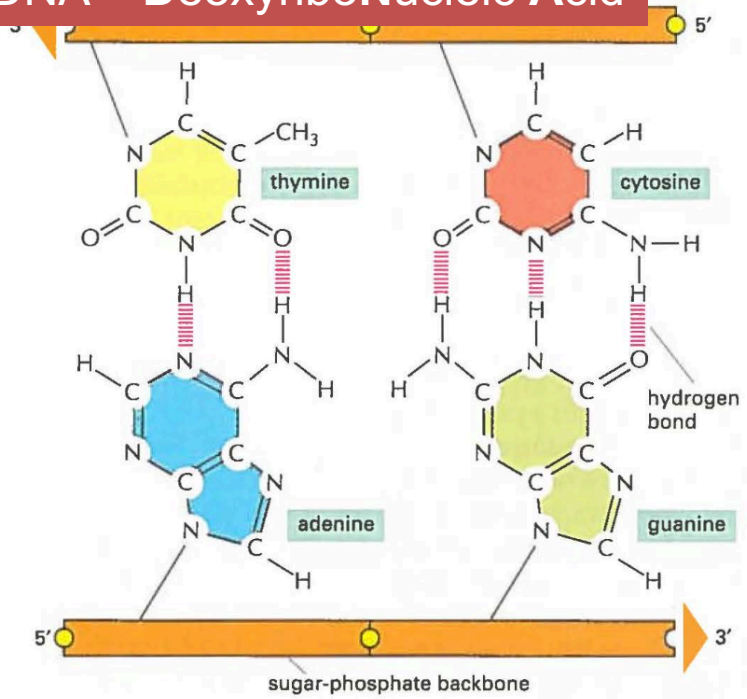
Start Here

Structure & Organization of DNA



DNA Strands are Complementary & Antiparallel

DNA = **D**eoxyribo**N**ucleic **A**cid



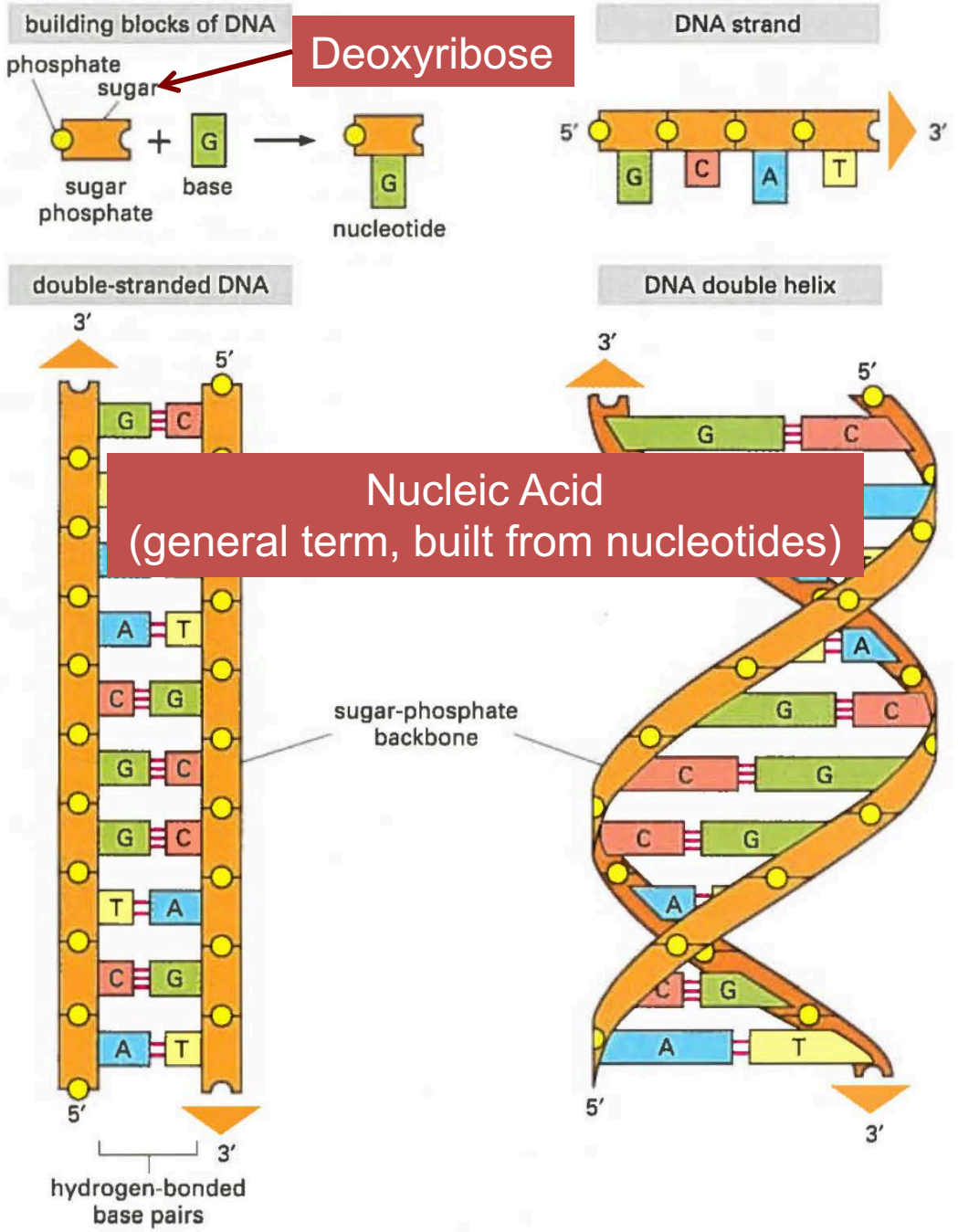


Figure 4-3 & 4-4, Alberts et. al., Molecular Biology of the Cell (eReserves)

DNA Organization

DNA double helix

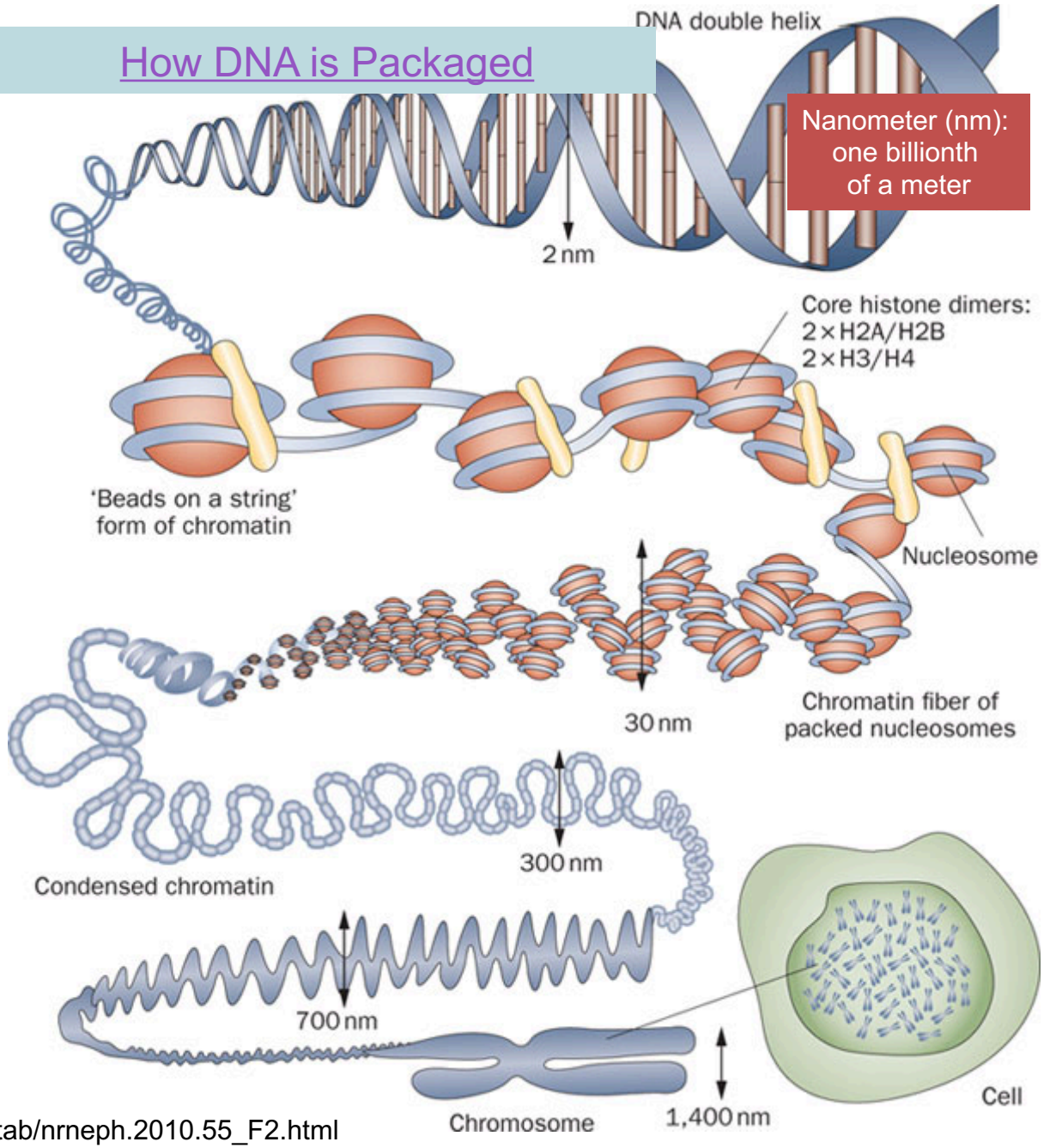
Chromatin of packed nucleosomes

Condensed chromatin

Even more condensed chromatin

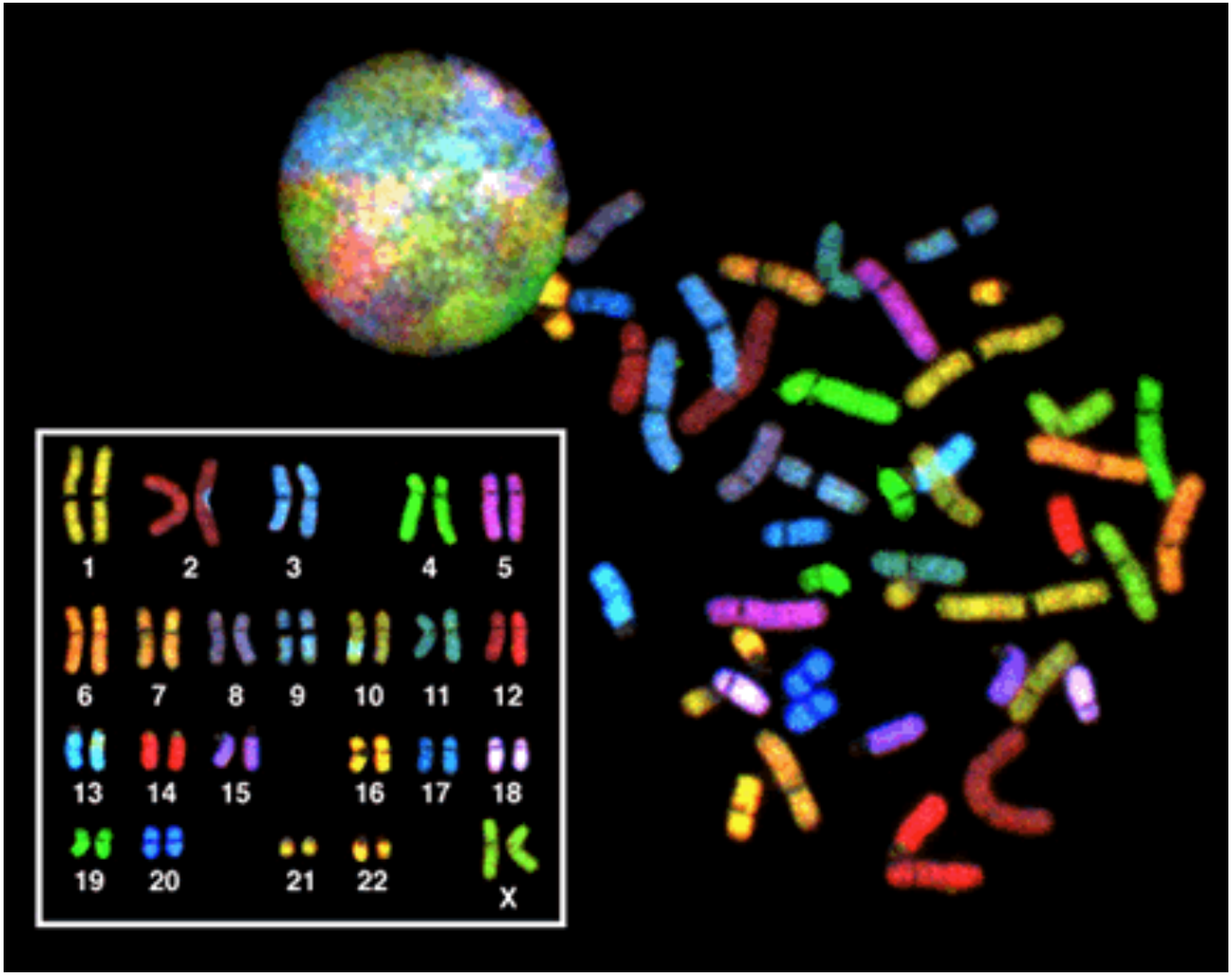
Chromosome

How DNA is Packaged



http://www.nature.com/nrneph/journal/v6/n6/fig_tab/nrneph.2010.55_F2.html

DNA Organization



"Sky spectral karyotype" by Courtesy: National Human Genome Research Institute - Found on :National Human Genome Research (USA)This image was copied from wikipedia:en.. Licensed under Public Domain via Commons - https://commons.wikimedia.org/wiki/File:Sky_spectral_karyotype.png#/media/File:Sky_spectral_karyotype.png

Mistakes in DNA Organization

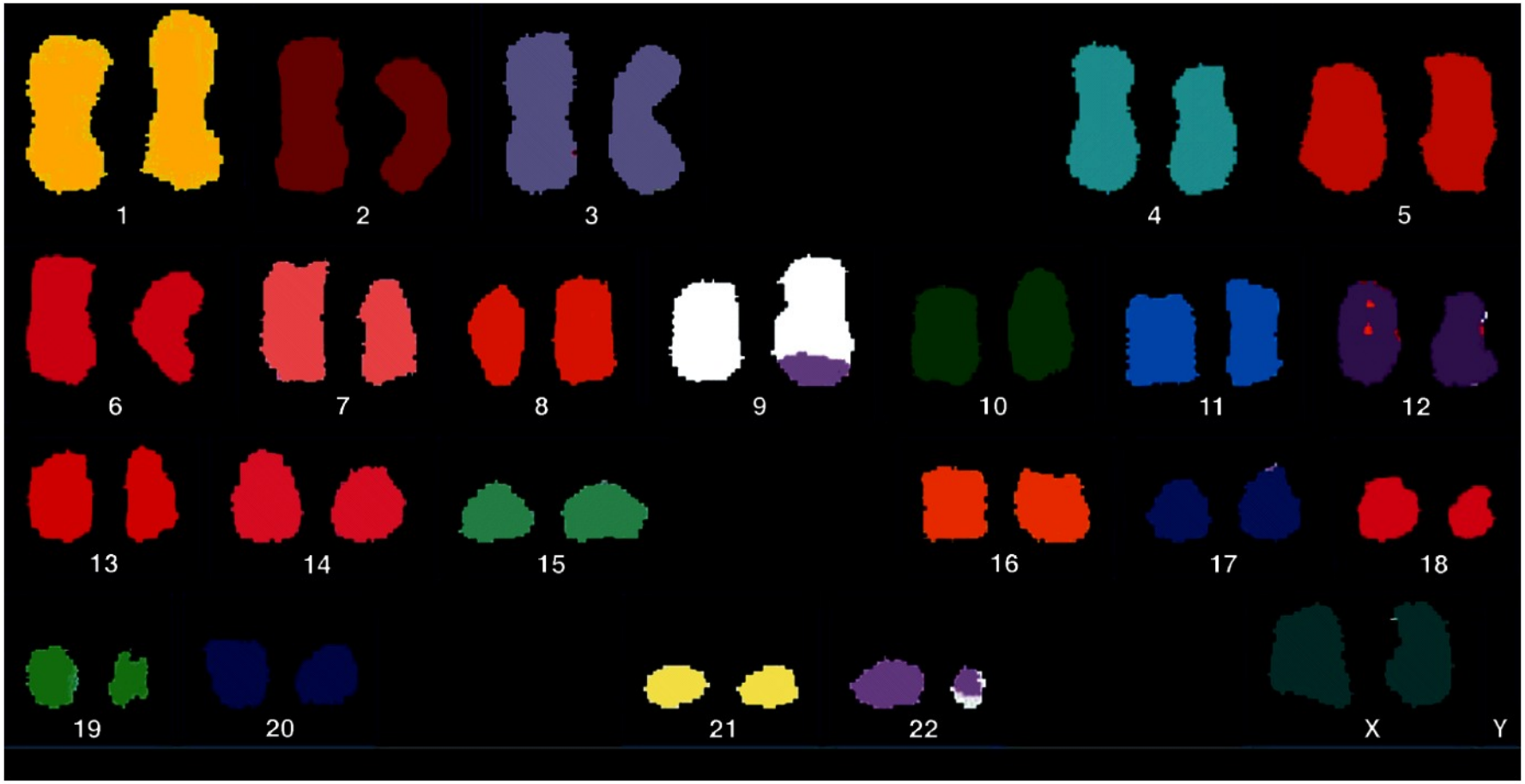


Figure 2.26b The Biology of Cancer (© Garland Science 2014)

Philadelphia chromosome: translocation occurs in ~95% of chronic myleogenous leukemia (CML) patients. (Biology of Cancer, 2nd Ed, Weinburg)

Lots of Mistakes in DNA Organization

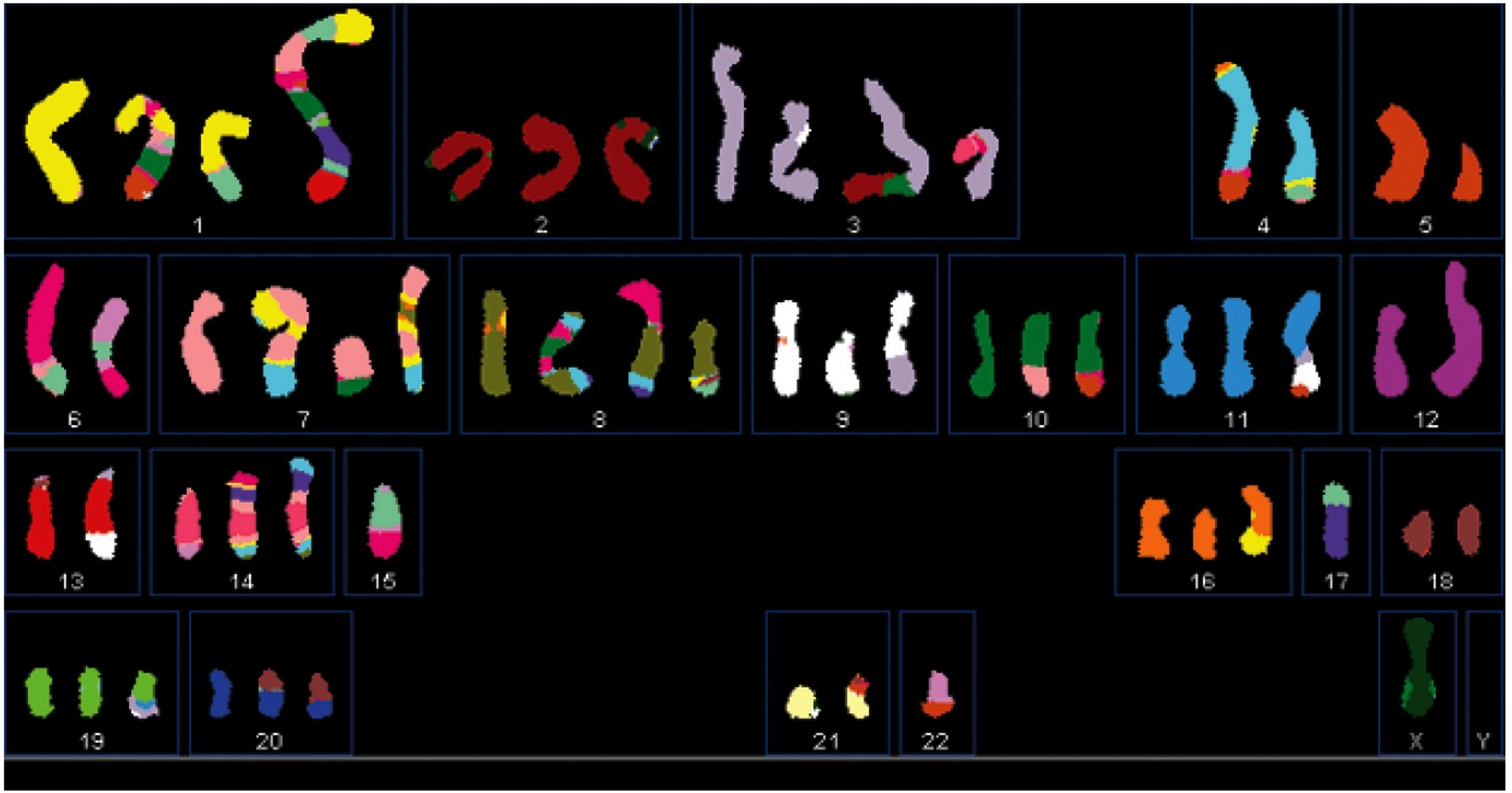


Figure 1.11c The Biology of Cancer (© Garland Science 2014)

Human pancreatic cancer cell. (Biology of Cancer, 2nd Ed., Weinberg)

Class Demographics

Year	Number
First Year	4
Sophomore	7
Junior	6
Senior	5

Major	Number
biochem	6
bio	6
bio-CS	1
chem	2
alt-bio	1
bio-psych	1
math-cs	2
psych	1
undecided	1
econ	1

Upcoming Schedule

Week 1	
Mon 1/23	Lecture HW1 Out
Lab1: Python Setup & Command Line Tools	
Wed 1/25	Lecture
Fri 1/27	Lecture
Week 2	
Mon 1/30	Lecture HW1 Due HW2 Out
Lab2: Python Pattern Maker	
Wed 2/1	Lecture
Fri 2/3	Lecture

Syllabus Qs?

Consider Tues Lab

Office Hours 10-11am W/Th

DoJo (Rose) 8-10pm Thurs