Disorders Associated with the Immune System

Ch 19

We'll discuss:

- Hypersensitivity:
  - Type I:
    - reactions
    - systemic vs. localized
    - desensitization
  - Type II:
    - blood types
- Cancer
- AIDS

Hypersensitivity

Type of Reaction	**Time After Exposure for Clinical Symptoms**
Type I (anaphylactic)	<30 min
Type II (cytotoxic)	5–12 hours
Type III (immune complex)	3–8 hours
Type IV (delayed cell-mediated)	≥1 day

Hypersensitivity

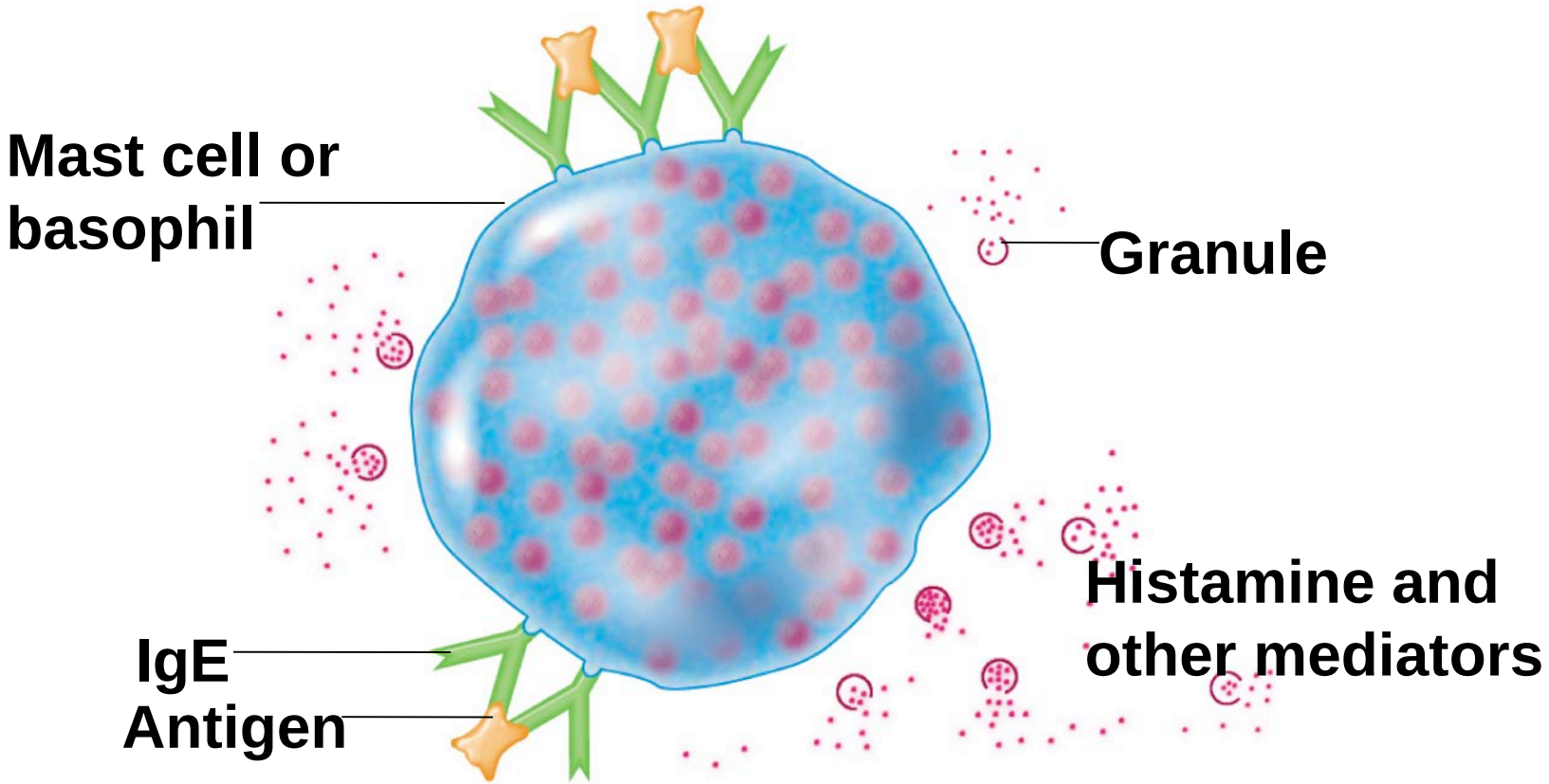
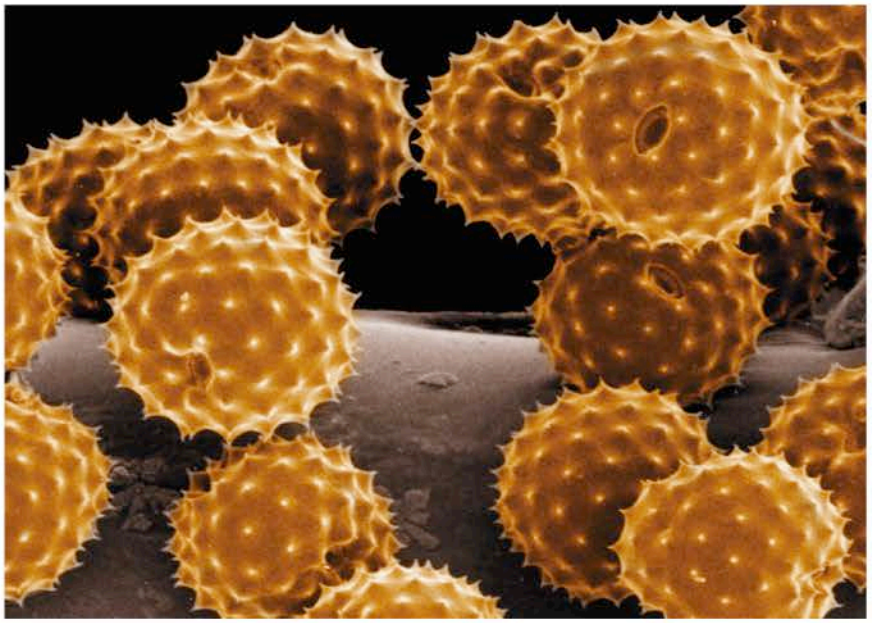


Figure 19.1a

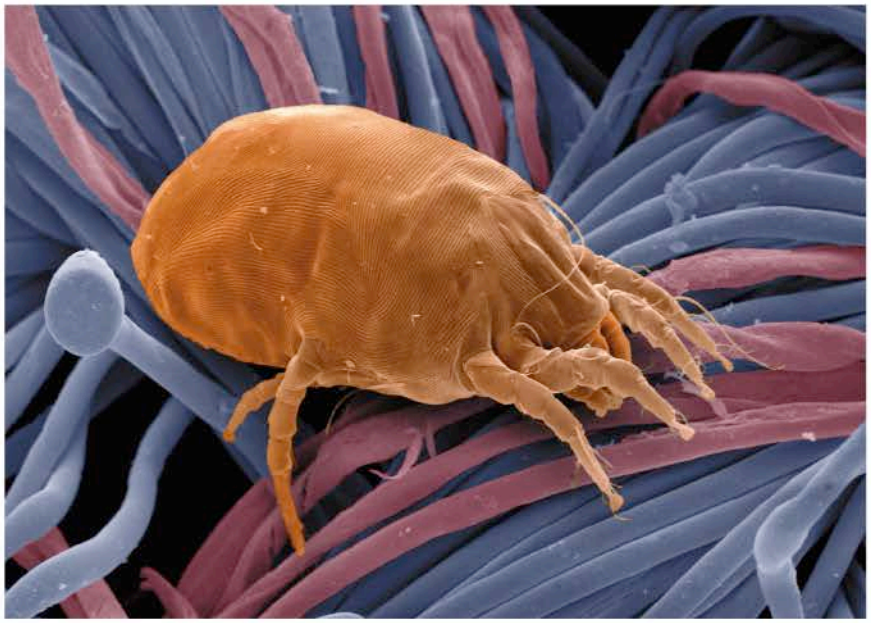
Hypersensitivity

Figure 19.1b

Hypersensitivity - Localized



(a)



(b)

Figure 19.2

Hypersensitivity - Desensitization

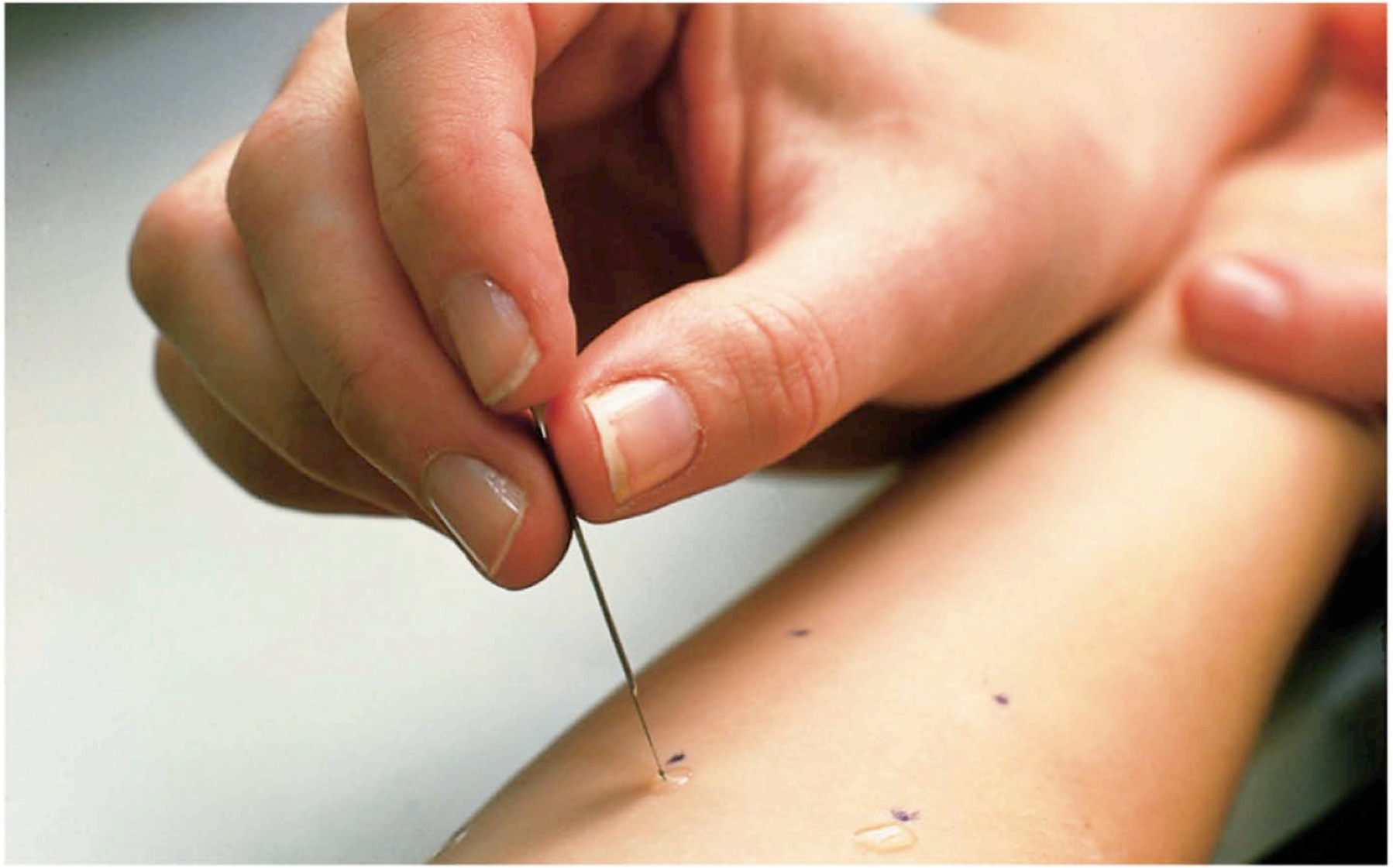
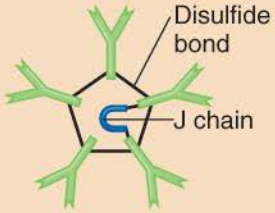
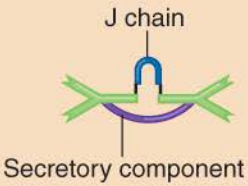


Figure 19.3

Hypersensitivity - Desensitization

Table 17.1 A Summary of Immunoglobulin Classes

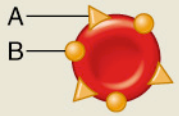
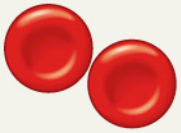
Characteristics	IgG	IgM	IgA	IgD	IgE
					
Structure	Monomer	Pentamer	Dimer (with secretory component)	Monomer	Monomer
Percentage of Total Serum Antibody	80%	5–10%	10–15%*	0.2%	0.002%
Location	Blood, lymph, intestine	Blood, lymph, B cell surface (as monomer)	Secretions (tears, saliva, mucus, intestine, milk), blood, lymph	B cell surface, blood, lymph	Bound to mast and basophil cells throughout body, blood
Molecular Weight	150,000	970,000	405,000	175,000	190,000
Half-Life in Serum	23 days	5 days	6 days	3 days	2 days
Complement Fixation	Yes	Yes	No†	No	No
Placental Transfer	Yes	No	No	No	No
Known Functions	Enhances phagocytosis; neutralizes toxins and viruses; protects fetus and newborn	Especially effective against microorganisms and agglutinating antigens; first antibodies produced in response to initial infection	Localized protection on mucosal surfaces	Serum function not known; presence on B cells functions in initiation of immune response	Allergic reactions; possibly lysis of parasitic worms

*Percentage in serum only; if mucous membranes and body secretions are included, percentage is much higher.
†May be yes via alternative pathway.

Table 17.1

Hypersensitivity – Blood types

TABLE 19.2 The ABO Blood Group System

Blood Group	Erythrocyte or Red Blood Cell Antigens	Illustration	Plasma Antibodies	Blood That Can Be Received	Frequency (% U.S. Population)		
					White	Black	Asian
AB	A and B		Neither anti-A nor anti-B antibodies	A, B, AB, O	3	4	5
B	B		Anti-A	B, O	9	20	27
A	A		Anti-B	A, O	41	27	28
O	Neither A nor B		Anti-A and Anti-B	O	47	49	40

Hypersensitivity – Blood types

blood
2010 115: 4635-4643
Prepublished online March 22, 2010;
doi:10.1182/blood-2010-01-261859

The relationship between blood groups and disease

David. J. Anstee

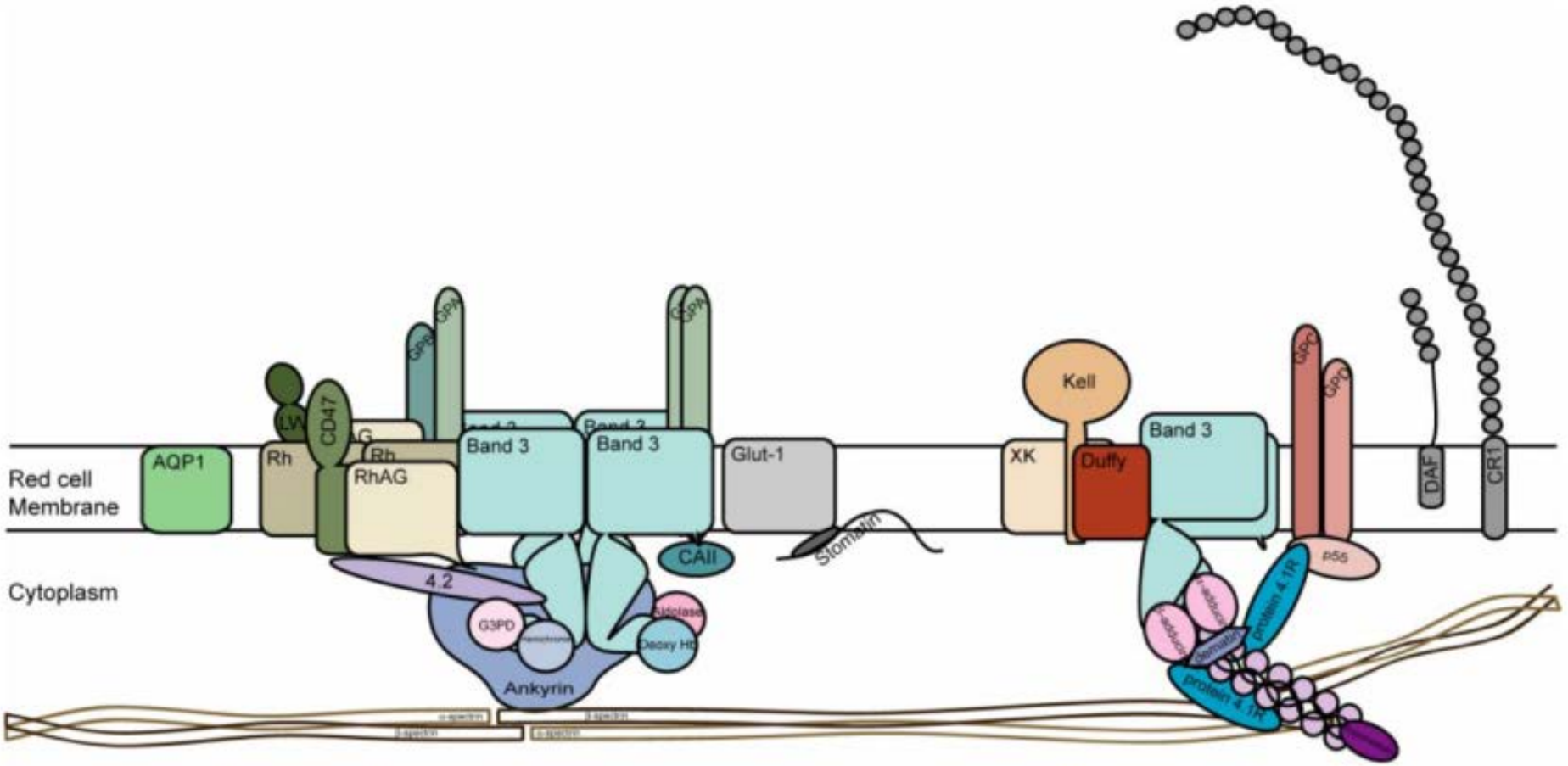


Figure 3. Structure of the human red cell membrane showing the major surface proteins and minor proteins Fy and CR1. Two major membrane complexes linked to the underlying red cell skeleton are depicted. The Band 3 complex containing glycophorins A (GPA) and B (GPB) and Rh proteins, Rh-associated protein (RhAG), CD47, LW glycoprotein (intercellular adhesion molecule–4), and the junctional complex comprising glycophorins C and D (GPC, GPD), Kell glycoprotein, XK glycoprotein, and Duffy (Fy) glycoprotein. Aquaporin 1 (AQP1), the glucose transporter (GLUT1), decay accelerating factor (DAF, CD55), and complement receptor 1 (CR1) are also shown. ABH active oligosaccharides known to be present on all major surface proteins except Rh proteins are not depicted.

Hypersensitivity – Blood types

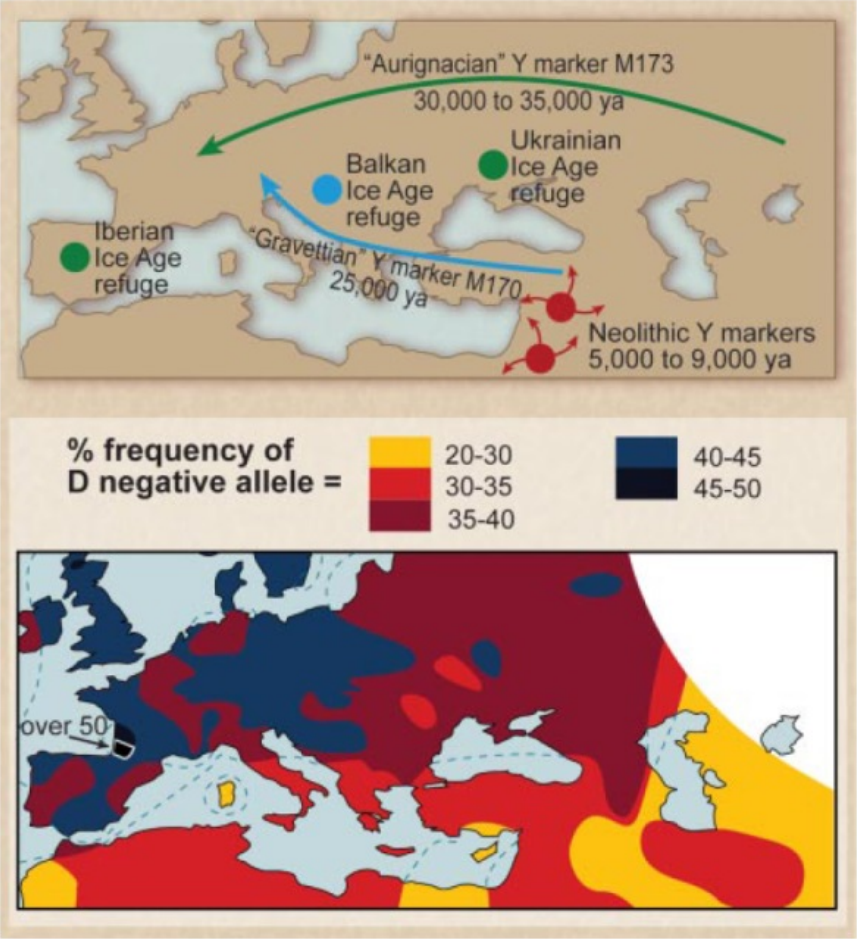


Figure 2. Paleolithic settlers from the last glacial maximum may be the source of the high frequency of D− allele in Europeans. (Top) European location of Paleolithic refuges at the time of the last glacial maximum. Note migration of population containing marker M173 (from Gibbons[58]; reprinted with permission from American Association for the Advancement of Science). (Bottom) Distribution of the D− allele in Europe (from Mourant et al[52]; reprinted by permission of Oxford University Press).

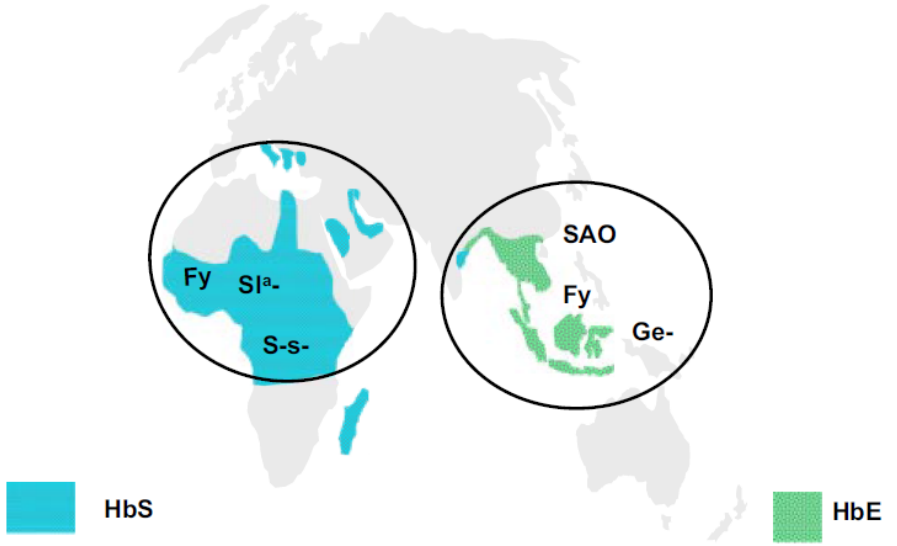
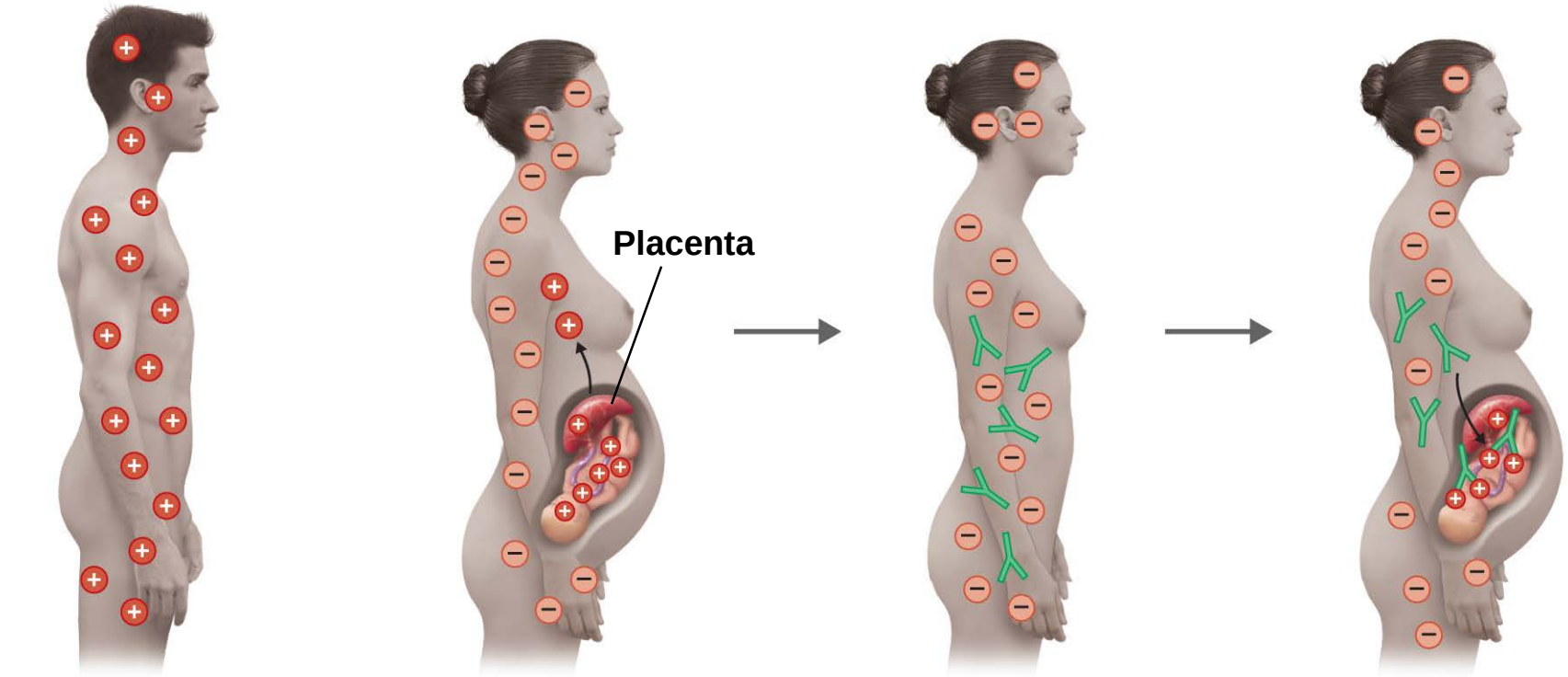


Figure 4. Distribution of rare blood group phenotypes selected by malaria in Africa and South East Asia. The location of rare blood group phenotypes lacking glycophorin B (S-s−), having altered glycophorin C (Ge−; Gerbich-negative), Fy (Duffy) blood group–null allele (Fy), SI(a−) allele of complement receptor 1 (CR1), and the Band 3 mutation causing South East Asian ovalocytosis (SAO) in comparison with the distribution of HbS and HbE alleles.[72]

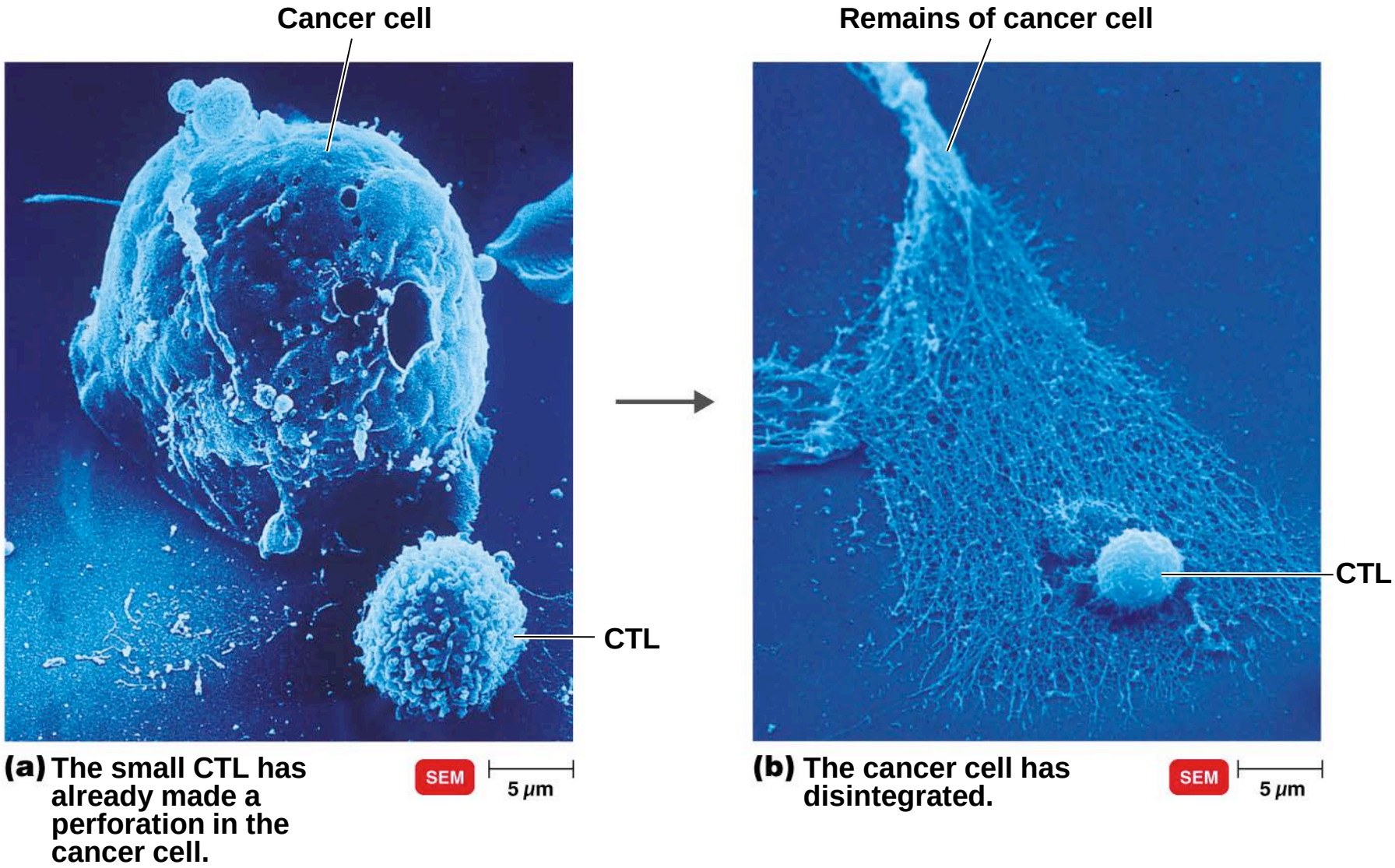
Hypersensitivity – Blood types



1. Rh^+ father.
2. Rh^- mother carrying her first Rh^+ fetus. Rh antigens from the developing fetus can enter the mother's blood during delivery.
3. In response to the fetal Rh antigens, the mother will produce anti-Rh antibodies.
4. If the woman becomes pregnant with another Rh^+ fetus, her anti-Rh antibodies will cross the placenta and damage fetal red blood cells.

Figure 19.4

Cancer

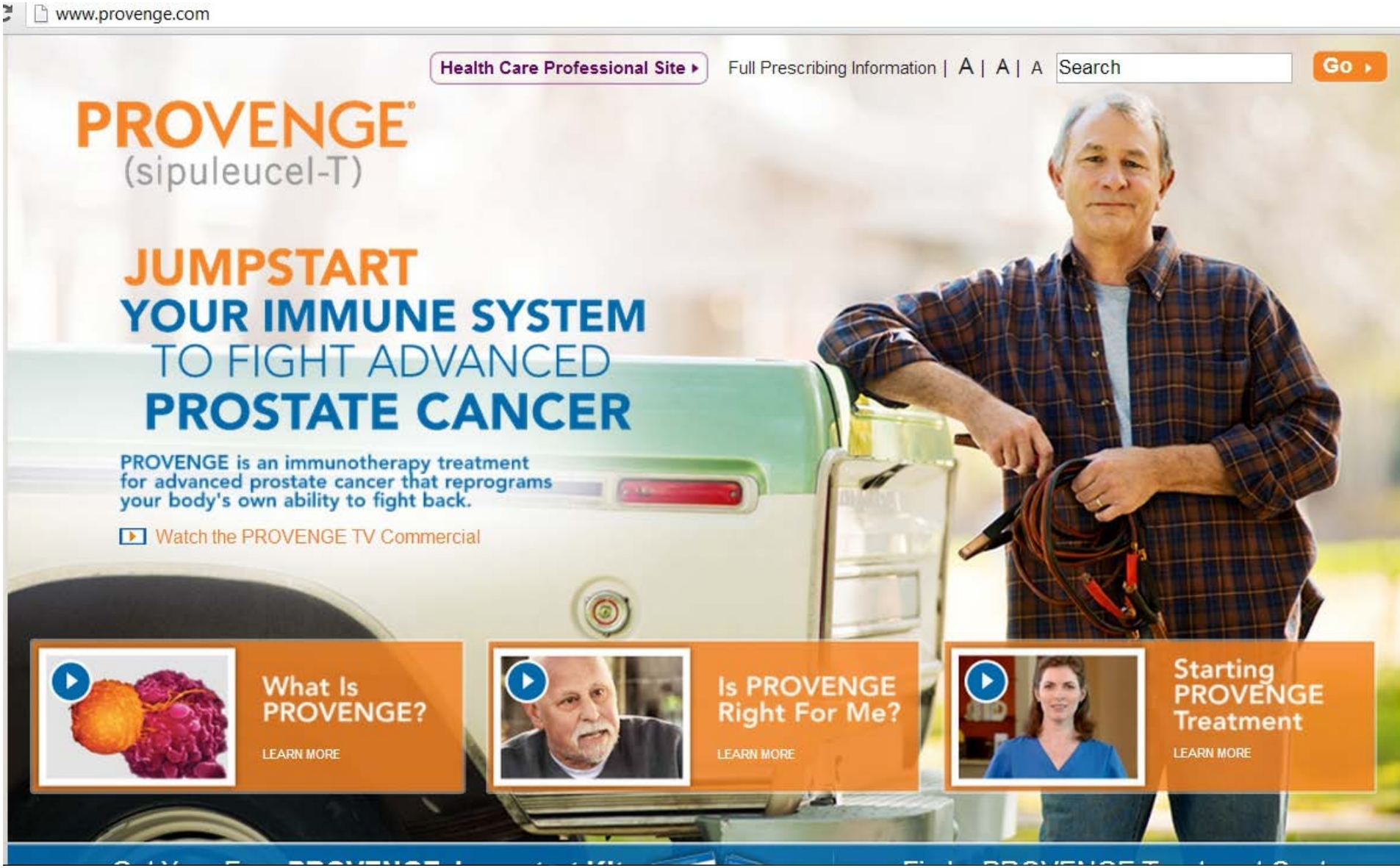


(a) The small CTL has already made a perforation in the cancer cell.

(b) The cancer cell has disintegrated.

Figure 19.11

Cancer


www.provenge.com
Health Care Professional Site
Full Prescribing Information | A | A | A
Search
Go
PROVENGE®
(sipuleucel-T)
JUMPSTART
YOUR IMMUNE SYSTEM
TO FIGHT ADVANCED
PROSTATE CANCER
PROVENGE is an immunotherapy treatment for advanced prostate cancer that reprograms your body's own ability to fight back.
Watch the PROVENGE TV Commercial
What Is PROVENGE?
LEARN MORE
Is PROVENGE Right For Me?
LEARN MORE
Starting PROVENGE Treatment
LEARN MORE

Cancer

What is PROVENGE and how does it work?

PROVENGE (sipuleucel-T) is an autologous cellular immunotherapy designed to stimulate a patient's own immune system against cancer. PROVENGE is manufactured in several steps. First the patient's blood is run through a machine in a process known as leukapheresis. During the process, some of the patient's immune cells are collected. These **immune cells are then exposed to a protein intended to stimulate and direct them against prostate cancer. Following this exposure, the activated immune cells are then returned to the patient to treat the prostate cancer.**

PROVENGE is administered intravenously in a three-dose schedule at approximately two week intervals. Each dose is preceded by the leukapheresis procedure approximately three days prior to the scheduled treatment, and is administered only to the patient from whom the cells were obtained.

What are the ingredients in PROVENGE?

The active components of PROVENGE are **autologous antigen presenting cells (APCs) and the protein called PAP-GM-CSF. APCs are activated during a defined culture period with a recombinant human protein, PAP-GM-CSF, consisting of prostatic acid phosphatase (PAP), an antigen expressed in prostate cancer tissue, linked to granulocyte-macrophage colony-stimulating factor (GM-CSF), an immune cell activator.**

The cellular composition of PROVENGE will vary, depending on the cells obtained from the individual patient during leukapheresis. In addition to the APCs, the product also contains T cells, B cells, natural killer (NK) cells, and other cells.

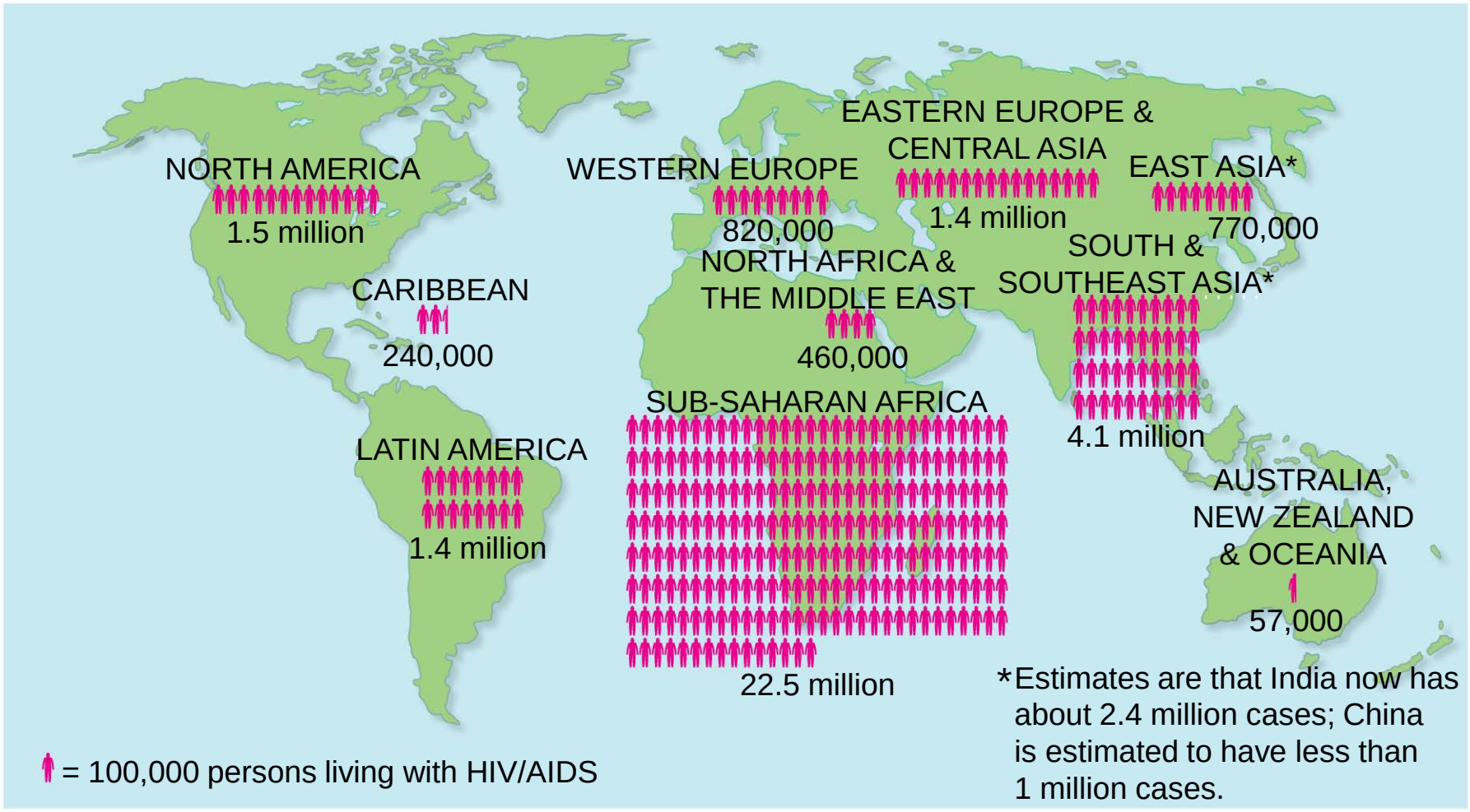
Each dose of PROVENGE is suspended in 250 mL of Lactated Ringer's Injection, USP in a sealed, patient-specific infusion bag.

PROVENGE contains no preservatives or adjuvants.

AIDS

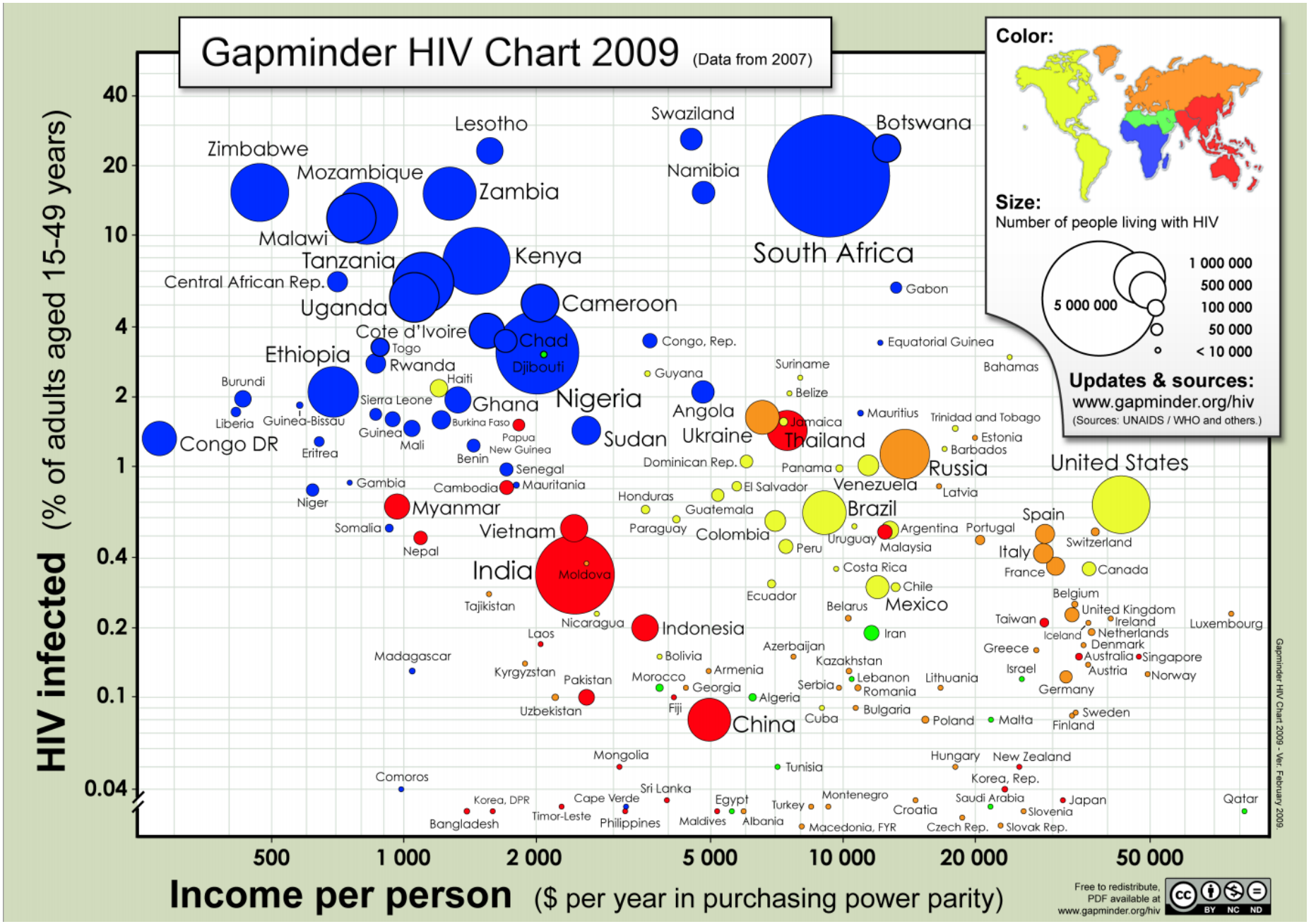
Figure 19.16

AIDS

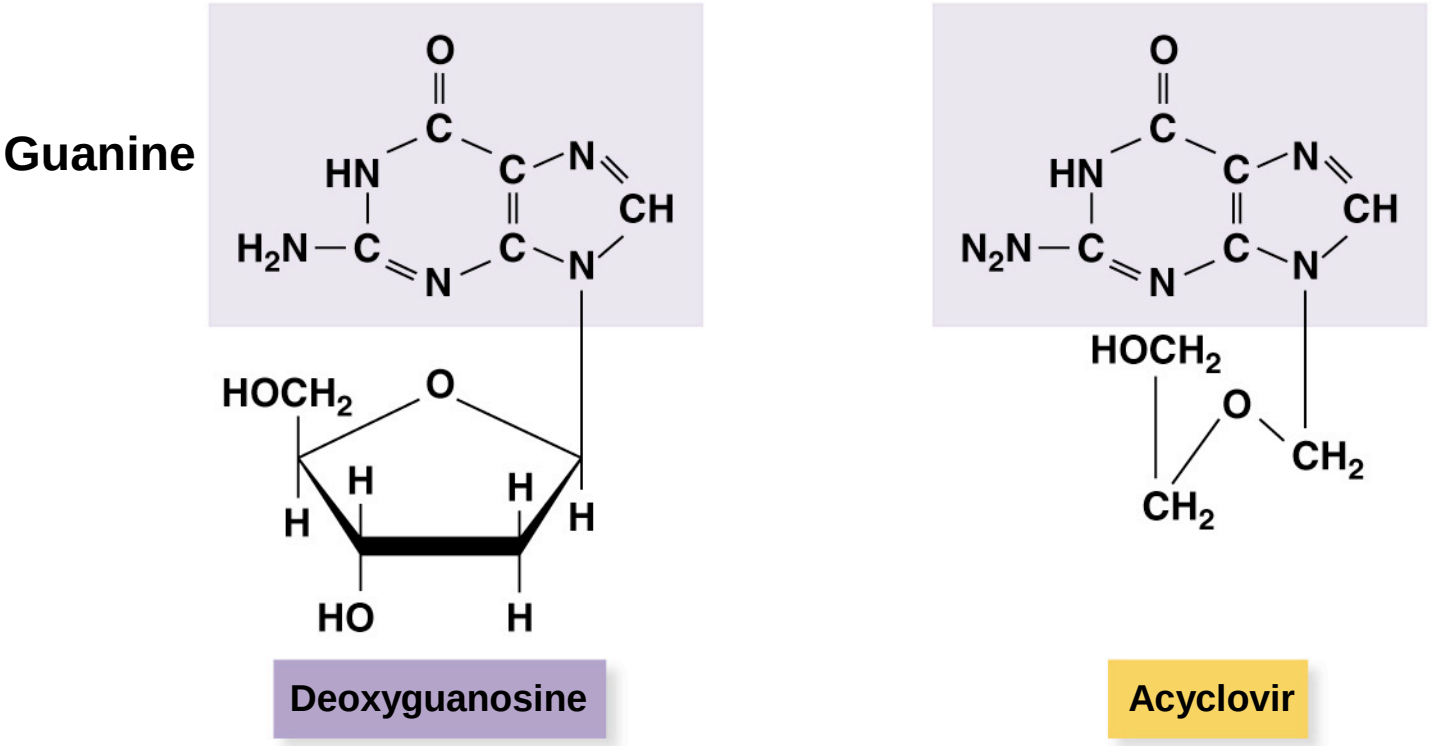


TED talk:
"Hans Rosling: Insights on HIV, in stunning data visuals"
https://www.ted.com/talks/hans_rosling_the_truth_about_hiv?language=en#t-570752

AIDS

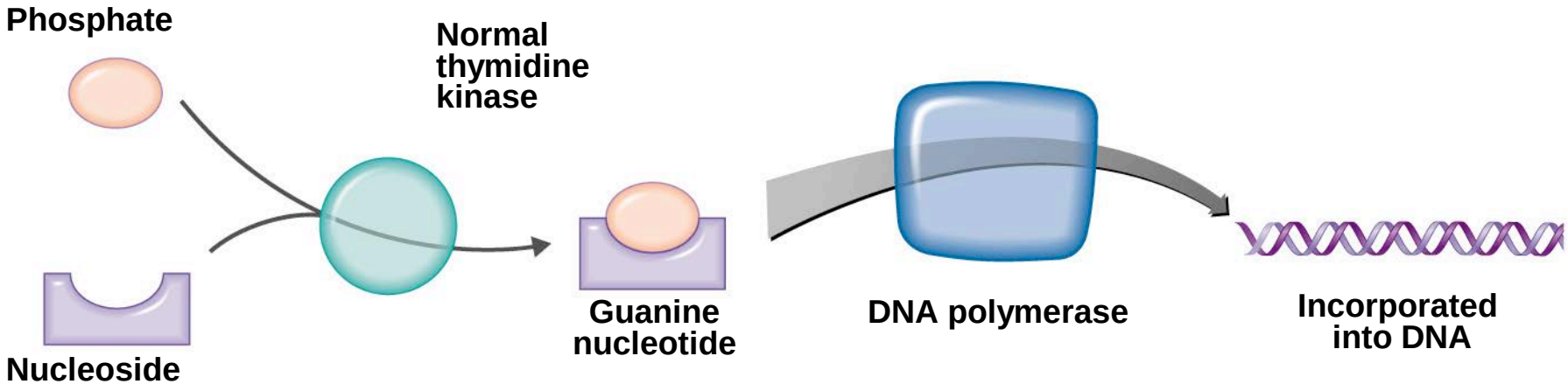

Gapminder HIV Chart 2009 (Data from 2007)
Color:
Size:
Number of people living with HIV
1 000 000
500 000
100 000
50 000
< 10 000
5 000 000
Updates & sources:
www.gapminder.org/hiv
(Sources: UNAIDS / WHO and others.)
HIV infected (% of adults aged 15-49 years)
40
20
10
4
2
1
0.4
0.2
0.1
0.04
Income per person ($ per year in purchasing power parity)
500
1 000
2 000
5 000
10 000
20 000
50 000
Zimbabwe
Lesotho
Swaziland
Botswana
Mozambique
Zambia
Namibia
South Africa
Malawi
Tanzania
Kenya
Central African Rep.
Uganda
Cameroon
Gabon
Cote d'Ivoire
Chad
Congo, Rep.
Equatorial Guinea
Ethiopia
Togo
Rwanda
Djibouti
Guyana
Suriname
Bahamas
Burundi
Haiti
Belize
Sierra Leone
Ghana
Nigeria
Angola
Mauritius
Liberia
Guinea-Bissau
Guinea
Burkina Faso
Jamaica
Trinidad and Tobago
Congo DR
Mali
Sudan
Ukraine
Thailand
Estonia
Papua New Guinea
Barbados
Eritrea
Benin
Dominican Rep.
Panama
Russia
United States
Senegal
Gambia
Cambodia
Mauritania
El Salvador
Venezuela
Latvia
Niger
Honduras
Myanmar
Guatemala
Brazil
Spain
Somalia
Vietnam
Paraguay
Colombia
Argentina
Portugal
Uruguay
Malaysia
Switzerland
Nepal
Peru
Italy
India
Moldova
Costa Rica
France
Canada
Ecuador
Chile
Belgium
Tajikistan
Belarus
Mexico
United Kingdom
Taiwan
Ireland
Luxembourg
Nicaragua
Indonesia
Iceland
Netherlands
Laos
Iran
Azerbaijan
Greece
Denmark
Madagascar
Bolivia
Kazakhstan
Australia
Singapore
Kyrgyzstan
Armenia
Lebanon
Lithuania
Israel
Austria
Norway
Pakistan
Morocco
Serbia
Germany
Georgia
Romania
Algeria
Uzbekistan
Fiji
Bulgaria
Sweden
China
Cuba
Poland
Malta
Finland
Mongolia
Tunisia
Hungary
New Zealand
Comoros
Korea, Rep.
Sri Lanka
Korea, DPR
Cape Verde
Egypt
Montenegro
Saudi Arabia
Japan
Qatar
Turkey
Croatia
Slovenia
Bangladesh
Timor-Leste
Philippines
Maldives
Albania
Macedonia, FYR
Czech Rep.
Slovak Rep.
Gapminder HIV Chart 2009 - Ver. February 2009.
Free to redistribute,
PDF available at
www.gapminder.org/hiv
BY NC ND

AIDS

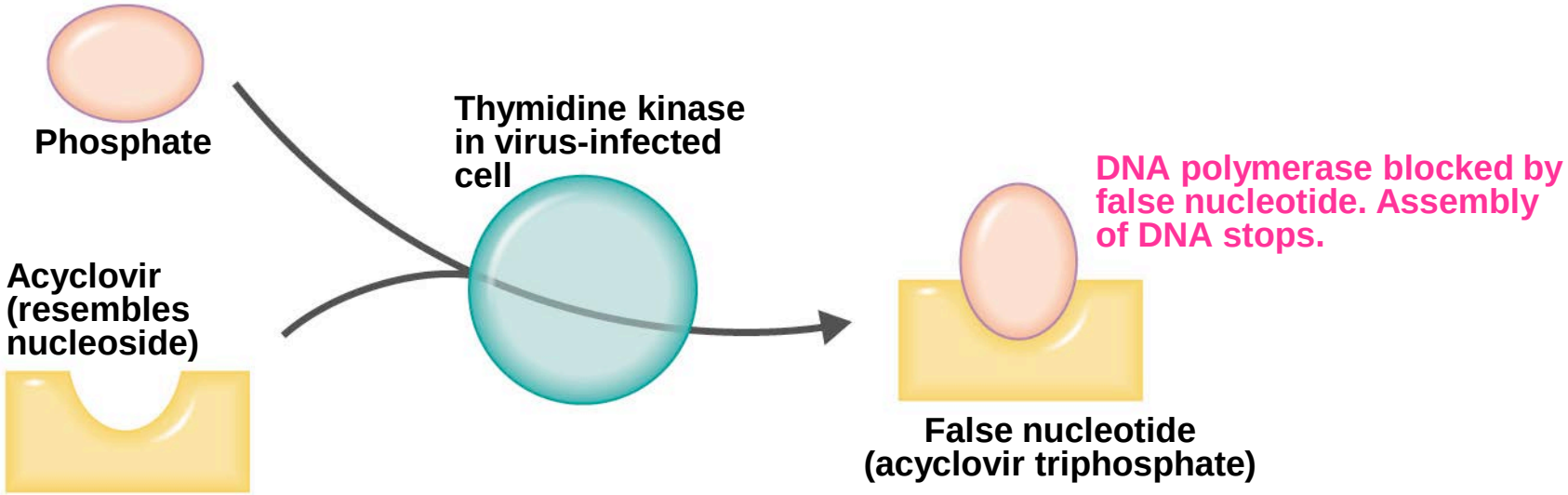


(a) Acyclovir structurally resembles the nucleoside deoxyguanosine.

Figure 20.16a



(b) The enzyme thymidine kinase combines phosphates with nucleosides to form nucleotides, which are then incorporated into DNA.



(c) Acyclovir has no effect on a cell not infected by a virus, that is, with normal thymidine kinase. In a virally infected cell, the thymidine kinase is altered and converts the acyclovir (which resembles the nucleoside deoxyguanosine) to a false nucleotide, which blocks DNA synthesis by DNA polymerase.

Figure 20.16bc