

Introduction to Microbiology



Anas Abu-Humaidan
M.D. Ph.D.

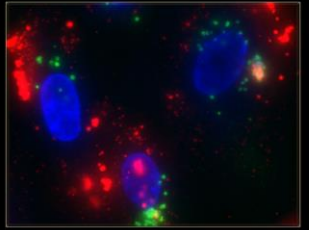
Course introduction



Anas Abu Humaidan


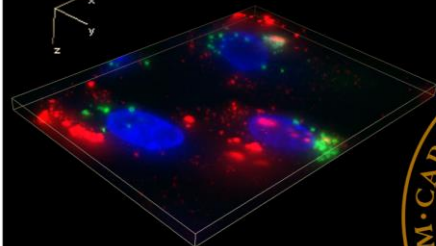

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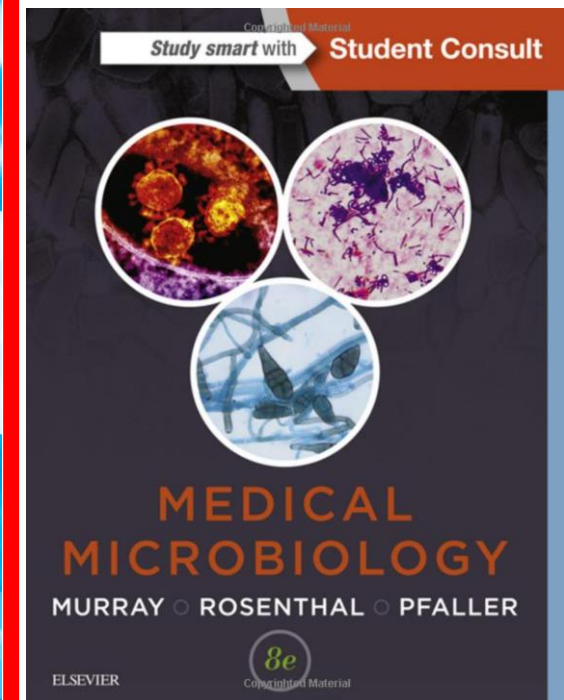
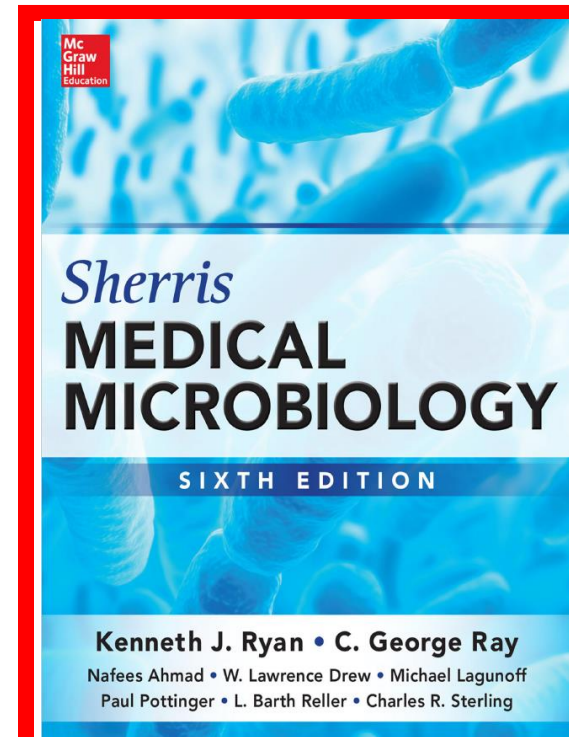
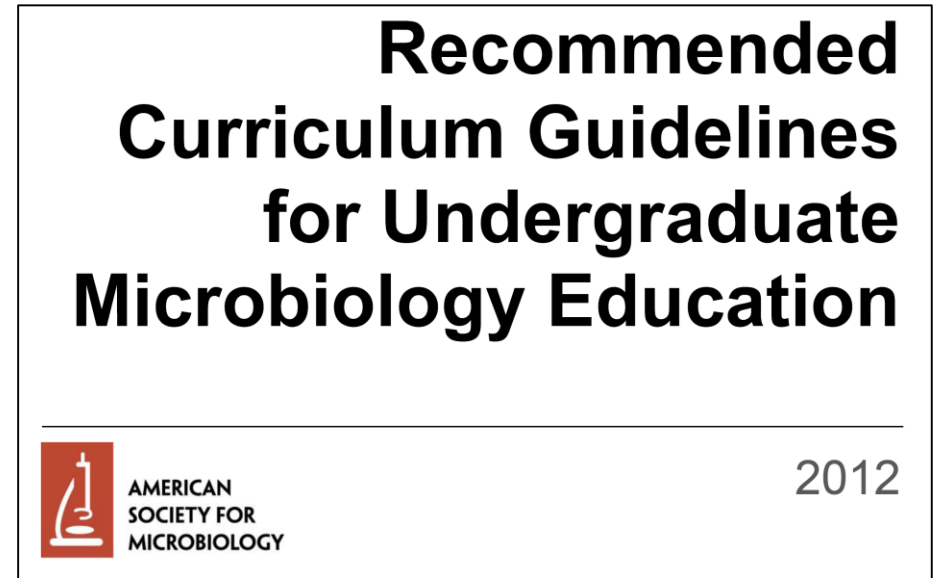
Rules of engagement
Regulation of complement response in tissue

ANAS ABU-HUMAIKAN
DEPARTMENT OF CLINICAL SCIENCES | FACULTY OF MEDICINE | LUND UNIVERSITY



Resources used for this course

- “These reports urge faculty to refrain from presenting science as a sea of facts and work towards ensuring that students have a foundational understanding in biology.”
- Lectures will provide a general outline of main intended learning outcomes, but textbooks are essential for better understanding of the subject.



Resources used for this course

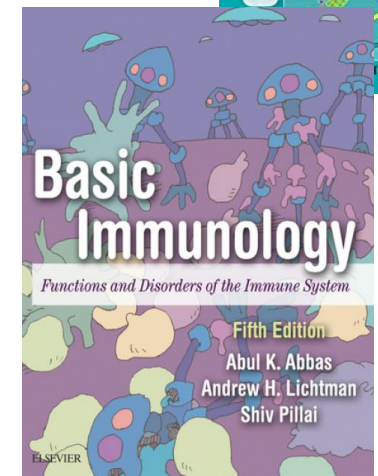
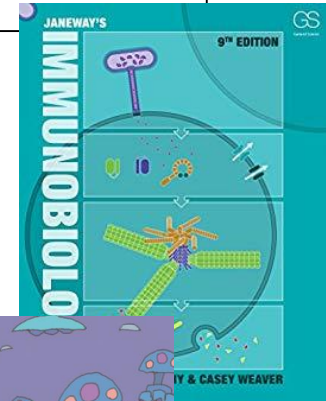
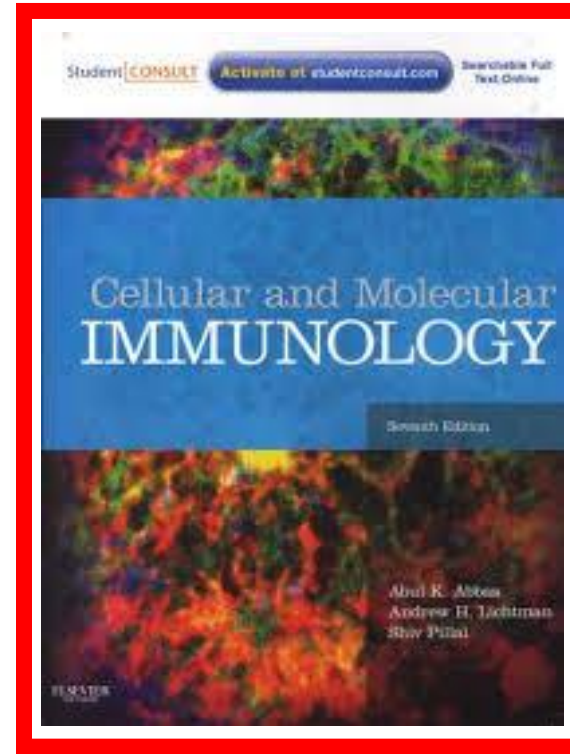
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Recommended Curriculum Guidelines for Undergraduate Microbiology Education



AMERICAN
SOCIETY FOR
MICROBIOLOGY

2012



Course outline

General biology of microbes
(e.g. Structure, metabolism,
genetics, growth)

Role of microbes in health and
disease. (e.g. Microbiome,
important pathogens)

Applications in microbiology
(cultivation of microbes,
emerging microbial threats)

- **Microbiology** is the study of all living organisms that are too small to be visible with the naked eye. This includes bacteria, archaea, viruses, fungi, prions, protozoa and algae, collectively known as 'microbes'.

Course outline

Biology of the immune system
(e.g. Cells of the immune system,
their activation and regulation)

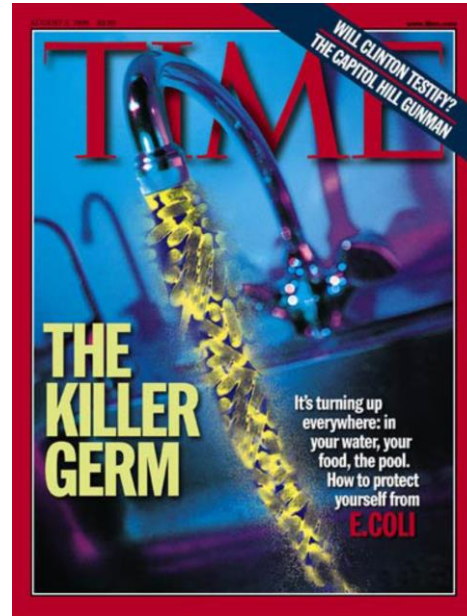
Role of the immune system in
health and disease. (e.g. Role
in fighting microbes,
immunopathologies)

Applications of the
immunology (serology,
immunotherapy)

- **Immunology** is the study of the immune system, including its responses to microbial pathogens and damaged tissues and its role in disease.

Why Microbiology?

- Epidemics and pandemics change the course of history.



Why Microbiology?

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Why Microbiology?



World Map



U.S. Map



Critical Trends



COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)



Total Confirmed

9,882,496

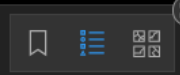
Confirmed Cases by
Country/Region/Sovereignty

2,500,419 US
1,274,974 Brazil
626,779 Russia
508,953 India
311,727 United Kingdom
272,364 Peru
267,766 Chile
248,469 Spain
240,136 Italy

Admin0

Last Updated at (M/D/YYYY)

6/28/2020, 12:33:44 AM



Esri, FAO, NOAA

Cumulative Confirmed Cases

Active Cases

Incidence Rate

Case-Fatality Ratio

Testing Rate

Hospitalization Rate

188

countries/regions

Lancet Inf Dis Article: [Here](#). Mobile Version: [Here](#).

Lead by JHU CSSE. Technical Support: [Esri Living Atlas team](#) and [JHU APL](#). Financial Support: [JHU](#) and [NSF](#). Click [here](#) to donate to the CSSE dashboard team, and other JHU COVID-19 Research.

Global Deaths

495,993

125,434 deaths
US

55,961 deaths
Brazil

43,598 deaths
United Kingdom

34,716 deaths
Italy

29,781 deaths

Global Deaths

US State Level

Deaths, Recovered

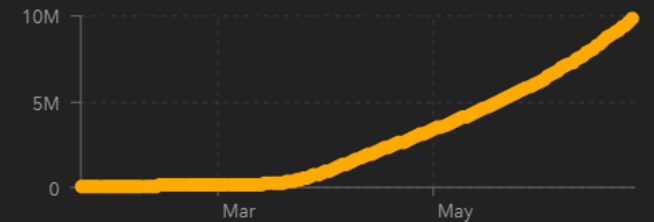
31,362 deaths, **70,010**
recovered
New York US

14,948 deaths, **29,967**
recovered
New Jersey US

8,040 deaths, **recovered**
Massachusetts US

6,873 deaths, **recovered**
Illinois US

US Deaths, Recov...



Confirmed

Logarithmic

Daily Cases

COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Global Cases

37,010,669

Cases by Country/Region/Sovereignty

- 7,689,358 US
- 6,979,423 India
- 5,055,888 Brazil
- 1,278,245 Russia
- 894,300 Colombia
- 871,468 Argentina
- 861,112 Spain
- 843,355 Peru
- 810,020 Mexico
- 732,434 France



Esri, FAO, NOAA

Global Deaths

1,069,836

- 214,007 deaths US
- 149,639 deaths Brazil
- 107,416 deaths India
- 83,497 deaths Mexico
- 42,769 deaths United Kingdom

Global Deaths

US State Level

Deaths, Recovered

- 33,293 deaths, 77,432 recovered New York US
- 16,871 deaths, 698,481 recovered Texas US
- 16,508 deaths, recovered California US
- 16,171 deaths, 35,247 recovered New Jersey US

US Deaths, Recov...

- Cumulative Cases
- Active Cases
- Incidence Rate
- Case-Fatality Ratio
- Testing Rate

188 countries/regions

Lancet Inf Dis Article: Here. Mobile Version: Here. Data sources: Full list. Downloadable database: GitHub, Feature Layer.

Lead by JHU CSSE. Technical Support: Esri Living Atlas team and JHU API. Financial Support:

Last Updated at (M/D/YYYY)

10/10/2020 9:23 PM

Daily Cases



COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Last Updated at (M/D/YYYY)
10/9/2021. 12:21 PM

Total Cases

237,324,461

Total Deaths

4,844,292

Total Vaccine Doses Administered

6,430,398,850

28-Day Cases

13,306,895

28-Day Deaths

225,770

28-Day Vaccine Doses Administered

748,871,252

Cases | Deaths by
Country/Region/Sovereignty

US

28-Day: **3,328,662** | **52,980**

Totals: **44,290,093** | **712,695**

United Kingdom

28-Day: **917,230** | **3,632**

Totals: **8,119,442** | **137,945**

Turkey

28-Day: **773,561** | **6,394**

Totals: **7,387,507** | **65,778**

India

28-Day: **726,979** | **8,058**

Totals: **33,935,309** | **450,375**

Russia

28-Day: **601,750** | **22,905**



Esri, FAO, NOAA

Powered by Esri

Last Updated at (M/D/YYYY)
10/8/2022, 11:21 AM

621,025,371

6,556,290

9,063,463,316

Cases | Deaths by
Country/Region/Sovereignty

28-Day Cases
13,021,399

28-Day Deaths
42,247

28-Day Vaccine Doses Administered
77,387,166

Japan
28-Day: 1,518,496 | 3,100
Totals: 21,517,962 | 45,450

Germany
28-Day: 1,496,382 | 2,236
Totals: 33,948,632 | 150,535

US
28-Day: 1,438,073 | 11,959
Totals: 96,686,904 | 1,062,513

Russia
28-Day: 1,191,713 | 2,783
Totals: 20,861,561 | 380,151

Taiwan*
28-Day: 1,168,437 | 1,164
Totals: 6,782,664 | 11,389

France
28-Day: 1,084,696 | 954
Totals: 35,000,405 | 145,440



Esri, FAO, NOAA, USGS

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◀ Admin0 ▶

◀ 28-Day ▶



COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

JHU Ceased Updates at:

3/10/2023, 4:21 PM

[See Terms of Use for more info](#)

Total Cases

676,609,955

Total Deaths

6,881,955

Total Vaccine Doses Administered

13,338,833,198

28-Day Cases

4,035,254

28-Day Deaths

28,018

28-Day Vaccine Doses Administered

28,156,730

Cases | Deaths by Country/Region/Sovereignty

US

28-Day: **959,794** | **9,451**

Totals: **103,804,263** | **1,123,836**

Japan

28-Day: **418,671** | **2,804**

Totals: **33,329,551** | **73,046**

Germany

28-Day: **355,168** | **2,275**

Totals: **38,249,060** | **168,935**

Russia

28-Day: **350,549** | **989**

Totals: **22,086,064** | **388,521**

Korea, South

28-Day: **290,039** | **396**

Totals: **30,615,522** | **34,093**

Taiwan*

28-Day: **216,931** | **778**

Totals: **9,970,937** | **17,672**

Brazil

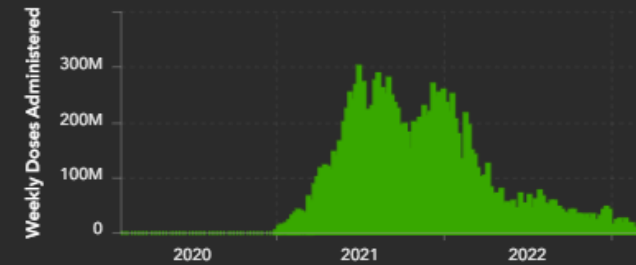
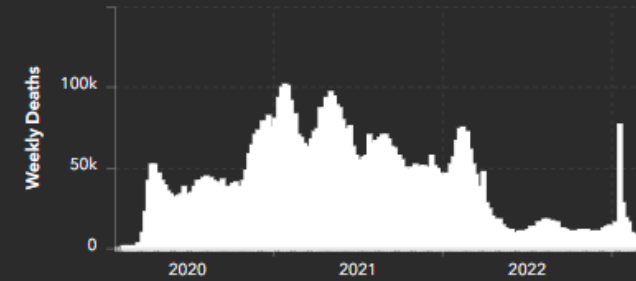
28-Day: **170,852** | **1,613**

Totals: **37,085,675** | **699,310**

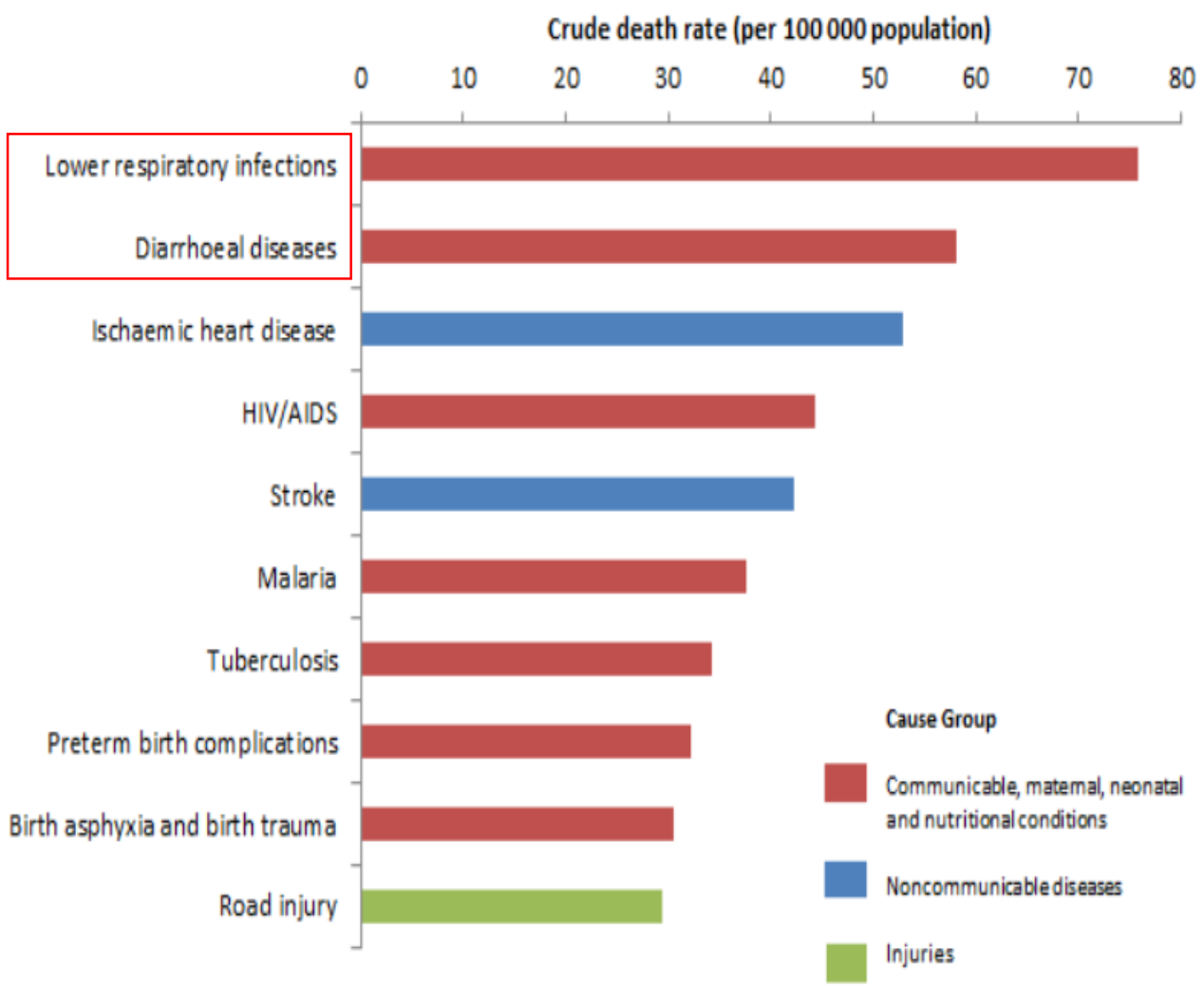


Esri, FAO, NOAA, USGS

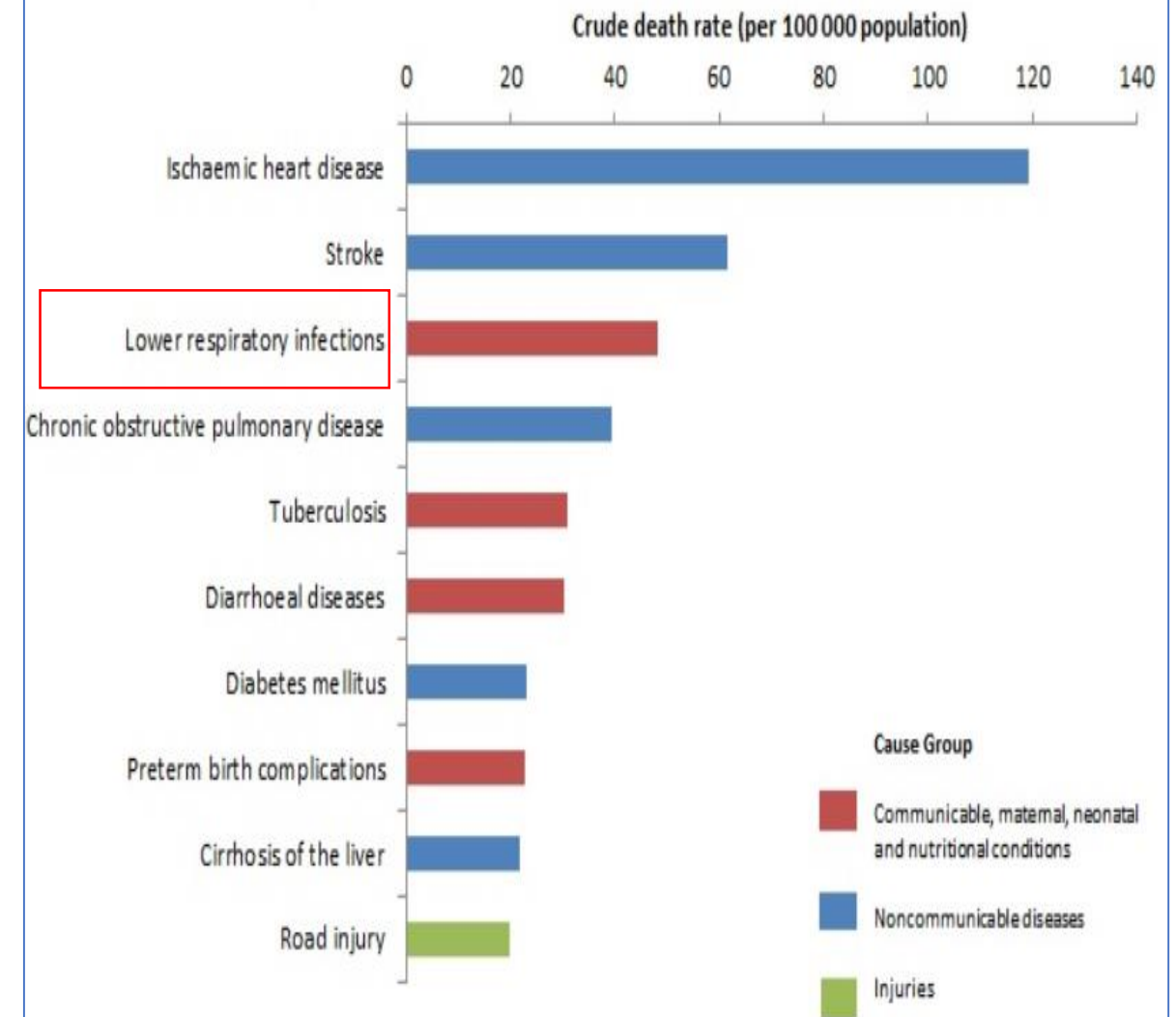
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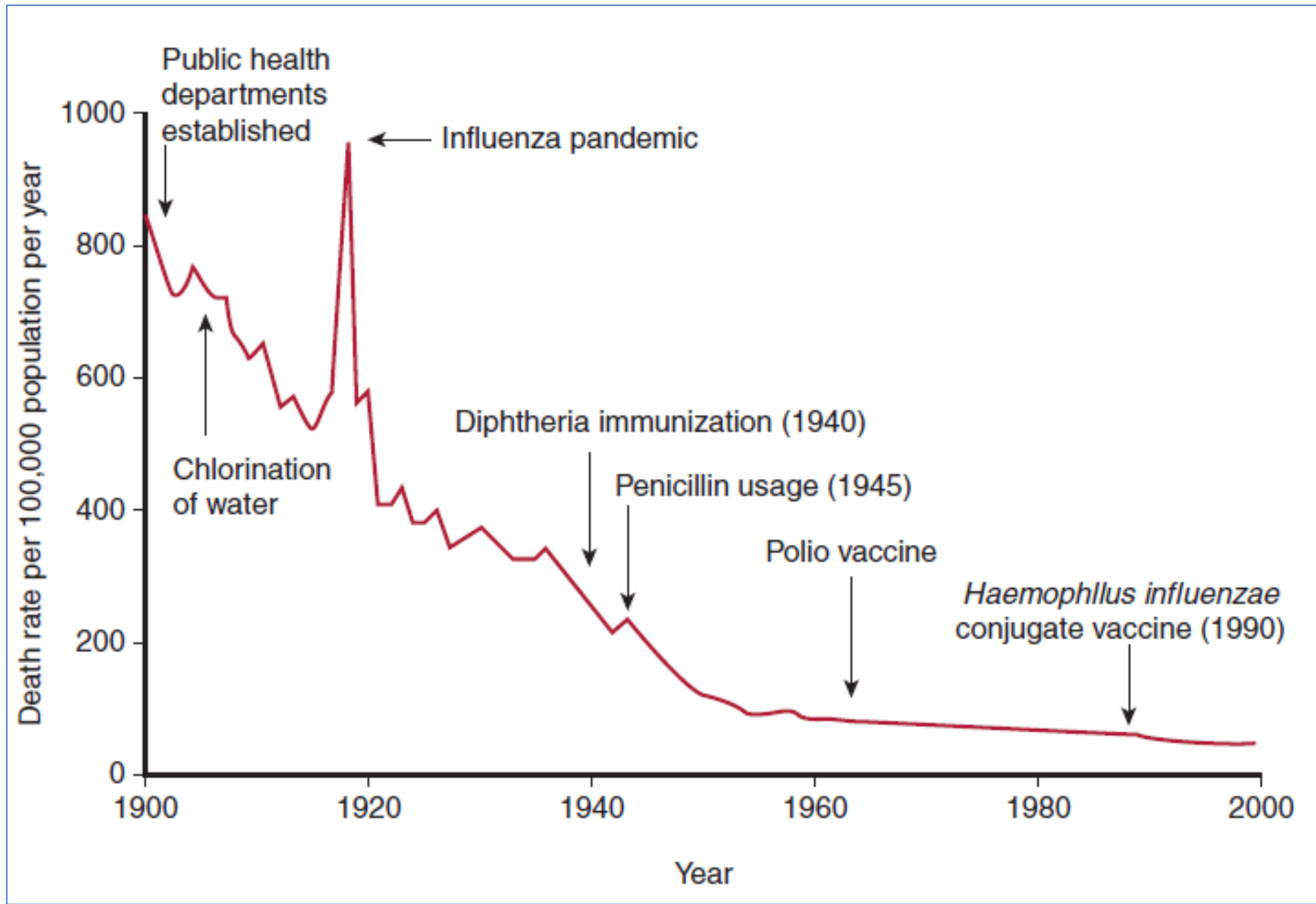


Top 10 causes of deaths in low-income countries in 2016



Top 10 causes of deaths in lower-middle-income countries in 2016





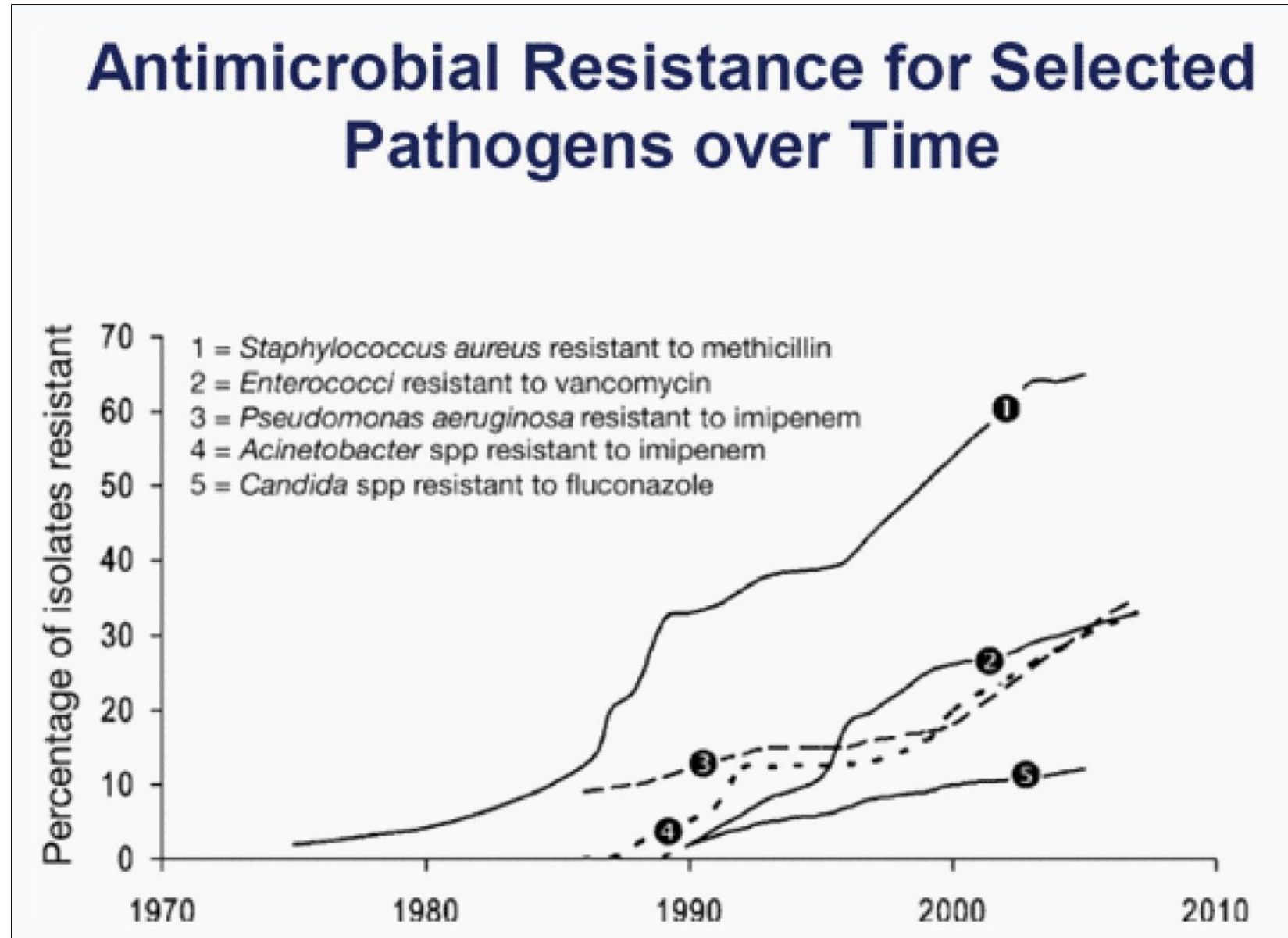
Why Microbiology?

- Dissemination of scientific knowledge in Microbiology to the community is important in limiting the spread of disease.



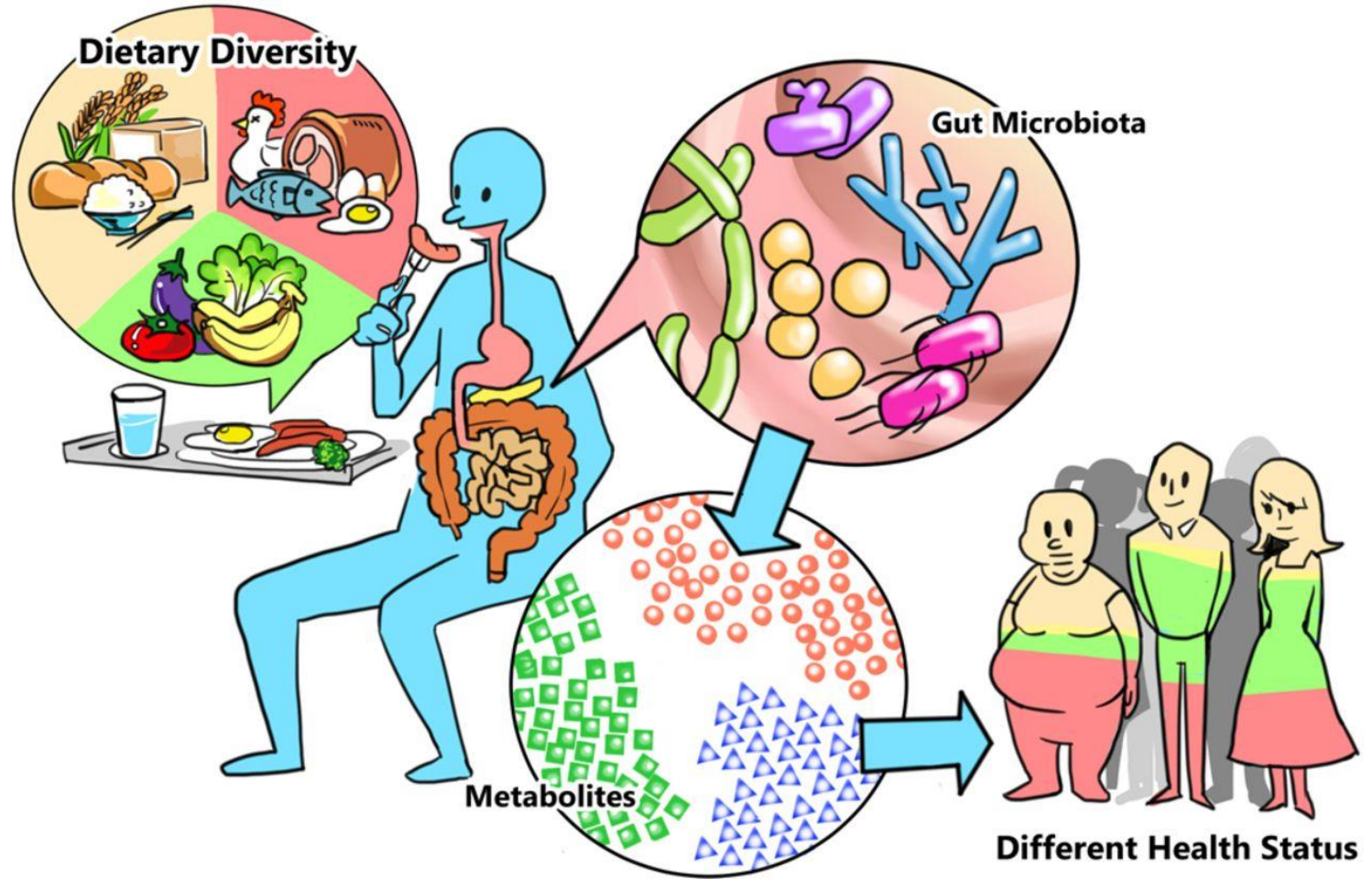
Why Microbiology?

- Antimicrobial resistance is a pressing issue that needs to be addressed.
- Physicians, scientists and governments are at the forefront.



Why Microbiology?

- On average, There's more bacterial cells than human cells living in your body !
- The human microbiome is an organ in its own right.



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- On average, There's more bacterial cells than human cells living in your body !
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Why Microbiology?

- An ever-evolving science with consequences on human and animal health, our environment...
- For the love of science !



Aims of the course

The course is divided into 2 main parts, microbiology and immunology.

In the microbiology part, the course aims to:

- Explain basic concepts in bacterial, viral, protozoal and fungal biology, including structure, metabolism, growth, and genetics. and the application of that knowledge in cultivation, classification, and identification of microbes.
- Describe methods of sterilization and antimicrobial therapy.
- Describe and demonstrate common procedures done in the microbiology lab.
- Introduce the student to the human microbiota and its role in health and disease.
- Describe the infection process, including pathogenesis of microbes and ways through which they evade the immune system.
- Briefly introduce the student to important medical pathogens. Their classes, pathogenesis, diagnosis, and treatment.

Aims of the course

In the Immunology part, the course aims to:

- Describe in detail the biology of the immune system, starting with cells, tissue, and molecules involved in the immune response, their development, activation, and regulation.
- Describe in detail the main arms of the immune system, the innate and adaptive.
- Explain the concept of recognition of non-self and related topics, including tolerance and autoimmunity.
- Explain immunopathology with examples, including types of hypersensitivity and immunodeficiencies.
- Introduce clinical aspects of immunology, including vaccines, serology, transplantation, and immunotherapy.

Intended Learning Outcomes (ILOs):

After completion of the course, the student is expected to:

- Explain and discuss major concepts in Microbiology and Immunology (found in course aims above) and understand how microbes and the immune system interact.
- Describe how the immune system functions in health and disease.
- Describe, in general terms, diseases caused by important medical pathogens.
- Recognize and discuss clinical scenarios related to infectious diseases or immunopathology.
- Describe some of the methods used in microbiology and immunology labs.

Conclusion

- Understand and be able to discuss subjects related to Microbiology and Immunology.
- Complete class work and pass the exams.
- Learn to like Microbiology !