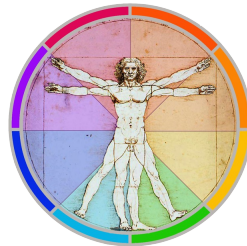


HUBS191 Lecture Material

This pre-lecture material is to help you prepare for the lecture and to assist your note-taking within the lecture, it is NOT a substitute for the lecture !



Please note that although every effort is made to ensure this pre-lecture material corresponds to the live-lecture there may be differences / additions.

HUBS 191

Lecture 31

Immunology II – Innate immunity: immune cells in the blood

A/Prof Joanna Kirman



© The content and delivery of all resources in this course are copyrighted. This includes video and audio recordings, PowerPoints, lecture notes and handouts. You may access the materials provided for your private study or research but may not further distribute the materials for any purpose, or in any other form, whether with or without charge.

Progress Test 2 – Saturday 17th May @ 10.30am-

11:15am

- If you are unable to sit the test for an unavoidable reason go to the HUBS office ASAP BEFORE **12pm Wednesday 14th May** with documentation.
- **Check your eVision timetable the week of the test to see which venue you must attend as there may be changes.**
 - If you do not attend the test you will get a mark of zero – there is NO PLUSAGE!
- The test comprises 25 multiple-choice questions (options A-D)
- **Duration of the MCQ TEST is 30 min and you will not be permitted to enter the test after 10:45am.**
 - **Material covered = Lectures 16 – 32 inclusive and associated readings, content from Labs 3 and 4**
 - Bring Student ID card, pencil, eraser
 - Only List A university approved calculators will be permitted

Practice Mini-Essay

After 30 minutes, you must finish your MCQs and then have 15 minutes to complete a practice mini-essay under exam conditions. You cannot leave until 11:15 and cannot revisit MCQs during the practice mini-essay time. You can take your practice mini-essay home to self or peer mark against a model answer on Bb. The practice essay does not contribute to your final grade.

Illness etc ON THE DAY.

In case of illness, or another situation affecting your ability to do the test **on the day**, you must go to the HUBS office with documentation (see HUBS policy on Health Declaration Certificate on Bb) by **5pm Monday 19th May** in order to have your case considered.

Objectives

2

To be able to:

- List and describe the function of the immune cells in the blood
- Give examples of phagocytic cells
- Explain how innate cells recognise pathogens
- Explain how fever is induced

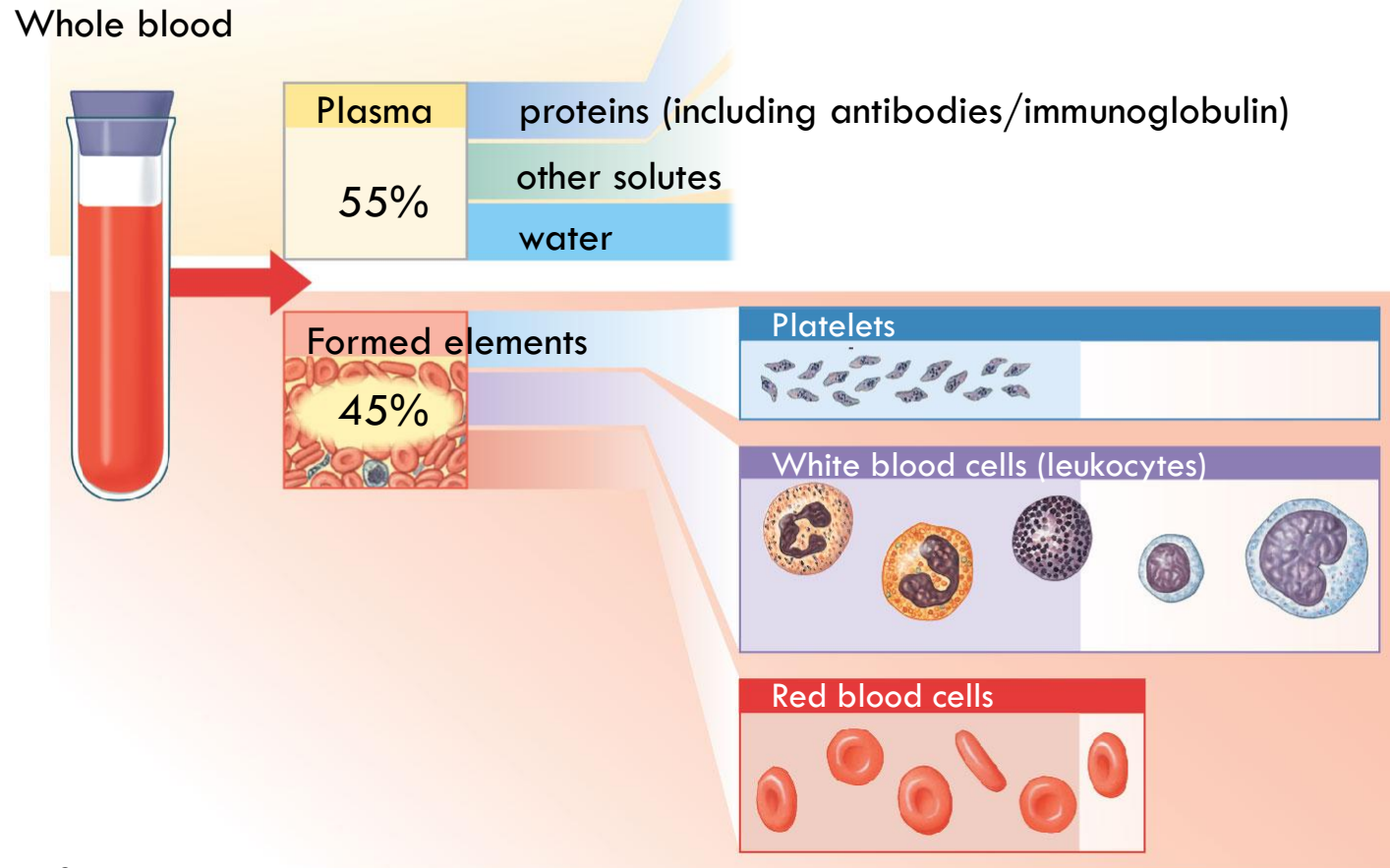
Readings:

- Marieb 10e Chapter 21 first part of Section 21.2, page 793 only
- Marieb 10e Chapter 21 page 796 (Section “Inflammatory Chemical Release”)
- Marieb 10e Chapter 21 page 799 (Section “Fever”)
- Marieb 10e Chapter 21 page 804-805 (Section “Dendritic Cells” and “Macrophages”)

Obj 1: Immune cells in the blood

Blood is composed of plasma and cells

4



Bone marrow

5

Bone marrow stem cells = source of blood cells
(hematopoiesis)



Blood Cell Lineages

6

Derived from
hematopoietic
stem cells in
the bone
marrow
(see Martini 3e
Module 17.3)

□ Myeloid →

red blood cells (erythrocytes)

granulocytes, monocytes, dendritic cells,
platelets (innate immune cells)

□ Lymphoid →

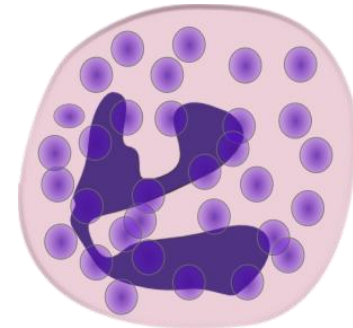
B and T lymphocytes (adaptive immune
cells)

White
blood
cells

Granulocytes in Blood

7

Neutrophils – 75% of all leukocytes, highly phagocytic
“eat and kill” – numbers in blood increase during infection

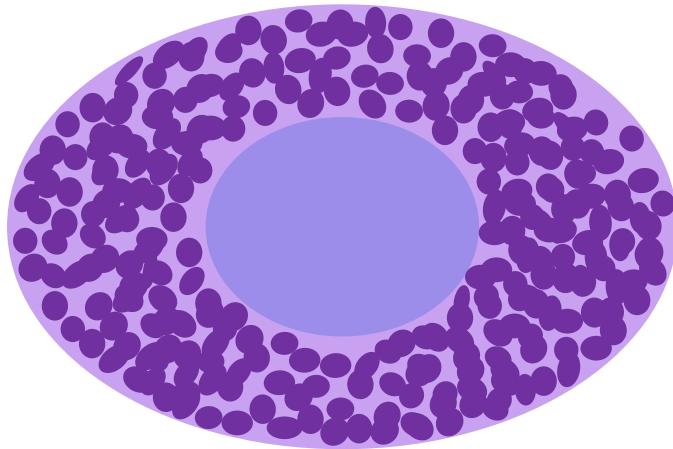


Granulocytes circulate in the blood and can move into tissue during inflammation

Granulocytes in Tissue

8

□ Mast cells



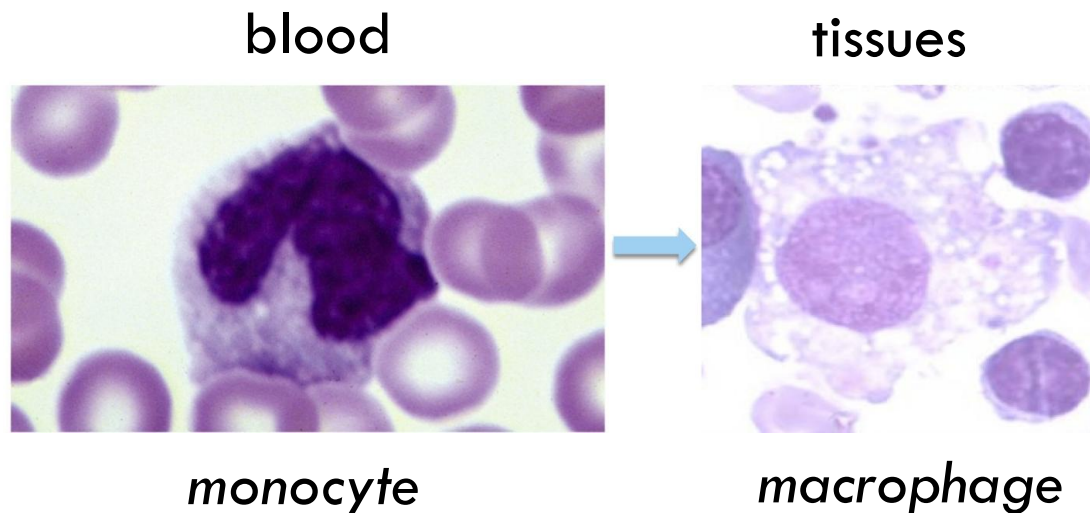
- Mast cells line mucosal surfaces (not found in blood)
- Release granules (*in dark purple*) that attract white blood cells to areas of tissue damage

Obj 2: Phagocytic cells

Monocytes and Macrophages

10

- Monocytes present in blood → low phagocytosis
- Leave blood - develop into macrophages in tissues e.g. spleen, liver → high phagocytosis



Macrophages

11

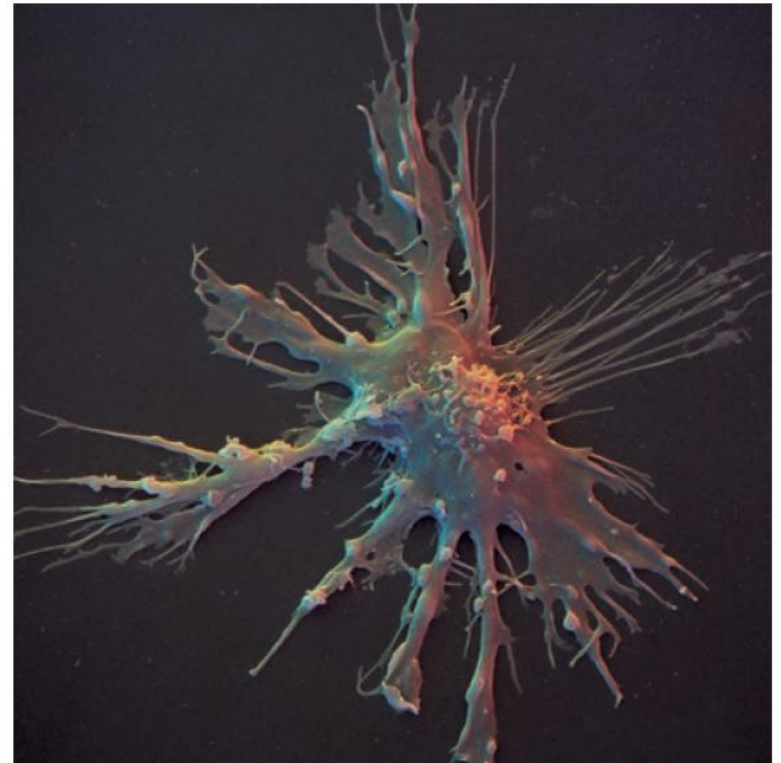
- Macrophage become resident (sessile) or move through tissues (migratory)
- 3 important functions
 1. Phagocytosis (professional eaters)
 2. Release of chemical messengers
 3. Show information about pathogenic microbes to T cells (linking innate and adaptive immunity)



Dendritic cells: linking innate and adaptive immune responses

12

- Found in low numbers blood and all tissues in contact with the environment
- Phagocytic
- **Most important cell type to help trigger adaptive immune responses**

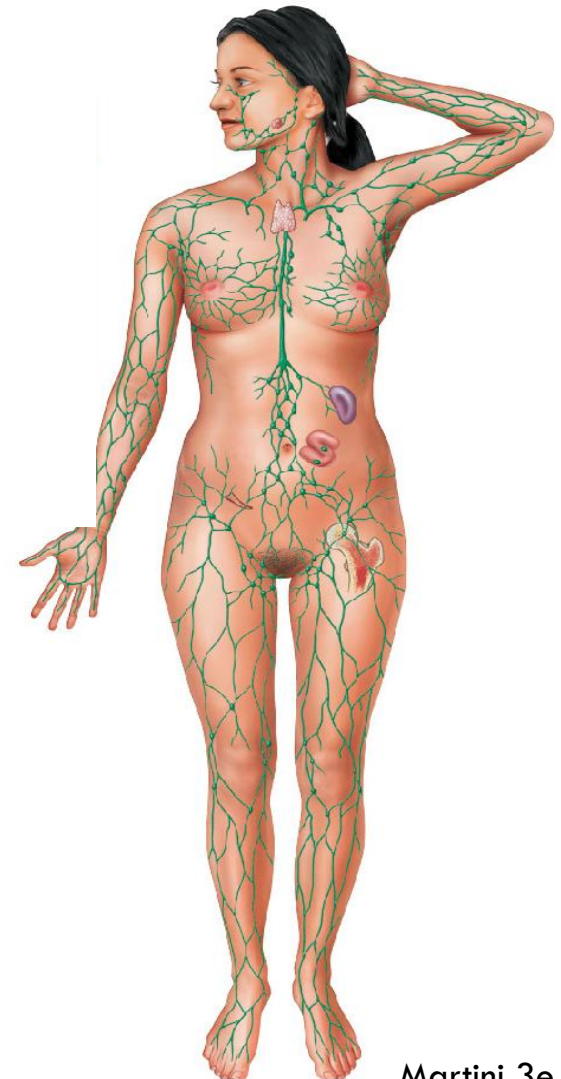


Marieb 10e Chapter 21 Figure 21.10

How do cells of the immune system move around the body?

13

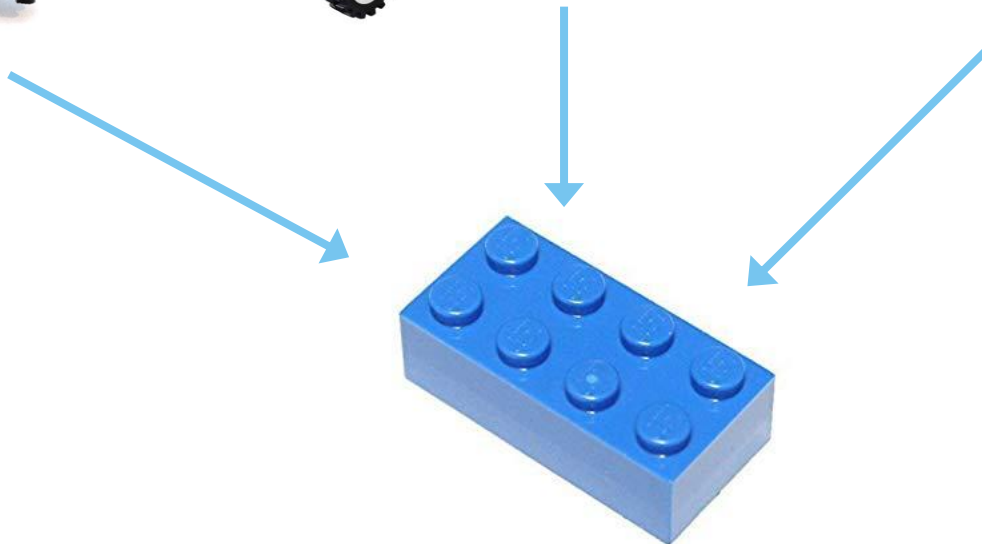
- Cells are carried in the **blood** and in the **lymph**
- Cells can leave blood to enter tissues
- Lymph in tissues collects into lymphatic vessels. These drain lymph into lymph nodes.



Obj 3: How innate cells recognise pathogens

Pathogen-associated molecular patterns (PAMPS)

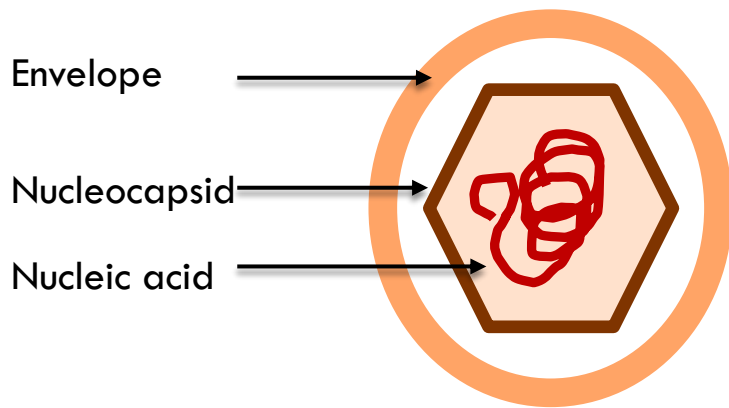
15



Pathogen-associated molecular patterns (PAMPS) examples

16

Virus

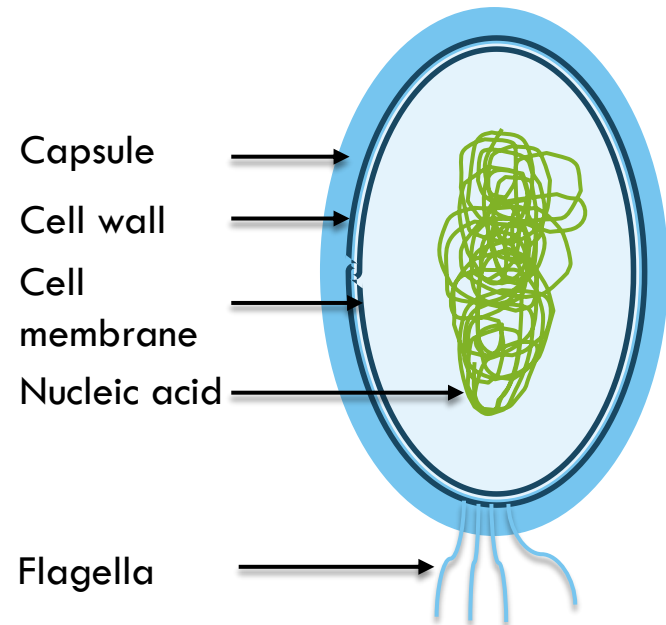


COMMON BUILDING BLOCKS OF VIRUSES:

Nucleic acid: ssRNA, dsRNA



Bacterium



COMMON BUILDING BLOCKS OF BACTERIA:

Cell wall: lipopolysaccharide (LPS)/
endotoxins, lipoteichoic acid

Flagella: flagellin

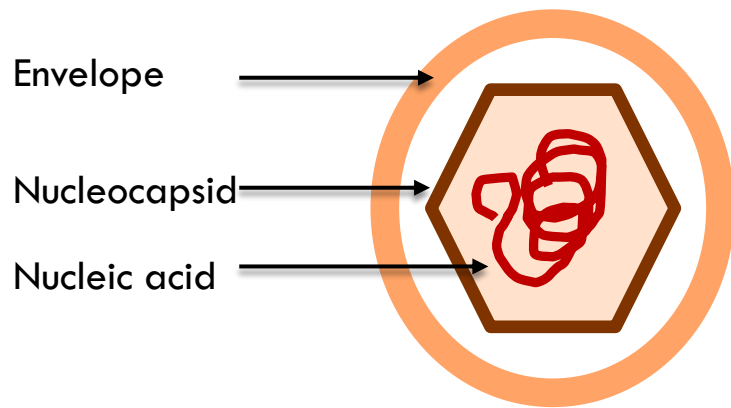
Nucleic acid: unmethylated CpG DNA



Pathogen-associated molecular patterns (PAMPS) examples

17

Virus

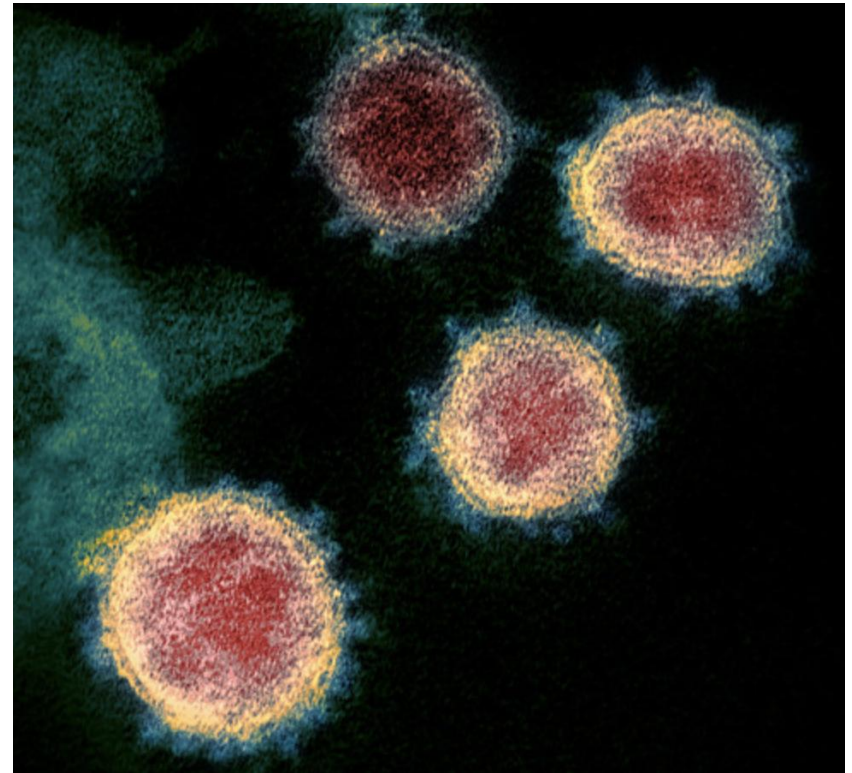


COMMON BUILDING BLOCKS OF VIRUSES:

Nucleic acid ssRNA, dsRNA



SARS-CoV-2



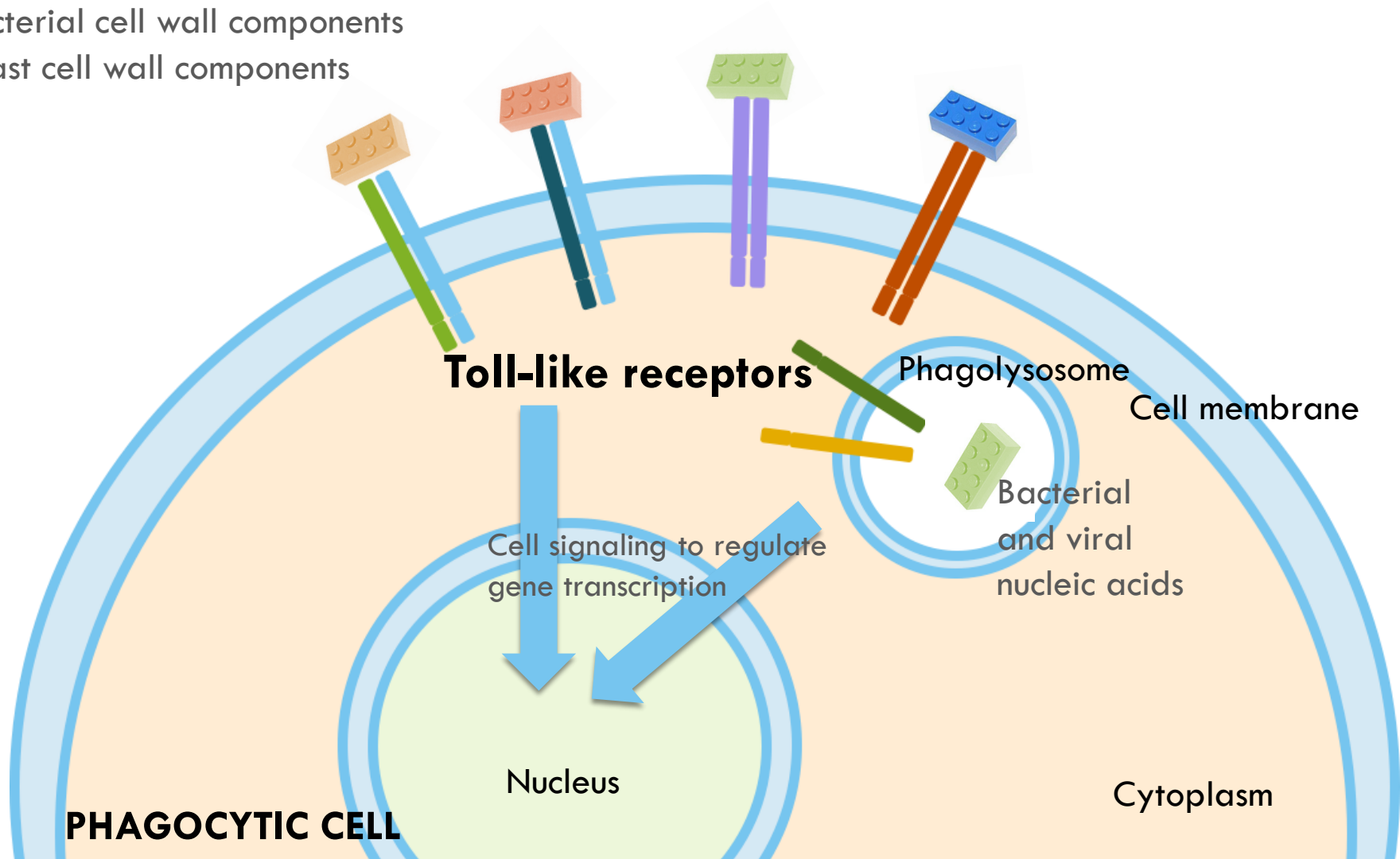
SARS-CoV-2

Pattern Recognition Receptors

18

Bacterial cell wall components

Yeast cell wall components



FEVER/PYREXIA

19

- Abnormally high temperature $>37^{\circ}\text{C}$
- Re-setting of thermostat (hypothalamus)
- Pyrogens – released by cells of the immune system
- Phagocytes produce the chemical messenger and pyrogen interleukin-1 (IL-1) after ingesting bacteria
- Why might fever be useful?
- $\downarrow\text{phagocytosis} \rightarrow \downarrow\text{IL-1} \rightarrow \downarrow\text{temperature}$



Revision MCQ

20

A common **virus**-associated pathogen associated molecule pattern (PAMP) is:

- a) unmethylated CpG DNA
- b) ds RNA
- c) ss DNA
- d) lipopolysaccharide/endotoxin

HUBS191

Copyright Warning Notice

This coursepack may be used only for the University's educational purposes. It includes extracts of copyright works copied under copyright licences. You may not copy or distribute any part of this coursepack to any other person.

Where this coursepack is provided to you in electronic format you may only print from it for your own use. You may not make a further copy for any other purpose. Failure to comply with the terms of this warning may expose you to legal action for copyright infringement and/or disciplinary action by the University

