

## LEAGUE OF IMMUNO LEGENDS

# Slide Guide and Presentation Notes

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**Instructions:** Use this slide guide better prepare for and help navigate through the PowerPoint presentation as well as provide the students with a greater source of information.

- *Define, state and show* indicate something needs to be better explained or may be useful for the students understanding of the content given
- *Ask* indicates a question that should prompt student participation/responses, with an answer example given
- *Common questions* give a look into what students often have a difficulty understanding and potential answers you can give
- *Citations* indicate any sources used within this slide guide, or images/videos used within the PowerPoint itself, actual sources used for the information on the slides can be found at the end of the presentation

### Slide 1: *Title*

### Slide 4: *Outline*

### Slide 5: *General Vocabulary*

After reading through these basic vocab words, prompt the students to ask questions about any terms they are still unsure of.

### Slide 6: *What is the Immune System?*

#### Define:

- *Immune recognition:* The immune system's ability to recognize pathogenic molecular structures and further distinguish infectious non-self [foreign matter] from non-infectious self
- *Immune effector functions:* Involves effector cells that are relatively short-lived activated cells that defend the body in an immune response. These include effector B cells (called plasma cells) that secrete antibodies, and activated T cells (cytotoxic T cells and helper T cells), which carry out cell-mediated responses.

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- *Immune regulation*: Involves regulatory T cells secreting cytokines (chemical messengers of the immune system) to inhibit immune responses. This, in turn, prevents the immune response from continuing indefinitely and avoids extensive damage to the body.
- *Immune memory*: Ensures that the immune system remembers the antigens it has previously encountered and can launch a more intense immune reaction during subsequent exposures. This function is important for adaptive immunity.

### Common Questions:

*"How does the immune system recognize self from non-self?"*

- When the immune system looks at the surface molecules (antigens), of the non-self, they appear foreign. Certain immune cells can recognize and take note of this to relay to other cells.

### Ask:

1. *"What might happen if the immune regulation function fails?"*

Potential Answer:

The body may not be able to recognize itself, and the immune system will begin attacking the body and healthy cells. This is more commonly known as an autoimmune disease.

2. *"Where might immune memory be important for addressing diseases as a biomedical engineer?"*

Potential Answer:

Could be helpful for vaccines, with the vaccine giving a "safer" first exposure, allowing a faster response to later exposures.

### Definition Citations:

1. Janeway Jr, Charles A., and Ruslan Medzhitov. "Innate immune recognition." *Annual review of immunology* 20.1 (2002): 197-216.
2. The Editors of Encyclopaedia Britannica (Ed.). (2019, October 22). Effector cell. Retrieved January 14, 2021, from <https://www.britannica.com/science/effector-cell>
3. Delves, P. J. (2020, April). Overview of the Immune System. Retrieved January 13, 2021, from <https://www.merckmanuals.com/home/immune-disorders/biology-of-the-immune-system/overview-of-the-immune-system>
4. Tao, X., & Xu, A. (Eds.). (2016). Basic Knowledge of Immunology. *Amphioxus Immunity*, 15-42. <https://doi.org/10.1016/B978-0-12-849903-0.00002-6>

## Slide 7: Two main categories

**Before** clicking on the slide to continue,

Ask:

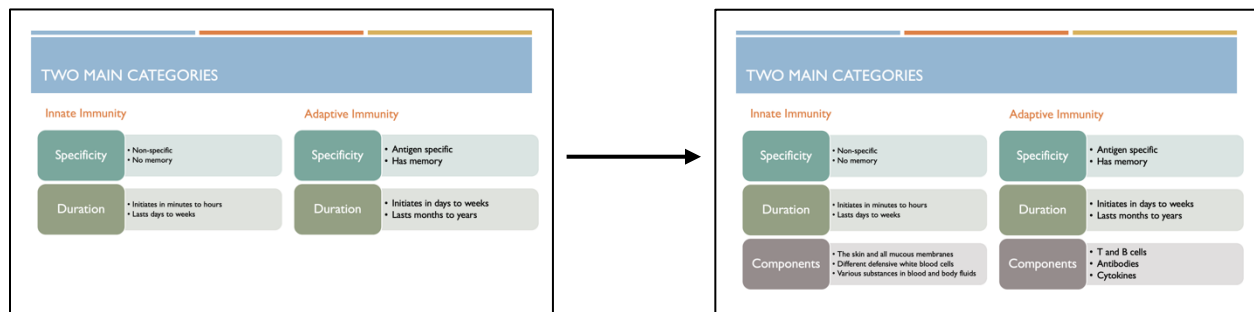
1. “What sort of antigens/attackers do you think each category would address?”

Potential Answer:

The innate immune system would include skin, mucous membranes, substances in blood and bodily fluids, white blood cells without memory (students may name specifics but will be given more information in the following slides).

The adaptive immune system would include antibodies, cytokines, nonspecific white blood cells/lymphocytes (students may name specifics but will be given more information in the following slides).

**After** listening to responses, click on slide to reveal answers (as seen below)



## Slide 8: Meet the players

Citations:

1. *Natural Killer Cells*

Gitig, Diana. *GenEng News*. Visited July 2020.

<https://www.genengnews.com/insights/natural-killer-cells-emerge-as-an-anticancer-alternative-to-t-cells/>

2. *Cytotoxic T Cells*

British Society for Immunology. Visited July 2020. <https://www.immunology.org/public-information/bitesized-immunology/cells/helper-and-cytotoxic-t-cells>

3. *Helper T Cells*

Thing Link. Visited July 2020. <https://www.thinglink.com/scene/632999878879870977>

4. *Regulatory T Cells*

Yu, Yu. *Endonews*, Visited July 2020. <https://www.endonews.com/immune-response-in-endometriosis-andregulatory-t-cells>

## Slide 9: Meet the players (cont.)

### Citations:

1. *Macrophages*

Archoncology. Visited July 2020. <https://archoncology.com/science/figure-3-macrophage-consumes-tumor/>

2. *Dendritic Cells*

Rees, Victoria. *Drug Target Review*. Visited July 2020. <https://www.drugtargetreview.com/news/53501/previously-unknown-role-of-dendritic-cells-in-inflammation-revealed/>

3. *B Cells*

Burgstedt, Christoph. *Science Photo Library*. Shared on *Thought Co*. Visited July 2020. <https://www.thoughtco.com/b-cells-meaning-373351>

4. *Memory B Cells*

Katarina, Zimmer. *The Scientist*. Visited July 2020. <https://www.the-scientist.com/news-opinion/crispred-b-cells-produce-antibodies-against-hard-to-treat-viruses-65904>

## Slide 10: Meet the players (cont.)

### Citations:

1. *Mast Cells*

*Mast Cell Aware*. Visited July 2020. <http://www.mastcellaware.com/mast-cells/about-mast-cells.html>

2. *Basophils*

Blausen.com staff (2014). "[Medical gallery of Blausen Medical 2014](#)". *WikiJournal of Medicine* 1 (2). DOI:[10.15347/wjm/2014.010](#). ISSN 2002-4436.

3. *Neutrophils*

Blausen.com staff (2014). "[Medical gallery of Blausen Medical 2014](#)". *WikiJournal of Medicine* 1 (2). DOI:[10.15347/wjm/2014.010](#). ISSN 2002-4436.

4. *Eosinophils*

Blausen.com staff (2014). "[Medical gallery of Blausen Medical 2014](#)". *WikiJournal of Medicine* **1** (2). DOI:[10.15347/wjm/2014.010](#). ISSN [2002-4436](#).

## Slide 11: *Macrophages at work!*

Show:

Click and show the embedded youtube video.

Note: Only the first couple of seconds are needed.

Video Information:

Credit: Curtis Sleva

Animation by: Fusion Media Animation

Microscopy by: Timelapse Vision

Link: <https://youtu.be/iZYLeIJwe4w>

## Slide 12: *Viral Infections*

(This is a simplified version of the body's immune response to viral infections and will be useful for the game afterwards.)

Note: Diagram is of first exposure.

## Slide 13: *Bacterial Infections*

(This is a simplified version of the body's immune response to bacterial infections and will be useful for the game afterwards.)

Note: Diagram is of first exposure.

## Slide 14: *Infections cont.*

State:

- Fungal infections involve dendritic cells, macrophages, and neutrophils. The receptors on these cells recognize the pathogenic fungus, signaling to the cells to bind and begin the process of phagocytosis.

Note: Image made using the free online tool, Canva.

## Slide 15: Immune System Failures - Allergies

### Ask:

1. *"Given the fact that the chemical, histamine, plays a large role in executing the allergic reaction, how might allergy medicines work?"*

(Hint: Think about how cell and cell receptors work)

### Potential Answer:

The medicines, known as antihistamines, aim to block the histamine receptors, thus leading to suppression of the histamine response.

Note: Image made using the free online tool, Canva.

## Slide 16: Immune System Failures - Autoimmune Diseases

Note: Picture indicates common causes/risk factors

## Slide 17: Immune System Failures- Cancer

### Citations:

#### Image

Buchholz, K. (2020, February 03). Infographic: The Most Common Types of Cancer in the U.S. Retrieved July 28, 2020, from <https://www.statista.com/chart/20692/most-common-types-of-cancer-us/>

## Slide 18: Georgia Tech Defines Immunoengineering as ...

### Ask:

1. *"What are some examples of an immunoengineering application?"*

### Potential Answer:

Vaccines, antibiotics, antivirals, cancer therapies (CAR-T, monoclonal antibodies, etc. although do not expect students to know specifics), over the counter medications for colds, flu, etc.

## Slide 19: Immunoengineering applications - Vaccines, antibiotics, and antivirals

### Ask:

1. *"What category of the immune system do vaccines target and why?"*

### Potential Answer:

The adaptive immune system, as it acts as a regulated and controlled first exposure to better prepare the body for a potential exposure to the natural pathogen.

## Slide 20: Immunoengineering applications - Cancer Therapy

### Citations:

#### *Image*

Types of cancer immunotherapy. (2019, October 07). Retrieved July 28, 2020, from <https://healthscientific.net/types-of-cancer-immunotherapy/>

## Slide 21: Cancer Therapies - CAR-T Cell Therapy

### State:

- The extracted T-cells can either be from the patient themselves (known as autologous) or a healthy donor (known as allogenic).
- CAR-T cell therapy is known as a “living drug” as they can become activated and work within the body following injection

### Common Questions:

#### *“What does chimeric mean?”*

- In this instance, chimeric indicates that there is a fusion of both antigen-binding and T-cell activating functions in a single receptor.

### Ask:

1. *“What may be the greatest issue when making a CAR-T cell therapy?”*

Potential Answer:

One of the main issues is determining the correct antigen to program the T-cells to detect and attack. Some researchers may find that the antigen they tagged is expressed on healthy cells, leading to the modified T-cells attacking healthy cells.

### Citations:

#### *Image*

Kavanagh, D. (2019, May 13). Ethical and Biosafety Oversight of New CAR T-Cell Products. Retrieved July 28, 2020, from <https://www.genengnews.com/insights/ethical-and-biosafety-oversight-of-new-car-t-cell-products/>

## Slide 22: Cancer Therapies – MAB

### State:

- Though their use has proven to be quite innovative in the cancer therapy field, Monoclonal antibodies can be used for more than just cancer treatment. mAbs have been used to treat conditions such as psoriasis, multiple sclerosis, and more.

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- Monoclonal antibodies can also be used to block certain molecules that cancer cells need to grow or they might attack and harm cancer cells directly.

### Common Questions:

*“What is a hybridoma cell?”*

- Resulting cells that are the fusion between an antigen presenting B cell and an *immortal* myeloma (cancerous) cell. Immortal indicates that the cells can continue to divide infinitely given the proper conditions, allowing for continuous production of antibodies.

### Citations:

#### *Information*

NCI Dictionary of Cancer Terms. (n.d.). Retrieved January 21, 2021, from <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/monoclonal-antibody>

#### *Image*

Monoclonal Antibodies. (n.d.). Retrieved July 28, 2020, from <https://ib.bioninja.com.au/higher-level/topic-11-animal-physiology/111-antibody-production-and/monoclonal-antibodies.html>

## Slide 23: *References*