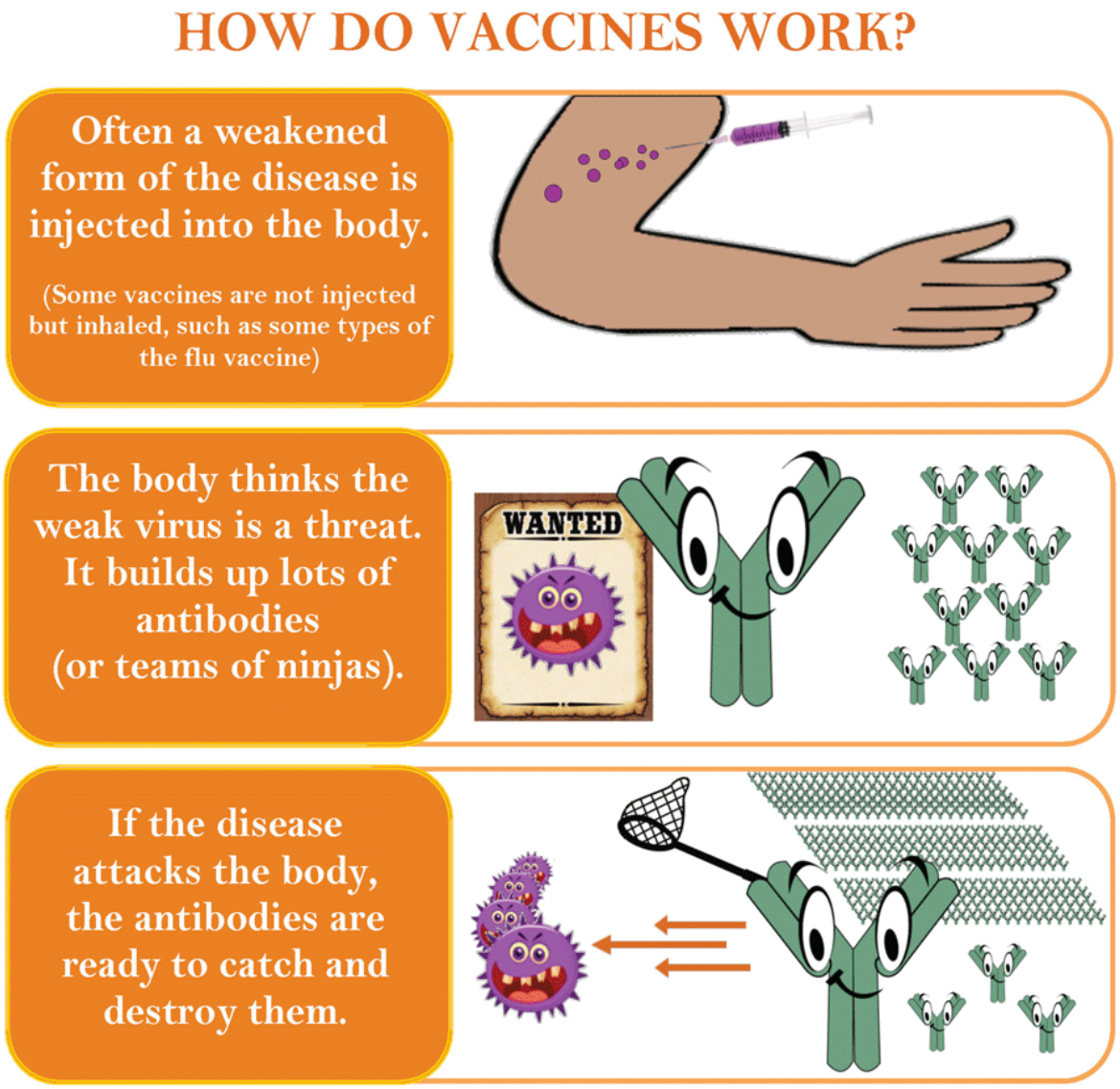
HOW VACCINES WORK

Agenda

- Overview
- How Vaccines Work
- Types of Vaccines
- How Vaccines are Approved
- Why are Vaccines Important

OVERVIEW

- Vaccines work by mimicking disease agents (pathogens) and stimulating the immune system to build up defenses against them



Important Terminology

Pathogen

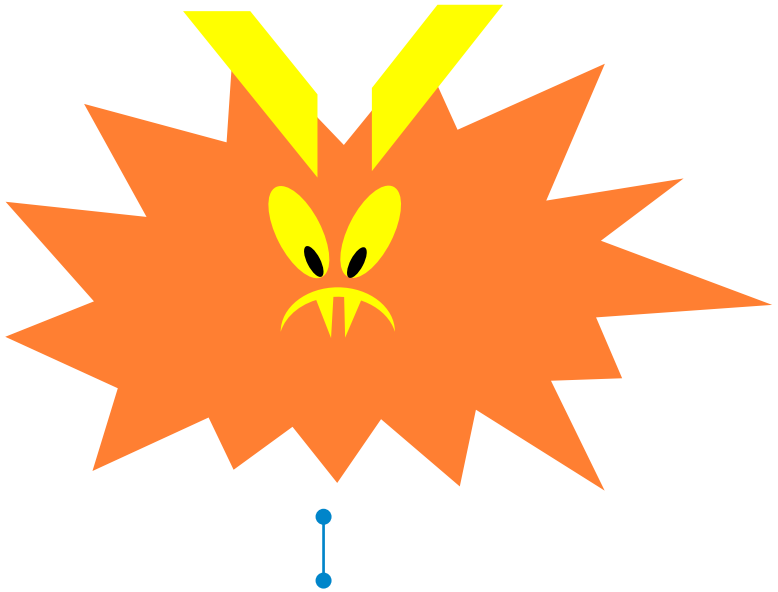
The Immune System

Antigen

Helper Cell

Antibody

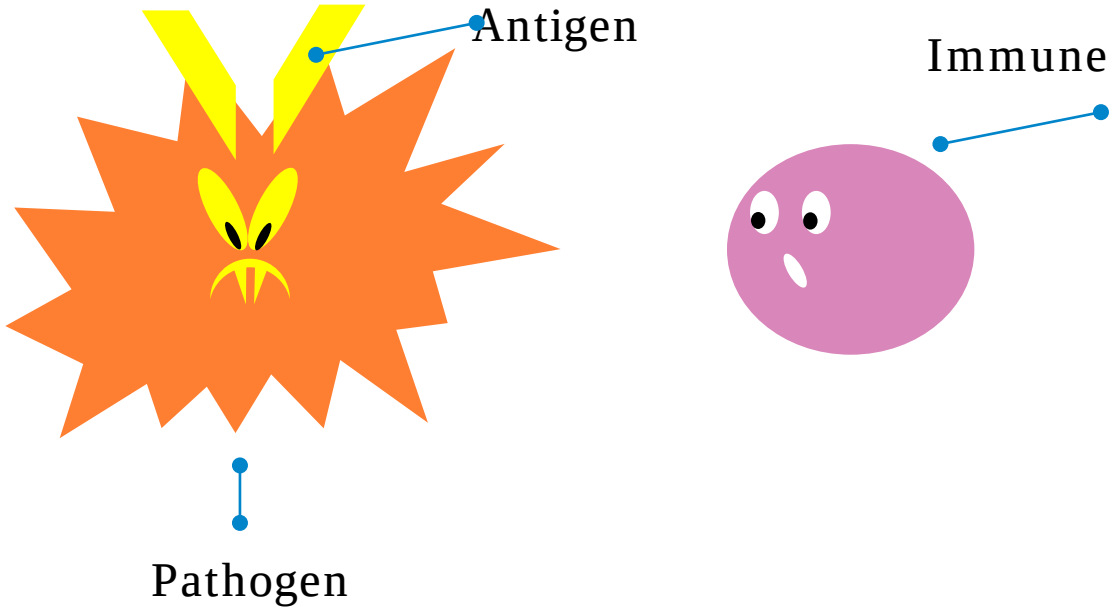
Terminology



Pathogen: an infectious agent such as a virus or bacteria that can cause a disease

Your health →

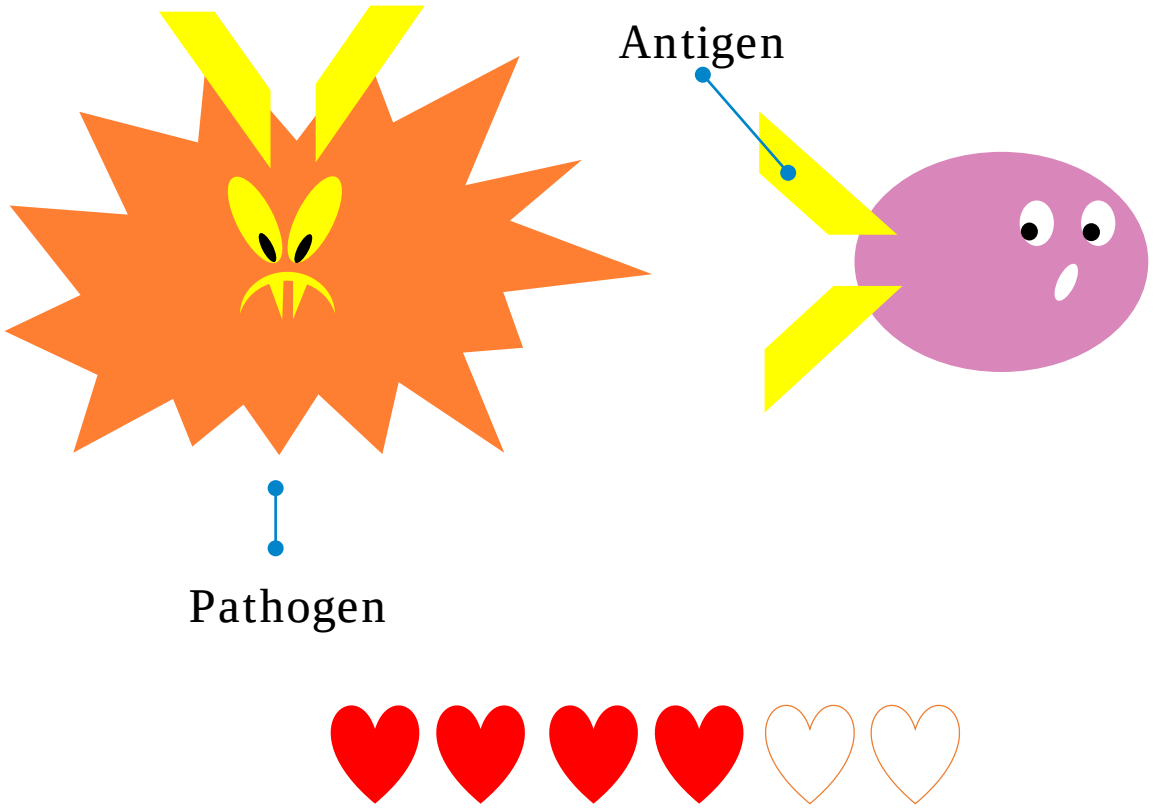
Terminology



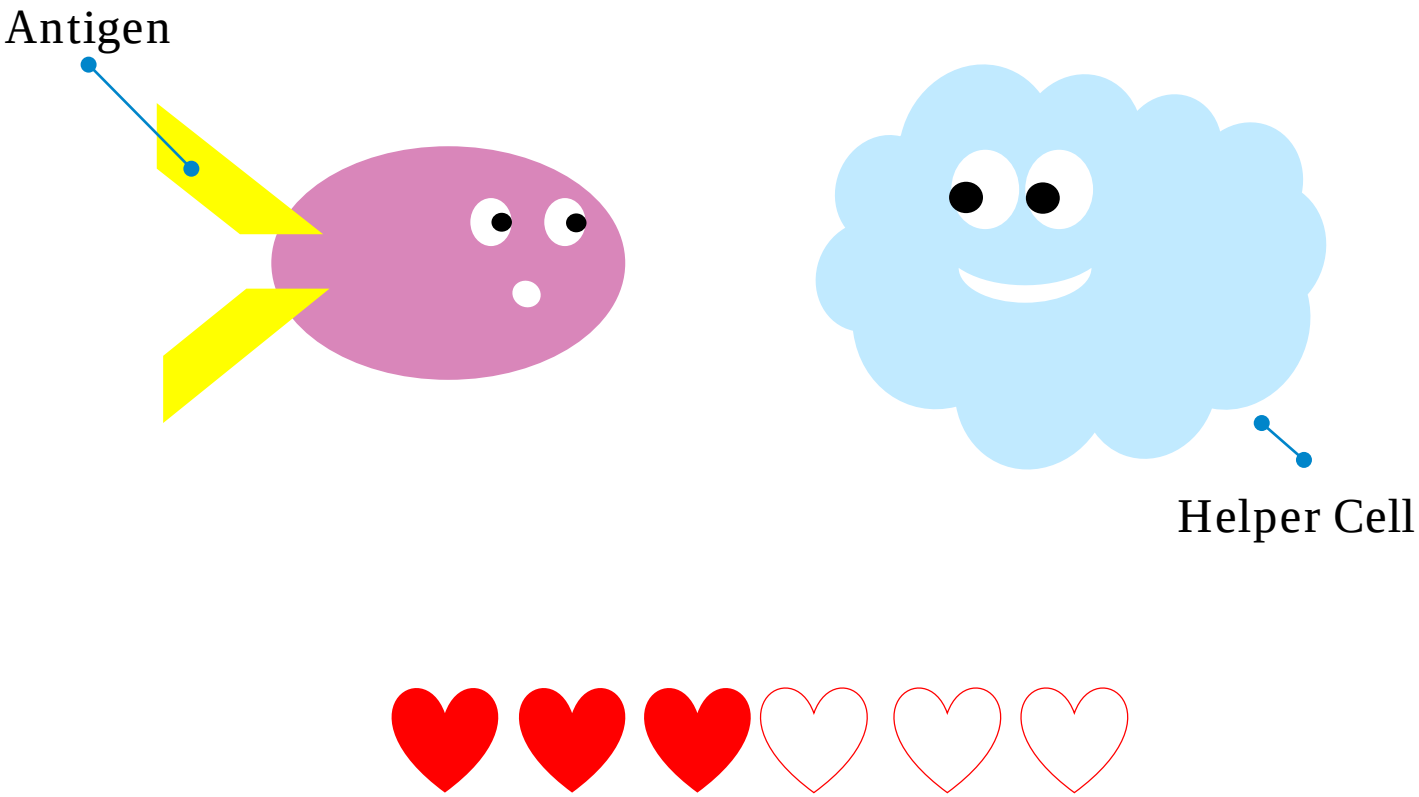
<u>Immune System</u>: the body's defense against infectious pathogens and other invaders

Terminology

<u>Antigen:</u> a molecule that binds to a specific receptor in the body, but cannot induce an immune response in the body itself. They are usually proteins, peptides, and polysaccharides



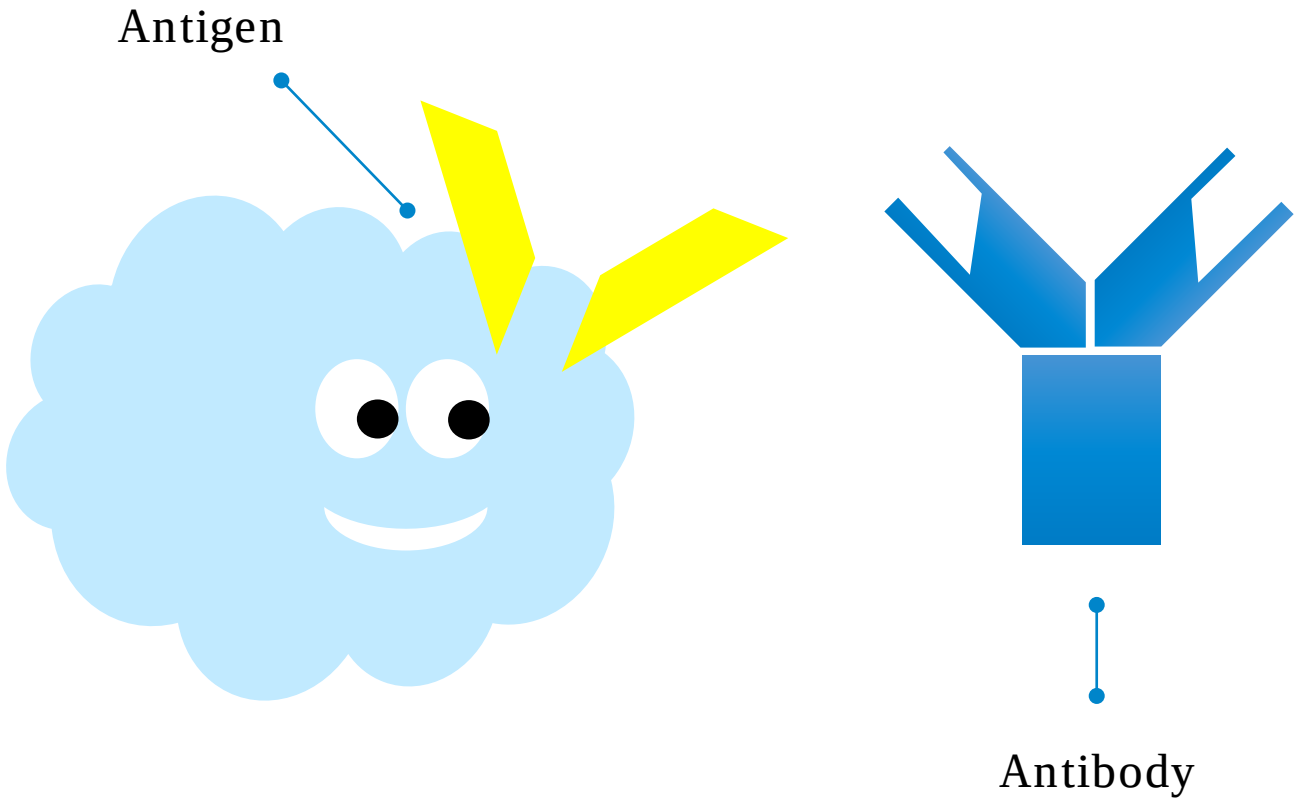
Terminology



<u>Helper Cell</u>: A T-cell that influences the differentiation or activity of other cells of the immune system

Terminology

<u>Antibody</u>: a large Y-shaped protein that is used by the immune system to neutralize pathogens

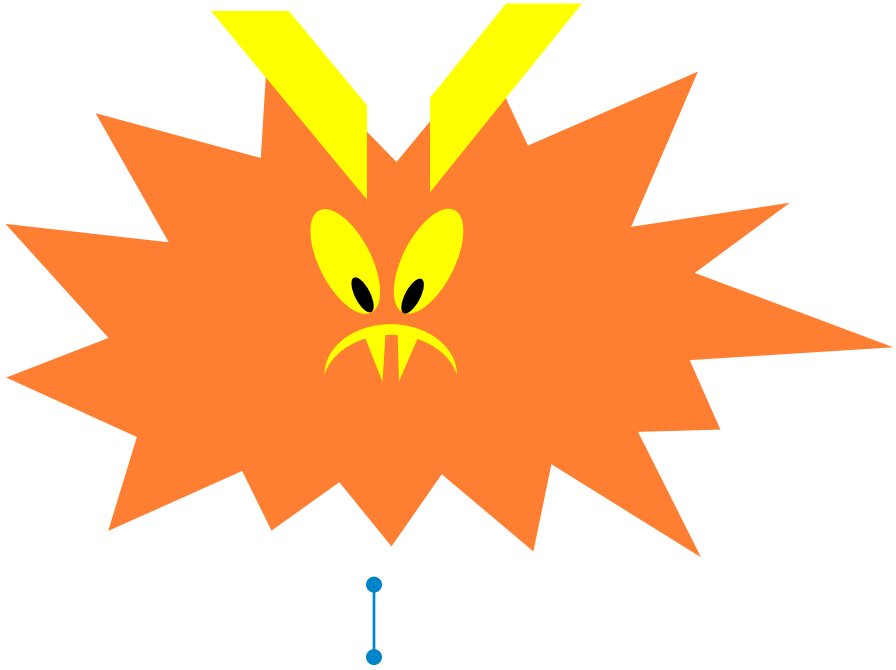


How Does a Disease Enter the Body

Pathogen

The Immune System

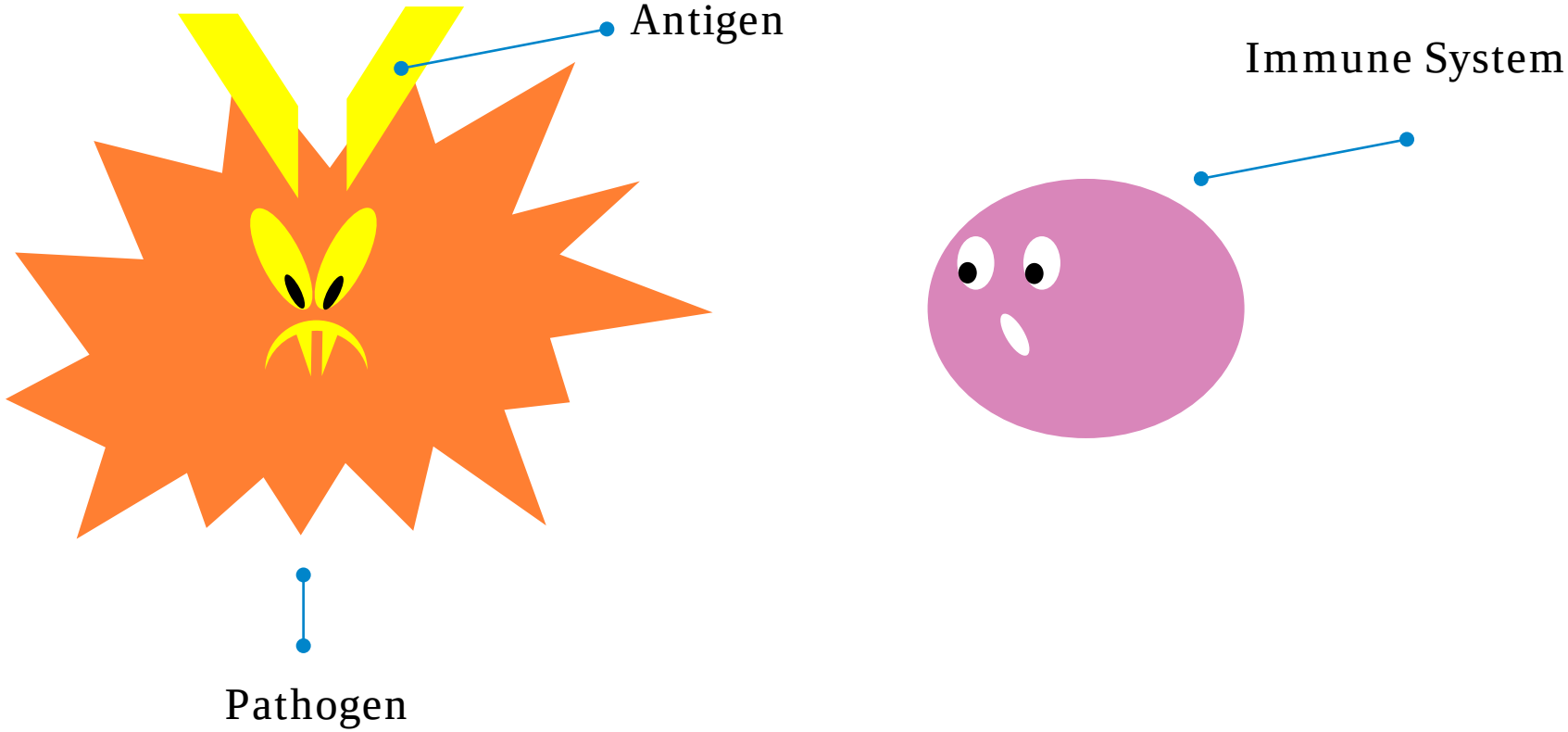
How Does a Disease Enter the Body



Pathogen

Your health →

How Does a Disease Enter the Body



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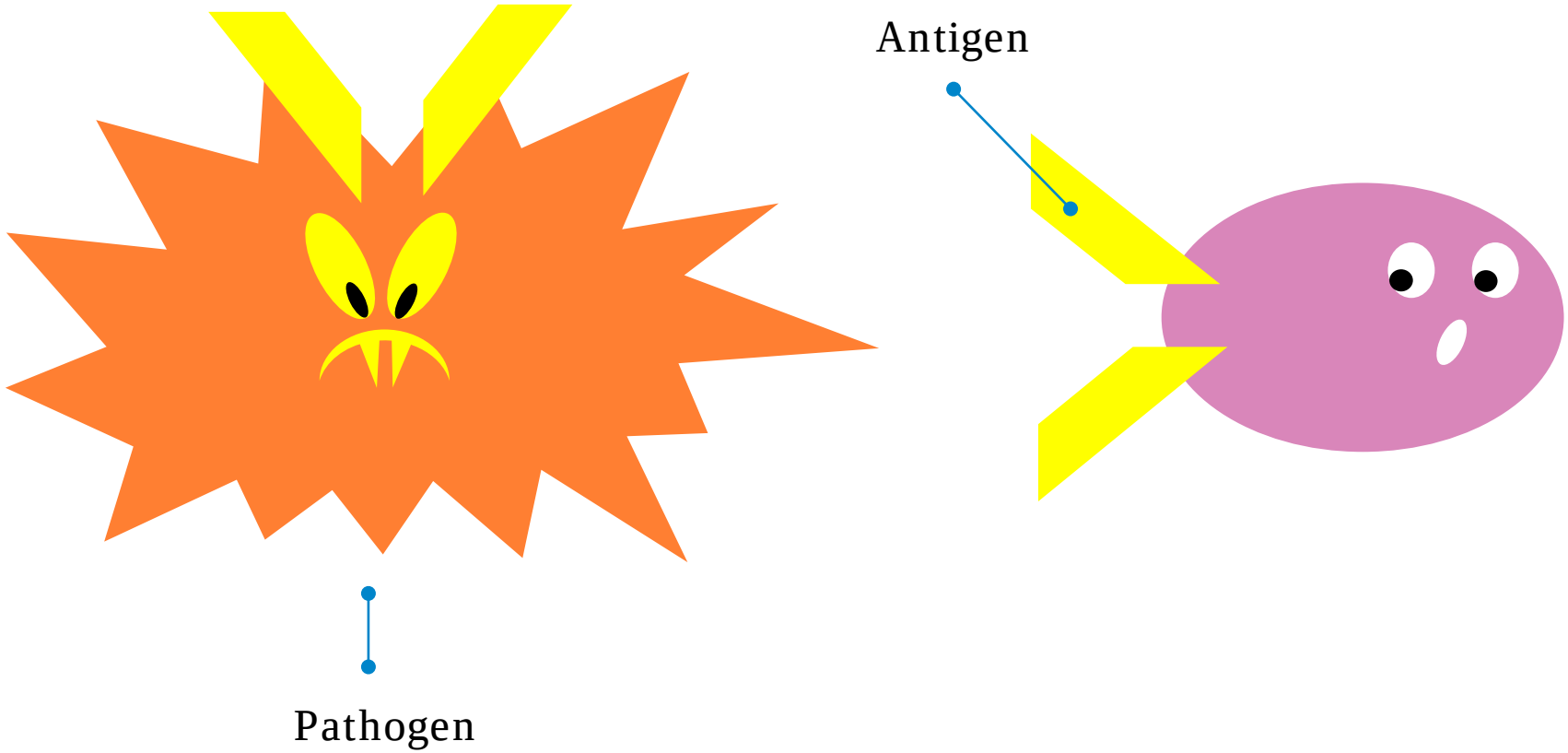

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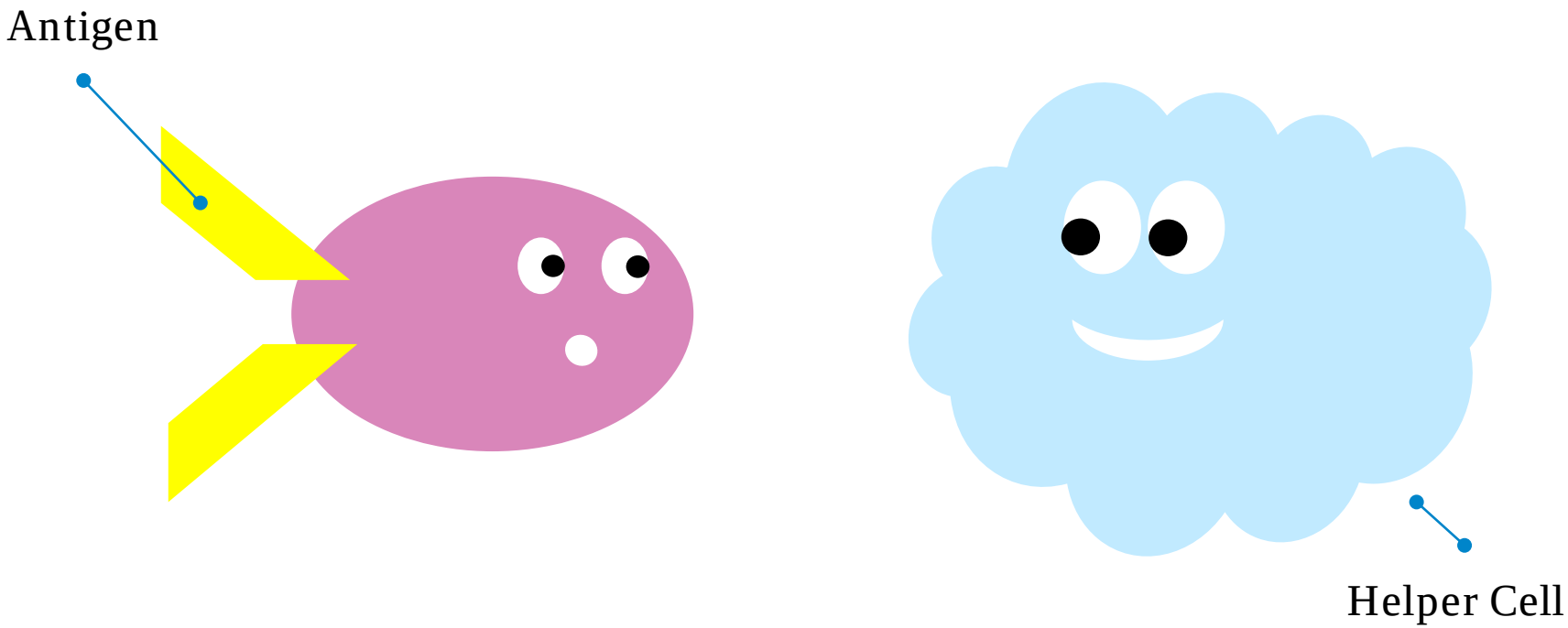

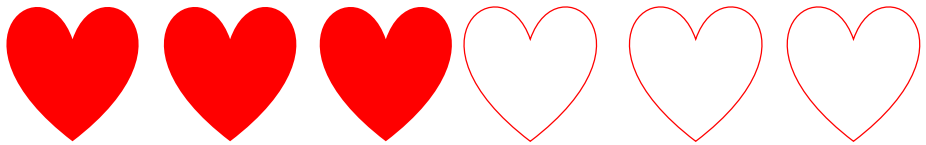

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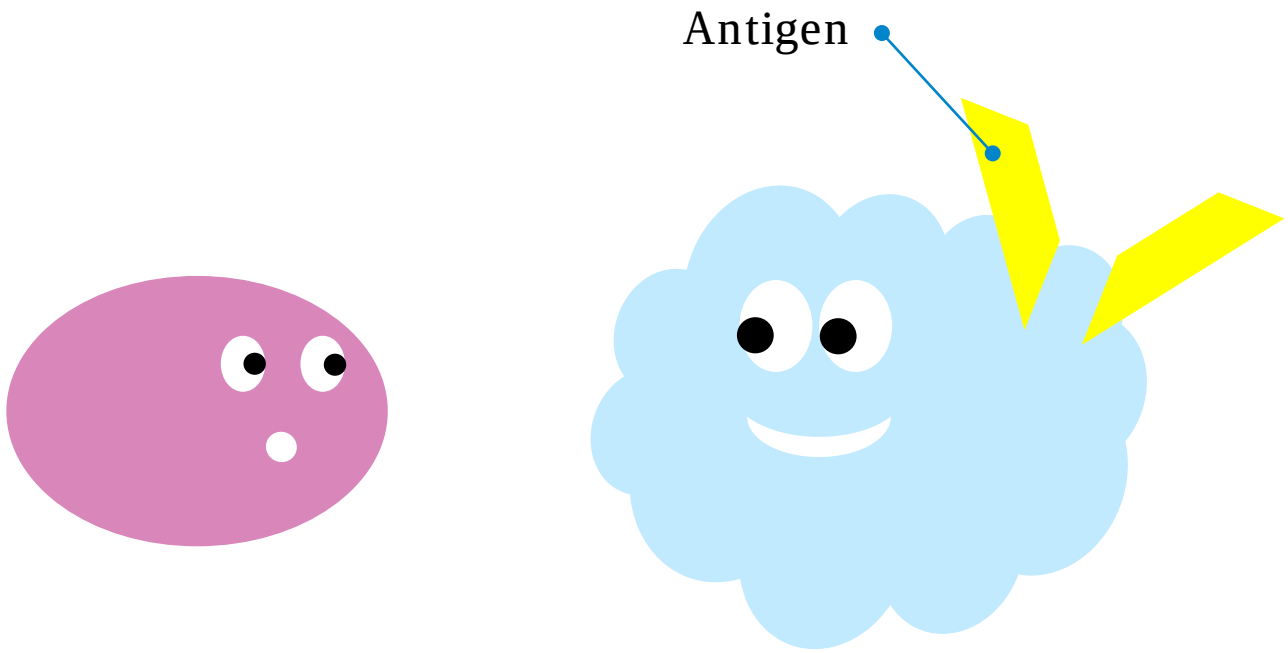

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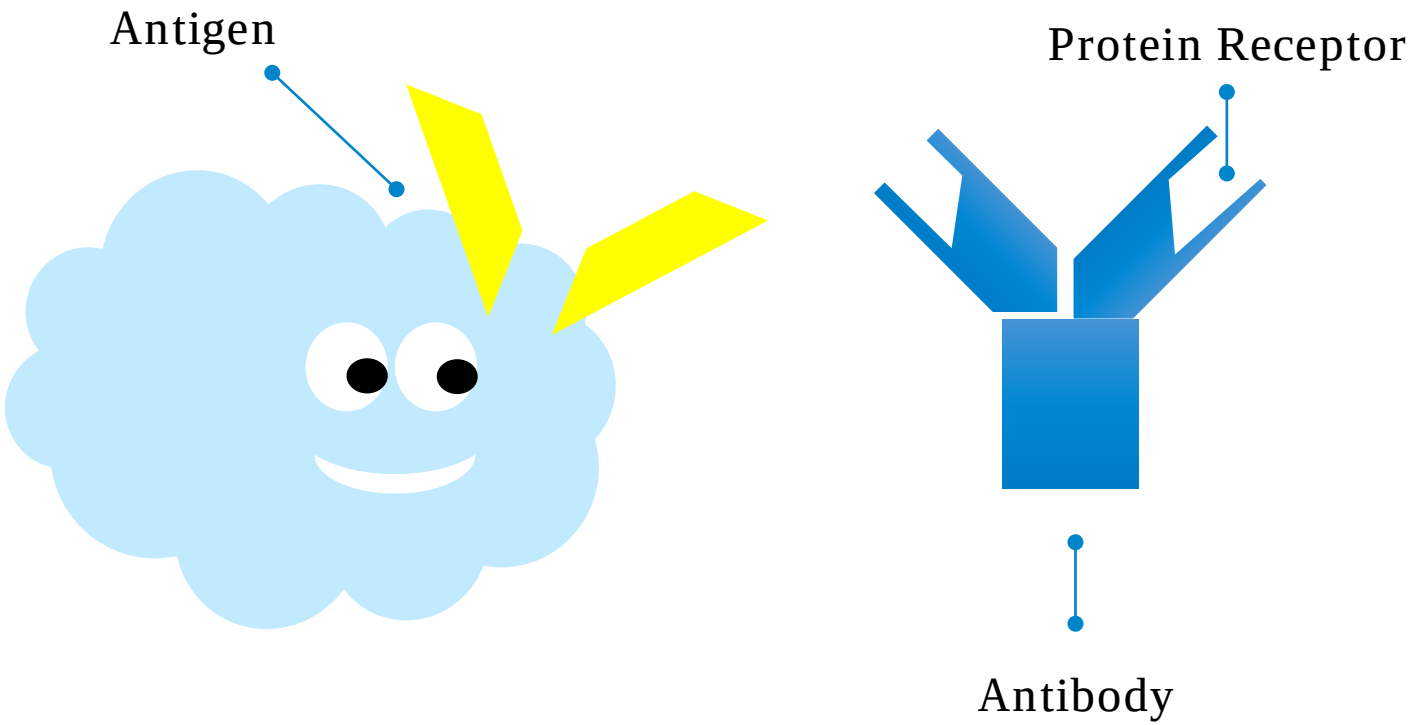

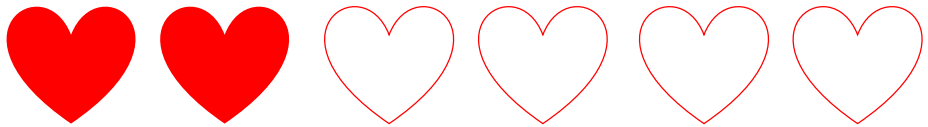

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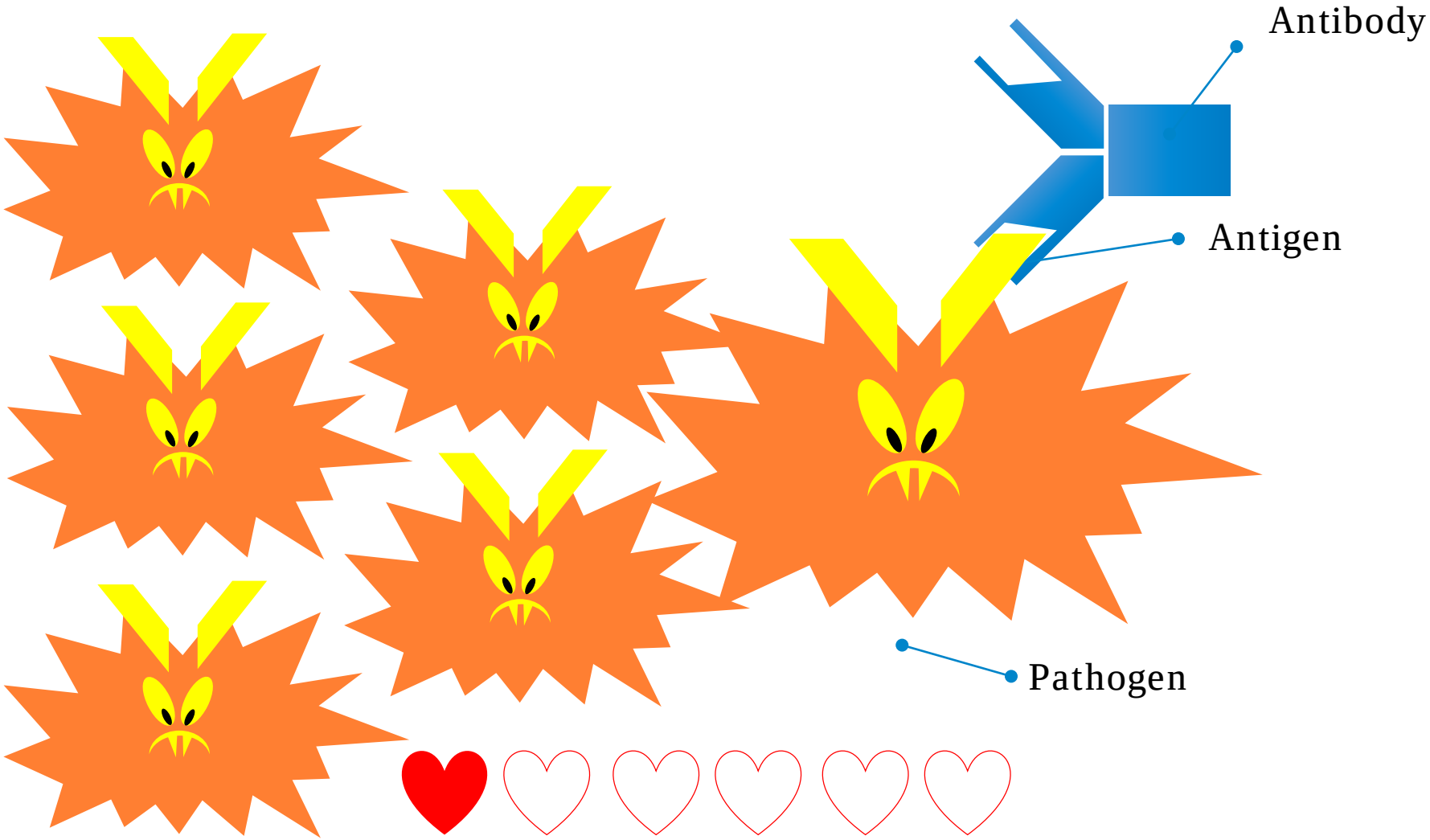

How Vaccines Work

Pathogen

The Immune System

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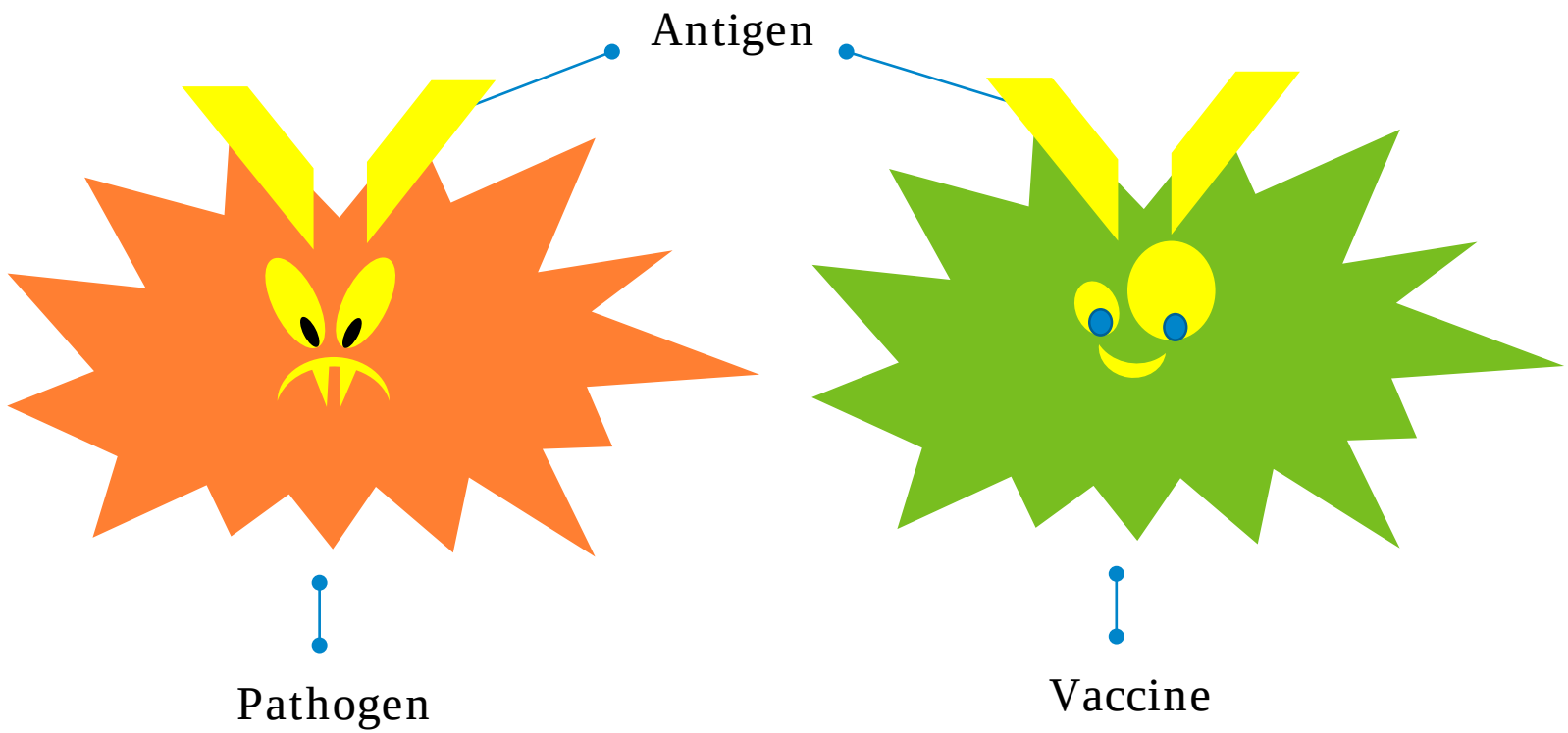
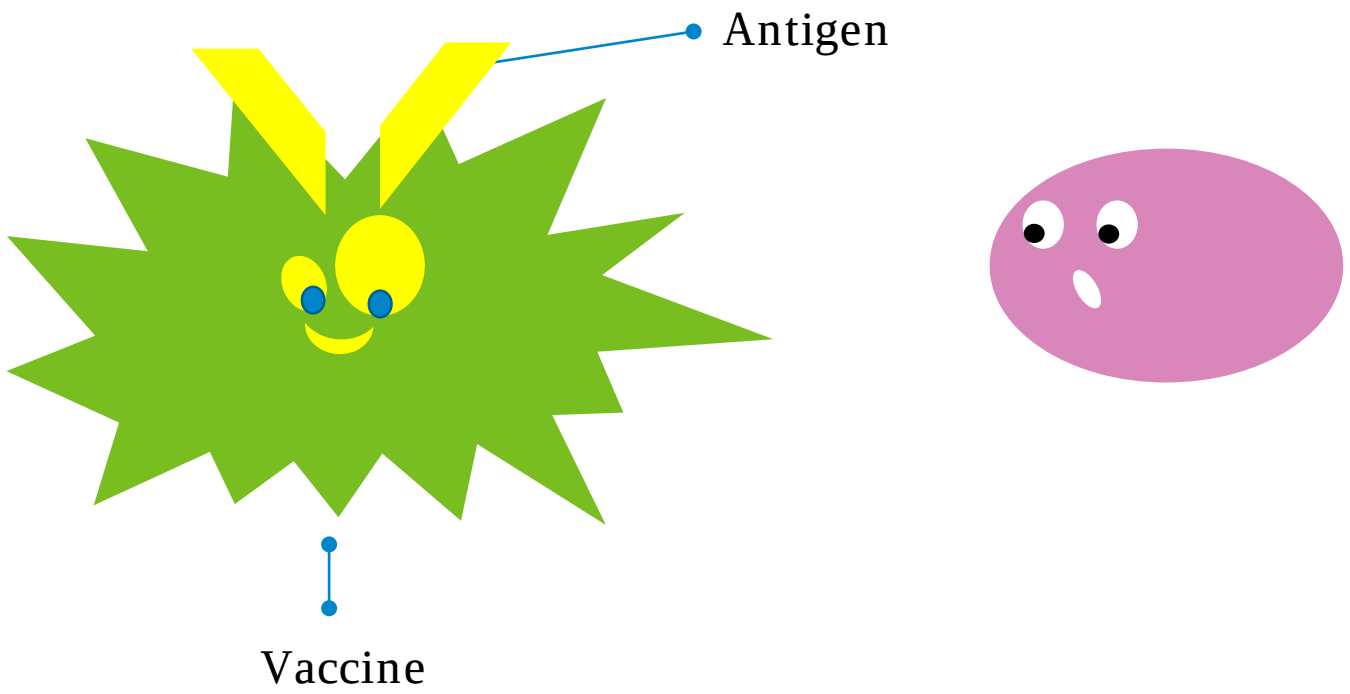
Helper Cell

Antibody

How Vaccines Work



How Vaccines Work



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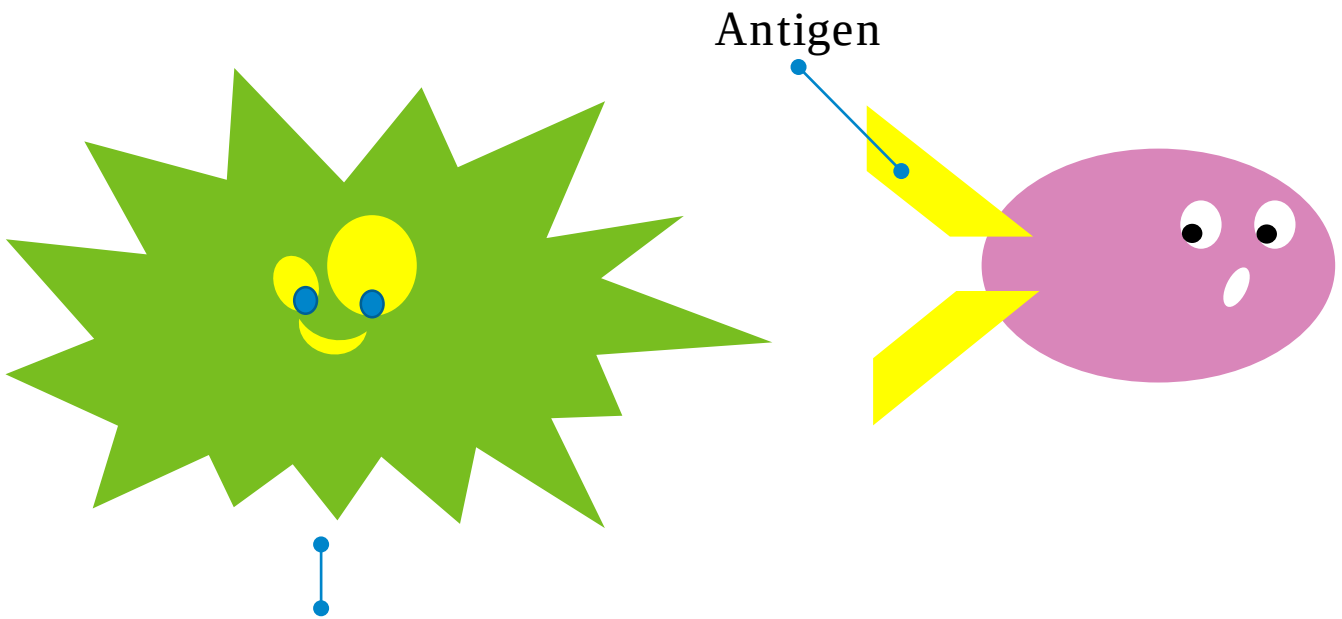

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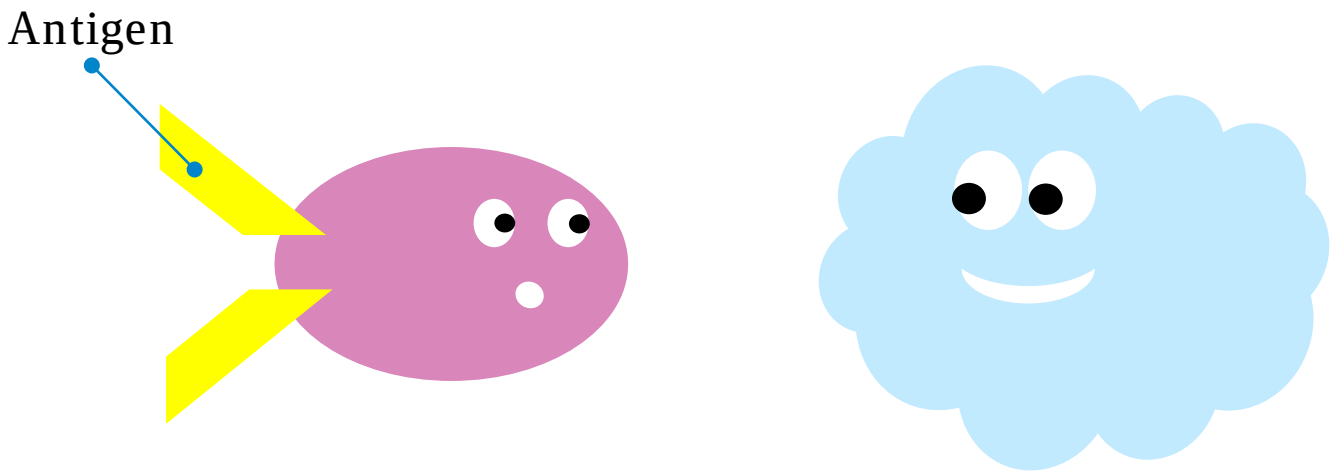

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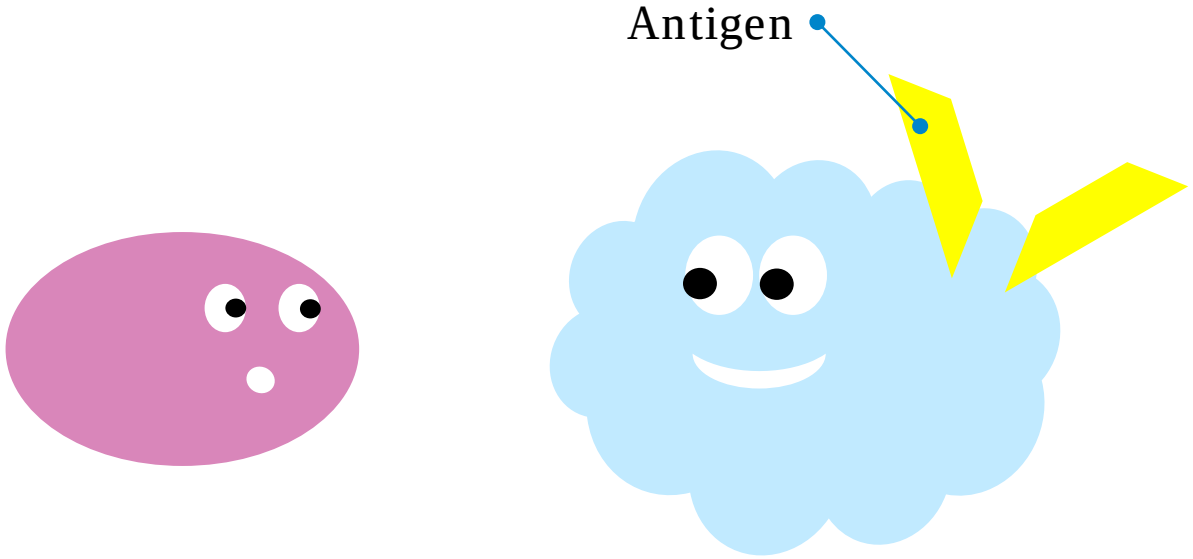

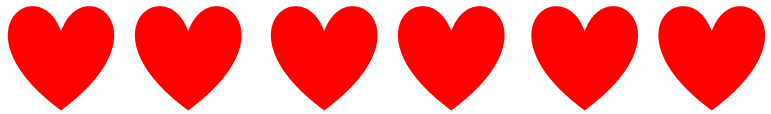

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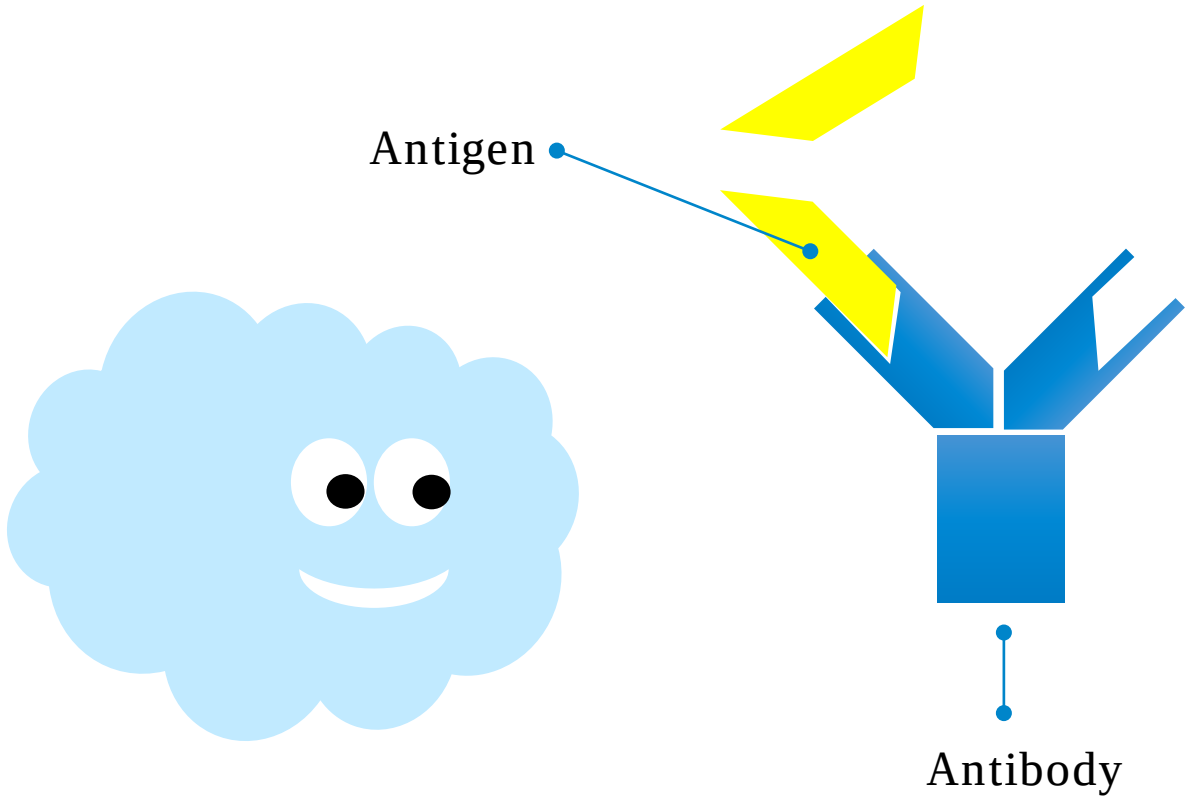

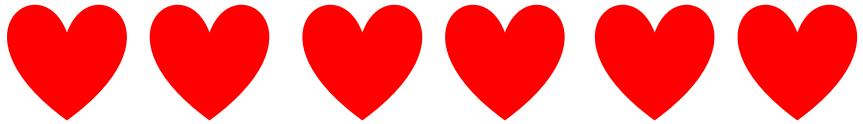

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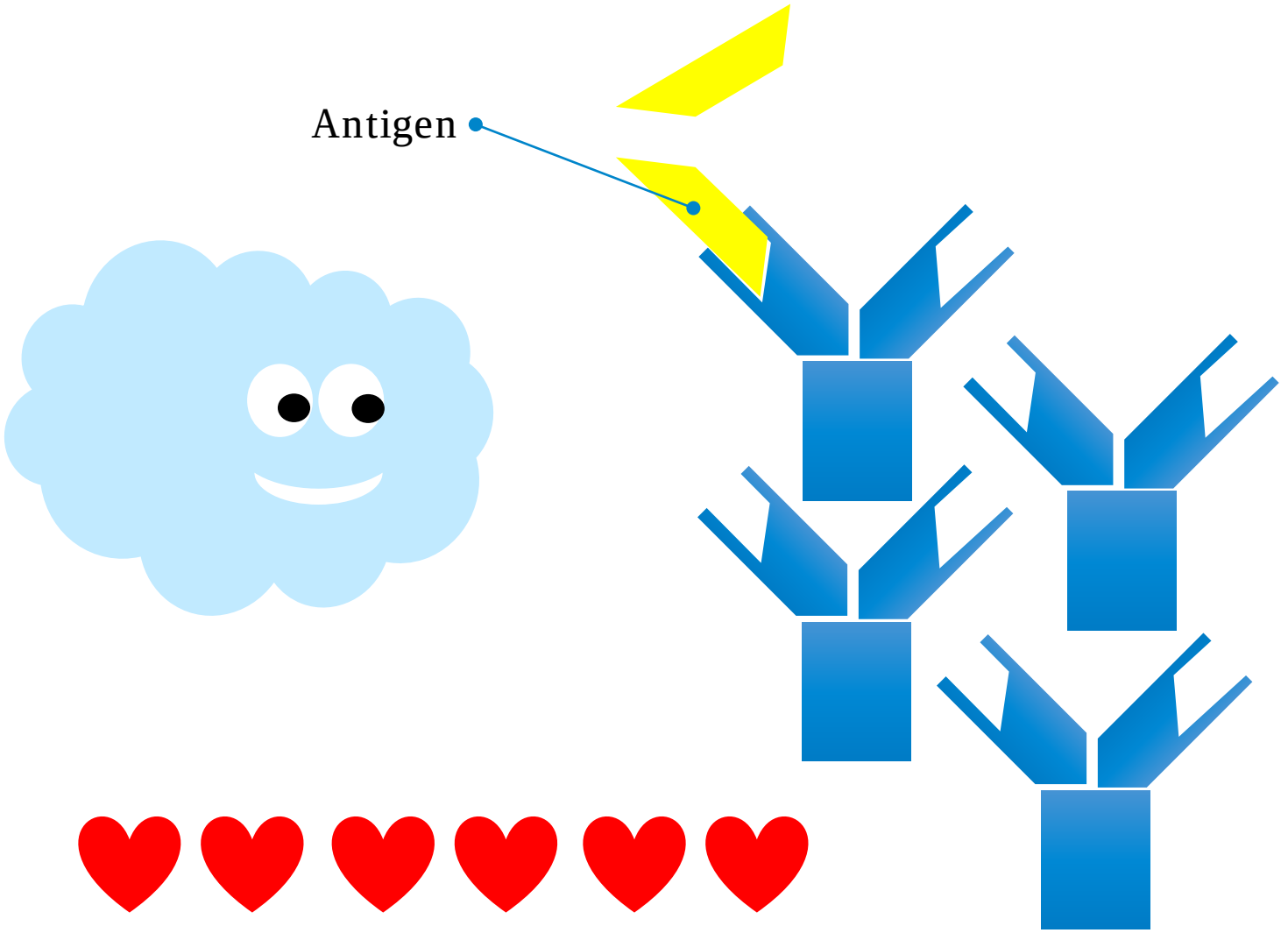

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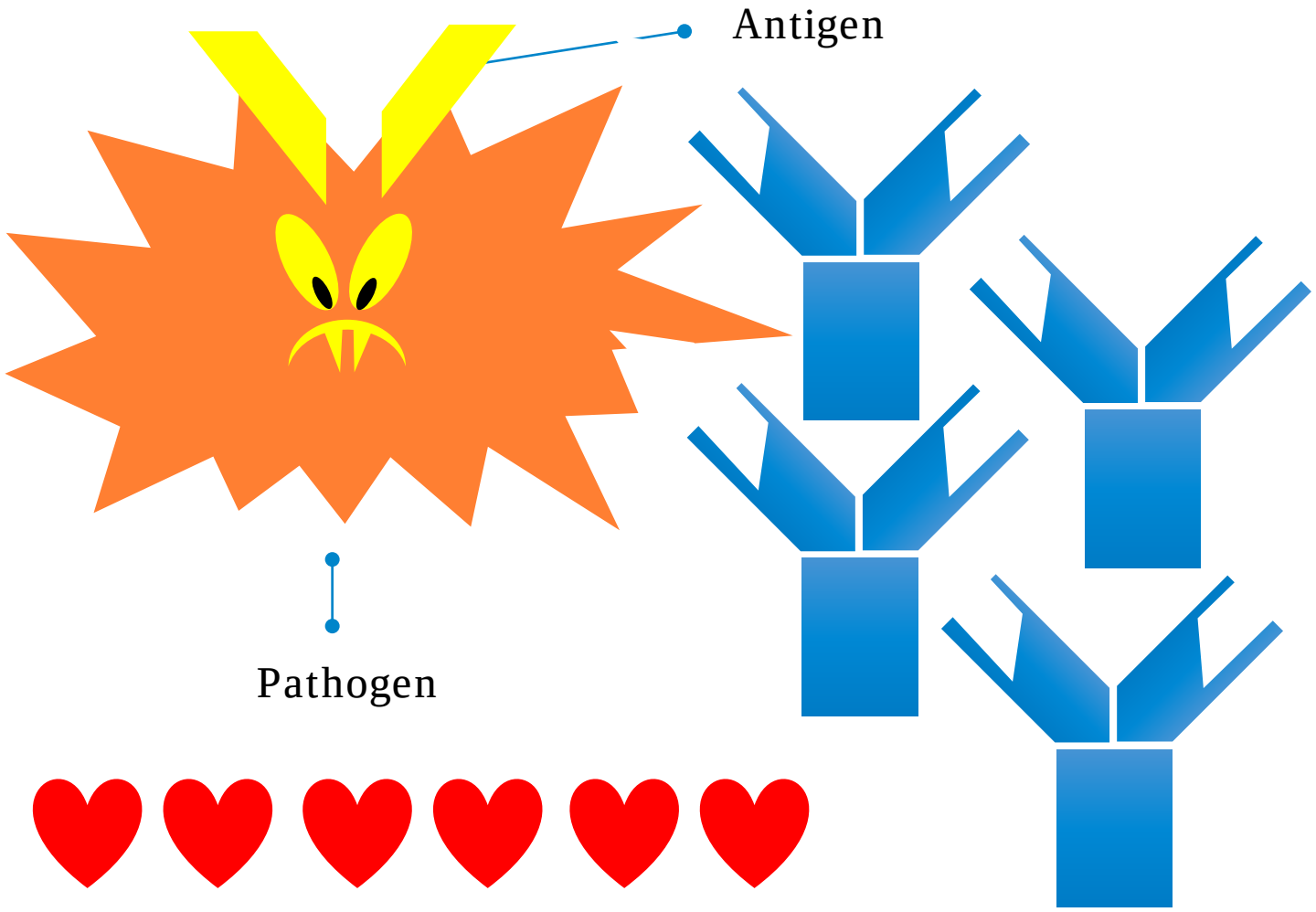

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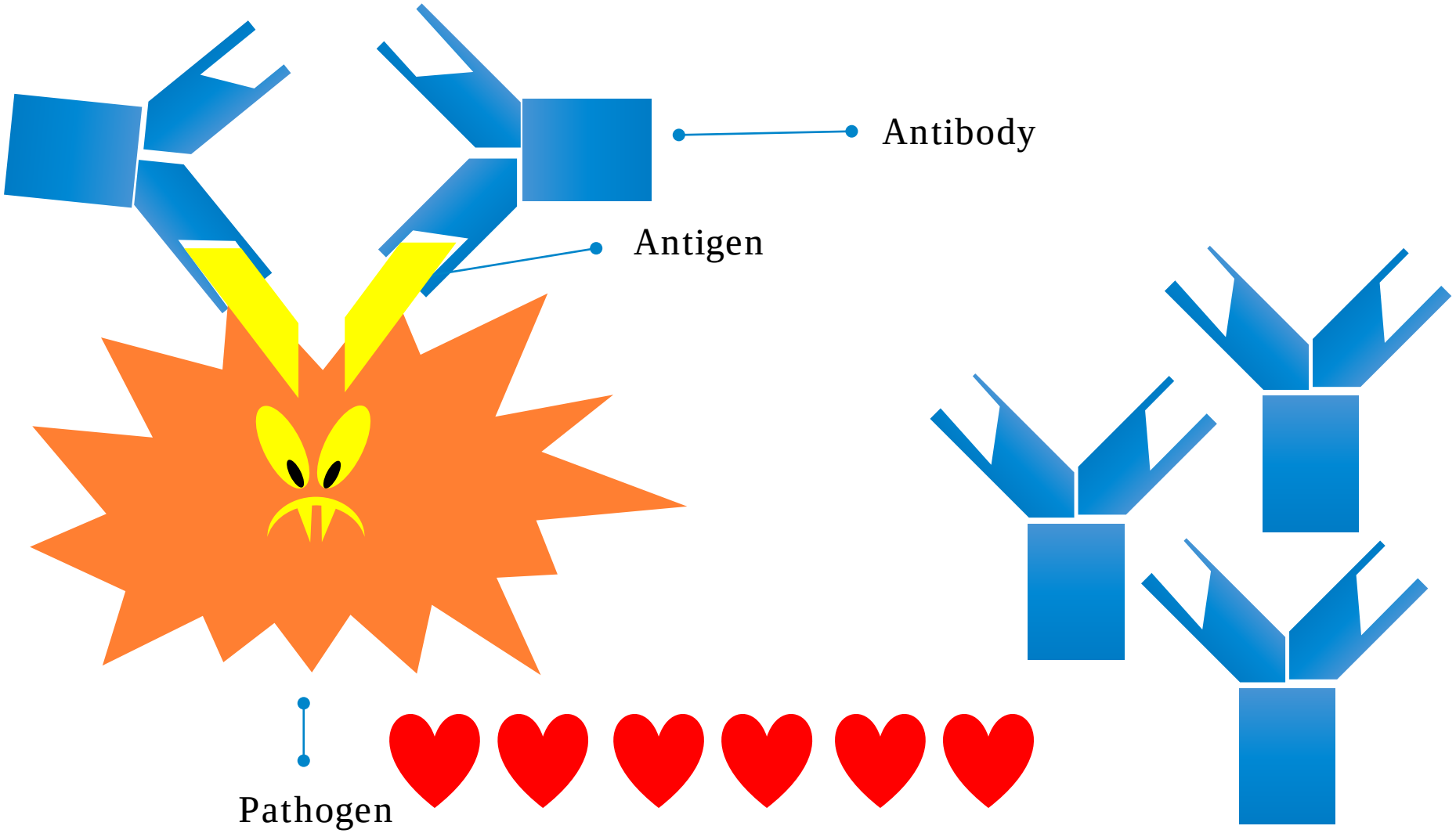

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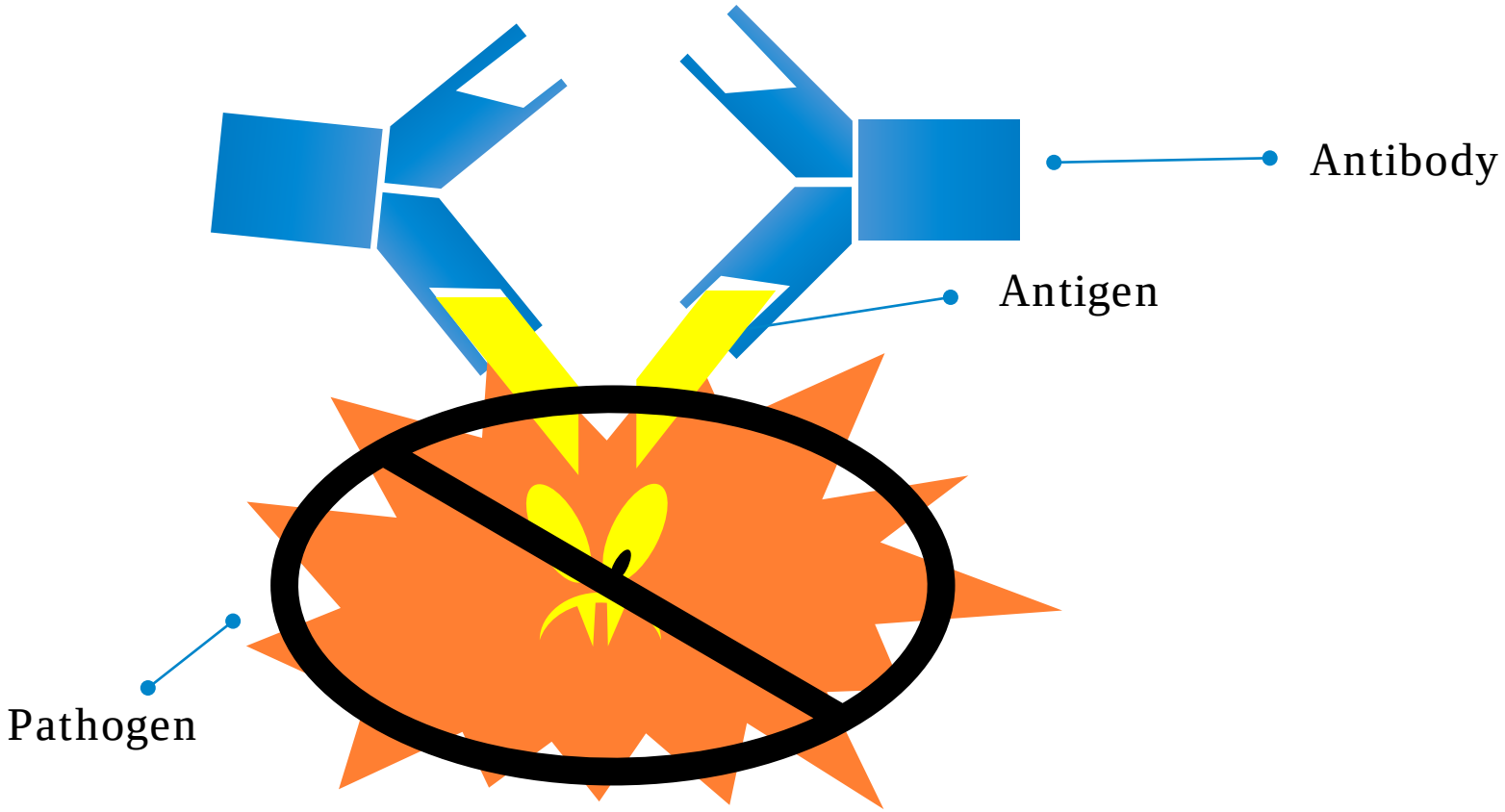
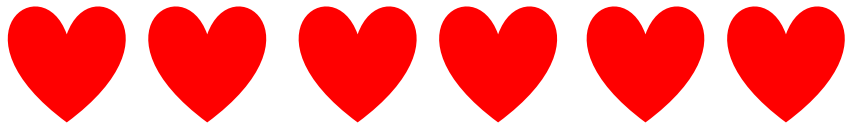




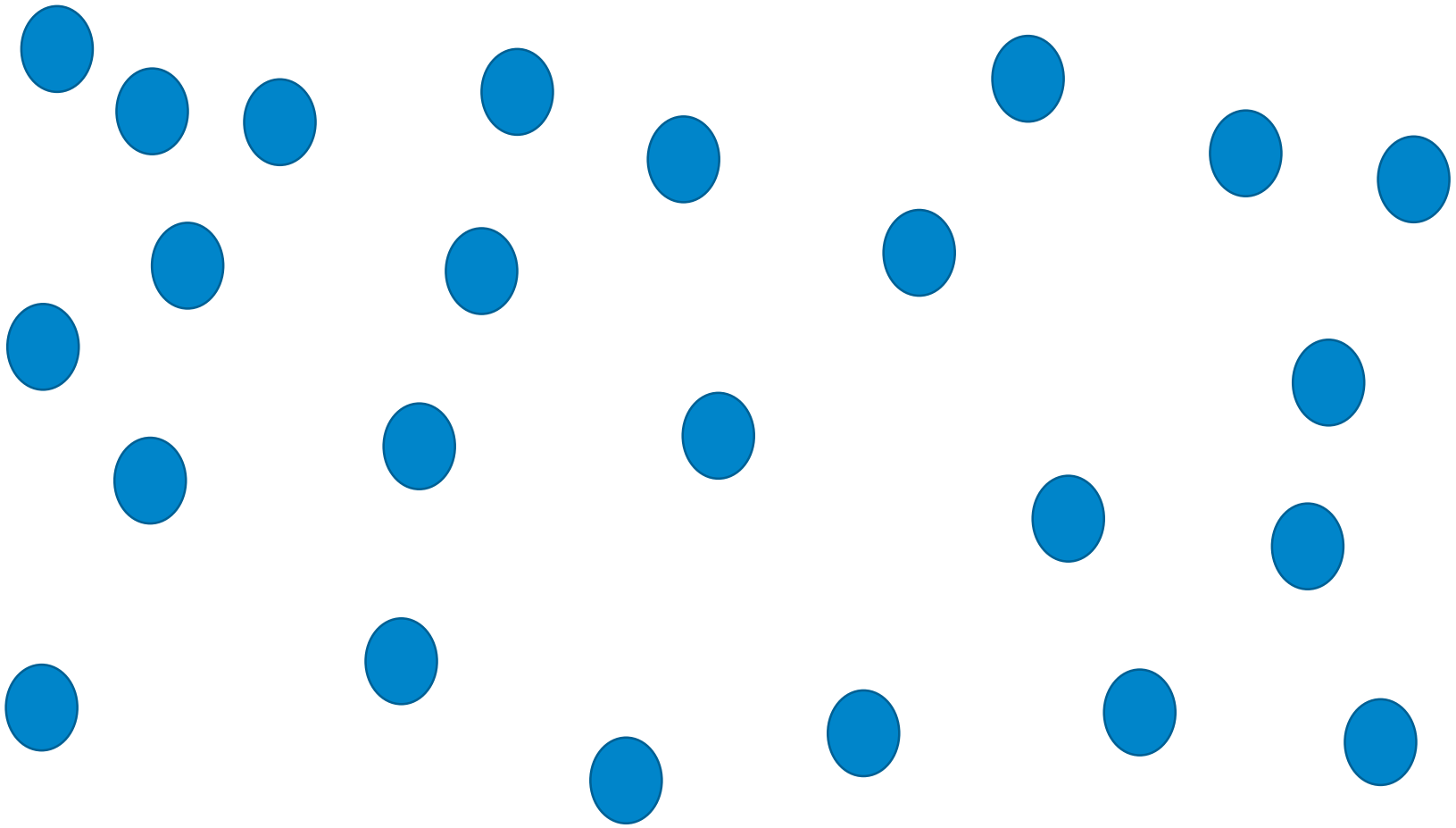
Herd Immunity

Unvaccinated Community

Vaccinated Community

The Importance

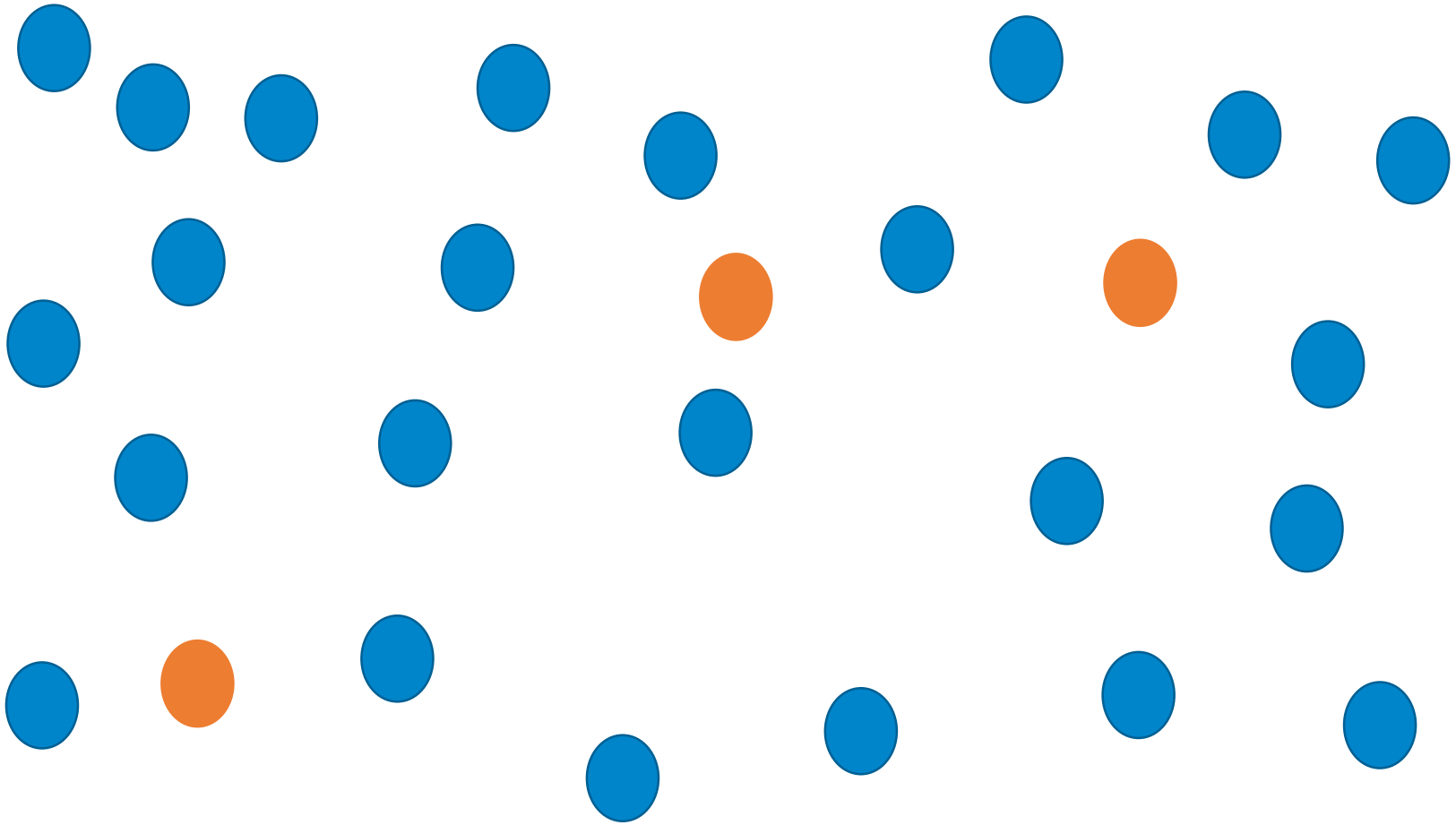
Unvaccinated Community

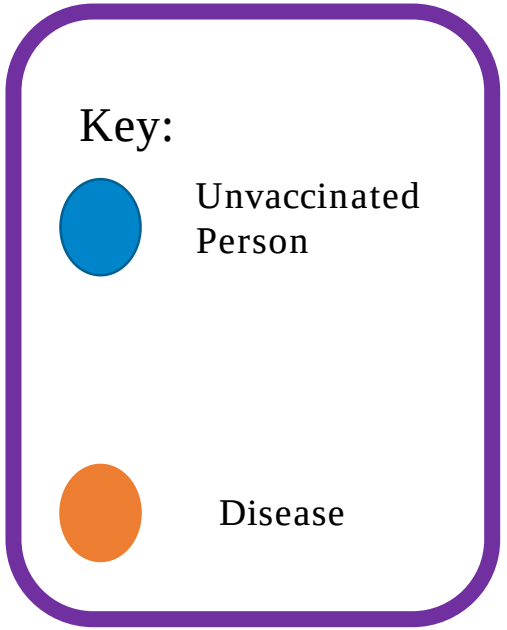


Key:

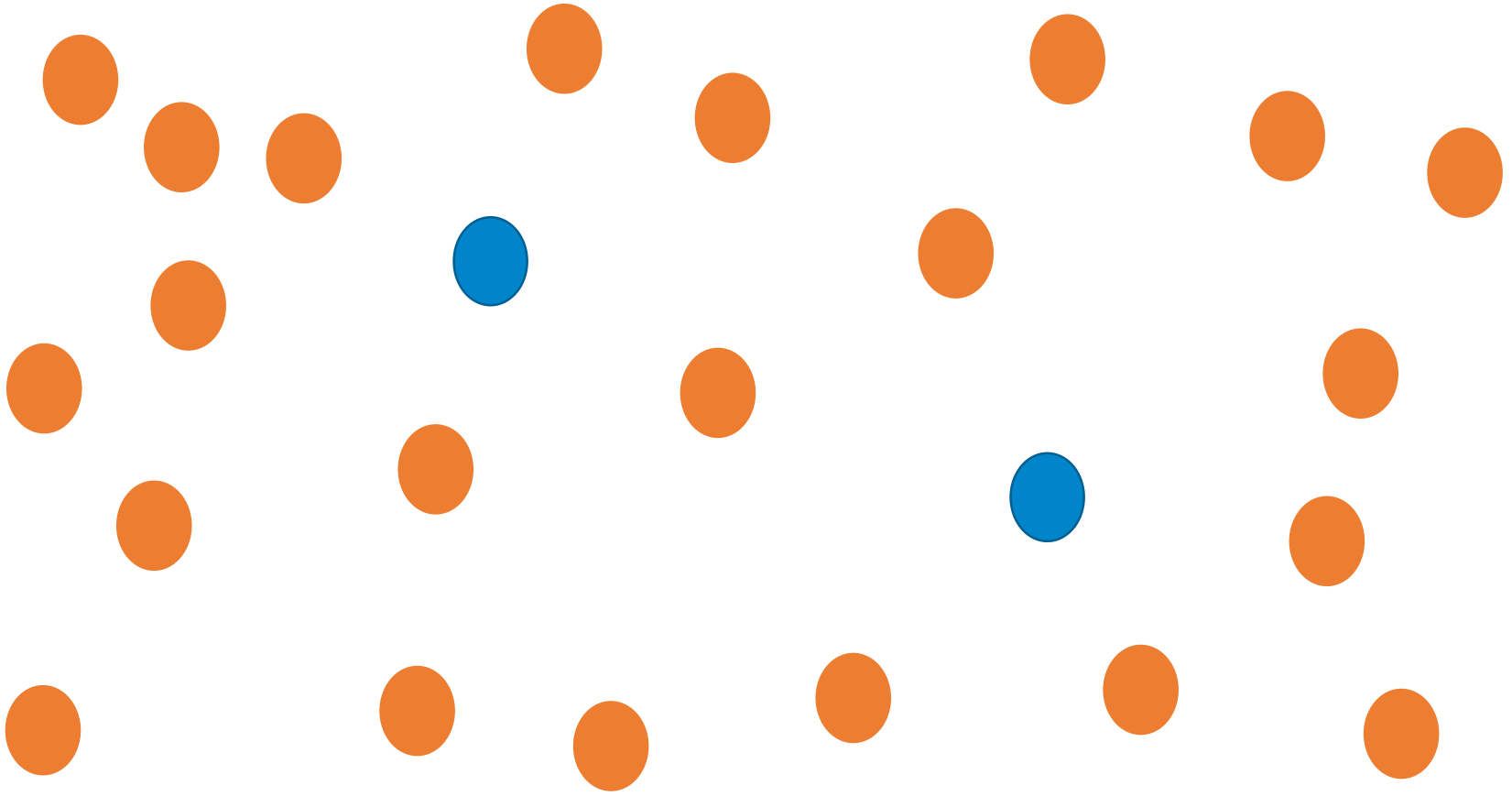
Unvaccinated Person

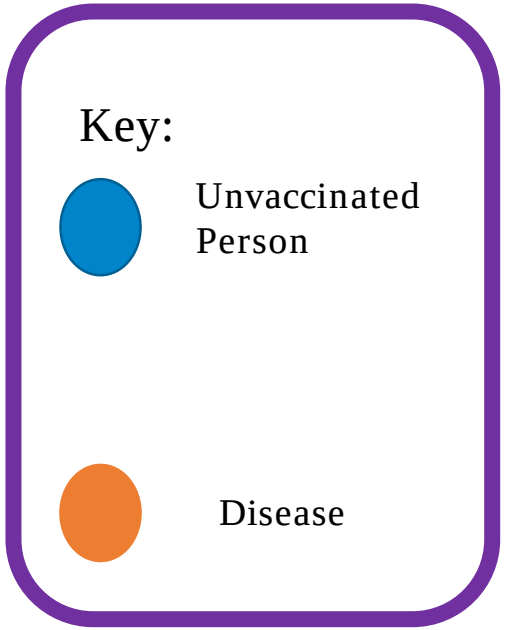
Unvaccinated Community + Disease



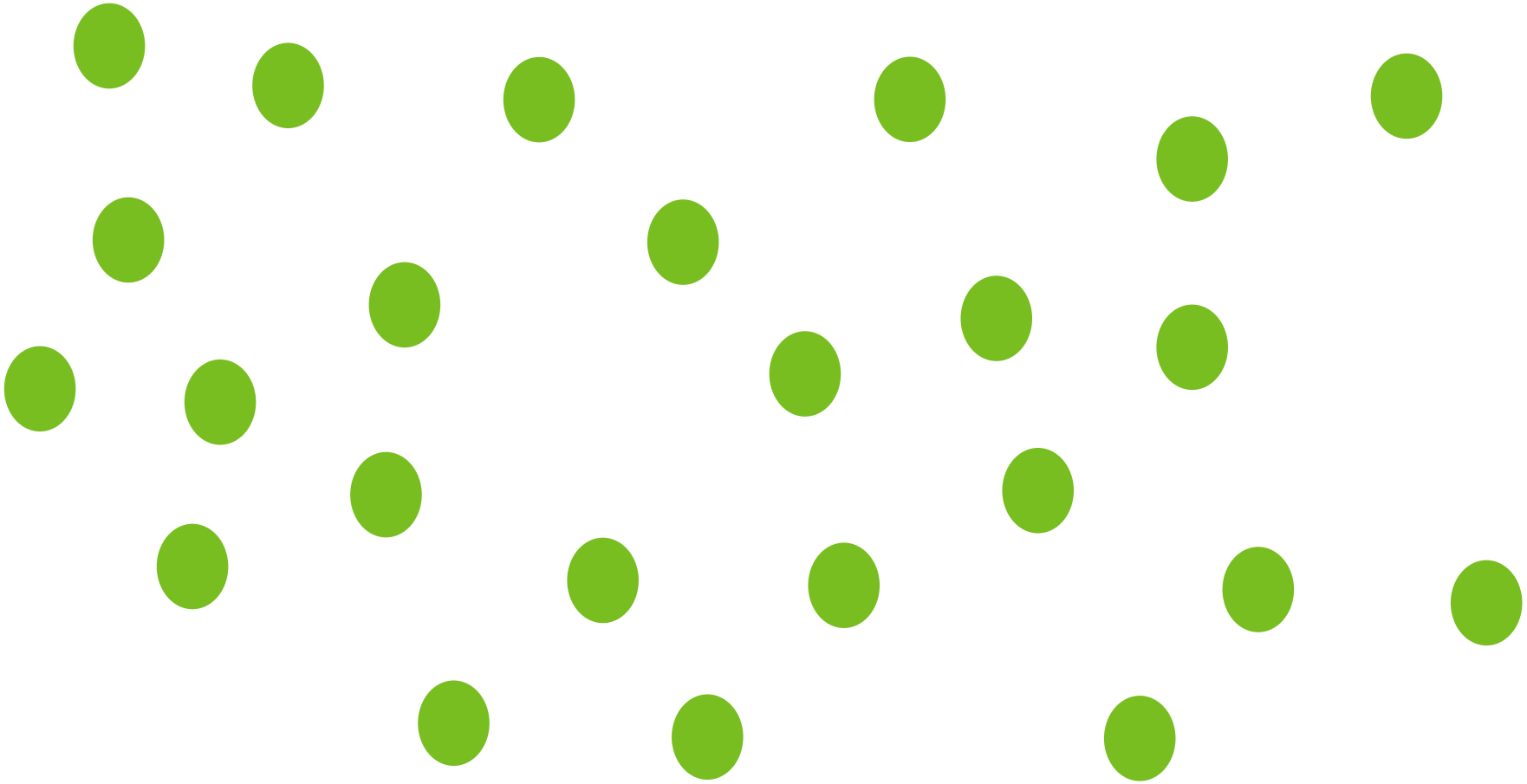


Unvaccinated Community = Widespread Disease Outbreak





Vaccinated Community



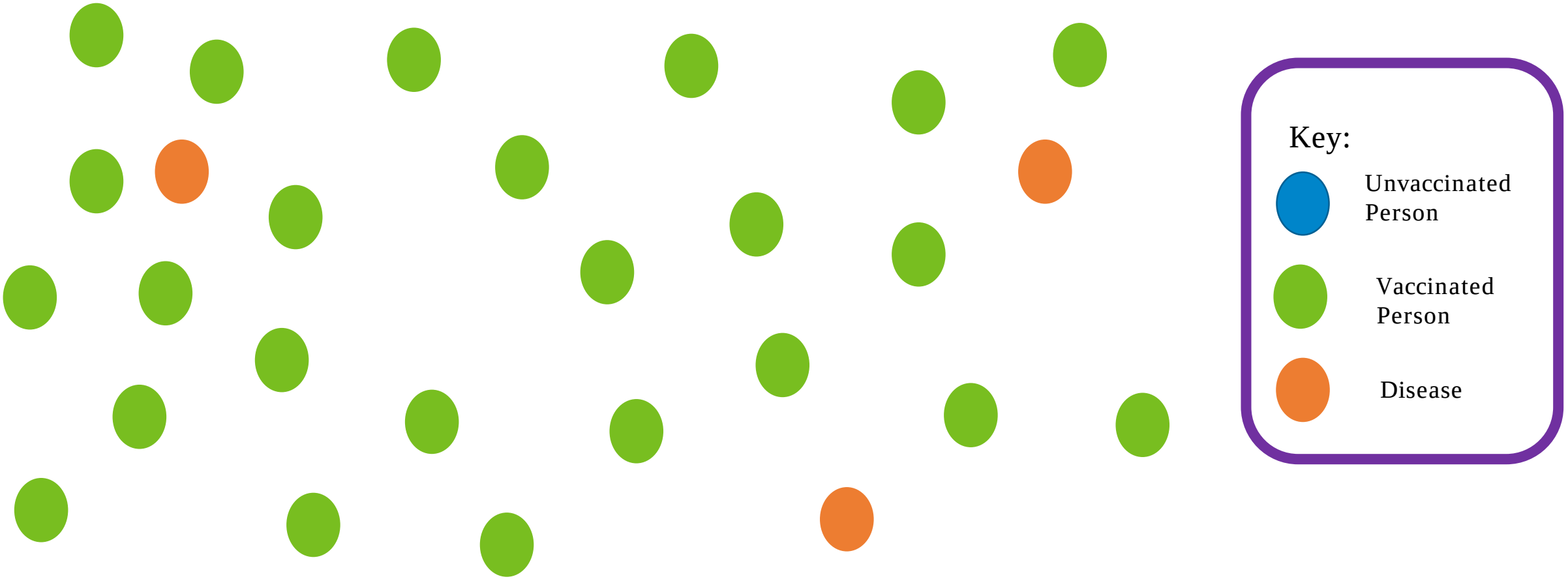
Key:

Unvaccinated Person

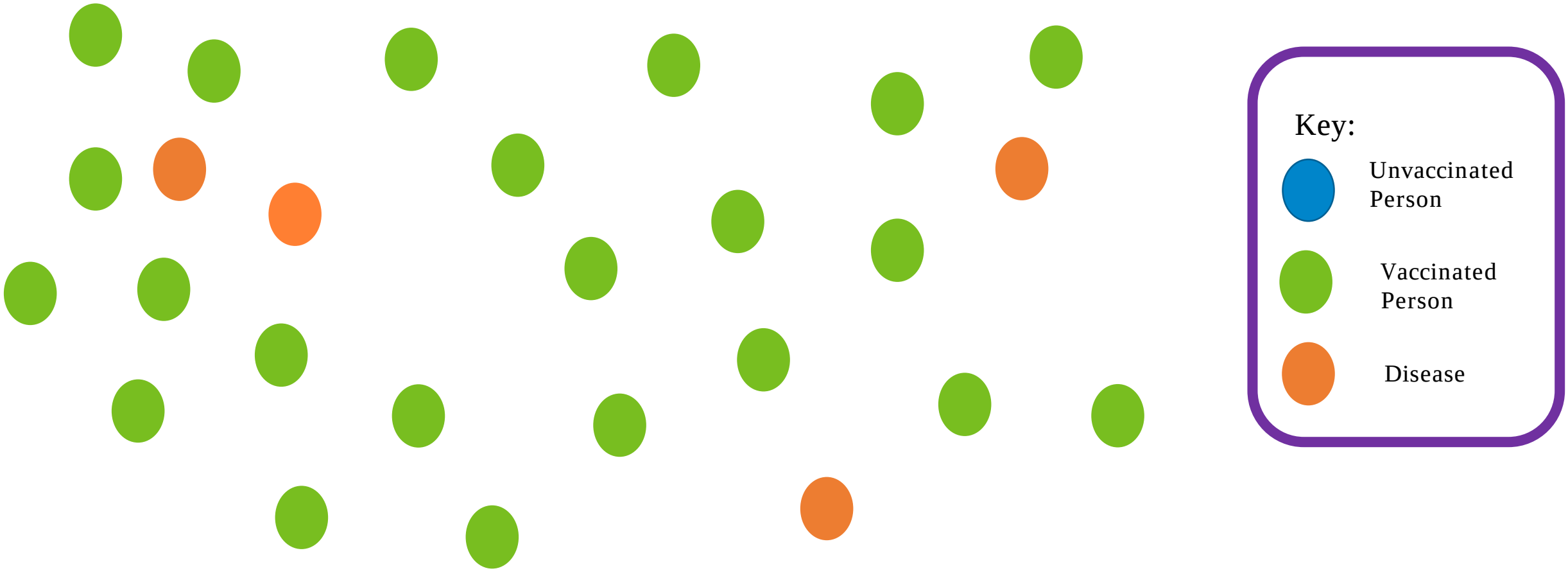
Vaccinated Person

Disease

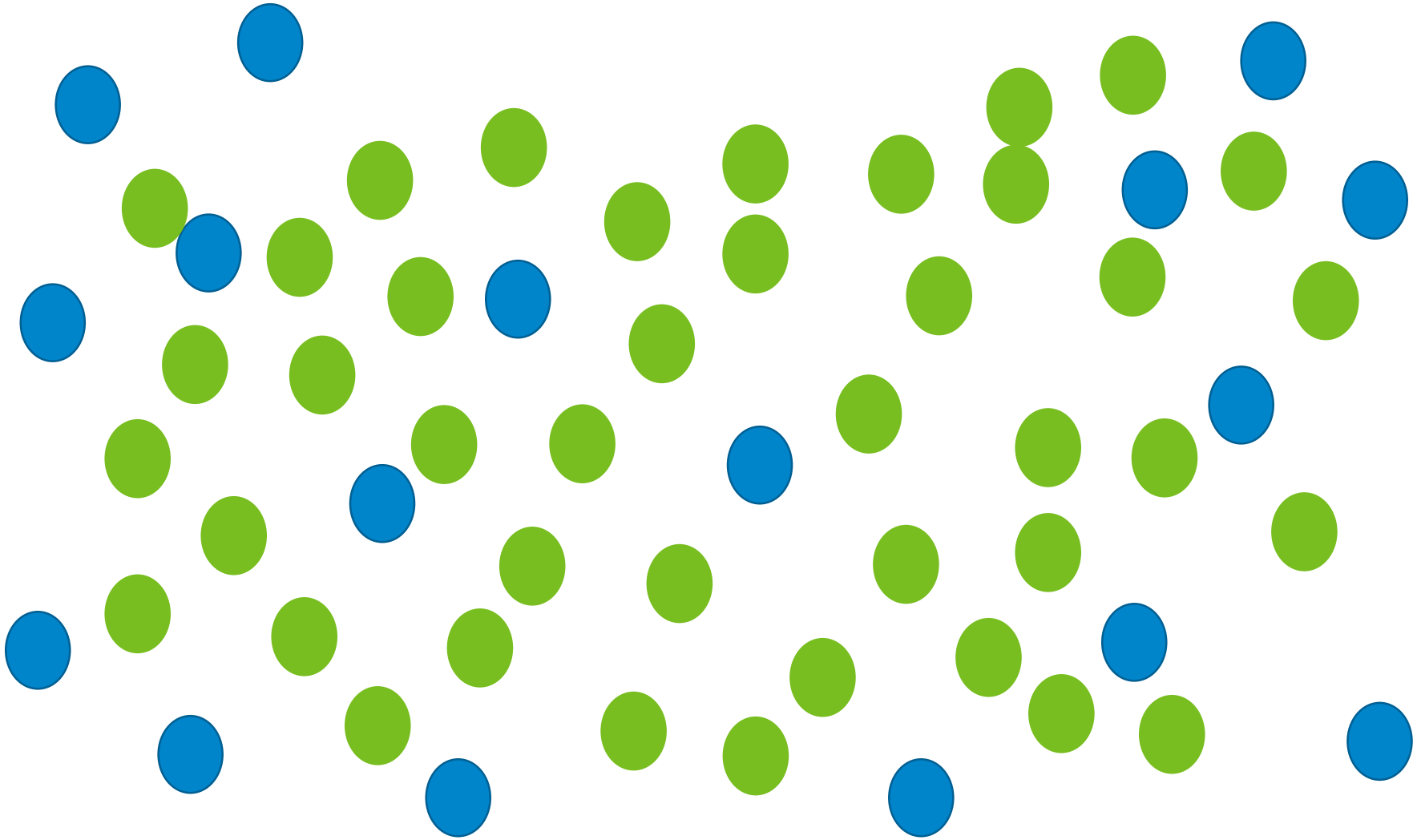
Vaccinated Community + Disease



Vaccinated Community = Minimal Disease Outbreak



Vaccinated > Unvaccinated



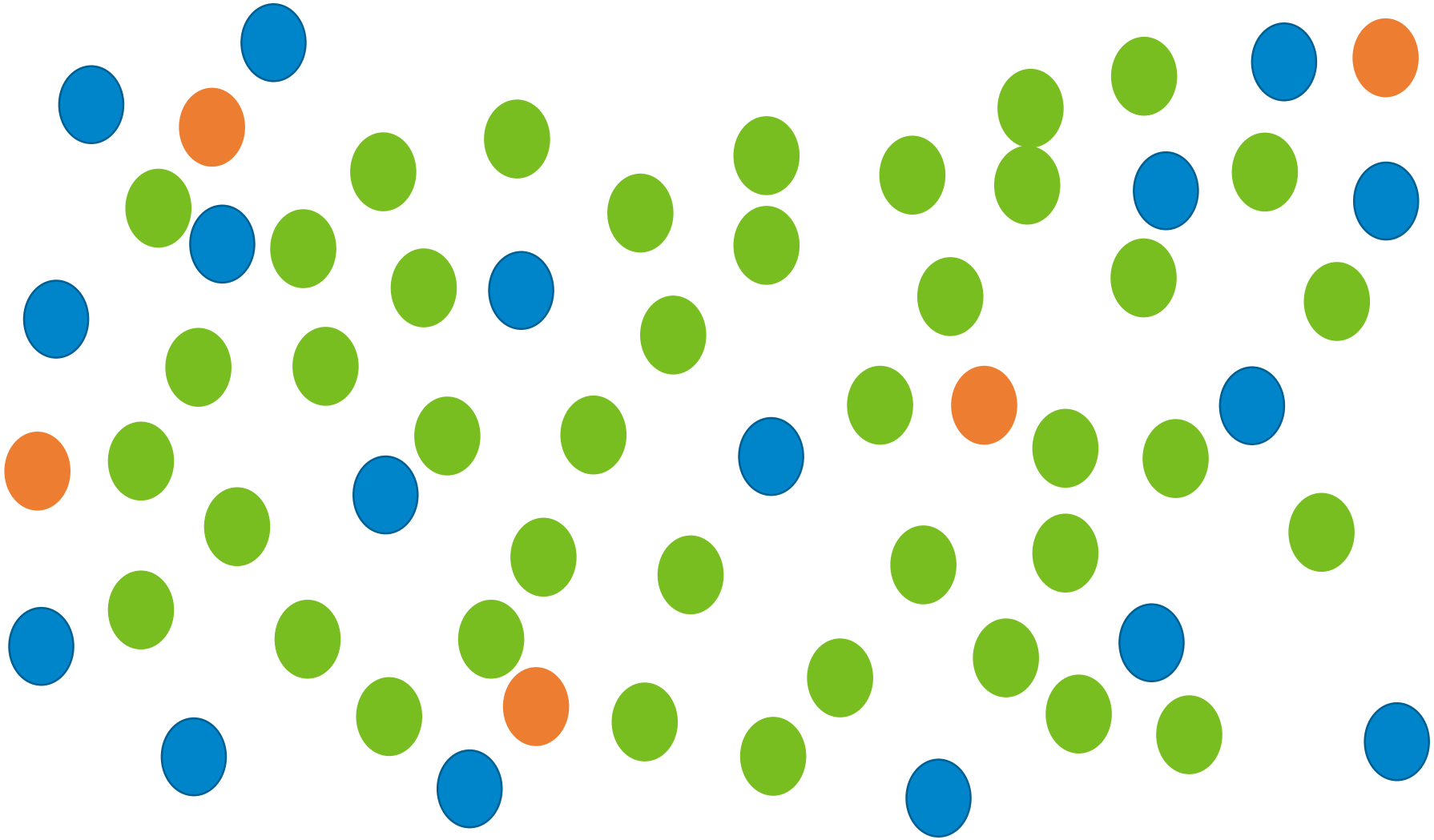
Key:

Unvaccinated Person

Vaccinated Person

Disease

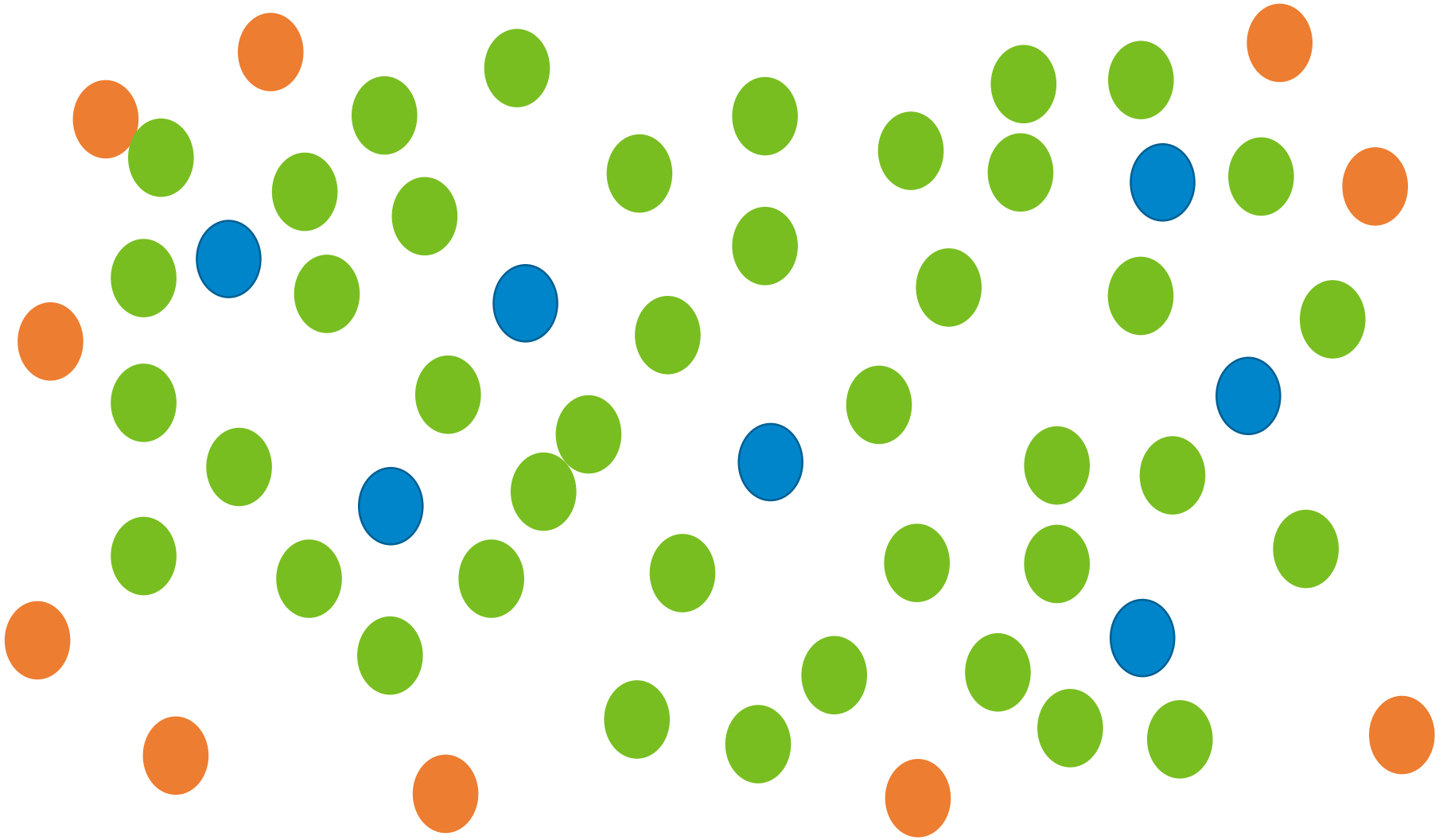
Vaccinated > Unvaccinated + Disease



Key:

- Unvaccinated Person
- Vaccinated Person
- Disease

The vaccinated protect the unvaccinated!



Key:

- Unvaccinated Person
- Vaccinated Person
- Disease


COMMUNITY IMMUNITY
ACHIEVED !

Types of Vaccines

Live-Attenuated

Inactivated

Sub-unit/Conjugate

Live-Attenuated Vaccines

- Live, attenuated vaccines contain a version of the living microbe that has been weakened in the lab so it can’t cause disease.

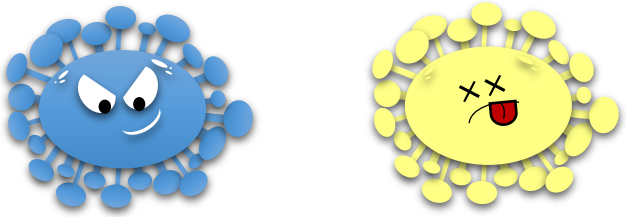
- Examples: MMR (Measles, Mumps & Rubella) Varicella (“Chicken pox”), Zoster (“Shingles”), intranasal flu vaccine

Live-Attenuated Vaccines

- Benefits
  - Closest thing to a natural infection
  - Often confer lifelong immunity with only one or two doses
- Risks
  - An attenuated microbe in the vaccine could revert to a virulent form and cause disease
  - Not everyone can safely receive live, attenuated vaccines
  - Usually need to be refrigerated to stay potent

Inactivated Vaccines

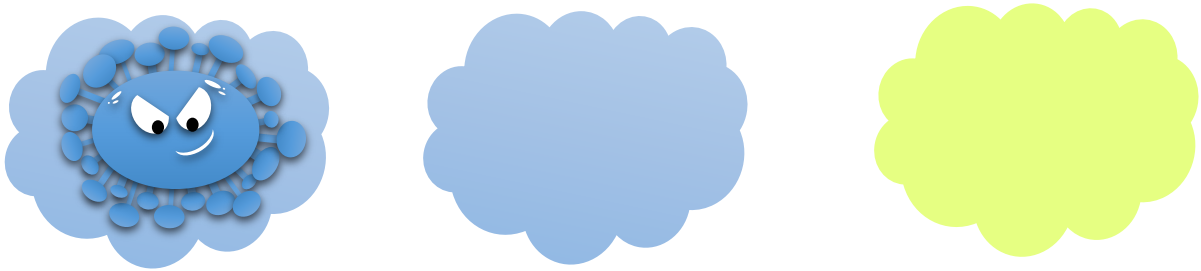
- Scientists produce inactivated vaccines by killing the disease-causing microbe with chemicals, heat, or radiation.



- Examples: Most injected influenza vaccines (“flu shot”), Hepatitis A

Toxoid (Inactivated Toxins) Vaccines

- When a toxin created by bacteria is the main cause of illness, a toxoid vaccine is created by “detoxifying” the toxins.



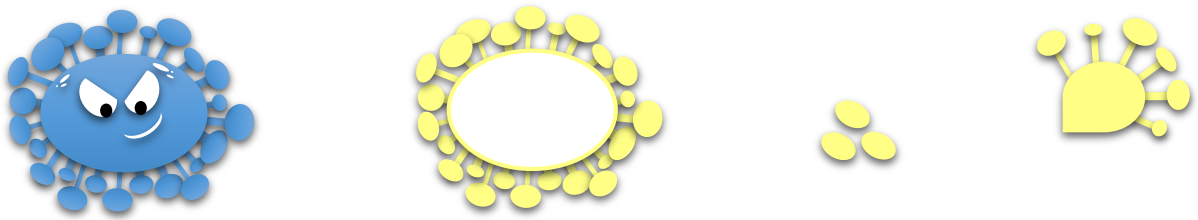
- Examples: Tetanus, Diphtheria

Inactivated Vaccines

- Benefits
  - More stable and safer than live vaccines.
  - Usually don’t require refrigeration
- Risks
  - Stimulate a weaker immune system response than do live vaccines
  - Likely take several additional doses, or booster shots, to maintain a person’s immunity

Sub-Unit/Conjugate Vaccines

- Instead of the entire microbe, sub-unit vaccines include only the antigens that best stimulate the immune system.



- Examples: Hepatitis B, HPV

Sub-Unit/Conjugate Vaccines

- Benefits
  - chances of adverse reactions to the vaccine are lower
- Risks
  - Likely take several additional doses, or booster shots, to maintain a person's immunity

How Vaccines are Approved

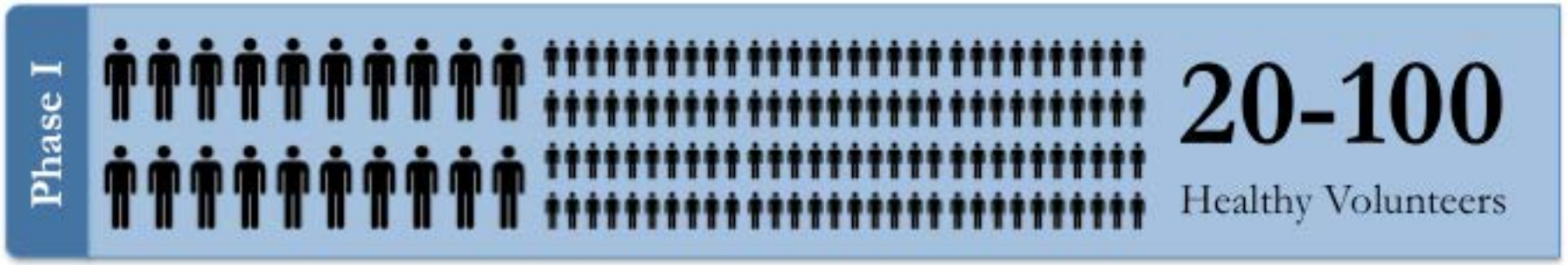
Clinical Trials

Annual Review

How Vaccines Are Approved

- Food and Drug Administration (FDA) sets rules for the three phases of clinical trials to ensure the safety of the volunteers.
- The vaccine is only licensed if:
  - It’s safe and effective.
  - The benefits outweigh risks.

How Vaccines Are Approved



- Is this vaccine safe?
- Does this vaccine seem to work?
- Are there any serious side effects?
- How is the size of the dose related to side effects?

How Vaccines Are Approved

- What are the most common short-term side effects?
- How are the volunteers' immune systems responding to the vaccine?

How Vaccines Are Approved

- How do people who get the vaccine and people who do not get the vaccine compare?
- Is the vaccine safe?
- Is the vaccine effective?
- What are the most common side effects?

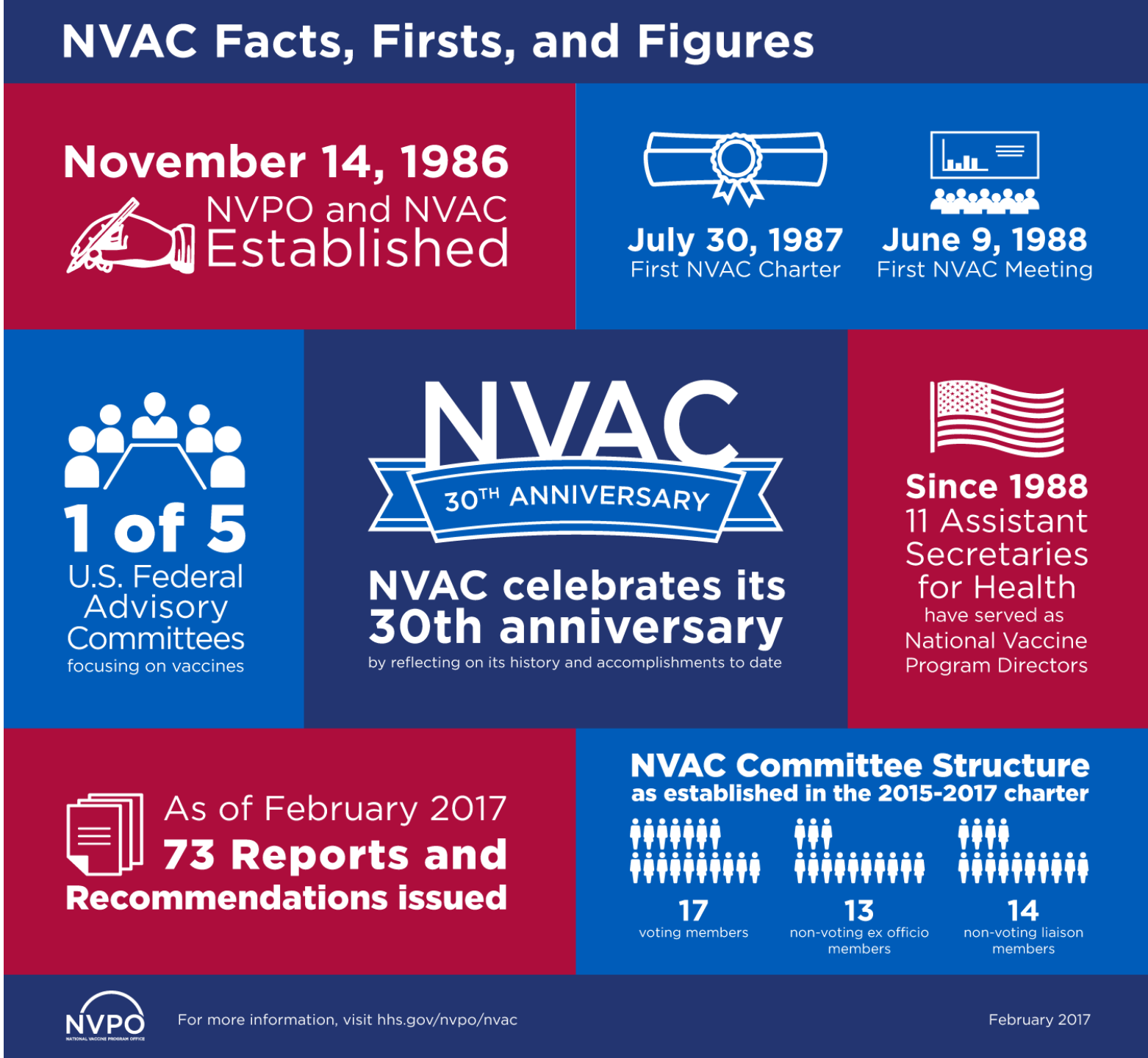
ACIP Advisory Committee on Immunization Practices

- Founded in 1964
- Develops written recommendations on vaccinations for infancy through geriatric care
- Develops the CDC Vaccine Schedule
- Contains fifteen regular members, each an expert in one of the following fields:
  - immunization practices and public health
  - use of vaccines and other immunobiologic agents in clinical practice or preventive medicine
  - clinical or laboratory vaccine research
  - assessment of vaccine efficacy and safety
  - consumer perspectives and/or social and community aspects of immunization programs
- Meets 3 times a year to review data and maintain or make new recommendations based upon the latest data

CDC
CENTERS FOR DISEASE™ CONTROL AND PREVENTION

National Vaccine Advisory Committee (NVAC)

- Established in 1986
- Advises the Assistant Secretary for Health at Health and Human Services



Thank You