

IMMUNE SYSTEM · FOUNDATIONAL CONCEPT

IMMUNITY

Innate · Adaptive · Humoral · Cell-Mediated

1 Definition & Overview

- ✚ **Immunity** = the body's ability to recognize "self" vs. "non-self" and defend against foreign invaders (pathogens, toxins, abnormal cells).
- ✚ Two main divisions: **INNATE** (born with it, non-specific) and **ADAPTIVE** (acquired, specific, has memory).
- ✚ Adaptive immunity has two arms: **HUMORAL** (B cells → antibodies) and **CELL-MEDIATED** (T cells).
- ✚ Why it matters: drives vaccines, transfusion reactions, HIV/AIDS, autoimmune disease, transplant rejection, allergies, and neutropenic precautions.



INNATE (Natural)

- ▶ Present **from birth**
- ▶ **Non-specific** — attacks everything foreign



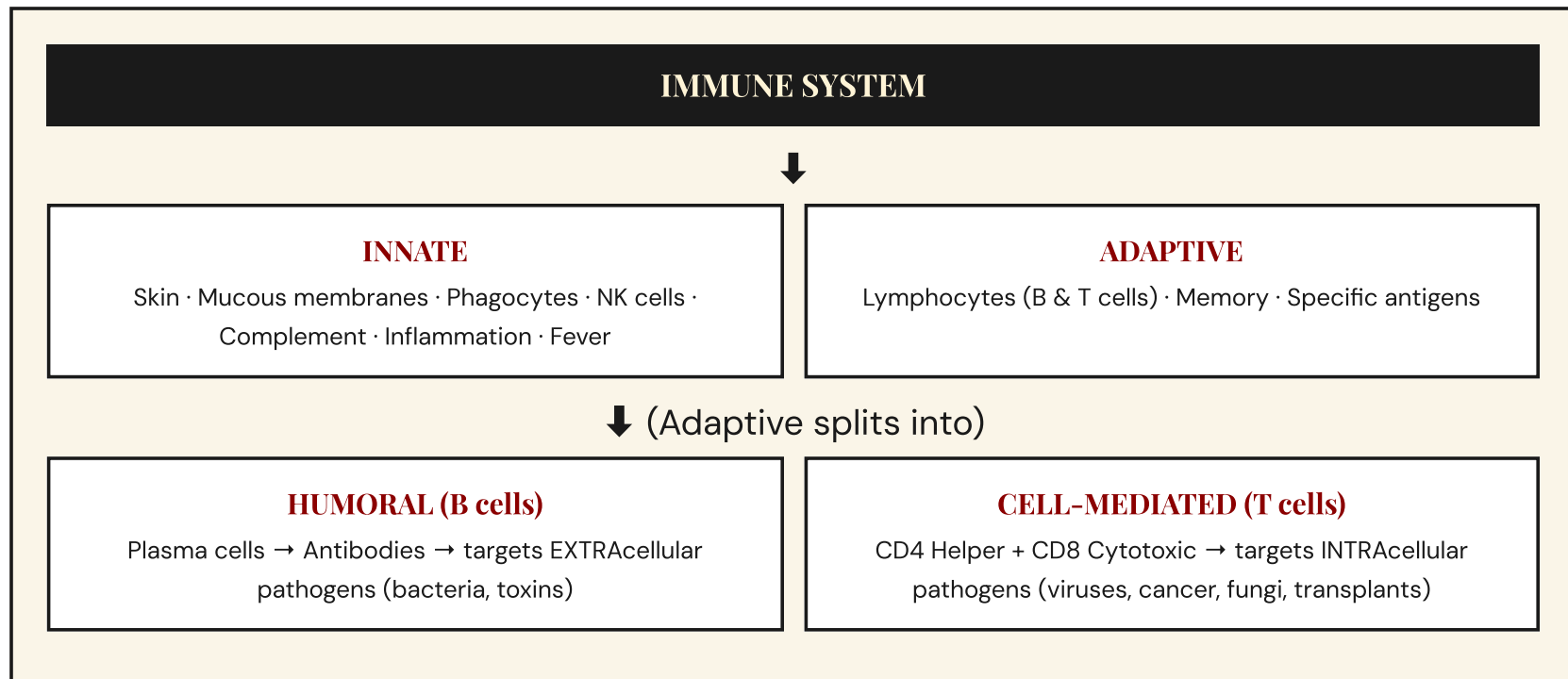
ADAPTIVE (Acquired)

- ▶ Develops **over time**
- ▶ **Specific** — targets exact antigen

- ▶ **Rapid** response (minutes–hours)
- ▶ **NO memory** — same response every time
- ▶ First line of defense

- ▶ **Slower** initial response (days)
- ▶ **HAS memory** — faster 2nd time
- ▶ Humoral + Cell-mediated branches

2 How Immunity Works (Simplified Flow)



1 Pathogen enters body → physical barriers (skin, mucus, cilia, stomach acid) block it first.



2 Innate response activates → neutrophils & macrophages phagocytize; NK cells kill infected cells; complement proteins & inflammation kick in.



3 Antigen-presenting cells (macrophages, dendritic cells) display antigen to T cells → activates adaptive immunity.



4 HUMORAL arm: CD4 helper T cells → activate B cells → B cells become plasma cells → make antibodies (Ig) that tag/neutralize pathogens.



5 CELL-MEDIATED arm: CD8 cytotoxic T cells directly kill infected/abnormal cells; CD4 helpers coordinate everything.



6 Memory cells form → remember the antigen for faster, stronger response on re-exposure. This is the basis of vaccination.

The 5 Immunoglobulins (Antibodies)

IgM

FIRST responder
Acute infection marker
Largest Ig

IgG

MOST abundant
Crosses placenta
Long-term immunity

IgA

Mucous membranes
Tears, saliva
Breast milk

IgE

Allergies
Parasites
Anaphylaxis

IgD

B-cell receptor
Role least understood

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Active vs. Passive Immunity (Critical for Vaccines!)

ACQUIRED IMMUNITY



ACTIVE

Body makes its OWN antibodies
Slow onset · Long-lasting · HAS memory

PASSIVE

Antibodies GIVEN from another source
Fast onset · Short-lived · NO memory

↓ (each splits into natural & artificial)

Active-Natural

Getting sick & recovering (e.g., chickenpox)

Passive-Natural

Mother → baby via placenta (IgG) or breast milk (IgA)

Active–Artificial
VACCINES
(MMR, flu, Tdap, HPV, COVID)

Passive–Artificial
Immunoglobulins (
RhoGAM
, tetanus Ig, rabies Ig, hep B Ig, anti-venom)

RED FLAG: IMMUNITY FAILURE

-  **HIV/AIDS:** Destroys **CD4 Helper T cells** — $CD4 < 200$ = AIDS diagnosis
-  **Neutropenia:** $ANC < 500$ = SEVERE — implement **neutropenic precautions** immediately
-  **Anaphylaxis:** IgE-mediated — airway compromise is priority (give IM epinephrine)
-  **Autoimmune:** Body attacks self (SLE, RA, MS, Graves, T1DM, Hashimoto's)
-  **Transplant rejection:** Cell-mediated (T-cell) response — requires lifelong immunosuppression

4 Priority Nursing Interventions

ABC

Monitor airway in anaphylaxis & severe immune reactions — assess for stridor, wheezing, edema. Give IM epinephrine 1st (lateral thigh, 0.3–0.5 mg adult).

SAFETY

Neutropenic precautions if $ANC < 500$: private room, strict hand hygiene, NO fresh flowers/raw fruits/vegetables, no live-plant soil, limit visitors, avoid crowds.

SAFETY

Do NOT give live vaccines (MMR, varicella, yellow fever, live flu nasal, rotavirus) to immunocompromised clients, pregnant women, or those on high-dose steroids/chemo.

ASSESS

Monitor WBC & differential — especially ANC (absolute neutrophil count), CD4 count (HIV), lymphocytes. Fever in immunocompromised = EMERGENCY.

ASSESS

Watch for masked infection signs — immunocompromised clients may NOT show classic fever, redness, purulence. Assess subtle changes in LOC, vitals, appetite.

ABC

Transfusion reactions (immune-mediated): STOP blood first, maintain IV with 0.9% NS, notify HCP + blood bank, send blood bag & urine to lab.

SAFETY

Give RhoGAM to Rh-negative moms at 28 weeks and within **72 hours** postpartum (or after miscarriage/amnio) to prevent maternal antibody formation.

TEACH

Vaccine schedule adherence — especially for pediatrics, pregnant women (Tdap every pregnancy), and immunocompromised (inactivated flu, pneumococcal).

5**Pharmacology****VACCINES — Active Artificial Immunity**

LIVE attenuated:	MMR, varicella, yellow fever, rotavirus, intranasal flu (FluMist), BCG. Avoid in immunocompromised & pregnancy.
Inactivated:	Flu shot (IM), hep A, rabies, polio (IPV). Safe in immunocompromised.
Subunit/Toxoid:	Tdap, HPV, hep B, pneumococcal, meningococcal.
mRNA:	COVID-19 (Pfizer, Moderna) — teach 2-dose series + boosters.
Side effects:	Low-grade fever, soreness at site, fatigue. Anaphylaxis = rare but emergency.



IMMUNOGLOBULINS — Passive Artificial

RhoGAM:	Rh-neg mom carrying Rh-pos fetus. Give at 28 wks + within 72 hrs postpartum.
Tetanus Ig:	Dirty wound in unvaccinated client.
Hep B Ig:	Post-exposure (needlestick, infant of hep B+ mom).
Rabies Ig:	Animal bite exposure — give with rabies vaccine.
IVIG:	Immunodeficiency, Guillain-Barré, Kawasaki, ITP.



IMMUNOSUPPRESSANTS (Suppress Cell-Mediated)

Corticosteroids:	Prednisone, methylprednisolone. Side effects: infection, hyperglycemia, osteoporosis, Cushingoid. Never stop abruptly.
Calcineurin inhibitors:	Cyclosporine, tacrolimus. Used post-transplant. Monitor kidney function & drug levels.
Antimetabolites:	Azathioprine, methotrexate, mycophenolate. Monitor CBC for bone marrow suppression.
Biologics:	Adalimumab (Humira), etanercept (Enbrel), infliximab — TNF blockers for RA, Crohn's. TB screen before starting.
Nursing:	Infection prevention · No live vaccines · Monitor CBC · Teach s/s of infection to report immediately.

⚠️ ANTI-HISTAMINES & EPINEPHRINE (Allergic/IgE)

Diphenhydramine: H1 blocker — mild allergy, hives. Causes drowsiness, anticholinergic effects.

Epinephrine (EpiPen): **FIRST drug in anaphylaxis.** IM lateral thigh — adult 0.3–0.5 mg, child 0.15 mg. May repeat q 5–15 min.

Teach: Carry 2 EpiPens · call 911 after use · still go to ER even if symptoms improve (biphasic reaction).

6 NCLEX Test Traps ⚠️

⚠️ TRAP 1 · Active vs. Passive Immunity

❌ WRONG THINKING

"A vaccine is passive immunity because it's injected."

✅ CORRECT

Vaccines = ACTIVE artificial. The body MAKES its own antibodies. Passive = antibodies GIVEN pre-formed (RhoGAM, Ig).

⚠️ TRAP 2 · Live Vaccines in Immunocompromised

❌ WRONG THINKING

"Giving MMR to a child on chemo will protect them best."

✅ CORRECT

NEVER give LIVE vaccines (MMR, varicella, rotavirus, intranasal flu) to immunocompromised, pregnant, or high-dose steroid clients. Can cause actual disease.

⚠️ TRAP 3 · B cells vs. T cells

✗ **WRONG THINKING**

"B cells directly kill infected cells."

✓ **CORRECT**

B cells → plasma cells → make ANTIBODIES (humoral). T cells do the KILLING (cell-mediated, especially CD8).

⚠ **TRAP 4 · IgG vs. IgM Timing**

✗ **WRONG THINKING**

"IgG is the first antibody in acute infection."

✓ **CORRECT**

IgM = FIRST (acute/recent infection). **IgG = LATER** (past infection, immunity, crosses placenta).

⚠ **TRAP 5 · Fever in Neutropenic Client**

✗ **WRONG THINKING**

"Temp of 100.4°F in chemo pt — reassess in 4 hours."

✓ **CORRECT**

Neutropenic fever = **MEDICAL EMERGENCY**. Notify HCP IMMEDIATELY, draw blood cultures, start broad-spectrum antibiotics within 1 hour.

⚠ **TRAP 6 · Anaphylaxis Priority**

✗ **WRONG THINKING**

"Give Benadryl first for anaphylaxis."

✓ **CORRECT**

EPINEPHRINE IM first — airway is the priority. Benadryl + steroids are adjuncts, never the priority med.

⚠ **TRAP 7 · RhoGAM Timing**

✗ **WRONG THINKING**

"Give RhoGAM to Rh-positive moms."

✓ **CORRECT**

RhoGAM = for **Rh-NEGATIVE** moms only. Given at 28 wks & within **72 hrs** of delivery/miscarriage/amnio.

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Patient Education



Infection Prevention

- Hand hygiene is #1 defense
- Avoid crowds, sick contacts
- No raw fruits/veggies if neutropenic
- Cook meats well; wash produce
- No fresh flowers or live plants



Vaccines

- Stay up to date on schedule
- Flu shot yearly (IM, inactivated OK for all)
- Tdap every pregnancy (27–36 wks)
- Report severe reactions to HCP
- Soreness/low fever = normal



When to Call the HCP

- Temp $\geq 100.4^{\circ}\text{F}$ (38°C)
- Chills, shaking, new cough
- Burning with urination
- New mouth sores or skin lesions
- Any s/s of infection — don't wait



Nutrition & Lifestyle

- Balanced diet rich in protein, vit C, zinc
- Adequate sleep (7–9 hrs)
- Stress management (stress ↓ immunity)
- Don't smoke; limit alcohol
- Stay hydrated



Breastfeeding

- Provides passive-natural immunity
- IgA protects infant GI tract



Immunosuppressant Teaching

- Never stop steroids abruptly
- Take with food

→ Colostrum is "liquid gold"
→ Reduces infant infection risk

→ Report fever, cough, fatigue
→ Avoid live vaccines & sick people
→ Keep all lab appointments

8 NCJMM • Clinical Judgment Framework

STEP 1 • RECOGNIZE CUES

What do I see?

Fever in chemo pt (ANC < 500), low CD4 count, hives after transfusion, low back pain mid-transfusion, wheezing after antibiotic, new autoimmune symptoms (joint pain, butterfly rash), frequent infections.

STEP 2 • ANALYZE CUES

What does it mean?

Neutropenic fever = sepsis risk. CD4 < 200 = AIDS, opportunistic infection risk. Low back pain in transfusion = HEMOLYTIC reaction. Wheezing = IgE-mediated anaphylaxis. Pattern of recurrent infection = immunodeficiency.

STEP 3 • PRIORITIZE HYPOTHESES

What's most urgent?

ABCs always first → Anaphylaxis (airway) before neutropenic fever. Stop transfusion before notifying HCP. Life-threatening immune reactions > chronic autoimmune management.

STEP 4 • GENERATE SOLUTIONS

What are my options?

Epi IM for anaphylaxis; stop blood & NS for reaction; neutropenic precautions for ANC < 500; RhoGAM per protocol; hold live vaccines in immunocompromised; blood cultures before antibiotics when possible.

STEP 5 • TAKE ACTION

STEP 6 • EVALUATE OUTCOMES

What do I do first?

Implement priority intervention (Epi, stop transfusion, isolate, administer meds). Notify HCP. Document. Educate pt & family. Place client in protective isolation if neutropenic.

Did it work?

Airway patent? Vitals stabilizing? Symptoms resolving? WBC/ANC trending up? No new s/s infection? Pt verbalizes understanding of precautions/meds/vaccine schedule?

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Memory Boosters & Mnemonics

MADE in GERMANY

The 5 Immunoglobulins:
IgM · IgA · IgD · IgE · IgG
(Also: "GAMED" works too!)

"M is for Main event"

IgM = **M**ain/current infection (first responder)
IgG = **G**one by / past infection (long-term)

"B for Bugs (extracellular)"

B cells (humoral) → fight **B**acteria & toxins in blood
T cells (cell-mediated) → fight viruses, **T**umors, **T**ransplants

"Active = Action you take"

Active: YOUR body makes antibodies (slow, lasts long)
Passive: you RECEIVE antibodies (fast, short-lived)

"4 & 8 = Help & Kill"

CD4 = T **H**elper cells (coordinate) · HIV attacks these
CD8 = **C**ytotoxic T cells (killer)

"MR. V CHIPS"

LIVE vaccines (avoid in immunocompromised):
MMR · **R**otavirus · **V**aricella · **C**holera · yellow fever (**H**imalaya) · **I**ntranasal flu · **P**olio (oral) · **S**mallpox

"200 = AIDS"

CD4 count < **200** = AIDS diagnosis
CD4 count < **500** = moderate immunocompromise
Normal CD4: 500–1500

"NEUTROPENIC = No Fresh"

ANC < **500** = precautions:
No fresh **F**lowers · fresh **F**ruit · fresh **V**eggies · **C**rowds · sick visitors · live plants

"SHE IS Rh-neg"

RhoGAM is for **Rh-NEGATIVE** moms only
28 weeks + within **72** hours postpartum/miscarriage/amnio

"Epi FIRST, Always"

Anaphylaxis priority order:
1. **Epinephrine IM** (lateral thigh)
2. Airway/O₂
3. Benadryl · steroids · fluids

 **You've got this, Diane!**

NGN NCLEX 2026 · Immune System · Clinical Judgment Ready