

HESI Exam 1 — NSG 520 Pathophysiology & Pharmacology

Scope: Units 1–4 (patho + pharm + dosage calcs)

How to use: Skim the **Rapid Recall** for each topic, then hit **Nursing Priorities**, then run the **Practice Stems**.

UNIT 1 — Intro to Patho & Pharm

1) Cellular Adaptation, Injury, Aging

Rapid recall

- Adaptations: **Atrophy** ↓size, **Hypertrophy** ↑size (HTN heart), **Hyperplasia** ↑number, **Dysplasia** atypia/precancer.
- Injury: **Hypoxia/ischemia = #1**, free radicals (oxidative), chemical/toxic, infection, physical (trauma/radiation).
- Aging: ↓repair, telomere shortening, ↑DNA mutations.

Nursing priorities

- Anticipate hypertrophy in long-standing HTN; teach BP control.
- Oxidative injuries → think antioxidants and remove exposure.

Classic HESI stems

- “Which adaptation in chronic HTN?” → **Hypertrophy**.
- “Most common cause of cell injury?” → **Hypoxia/ischemia**.

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2) Genetics & Congenital Disorders

Rapid recall

- **AD:** 50% risk each child (no carriers) – e.g., Huntington, Marfan.
- **AR:** 25% affected; carriers common – e.g., CF, SCD.

- **X-linked Recessive:** usually males; carrier mom → **50% of sons affected.**
- Chromosome: **Down 47, +21; Turner 45,X; Klinefelter 47,XXY.**
- **Nursing priorities**
- Pedigree pattern recognition in teaching; offer genetic counseling resources.
- **Classic stems**
- “Carrier mother hemophilia, chance affected son?” → **50%.**
- “Biopsy vs imaging for tumor confirmation?” → **Biopsy = definitive.**

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3) Safe Pharmacology Fundamentals

Rapid recall

- **6 Rights:** patient, med, dose, route, time, documentation.
- **PINCH** high-alert: Potassium, Insulin, Narcotics, Chemo, Heparin → **double check.**
- Med error most common: **wrong dose**; clarify unclear orders.
- **ADR buzzwords**
- **NSAIDs:** GI bleed, renal injury.
- **Opioids:** resp depression, constipation.
- **Corticosteroids:** infection risk, hyperglycemia, osteoporosis.
- **Immunosuppressants:** infection precautions; monitor WBC.
- **Classic stems**
- “Prednisone teaching priority?” → **Report fever immediately.**
- “Action that ensures safety?” → **Use two identifiers; double-check high-alert drugs.**

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4) Dosage Calculations (core)

Formulas

- **Tabs** = ordered ÷ on-hand strength.
- **mL** = (ordered ÷ on-hand strength) × volume on hand.
- **Weight-based:** mg/kg × kg; convert to mL.
- **Conversions**

- 1 kg = 2.2 lb; 1 g = 1000 mg; 1 mg = 1000 mcg; 1 L = 1000 mL.

Rounding

- ≥ 1 mL → **tenth**; < 1 mL → **hundredth**; tablets → **whole** (unless scored).

Quick examples

- Order 500 mg PO; 250 mg/tab → **2 tabs**.
- Order 600 mg; 200 mg/5 mL → $(600/200) \times 5 =$ **15 mL**.
- Order 10 mg/kg for 19.8 kg **q8h**; conc 50 mg/mL → Dose = 198 mg → **4.0 mL** (round to tenth).

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UNIT 2 — Primary Mechanisms of Disease

1) Malnutrition, Obesity, Starvation

Rapid recall

- **WAT** adipokines → chronic inflammation, insulin resistance, ↑cancer risk.
- Starvation sequence: glycogen → gluconeogenesis → lipolysis → **ketones**; prolonged → muscle wasting, immune suppression.

Stems

- “Cachexia pattern in cancer?” → **↑lipolysis, ↓LPL, fat + muscle wasting**.

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2) Aging & Stress

Rapid recall

- **Immunosenescence**: ↓T-cell function, ↓antibody response → ↑infection/cancer.
- **HPA axis**: CRH→ACTH→**cortisol** → ↑glucose/BP, immune suppression, delayed healing; chronic stress → CVD, depression, infection risk.

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3) Infectious Disease Essentials

Rapid recall

- Stages: **incubation** → **prodrome** → **invasion** → **convalescence**.
- **HIV**: targets CD4; AIDS OIs when **CD4 <200** (PCP, Kaposi).
- **SARS-CoV-2**: ACE2 binding; cytokine storm → ARDS risk.
Stems
- “When to screen for OIs?” → **CD4 <200**.

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4) Cancer Biology & Epidemiology

Rapid recall

- Hallmarks: uncontrolled growth, evasion apoptosis, **angiogenesis**, metastasis.
- **Paraneoplastic**: SIADH (SCLC), polycythemia (RCC), DIC (leukemia).
- Dx: **Biopsy gold standard**; markers PSA/AFP/CEA/hCG support.
- Risks: smoking, alcohol, obesity, diet (high fat/low fiber), radiation, occupational.
Stems
- “Best confirmation of malignancy?” → **Biopsy**.
- “Lifestyle factor raising colon cancer risk?” → **low fiber, high fat**.

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5) Adaptive/Altered Immunity

Rapid recall

- **B cells**: IgM first, then **IgG**; **T cells**: CD4 helper, CD8 cytotoxic.
- **Hypersensitivity**
 - **Type I (IgE)**: anaphylaxis, allergies.
 - **Type II (IgG/IgM)**: Graves, hemolytic anemia.
 - **Type III**: immune complex (SLE, RA).
 - **Type IV**: T-cell delayed (contact dermatitis, TB test).
- **Immunodeficiency**: primary (SCID, DiGeorge) vs secondary (HIV, chemo, malnutrition).

UNIT 3 — Inflammation & Wound Healing; Anti-inflammatory

1) Inflammatory Process

Rapid recall

- **Cardinal signs:** warmth, redness, swelling, pain, ↓function.
- Phases: **vascular** → **exudate (pus/WBC)** → **repair**; chronic → fibrosis/autoimmunity risk.
- **Stem**
- “Prolonged inflammation leads to?” → **tissue destruction/fibrosis.**

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2) NSAIDs vs Acetaminophen

NSAIDs

- Block **COX-1 &/or COX-2** → ↓prostaglandins → ↓pain, swelling, warmth.
- AEs: **GI ulcer/bleed**, ↓platelets → bleed, **renal injury**, asthma rxn, MI/stroke risk.
- Avoid **aspirin in children** (Reye); avoid in **3rd-trimester pregnancy** (ductus closure).
- Nursing: check allergies (NSAID/sulfa), BP, bleeding, UOP; give with food.

Acetaminophen

- Central COX inhibition; **analgesic + antipyretic only** (no anti-inflammatory).
- **Max ≤4 g/day** (≤3 g/day elderly/long-term); **antidote = N-acetylcysteine.**

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3) Systemic Glucocorticoids

Rapid recall

- Cortisol-like: broad anti-inflammatory & immunosuppression.

- AEs: **adrenal suppression** (never stop abruptly), infection risk, **delayed wound healing**, hyperglycemia, osteoporosis, mood changes, fluid retention (“Cushingoid”).
- Nursing: **taper**, monitor vitals/weight, infection signs; take with food; stress-dose during illness.

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4) Infection–Inflammation Link

- Infection commonly **triggers** inflammation; chronic infection-driven inflammation can contribute to **cancer** (e.g., H. pylori → gastric CA).

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UNIT 4 — Antimicrobial Agents

1) Principles, Spectrum, Resistance

Rapid recall

- **Selective toxicity** is the goal; narrow vs broad (broad ↑superinfection/resistance).
- Resistance: **β-lactamases**, target modification, efflux pumps; misuse drives resistance.

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2) Cell-Wall Agents

Penicillins (bind PBPs → no cross-linking → lysis)

- Natural (Pen G/V) = Strep; AminoPCN (amox/amp) broader; Anti-staph (nafcillin/dicloxacillin) = **MSSA**; Antipseudomonal (piperacillin) = **Pseudomonas**.
 - AEs: allergy/anaphylaxis, C. diff risk.
- Cephalosporins**
- ↑Generation → ↑Gram-neg, ↓Gram-pos: **1st cefazolin** (surgical proph), **3rd ceftriaxone** (meningitis, gonorrhea), **4th cefepime** (Pseudomonas), **5th**

ceftaroline (MRSA).

Carbapenems: very broad; seizure risk (imipenem).

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3) Protein Synthesis Inhibitors

Tetracyclines (30S)

- Uses: acne, atypicals; **avoid milk/antacids; avoid in pregnancy/kids <8;** photosensitivity.
Macrolides (50S)
- Azithro/erythro: resp/atypicals; **QT prolongation**, GI upset, CYP interactions.
Clindamycin (50S)
- Anaerobes **above diaphragm; high C. diff risk.**

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4) Aminoglycosides (30S, bactericidal)

- Gent/Tobra/Amikacin; serious Gram-neg; synergy with β -lactams.
- **Nephrotoxicity, ototoxicity, neuromuscular blockade; monitor drug levels.**

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5) Sulfonamides & Trimethoprim

- TMP-SMX synergy (folate blockade).
- Uses: **UTIs, PCP**, MRSA skin.
- AEs: **Rash/SJS, hemolysis in G6PD, hyperkalemia** (TMP).
- Teaching: hydrate; photosensitivity.

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6) Fluoroquinolones & Metronidazole

FQs (DNA gyrase/topo)

- Tendon rupture, QT prolongation, CNS effects, photosensitivity; **avoid in pregnancy/children.**

Metronidazole

- **Below-the-belt anaerobes** (C. diff, Bacteroides), trichomonas/giardia.
- **Disulfiram-like** with alcohol, metallic taste, neuropathy.

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7) Antifungals & Common Antivirals

Antifungals

- **Azoles:** CYP inhibition, hepatotoxicity.
- **Ampho B:** “Ampho-terrible” nephrotoxicity, electrolyte wasting, fever/chills.
- **Echinocandins:** Candida/Aspergillus (β -glucan block).

Antivirals

- **Acyclovir/Valacyclovir:** HSV; **nephrotoxicity (crystalluria).**
- **Oseltamivir:** start \leq 48 h.
- **HBV:** tenofovir/entecavir; **HCV:** DAAs (e.g., sofosbuvir).

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8) Dosing by Weight & BSA (individualized dosing)

- Methods: **BW/IBW/ABW/LBW** selection per drug; **BSA** used for some therapies.
- Clinical: round safely, check renal/hepatic function; watch narrow TI meds.

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Night-Before “No-Miss” Checklist

- Cell adaptation patterns and **hypoxia** as #1 injury.

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- Inheritance patterns and **X-linked son 50%** rule; biopsy = definitive.

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- **6 Rights + PINCH**; steroid fever = call.

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- **Immunosenescence** with aging; **HPA** → **cortisol** effects.

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- Infection stages; **HIV CD4 <200** → **OIs**.

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- **NSAIDs vs APAP** differences; **APAP max 4 g/day (3 g elderly)**; aspirin no kids.

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- **Steroids must be tapered**; infection risk, wound healing delay.

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- Abx class → **MOA + big AEs** (FQ tendon, TMP hyperK, AG oto/nephro, Clinda C. diff).

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- **Calc formulas, conversions, rounding rules.**

NSG520 UNIT 1 REVIEW

15 Quick Practice Stems (answers beneath each)

1. Long-standing untreated HTN → LV change? **Hypertrophy.**

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2. Most common cellular injury cause? **Hypoxia/ischemia.**

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3. Carrier mother for hemophilia: % affected sons? **50%.**

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4. Test to confirm malignancy? **Biopsy.**

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5. Stage after prodrome in infection? **Invasion.**

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6. CD4 count threshold for PCP prophylaxis? **<200.**

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7. Chronic cortisol excess risks? **Infection, delayed healing, HTN, hyperglycemia.**

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8. NSAID counseling priority in elderly on ACE-I/diuretic? **Renal injury/monitor UOP & BP.**

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9. Child with viral fever: analgesic choice? **Acetaminophen** (avoid aspirin).

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10. Stopping prednisone abruptly: risk? **Adrenal crisis** (must taper).

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11. Abx for MSSA skin infection in PCN-tolerant patient? **Dicloxacillin/nafcillin** class.

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12. Antibiotic with high C. diff risk? **Clindamycin.**

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13. UTI with sulfa allergy alternative? **Avoid TMP-SMX**; select non-sulfa option per local guidance.

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14. FQ teaching for Achilles pain? **Stop drug; risk of tendon rupture.**

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15. APAP maximum dose for older adult long-term use? **≤ 3 g/day.**

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