PHARMACOLOGY · STUDY GUIDE

Final Exam Study Guide

The final covers all fourteen chapters. Each chapter here is shorter than in the exam guides: four paragraphs of what to know, the points to lock in, two short tables, one worked example, the traps and six new self-test items. If a chapter feels shaky, go back to its exam guide for the full treatment. The long cram sheet at the end pulls every antidote, level, hold parameter and timing rule into one place. Any dose or number in a worked example is a practice calculation only, not dosing advice. Work two chapters a day and the whole course fits into a week.

WHAT THIS GUIDE COVERS

- Principles and infection: chapters 1 and 2 (names, kinetics, dynamics, safety, supplements; antimicrobials).
- Immunity, cancer, pain and the mind: chapters 3, 4 and 5 (immunomodulators and chemotherapy; pain and substance use; mental health, seizures and anesthesia).
- Structure and control: chapters 6, 7 and 8 (bone and skin; autonomic drugs; endocrine drugs).
- The heart and the blood: chapters 9 and 10 (anticoagulants, blood products, antihypertensives; lipids, angina, heart failure, rhythm).
- Fluids, air, gut and reproduction: chapters 11, 12, 13 and 14 (diuretics, fluids and antidotes; respiratory, eye and ear; GI drugs; reproductive drugs).
- Every chapter carries what to know, tables, a worked example, the traps and a six-item self-test, and the cram sheet holds the numbers and rules.

CHAPTER 1

Pharmacological Principles and Herbal Supplements

Read it in full: **Chapter 1 in the textbook**. Practice it in the lab: **Decoding Drug-Name Stems** and **Check the Order**.

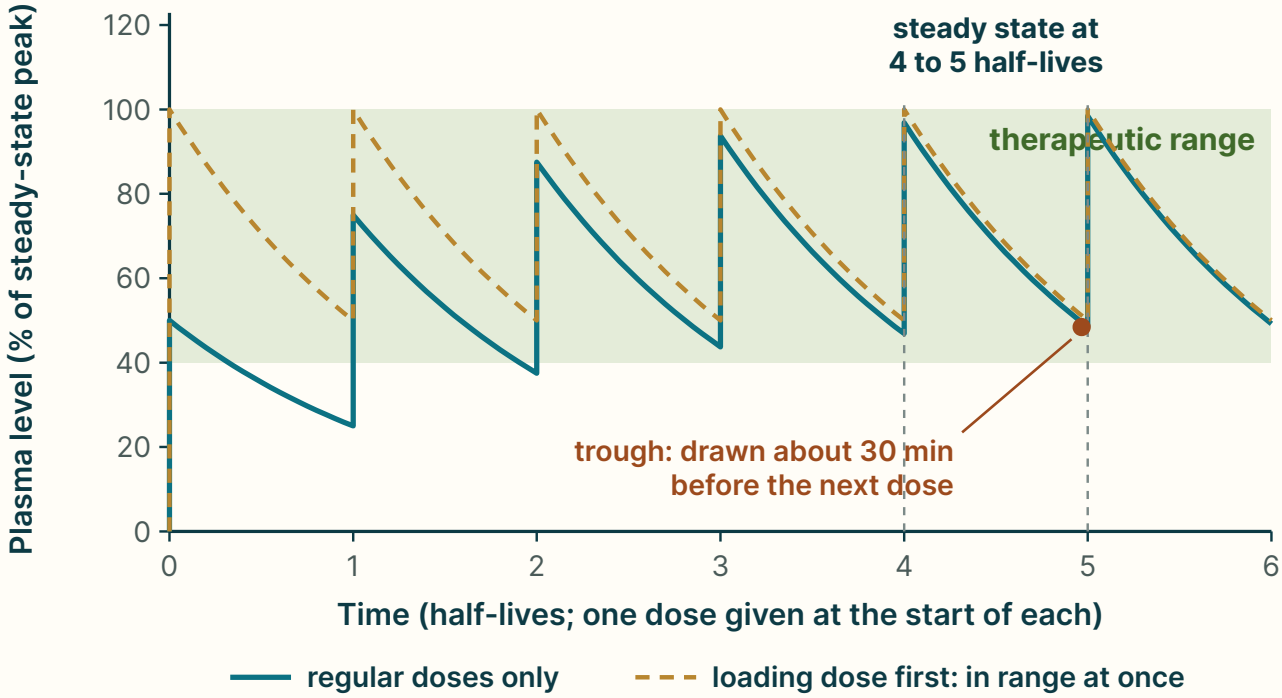
What to know

Every drug has a chemical, a generic and a trade name; nurses work in **generic names** because a duplicate cannot hide there. Stems name the class: -olol, -pril, -statin, -prazole, -cillin, -sartan. A class shares a mechanism, so learn the **prototype** and you know the family. Therapeutic class says what it treats; pharmacologic class says how it works.

ADME: absorption, distribution, metabolism, excretion. IV bioavailability is 100%. Only free (unbound) drug acts, so low albumin brings toxicity at normal doses. CYP450 **inducers** (rifampin, phenytoin, carbamazepine, St. John's wort) drop partner levels; **inhibitors** (azoles, clarithromycin, amiodarone, grapefruit) raise them. The **first-pass effect** means oral morphine needs about three times the IV dose. Four to five half-lives reach steady state and four to five clear the drug; a loading dose skips the wait. Troughs are drawn about 30 minutes before the next dose.

Agonists activate, antagonists block (the antidote mechanism), partial agonists have a ceiling. **Potency** is milligrams; **efficacy** is the maximum effect. TI = TD50 ÷ ED50; narrow-index drugs include warfarin, digoxin, lithium, phenytoin, levothyroxine, theophylline, carbamazepine, vancomycin, aminoglycosides and insulin. Digoxin runs about 0.5 to 2 ng/mL and hypokalemia makes it toxic.

Rights checked three times; two identifiers; chart after giving. High-alert drugs get an independent double-check, and KCl is never IV push. Leading zero yes, trailing zero no, spell out units, clarify unclear orders. Supplements are regulated as food; St. John's wort induces CYP3A4; garlic, ginger, ginkgo, ginseng and feverfew add bleeding; kava and black cohosh injure the liver; stop most herbs 1 to 2 weeks before surgery.



Half-life sets the climb to steady state. Each dose adds the same amount while the body clears half every half-life, so levels plateau after about 4 to 5 half-lives. A loading dose skips the wait.

LOCK THESE IN

- Generic names; stems name the class.
- Inducers lower, inhibitors raise partner drugs.
- 4 to 5 half-lives to steady state and to clear.
- Potency is milligrams; efficacy is maximum effect.
- KCl never IV push; no trailing zeros.
- St. John's wort: CYP3A4 inducer and serotonergic.

Chapter 1 key terms

Term	Meaning
Bioavailability	Fraction reaching circulation; IV 100%
First pass	Liver metabolism of oral dose before the body
Half-life	Time for level to fall by half
Trough	About 30 min before the next dose
Therapeutic index	TD50 ÷ ED50
Partial agonist	Weak activation with a ceiling (buprenorphine)

Supplements to ask about

Product	Concern
St. John's wort	CYP3A4 and P-gp inducer; serotonin syndrome
Ginkgo, garlic, ginger, ginseng, feverfew	Bleeding with anticoagulants
Kava	Liver injury; CNS depression
Valerian	Added sedation
Echinacea	Avoid in immunosuppression
Grapefruit juice	CYP3A4 inhibitor for about 24 h

Worked example

EXAMPLE 1.1 · CLEARING A DOSE

A single 200 mg IV dose of a practice drug has a half-life of 4 hours. How much remains at 12 hours, and about when is it essentially cleared?

STEP 1 · COUNT HALF-LIVES

12 ÷ 4 = 3 half-lives.

STEP 2 · HALVE THREE TIMES

200 → 100 → 50 → **25 mg**.

STEP 3 · CLEARANCE

4 to 5 half-lives: 16 to 20 hours.

TRAPS PEOPLE FALL INTO

- **Swapping IV and oral doses one for one.** First pass changes the dose.
- **Confusing potency and efficacy.** Fewer milligrams is not a stronger effect.
- **Assuming supplements are not drugs.** Ask about every bottle bought without a prescription.
- **Early troughs.** Draw about 30 minutes before the dose.

Chapter 1 self-test · six items

1. A drug is 90% bound to albumin. The patient's albumin falls sharply. What happens to the active drug?

A. The free fraction falls
B. The free fraction rises
C. Absorption is blocked
D. Excretion stops entirely

B. The free fraction rises Less albumin leaves more drug unbound, and only unbound drug acts.

2. Which route bypasses the first-pass effect?

A. Sublingual
B. Oral liquid
C. Enteric-coated
D. Oral tablet

A. Sublingual Sublingual absorption skips the portal vein. All oral forms pass the liver first.

3. Which describes an antagonist?

A. Binds and weakly activates with a ceiling
B. Binds and fully activates the receptor
C. Binds but produces no effect of its own
D. Changes the drug's rate of absorption

C. Binds but produces no effect of its own Antagonists occupy the receptor and block others. Naloxone is the classic example.

4. Which pair is on the narrow therapeutic index list?

A. Loratadine and cetirizine
B. Omeprazole and famotidine
C. Amoxicillin and cefazolin
D. Lithium and phenytoin

D. Lithium and phenytoin Lithium and phenytoin need levels and careful dosing.

5. Which abbreviation habit is safe?

A. Writing 0.5 mg
B. Writing .5 mg
C. Writing 5.0 mg
D. Writing 10 U

A. Writing 0.5 mg Use a leading zero. A trailing zero or "U" invites a tenfold error.

6. Which supplement is most linked to transplant rejection?

A. Black cohosh
B. St. John's wort
C. Ginger root
D. Milk thistle

B. St. John's wort St. John's wort induces CYP3A4 and P-gp, dropping cyclosporine levels.

CHAPTER 2

Antimicrobial Drugs

Read it in full: **Chapter 2 in the textbook**. Practice it in the lab: **Resistance & Stewardship** and **Antifungals & Antivirals**.

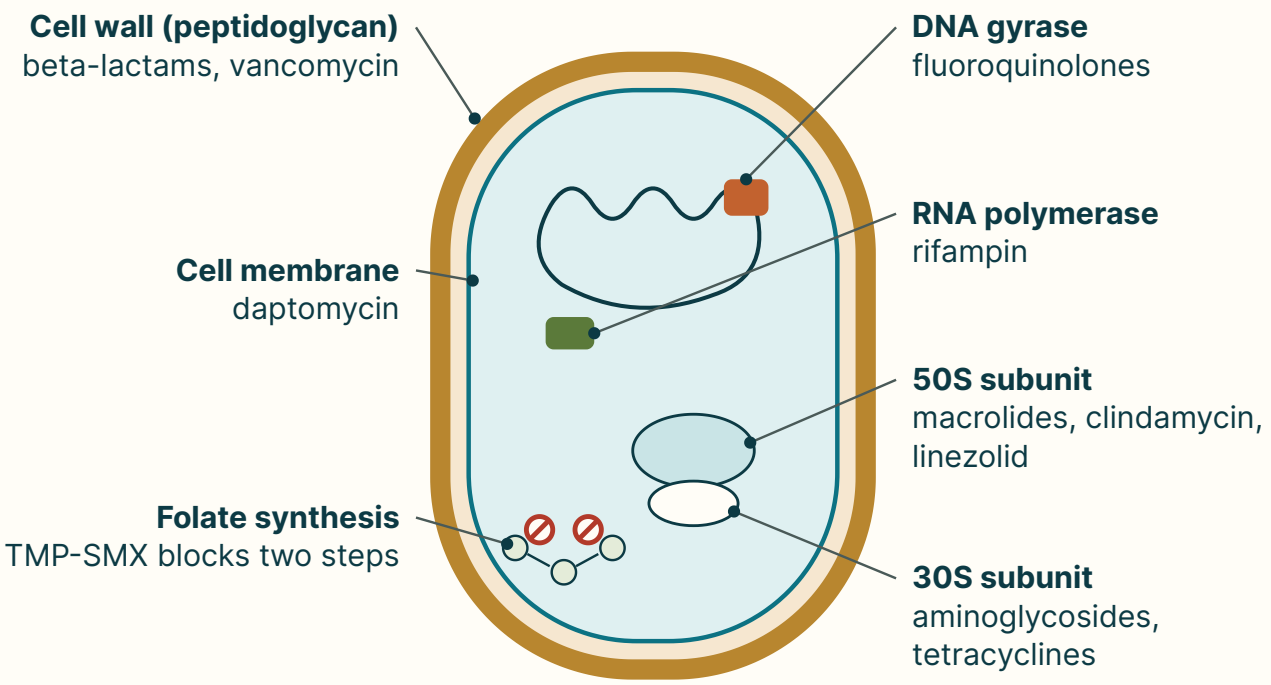
What to know

Selective toxicity: the smaller the microbe-host gap, the more toxic the drug. Narrow-spectrum is the goal; broad is an empiric bridge that is **de-escalated** after culture and sensitivity. Cidal drugs are needed in endocarditis, meningitis and neutropenia. Cultures come before the first dose, but in sepsis antibiotics go in within the hour; surgical prophylaxis within 60 minutes before incision.

Cell wall: beta-lactams (safe), vancomycin (infuse at least 60 minutes, levels, creatinine; flushing is a rate problem), daptomycin (CPK; not for pneumonia). 30S: aminoglycosides (kidney, ear, peak and trough) and tetracyclines (sun, teeth, no dairy or iron). 50S: macrolides (QT), clindamycin (C. difficile), linezolid (platelets, serotonin syndrome). Fluoroquinolones: tendon, aorta, QT, glucose. Rifampin: orange fluids, CYP inducer. Metronidazole: no alcohol for 3 days after. TMP-SMX: SJS, K+, INR, not first trimester or term. Isoniazid with pyridoxine.

Resistance is selected. MRSA (mecA, PBP2a) defeats traditional beta-lactams; use vancomycin, linezolid, daptomycin or ceftaroline. C. difficile needs oral vancomycin or fidaxomicin and soap and water. Stewardship: cultures first, real allergy history, day 3 review, IV to PO, right duration.

Antifungals: amphotericin B (rigors, nephrotoxicity, check formulation), azoles (liver, QT, CYP), echinocandins (best tolerated, IV). Antivirals: acyclovir (hydrate), oseltamivir (best within 48 h; severe or high risk any time), abacavir (HLA-B*5701 first), HCV cures in 8 to 12 weeks (screen HBV). Primaquine needs G6PD screening. Pinworm: treat the household and repeat in 2 weeks.



"Buy AT 30, CELL at 50." Human cells have no wall, 80S ribosomes and take folate from food: that is selective toxicity.

Antibacterial targets. Each class hits something the bacterium has and you lack: the wall, the 70S ribosome, its own folate pathway, or its DNA enzymes.

LOCK THESE IN

- Narrow is the goal; de-escalate after C&S.
- 30S: AG, tetracyclines; 50S: macrolides, clindamycin, linezolid.
- Vancomycin: 60 min or longer; flushing is not allergy.
- MRSA: vanc, linezolid, dapto, ceftaroline.
- C. diff: oral vanc or fidaxomicin; soap and water.
- HLA-B*5701 before abacavir; G6PD before primaquine.

Chapter 2 signature toxicities

Drug	Watch for
Gentamicin	Kidney, hearing; peak and trough
Doxycycline	Sun; teeth; separate from dairy and iron
Linezolid	Platelets; serotonin syndrome
Ciprofloxacin	Tendon rupture, aorta, QT
Metronidazole	Alcohol reaction
Amphotericin B	Rigors, kidney, K+ and Mg

Resistant organisms

Organism	Options
MRSA	Vancomycin, linezolid, daptomycin, ceftaroline
VRE	Linezolid, daptomycin
ESBL gram-negatives	Carbapenems
CRE	Newer combinations; colistin
C. difficile	Oral vancomycin, fidaxomicin

Worked example

EXAMPLE 2.1 · A VANCOMYCIN PUMP RATE

A practice order gives vancomycin in 200 mL over 90 minutes. What is the rate, and does it meet the 60 minute minimum?

STEP 1 · CONVERT TIME

90 min = 1.5 h.

STEP 2 · DIVIDE

200 ÷ 1.5 = 133.3, so about **133 mL/h**.

STEP 3 · CHECK

90 minutes is longer than 60, so it meets the rule.

TRAPS PEOPLE FALL INTO

- **Calling vancomycin flushing an allergy.** It is rate related.
- **IV vancomycin for C. difficile.** Only oral works in the gut.
- **Staying broad after the culture returns.** De-escalate.
- **Skipping the G6PD screen.** Primaquine can cause hemolysis.

Chapter 2 self-test · six items

1. Which drug is the escape option for a patient with true penicillin anaphylaxis needing gram-negative coverage?

A. Aztreonam
B. Ampicillin
C. Cefazolin
D. Amoxicillin

A. Aztreonam Aztreonam is a monobactam that covers gram-negatives and is safe in true penicillin anaphylaxis.

2. Daptomycin should not be used for which infection?

A. Skin infection
B. Pneumonia
C. Bacteremia
D. Endocarditis

B. Pneumonia Lung surfactant inactivates daptomycin.

3. Which teaching fits rifampin?

A. Take with grapefruit juice
B. Avoid dairy within 2 hours
C. Body fluids may turn orange
D. Expect a metallic taste only

C. Body fluids may turn orange Rifampin stains urine, sweat and tears orange and induces CYP enzymes.

4. Why is isoniazid given with pyridoxine?

A. To reduce orange discoloration
B. To boost its gut absorption
C. To prevent kidney stone formation
D. To prevent peripheral neuropathy

D. To prevent peripheral neuropathy Isoniazid causes neuropathy; vitamin B6 prevents it.

5. Which antifungal attacks a target humans lack and is best tolerated?

A. Fluconazole
B. Amphotericin B
C. Caspofungin
D. Terbinafine

C. Caspofungin Echinocandins block beta-glucan wall synthesis, which humans do not have.

6. A patient hospitalized with severe influenza on day 4 of symptoms asks if oseltamivir is too late. What is correct?

A. It is useless once 48 hours have passed
B. Treat now; severe illness is treated any time
C. Only the flu vaccine can help him now
D. Wait for the viral culture results first

B. Treat now; severe illness is treated any time The 48 hour window applies to uncomplicated outpatient flu. Hospitalized or high-risk patients are treated regardless.

CHAPTER 3

Immunomodulators and Antineoplastic Agents

Read it in full: **Chapter 3 in the textbook**. Practice it in the lab: **The Cell Cycle & Where Chemo Strikes** and **Immunostimulants & Vaccines**.

What to know

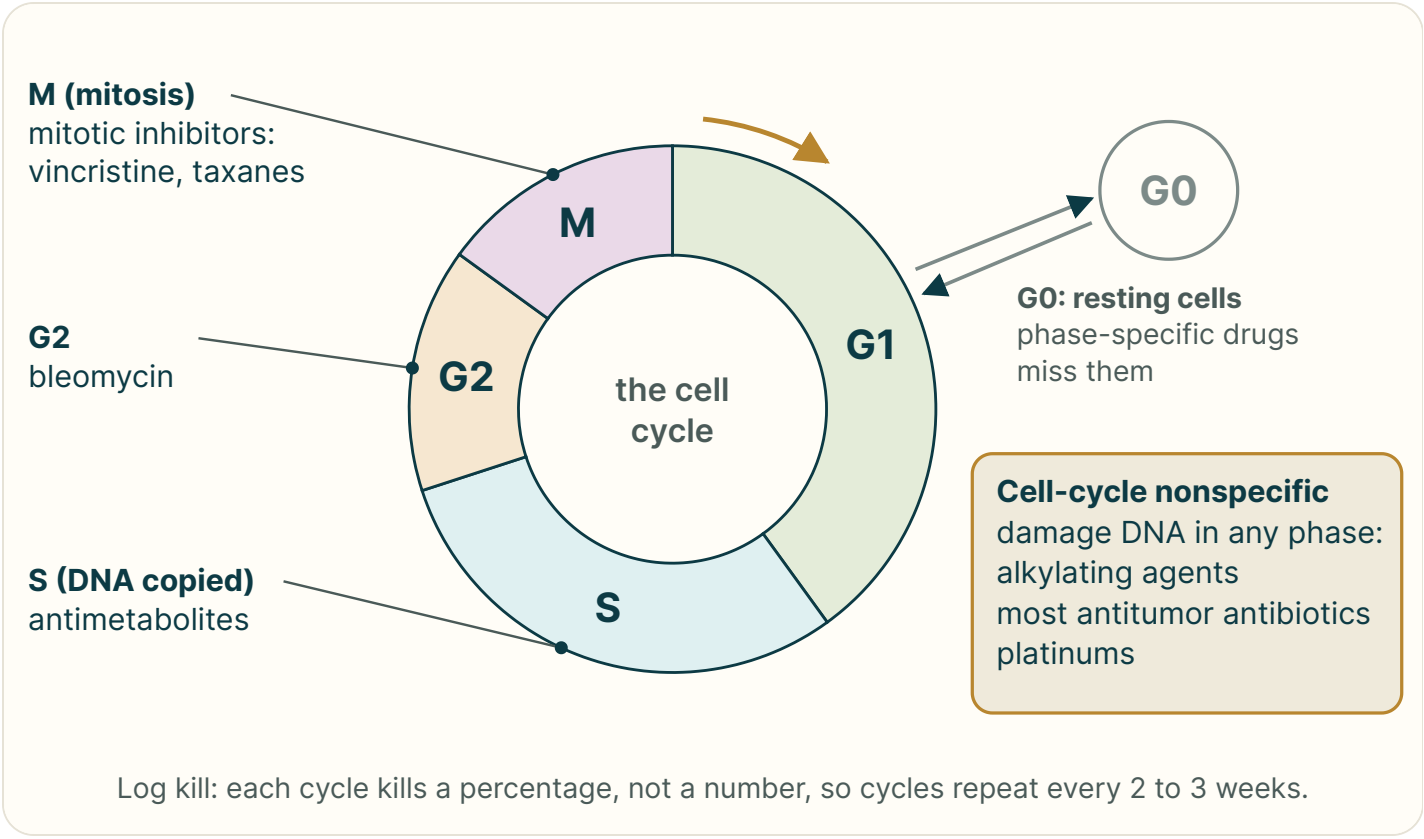
Transplant maintenance layers a calcineurin inhibitor, an antiproliferative and a steroid. Tacrolimus and cyclosporine need troughs, harm kidneys and avoid grapefruit; inducers cause rejection. Methotrexate for RA is **weekly**. Azathioprine with allopurinol causes marrow failure. TNF inhibitors need TB and hepatitis B screening. Immunosuppressed patients hide infection, so any fever matters, and live vaccines are avoided.

Filgrastim (bone pain) is given at least 24 hours after chemotherapy. ESAs carry thrombosis warnings. Checkpoint inhibitors cause immune colitis, pneumonitis and thyroiditis treated with steroids. Live vaccines (MMR, varicella, rotavirus, LAIV, yellow fever) are not given in pregnancy or significant immunosuppression; household contacts are generally still vaccinated. Active immunity is slow and lasting; passive is immediate and temporary.

Cell cycle G1, S, G2, M, with G0 resting. Antimetabolites act in S, vincas and taxanes in M, bleomycin in G2; alkylators and anthracyclines are nonspecific. **Log kill**: each dose kills a

percentage, so cycles are completed. Chemo hits fast-dividing tissue: marrow, gut, hair, gonads, fetus. Signatures: cyclophosphamide cystitis (mesna), cisplatin kidney and ear, doxorubicin cumulative heart damage, bleomycin lung fibrosis, vincristine neuropathy and fatal if intrathecal, taxane hypersensitivity.

Nadir 7 to 14 days. Febrile neutropenia (38.3°C once or 38.0°C for an hour) means cultures and antibiotics within an hour; no rectal temperatures. Antiemetics go before chemotherapy. Extravasation: stop, leave the needle, aspirate; cold for anthracyclines, warm for vincas. Chemotherapy is hazardous: double gloves, gown, home precautions about 48 hours.



Phase-specific versus nonspecific chemotherapy. Drugs that hit one phase miss resting G0 cells; alkylating agents and platinums damage DNA whatever the phase.

LOCK THESE IN

- CNI + antiproliferative + steroid.
- Methotrexate RA weekly; azathioprine not with allopurinol.
- Live vaccines not in pregnancy or immunosuppression.
- Log kill: finish every cycle.
- Febrile neutropenia: antibiotics within 1 hour.
- Cold for anthracyclines, warm for vincas.

Chapter 3 signatures

Drug	Signature
Tacrolimus	Kidney, tremor, glucose; troughs
Filgrastim	Bone pain; 24 h after chemo
Cyclophosphamide	Hemorrhagic cystitis; mesna
Doxorubicin	Cumulative cardiotoxicity; vesicant
Bleomycin	Pulmonary fibrosis
Vincristine	Neuropathy; IV only

Vaccine types

Type	Examples and rule
Live attenuated	MMR, varicella, rotavirus, LAIV, yellow fever; not in pregnancy or immunosuppression
Inactivated	Hepatitis A, IPV, rabies; safe in immunosuppression
Subunit/recombinant	Hepatitis B, HPV, recombinant zoster
Toxoid	Td, Tdap; Tdap each pregnancy 27 to 36 weeks
Passive	Immune globulin; immediate, temporary

Worked example

EXAMPLE 3.1 · LOG KILL WITH A WEAKER DRUG

A tumor has 10^{10} cells and each cycle kills 99%. How many remain after three cycles?

STEP 1 · SURVIVORS PER CYCLE

99% killed leaves 1%, one in 100.

STEP 2 · THREE CYCLES

$10^{10} \rightarrow 10^{8} \rightarrow 10^{6} \rightarrow \mathbf{10^{4}}$ (ten thousand) cells.

STEP 3 · MEANING

A scan may look clear long before the tumor is gone.

TRAPS PEOPLE FALL INTO

- **Daily methotrexate for RA.** It is weekly.
- **Antiemetics only after vomiting.** Give them before chemotherapy.
- **Rectal temperature in neutropenia.** Never.
- **Confusing red urine.** Doxorubicin harmless; cyclophosphamide pink urine is cystitis.

Chapter 3 self-test · six items

1. Which mTOR inhibitor effect is the reason it is often held right after surgery?

A. Impaired wound healing
B. Permanent tooth staining
C. Gum tissue overgrowth
D. Severe hyperkalemia

A. Impaired wound healing Sirolimus and everolimus slow wound healing, so they are typically held early post-op.

2. Which vaccine type is safe in significant immunosuppression?

A. MMR
B. Varicella (live)
C. Intranasal influenza
D. Recombinant zoster

D. Recombinant zoster Recombinant zoster is a subunit vaccine. The others are live.

3. Before trastuzumab, which baseline test matters most?

A. A baseline serum lithium level
B. Pulmonary function testing first
C. Left ventricular ejection fraction
D. A full audiology hearing exam

C. Left ventricular ejection fraction Trastuzumab causes cardiotoxicity, usually reversible, so LVEF is monitored.

4. A patient on vincristine reports no bowel movement for 4 days. Why does it matter?

A. It shows tumor lysis syndrome has begun
B. Autonomic neuropathy can progress to ileus
C. It means the drug is not working at all
D. It signals hemorrhagic cystitis is starting

B. Autonomic neuropathy can progress to ileus Vincristine causes neuropathy and constipation that can become ileus; a bowel regimen goes with the drug.

5. Which platelet count brings spontaneous bleeding risk?

A. Under 150,000/mm^3
B. Under 100,000/mm^3
C. Under 400,000/mm^3
D. Under 20,000/mm^3

D. Under 20,000/mm^3 Bleeding precautions start below about 50,000; spontaneous bleeding risk rises below 20,000.

6. Which mouthwash advice fits a patient with mucositis?

A. No rinsing of any kind at all
B. Saline or bicarbonate rinses
C. Alcohol-based mouthwash
D. Hydrogen peroxide gargles

B. Saline or bicarbonate rinses Saline or bicarbonate rinses and a soft brush help. Alcohol mouthwash burns damaged mucosa.

CHAPTER 4

Pain and Substance Use

Read it in full: **Chapter 4 in the textbook**. Practice it in the lab: **Where Analgesics Break the Pain Pathway** and **Substance Use & Withdrawal**.

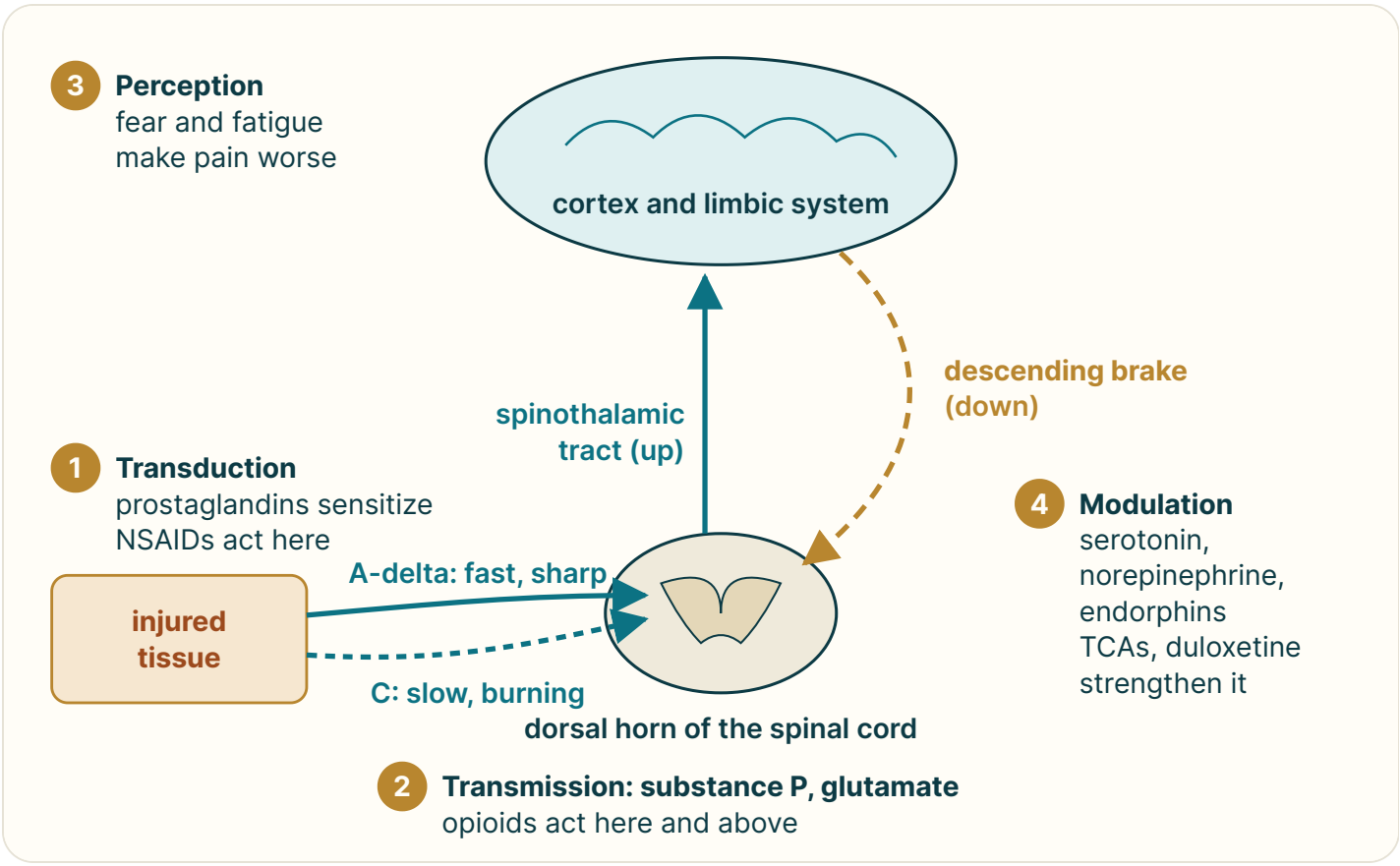
What to know

Nociception: transduction (NSAIDs), transmission and perception (opioids), modulation (antidepressant adjuvants). Neuropathic pain (burning, shooting) needs adjuvants, not more opioid. Self-report is the gold standard; vital signs are not a pain scale. Match the scale: FACES, FLACC, CRIES, PAINAD, CPOT. Reassess 15 to 30 minutes after IV and about 60 after oral.

Non-opioids have a **ceiling**. Acetaminophen: no anti-inflammatory or antiplatelet effect; 4 g/day healthy adult max, 2 g or less with liver risk; antidote acetylcysteine within 8 to 10 h. NSAIDs: COX-1 explains GI bleed, AKI (triple whammy) and platelet effects; avoid from 20 weeks of pregnancy; ketorolac 5 days; celecoxib sulfa; aspirin Reye syndrome and tinnitus.

Mu agonism gives analgesia and respiratory depression together. **Sedation comes first**. Naloxone works in 1 to 2 minutes but lasts 30 to 90; watch for re-sedation and titrate to breathing. Constipation never gets tolerance. Morphine accumulates in kidney failure; codeine and tramadol are CYP2D6 prodrugs, not under 12; methadone prolongs QT; fentanyl patches are for opioid-tolerant patients and heat raises absorption. Tolerance and dependence are not addiction.

Gabapentinoids are renally dosed and tapered. Triptans abort migraine at the first sign and are contraindicated in coronary disease. Alcohol withdrawal: seizures 12 to 48 h, DTs 48 to 96 h; benzodiazepines with CIWA-Ar; thiamine before glucose. Opioid withdrawal is rarely fatal; buprenorphine waits for moderate withdrawal. Benzodiazepine withdrawal can kill; taper.



Four steps, four kinds of analgesic. NSAIDs stop sensitization in the tissue, opioids damp transmission in the cord and brain, and antidepressant adjuvants strengthen the descending brake.

LOCK THESE IN

- Sedation precedes respiratory depression.
- Naloxone lasts 30 to 90 min.
- Acetaminophen 4 g/day; acetylcysteine.
- NSAID + ACE inhibitor + diuretic = AKI.
- Laxative with the first opioid.
- Thiamine before glucose.

Chapter 4 key drugs

Drug	Key point
Acetaminophen	Hidden in combinations; acetylcysteine
Ketorolac	5 days total
Morphine	Renal accumulation
Buprenorphine	Partial agonist; can precipitate withdrawal
Naloxone	Shorter acting than opioids
Sumatriptan	First sign; not with CAD

Withdrawal at a glance

Substance	Danger and treatment
Alcohol	Can be fatal; benzodiazepines, thiamine first
Opioids	Rarely fatal; buprenorphine, methadone, naltrexone
Benzodiazepines	Can be fatal; slow taper
Stimulants	Crash; screen for suicide risk
Nicotine	NRT, varenicline, bupropion

Worked example

EXAMPLE 4.1 · A 24 HOUR ACETAMINOPHEN COUNT

Ms. Cho takes hydrocodone/acetaminophen tablets with 325 mg acetaminophen, one every 4 hours (6 a day), plus 500 mg tablets for headache 4 times a day. She drinks heavily. What is her total and is it safe? (Practice numbers.)

STEP 1 · COMBINATION TABLETS

6 × 325 = 1,950 mg.

STEP 2 · HEADACHE TABLETS

4 × 500 = 2,000 mg.

STEP 3 · TOTAL

1,950 + 2,000 = **3,950 mg**.

STEP 4 · JUDGE IT

Just under 4 g, above the 3 g many teach, and nearly double the 2 g or less advised with heavy alcohol use. Notify and teach.

TRAPS PEOPLE FALL INTO

- **Waiting for a low respiratory rate.** Act on sedation.
- **More ibuprofen for poor relief.** Ceiling effect.
- **Opioids for neuropathic pain first.** Adjuvants first.
- **Dependence called addiction.** Different things.

Chapter 4 self-test · six items

1. Which scale fits a patient with advanced dementia?

A. PAINAD
B. CRIES
C. Wong-Baker FACES
D. Numeric 0 to 10

A. PAINAD PAINAD observes breathing, vocalization, expression, body language and consolability.

2. Why is ketorolac limited to 5 days?

A. It is converted into acetaminophen
B. It loses all of its effect after 5 days
C. High GI bleeding and kidney injury risk
D. It causes opioid dependence over time

C. High GI bleeding and kidney injury risk Ketorolac is a potent NSAID with brutal GI and renal risk.

3. Which opioid is preferred over morphine as kidney function falls?

A. Oxycodone ER
B. Codeine
C. Meperidine
D. Hydromorphone

D. Hydromorphone Morphine's active metabolite accumulates in renal impairment; hydromorphone or fentanyl is usually preferred.

4. A fentanyl patch user has a fever of 39°C. What is the concern?

A. The patch stops working fully
B. Faster absorption and overdose
C. A local skin allergy only
D. Opioid withdrawal symptoms

B. Faster absorption and overdose Heat speeds transdermal absorption, raising overdose risk.

5. Which medication helps maintain abstinence by blocking the reward of alcohol and opioids?

A. Naltrexone
B. Lorazepam
C. Clonidine
D. Disulfiram

A. Naltrexone Naltrexone is an opioid antagonist that blunts craving and reward.

6. Which withdrawal is least likely to be physically dangerous but carries suicide risk?

A. Barbiturate withdrawal
B. Benzodiazepine withdrawal
C. Stimulant withdrawal
D. Alcohol withdrawal

C. Stimulant withdrawal The stimulant crash brings dysphoria and depression; screen for suicidality.

CHAPTER 5

Mental Health, Antiepileptic and Anesthetic Drugs

Read it in full: **Chapter 5 in the textbook**. Practice it in the lab: **Neurotransmitters & Drug Targets** and **Anesthetics**.

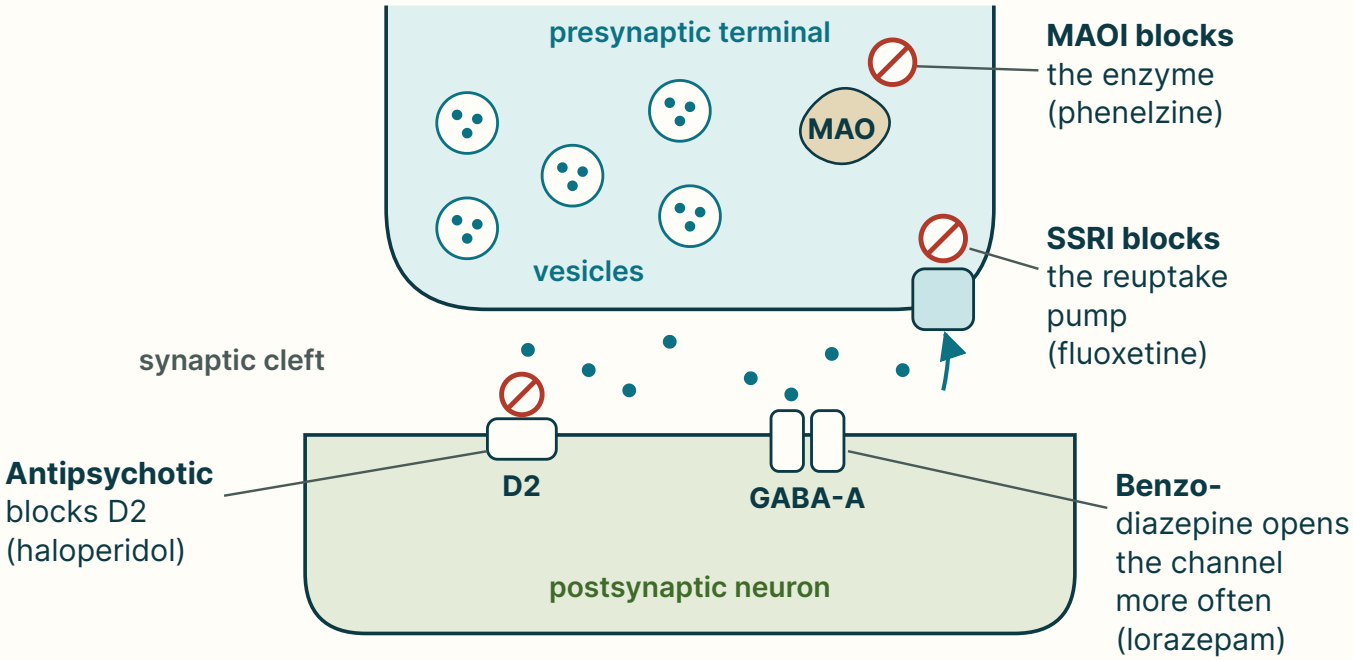
What to know

Drugs act on a pump, enzyme, receptor or channel. SSRIs are first-line; mood lifts in 2 to 6 weeks; suicidality warning under 25; taper to stop. SNRIs raise BP. TCAs are lethal in overdose (wide QRS, sodium bicarbonate). MAOIs need a tyramine-free diet and washouts (2 weeks; 5 after fluoxetine). Serotonin syndrome: hours, clonus, hyperreflexia; stop, cool, benzodiazepines, cyproheptadine.

Lithium 0.6 to 1.2 mEq/L; over 1.5 toxic; troughs 12 hours after the evening dose; dehydration, low salt, NSAIDs, thiazides and ACE inhibitors raise it. Typicals cause EPS (dystonia, akathisia, parkinsonism, tardive dyskinesia) and NMS (fever, rigidity, high CK; dantrolene). Atypicals cause metabolic syndrome; clozapine needs ANC monitoring. Benzodiazepines are dangerous with opioids and alcohol and are tapered.

AEDs slow sodium channels, block T-type calcium (absence), boost GABA or bind SV2A (levetiracetam). Never stop abruptly. Phenytoin 10 to 20 mcg/mL (saline only, slow push, gum overgrowth, believe the patient with low albumin); valproate 50 to 100 (liver, pancreas, neural tube defects); carbamazepine and lamotrigine: SJS, report rash today. Status epilepticus over 5 minutes: IV benzodiazepine first.

General anesthesia removes the brain; local anesthesia cuts the nerve. Neuromuscular blockers do not sedate. Stage II is the danger on induction and emergence. Malignant hyperthermia: rising end-tidal CO_2, dantrolene. LAST: circumoral numbness, metallic taste, tinnitus, then seizures and arrest; lipid emulsion.



Name the step, predict the effect. Each drug blocks a pump, an enzyme or a receptor, or tunes a channel, at the same synapse.

LOCK THESE IN

- SSRIs: 2 to 6 weeks; taper.
- Serotonin syndrome fast and jumpy; NMS slow and stiff.
- Lithium 0.6 to 1.2; over 1.5 toxic.
- Clozapine: ANC.
- Never stop an AED abruptly; status over 5 min.
- MH: dantrolene; LAST: lipid emulsion.

Chapter 5 levels and antidotes

Item	Value or treatment
Lithium	0.6 to 1.2 mEq/L
Phenytoin	10 to 20 mcg/mL
Valproate	50 to 100 mcg/mL
TCA overdose	Sodium bicarbonate
Acute dystonia	Diphenhydramine or benztropine
Malignant hyperthermia	Dantrolene

EPS timeline

Effect	When and action
Acute dystonia	Hours to days; airway, then anticholinergic
Akathisia	Days to weeks; do not raise the dose
Parkinsonism	Weeks; benztropine, fall risk
Tardive dyskinesia	Months to years; often irreversible; AIMS

Worked example

EXAMPLE 5.1 · WHEN A SEIZURE BECOMES STATUS

A patient begins a generalized seizure at 1402. At 1407 she is still seizing. What is this and what comes first?

STEP 1 · TIME IT

1407 − 1402 = **5 minutes**.

STEP 2 · NAME IT

A generalized seizure over 5 minutes is status epilepticus.

STEP 3 · TREAT

IV benzodiazepine first, then a loading agent such as fosphenytoin, valproate or levetiracetam. Protect the head, side-lying, nothing in the mouth.

TRAPS PEOPLE FALL INTO

- **Raising the antipsychotic for restlessness.** It may be akathisia.
- **IV phenytoin in dextrose.** Saline only.
- **Fast lamotrigine titration.** SJS risk.
- **Standing a post-spinal patient early.** Feet recover last.

Chapter 5 self-test · six items

1. Which antidepressant is a poor choice for a patient at high suicide risk because of overdose lethality?

A. Amitriptyline
B. Escitalopram
C. Bupropion
D. Sertraline

A. Amitriptyline TCAs block cardiac sodium channels in overdose; a week's supply can be fatal.

2. Which atypical antidepressant avoids sexual dysfunction but lowers the seizure threshold?

A. Mirtazapine
B. Paroxetine
C. Venlafaxine
D. Bupropion

D. Bupropion Bupropion is avoided in seizure disorders and eating disorders.

3. Which antipsychotic is a D2 partial agonist that rarely raises prolactin?

A. Haloperidol
B. Chlorpromazine
C. Aripiprazole
D. Risperidone

C. Aripiprazole Aripiprazole's partial agonism makes it less sedating and rarely raises prolactin.

4. Which AED works only for absence seizures?

A. Phenytoin
B. Ethosuximide
C. Valproate
D. Levetiracetam

B. Ethosuximide Ethosuximide blocks T-type calcium channels in the thalamus.

5. Which carbamazepine effect requires sodium monitoring?

A. Hyponatremia from SIADH
B. Hypercalcemia from bone
C. Hypernatremia from DI
D. Hyperkalemia from renal loss

A. Hyponatremia from SIADH Carbamazepine can cause SIADH and low sodium.

6. A benzocaine spray user has cyanosis with a normal PaO_2 and chocolate-brown blood. What is likely?

A. Anaphylaxis
B. LAST
C. Methemoglobinemia
D. Malignant hyperthermia

C. Methemoglobinemia Benzocaine can cause methemoglobinemia, treated with methylene blue.

CHAPTER 6

Bone and Skin Drugs

Read it in full: **Chapter 6 in the textbook**. Practice it in the lab: **Calcium, Vitamin D & the Bone Axis** and **Burn & Wound Antimicrobials**.

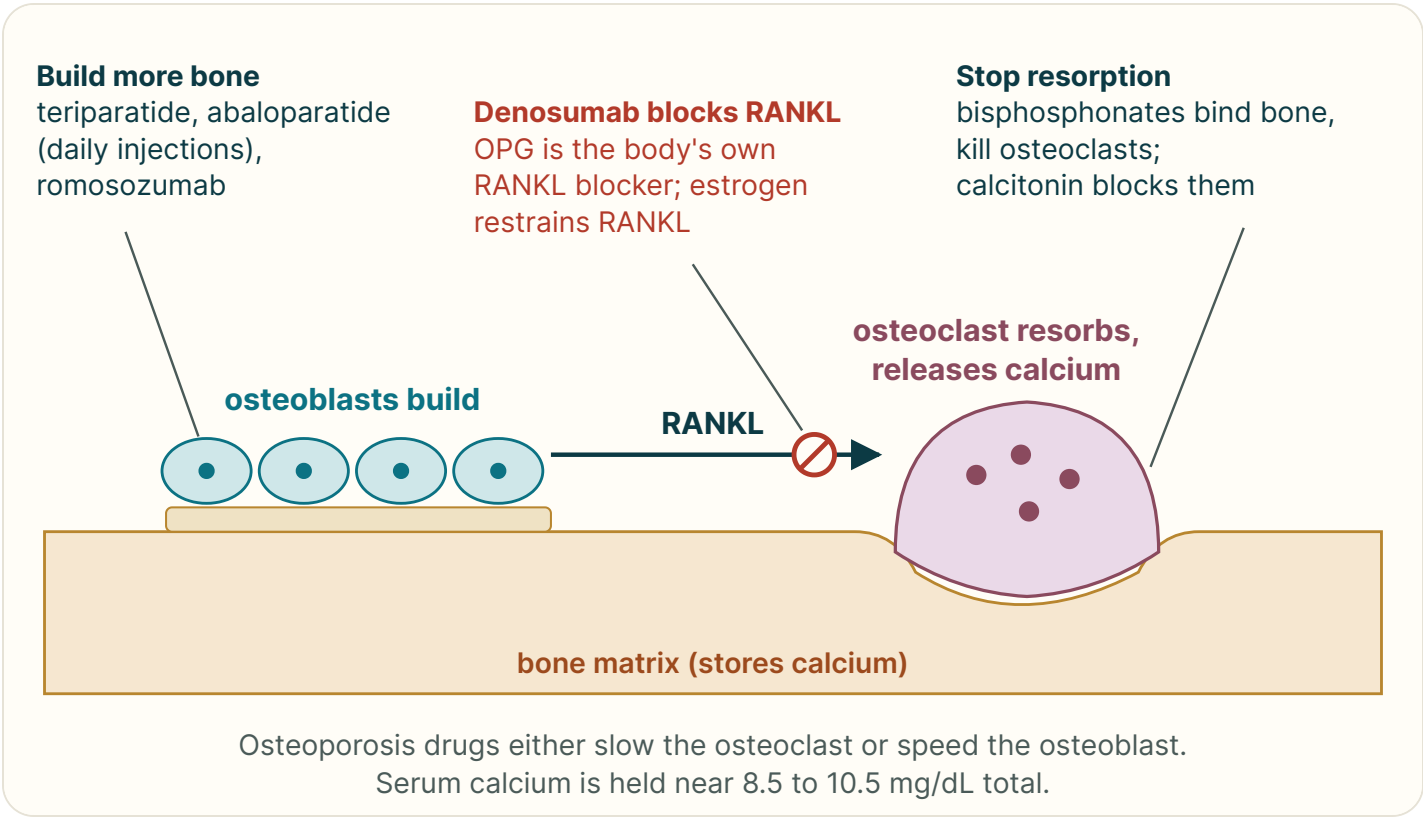
What to know

PTH raises calcium; calcitonin lowers it; vitamin D is activated in liver then kidney, so kidney failure needs calcitriol. Calcium carbonate is about 40% elemental and needs acid and food; citrate is about 21% and does not. About 500 to 600 mg absorbs per dose. IV calcium goes slowly on a monitor, especially with digoxin; gluconate peripheral, chloride central; never with bicarbonate or phosphate.

Bisphosphonates: empty stomach, plain water, upright 30 minutes (ibandronate 60). Teach thigh pain (atypical fracture) and dental work first (ONJ). Denosumab: never stop without a replacement; hypocalcemia warning in advanced CKD. Raloxifene: VTE, stop 72 h before immobility. Teriparatide, abaloparatide and romosozumab build bone; romosozumab has MI and stroke warnings.

Gout: flare drugs (colchicine; GI upset means stop; CYP3A4 and P-gp interactions) versus urate lowering (allopurinol to under 6 mg/dL; rash means stop; not with azathioprine). Methotrexate weekly with folic acid; mouth ulcers first; no pregnancy. Biologics need TB and hepatitis B screening and no live vaccines. Hydroxychloroquine needs a baseline eye exam, then yearly screening from year 5.

Isotretinoin: iPLEDGE, two contraceptives, monthly tests, no blood donation, never with a tetracycline. Topical steroid strength: potency, vehicle (ointment strongest), quantity (fingertip unit about 0.5 g covers two palms) and occlusion; potent ones off face and folds. Burns: silver sulfadiazine drops WBC, mafenide drops pH (painful, penetrates cartilage), silver nitrate drops sodium (keep wet, stains). Collagenase is inactivated by silver and iodine.



Osteoporosis drugs either slow the osteoclast or speed the osteoblast. Serum calcium is held near 8.5 to 10.5 mg/dL total.

Slow the osteoclast or speed the osteoblast. Bisphosphonates, denosumab and calcitonin slow resorption; teriparatide, abaloparatide and romosozumab build bone.

LOCK THESE IN

- Kidney failure: calcitriol.
- Carbonate with food; citrate without acid.
- Alendronate: upright 30 min.
- Denosumab: no abrupt stop.
- Colchicine GI upset: stop. Allopurinol rash: stop.
- SSD WBC; mafenide pH; silver nitrate Na.

Chapter 6 essentials

Drug	Rule
Calcium chloride	Central line; vesicant
Zoledronic acid	Renal check; flu-like reaction
Raloxifene	Stop 72 h before immobility
Allopurinol	Urate under 6 mg/dL
Isotretinoin	iPLEDGE; no tetracycline
Calcipotriene	Weekly maximum; hypercalcemia

Calcium signs

State	Signs
Hypocalcemia	Perioral tingling, cramps, Chvostek, Trousseau, tetany, long QT
Hypercalcemia	Stones, bones, groans, thrones, psychiatric overtones; short QT

Worked example

EXAMPLE 6.1 · CALCIUM CITRATE TABLETS

A calcium citrate tablet holds 1,500 mg of salt. Using the book's 21%, how much elemental calcium does it supply, and is one tablet within the per-dose absorption limit?

STEP 1 · MULTIPLY

1,500 × 0.21 = **315 mg** elemental.

STEP 2 · COMPARE

315 mg is under the 500 to 600 mg absorbed at one time.

WHY CITRATE

It dissolves without acid, so it suits a patient on a PPI.

TRAPS PEOPLE FALL INTO

- **Calcium carbonate with a PPI.** Use citrate.
- **Alendronate then back to bed.** Upright 30 minutes.
- **Allopurinol for an acute flare.** It does not treat the flare.
- **Silver products with collagenase.** They inactivate it.

Chapter 6 self-test · six items

1. Which sign suggests hypocalcemia?

A. Kidney stones along with constipation
B. Lethargy with a heavy urine output
C. Carpal spasm when a BP cuff is inflated
D. A shortened QT interval on the ECG

C. Carpal spasm when a BP cuff is inflated Trousseau's sign is carpal spasm from cuff inflation. The others point to hypercalcemia.

2. Which osteoporosis drug builds bone with a daily injection?

A. Teriparatide
B. Raloxifene
C. Alendronate
D. Denosumab

A. Teriparatide Teriparatide is an anabolic PTH analog. The others slow resorption.

3. Which drug interaction with colchicine can be fatal in kidney impairment?

A. Famotidine
B. Clarithromycin
C. Acetaminophen
D. Amoxicillin

B. Clarithromycin Clarithromycin inhibits CYP3A4 and P-gp, raising colchicine toward marrow suppression and myopathy.

4. What eye monitoring does hydroxychloroquine need?

A. Monthly intraocular pressure only
B. No eye monitoring at all
C. An eye exam only if headaches occur
D. Baseline eye exam, then yearly from year 5

D. Baseline eye exam, then yearly from year 5 It can deposit in the retina; patients report vision or color changes.

5. Which vehicle makes the same topical steroid most potent?

A. Ointment
B. Cream
C. Lotion
D. Foam

A. Ointment Ointments occlude and hydrate, increasing penetration.

6. Which burn agent is chosen for a burned ear because it penetrates cartilage?

A. Bacitracin
B. Silver sulfadiazine
C. Silver nitrate
D. Mafenide acetate

D. Mafenide acetate Mafenide penetrates eschar and cartilage but is painful and causes acidosis.

CHAPTER 7

Autonomic Drugs

Read it in full: **Chapter 7 in the textbook**. Practice it in the lab: **The Autonomic Switchboard** and **Wet vs Dry**.

What to know

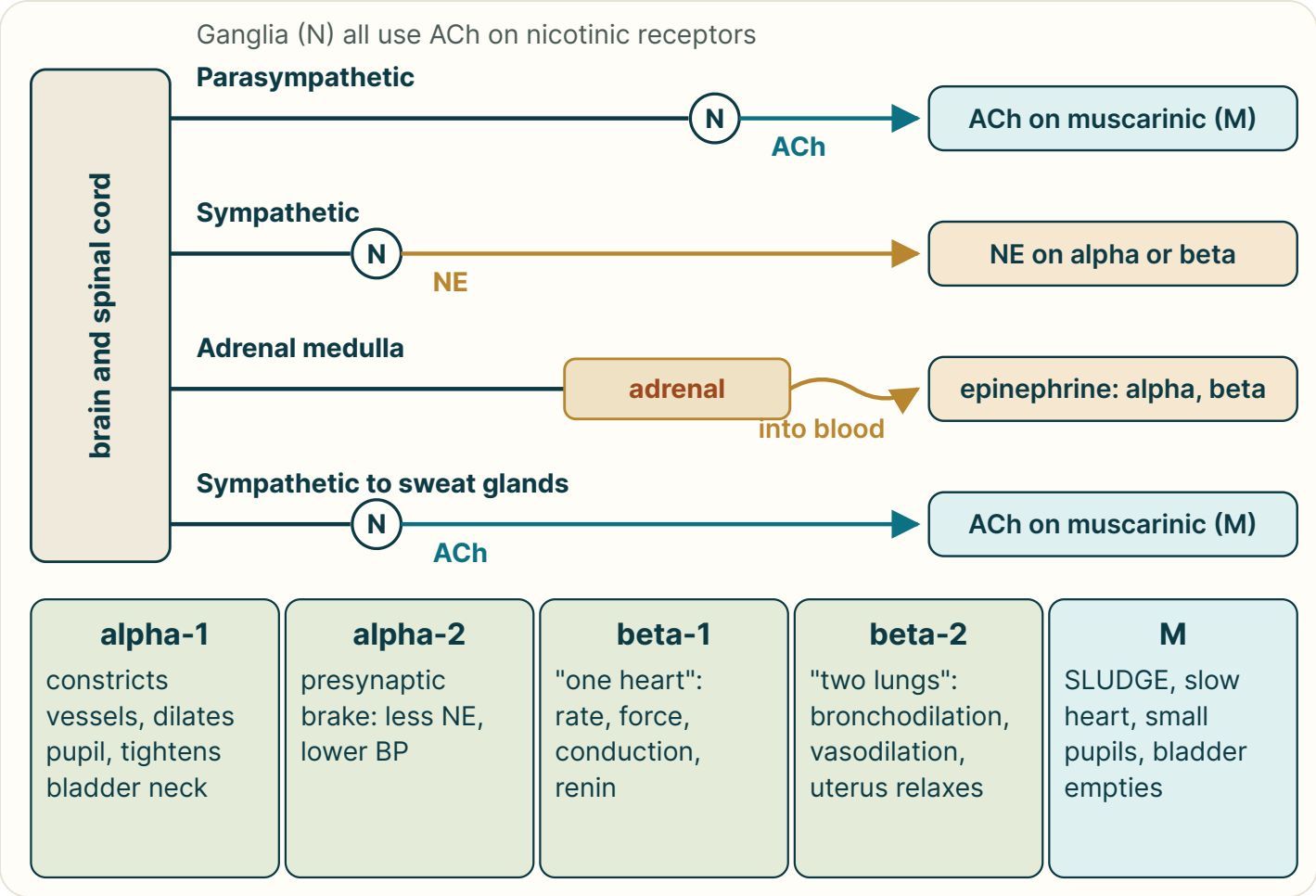
Sympathetic is fight or flight; parasympathetic is rest and digest. All ganglia are nicotinic; parasympathetic organs are muscarinic; sweat glands are sympathetic but cholinergic. Beta-1 heart, beta-2 lungs, alpha-1 vessels, alpha-2 presynaptic brake.

Epinephrine is dose dependent and first-line in anaphylaxis: 0.3 to 0.5 mg IM of 1 mg/mL into the lateral thigh, repeat every 5 to 15 minutes; child 0.01 mg/kg. The 0.1 mg/mL syringe is for IV arrest. Vasopressor extravasation: phentolamine. Albuterol causes tremor, tachycardia, low K+. Clonidine lowers BP and rebounds if stopped.

Alpha-1 blockers cause first-dose syncope (bedtime). Beta blockers: never stop abruptly, mask hypoglycemia except sweating, hold for HR under 60; HFrEF benefit only with metoprolol succinate, bisoprolol and carvedilol; nonselective ones risk bronchospasm; overdose antidote glucagon. Timolol drops act systemically.

Bethanechol for non-obstructive retention; pyridostigmine for myasthenia; cholinergic crisis has SLUDGE, myasthenic crisis does not; organophosphates need atropine plus pralidoxime. Anticholinergics: dry, red, blind, mad, hot; burden stacks in older adults; physostigmine never

with a TCA. Succinylcholine has no reversal and risks hyperkalemia and MH; non-depolarizers reverse with neostigmine plus glycopyrrolate or sugammadex; monitor train-of-four; paralysis is not sedation.



The receptor map. Know the transmitter at each junction and what each receptor does, and every autonomic drug follows: blocking one division looks like stimulating the other.

LOCK THESE IN

- One heart, two lungs.
- Anaphylaxis: epinephrine IM, lateral thigh.
- Phentolamine for extravasation; glucagon for beta blocker overdose.
- Never stop beta blockers or clonidine abruptly.
- Atropine + pralidoxime for organophosphates.
- Succinylcholine: no reversal.

Chapter 7 receptor map

Receptor	Effect when stimulated
Alpha-1	Vasoconstriction, mydriasis, retention
Alpha-2	Less norepinephrine, lower BP
Beta-1	Faster, stronger heart; renin
Beta-2	Bronchodilation, vasodilation
Muscarinic	SLUDGE, bradycardia, miosis
Nicotinic NM	Skeletal muscle contraction

Blockers compared

Feature	Succinylcholine	Rocuronium
Mechanism	Depolarizing agonist	Competitive antagonist
Fasciculations	Yes	No
Reversal	None	Neostigmine + glycopyrrolate; sugammadex
Key danger	Hyperkalemia, MH	Prolonged weakness

Worked example

EXAMPLE 7.1 · THE TENFOLD SYRINGE ERROR

An adult needs 0.3 mg IM epinephrine. What volume is drawn from the 1 mg/mL vial, and what volume would the 0.1 mg/mL syringe need?

STEP 1 · 1 MG/ML

0.3 ÷ 1 = **0.3 mL**.

STEP 2 · 0.1 MG/ML

0.3 ÷ 0.1 = **3 mL**, ten times the volume.

THE LESSON

The 0.1 mg/mL product is the IV arrest concentration. Verify the concentration with a double-check.

TRAPS PEOPLE FALL INTO

- **Antihistamine first in anaphylaxis.** Epinephrine first.
- **Any beta blocker for HFrEF.** Only three agents.
- **Physostigmine with a TCA.** Contraindicated.
- **Neostigmine for succinylcholine.** It prolongs the block.

Chapter 7 self-test · six items

1. Which drug is the first-line vasopressor in septic shock?

A. Isoproterenol
B. Norepinephrine
C. Phenylephrine
D. Dobutamine

B. Norepinephrine Norepinephrine is first-line; watch the site for extravasation.

2. A patient starting tamsulosin is scheduled for cataract surgery. What must be shared?

A. Risk of floppy iris syndrome
B. Risk of severe hypoglycemia
C. Risk of permanent tooth staining
D. Risk of orange-colored urine

A. Risk of floppy iris syndrome Alpha blockers relax the iris dilator, complicating cataract surgery.

3. Which beta blocker blocks beta-1, beta-2 and alpha-1?

A. Bisoprolol
B. Atenolol
C. Metoprolol
D. Carvedilol

D. Carvedilol Carvedilol (and labetalol) add alpha-1 blockade, raising orthostasis.

4. Which drug treats non-obstructive urinary retention?

A. Oxybutynin
B. Atropine
C. Bethanechol
D. Tamsulosin

C. Bethanechol Bethanechol stimulates the detrusor; never with an obstruction.

5. An 80-year-old on diphenhydramine, oxybutynin and a TCA becomes confused with retention. What is this?

A. Myasthenic crisis now
B. Cholinergic crisis
C. Serotonin syndrome
D. Anticholinergic burden

D. Anticholinergic burden Antimuscarinic activity stacks across classes.

6. Which is true of rocuronium blockade?

A. It has no reversal agent at all
B. It causes fasciculations at first
C. It can be reversed with sugammadex
D. It sedates the patient deeply too

C. It can be reversed with sugammadex Sugammadex encapsulates rocuronium. Non-depolarizers cause no fasciculations and give no sedation.

CHAPTER 8

Endocrine Drugs

Read it in full: **Chapter 8 in the textbook**. Practice it in the lab: **The Axis & the Off-Switch** and **Thyroid Balance**.

What to know

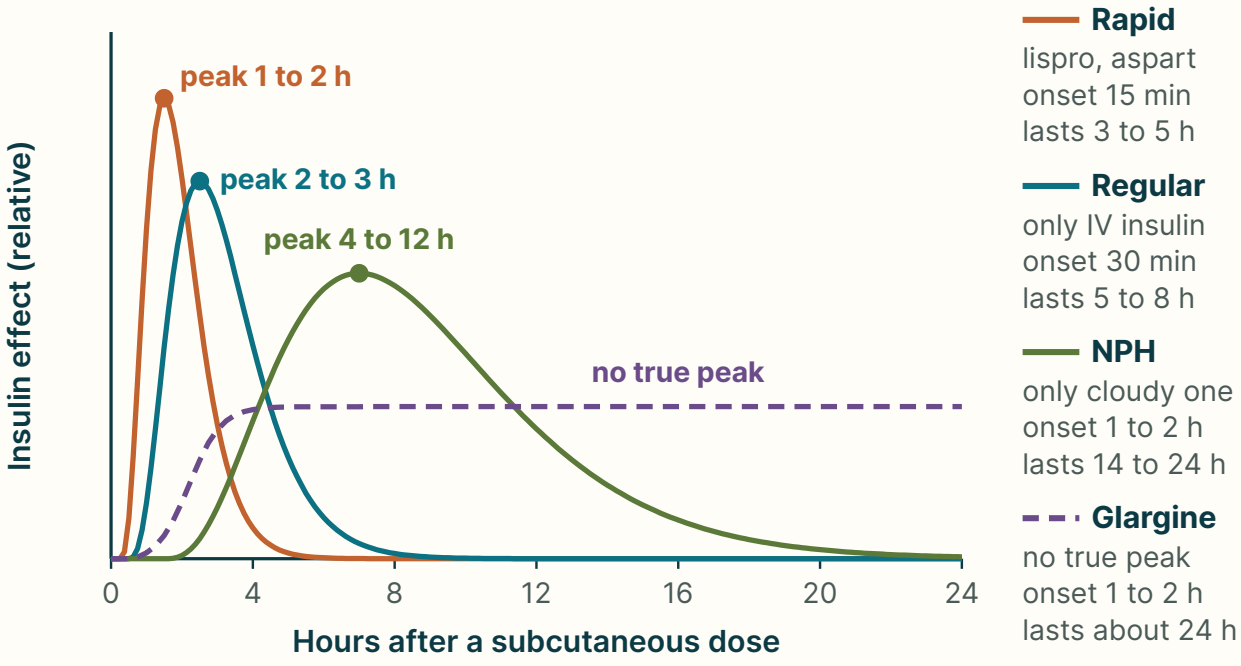
Peptides (insulin) are digested and injected; steroids and thyroid hormone act slowly on genes and can be swallowed. **Negative feedback** cannot tell your hormone from the patient's own, so exogenous steroids suppress the adrenal axis and must be tapered after more than 2 to 3 weeks. Desmopressin's danger is hyponatremia; watch sodium and weight.

Levothyroxine: empty stomach 30 to 60 minutes before breakfast, binders 4 hours apart, TSH 6 to 8 weeks after a change, start low in older and cardiac patients, lifelong. Methimazole first-line; PTU for first trimester and thyroid storm with a liver warning; both cause agranulocytosis, so sore throat and fever mean hold and CBC.

Hydrocortisone 20 = prednisone 5 = methylprednisolone 4 = dexamethasone 0.75 mg. Steroid effects: high glucose, infection with masked signs, bone loss, cushingoid changes, mood, ulcer, fluid retention, low K+. Abrupt stop causes adrenal crisis; increase doses during stress.

Insulin is high-alert. Peaks: rapid 1 to 2 h, regular 2 to 3 h (the only IV insulin), NPH 4 to 12 h (cloudy, roll), glargine and detemir no peak (never mix). Clear before cloudy. Hypoglycemia

under 70: rule of 15 if awake; D50 or glucagon if not. Metformin: no lows alone, eGFR under 30 avoid, lactic acidosis. Sulfonylureas cause lows; pioglitazone heart failure; GLP-1 C-cell warning; SGLT2 euglycemic DKA; acarbose lows need glucose.



Insulin peaks predict hypoglycemia. Match rapid insulin to the meal tray, and expect lows at each product's peak; glargine is flat basal coverage.

LOCK THESE IN

- Taper steroids after 2 to 3 weeks.
- Levothyroxine before breakfast; binders 4 h.
- Thionamide sore throat: hold, CBC.
- Regular is the only IV insulin.
- Rule of 15.
- Metformin: no lows alone.

Chapter 8 insulin peaks

Insulin	Peak
Lispro, aspart	1 to 2 h
Regular	2 to 3 h
NPH	4 to 12 h
Glargine, detemir	No true peak
Degludec	No peak; over 42 h duration
70/30	Both profiles

Oral agents: one alert each

Class	Alert
Metformin	Lactic acidosis; eGFR under 30 avoid
Sulfonylurea	Hypoglycemia
Pioglitazone	Heart failure
GLP-1 agonist	Nausea; thyroid C-cell warning
SGLT2 inhibitor	Genital infections; euglycemic DKA
Acarbose	Treat lows with glucose

Worked example

EXAMPLE 8.1 · A REGULAR INSULIN PEAK

Regular insulin is given at 0700 for an 0730 breakfast. When is the hypoglycemia risk highest?

STEP 1 · APPLY THE PEAK

2 to 3 h after 0700: **0900 to 1000**.

STEP 2 · CHECK TIMING

Regular is given about 30 minutes before the meal, which fits an 0730 tray.

STEP 3 · PLAN

Check glucose around the peak; know the rule of 15.

TRAPS PEOPLE FALL INTO

- **Stopping prednisone when symptoms resolve.** Taper.
- **Shaking NPH.** Roll it.
- **Mixing glargine.** Never mix.
- **Normal glucose rules out DKA on an SGLT2 inhibitor.** Euglycemic DKA exists.

Chapter 8 self-test · six items

1. Which test best judges a levothyroxine dose?

A. Hemoglobin A1C
B. Serum cortisol
C. Serum glucose
D. Serum TSH level

D. Serum TSH level TSH is the pituitary's verdict on the dose, checked 6 to 8 weeks after a change.

2. Which hormone drug is used for variceal bleeding and acromegaly?

A. Somatropin
B. Octreotide
C. Cabergoline
D. Desmopressin

B. Octreotide Octreotide is a somatostatin analog; watch glucose and gallstones.

3. Why might a patient on chronic prednisone need a higher dose before surgery?

A. A suppressed adrenal gland cannot surge cortisol
B. Surgery speeds up how fast steroids absorb
C. Anesthesia blocks the steroid receptors
D. Extra steroid prevents every wound infection

A. A suppressed adrenal gland cannot surge cortisol Stress dosing covers the cortisol surge the suppressed gland cannot make.

4. Which insulin is cloudy?

A. Insulin glargine
B. Insulin aspart
C. NPH (isophane)
D. Regular (human)

C. NPH (isophane) NPH is the only cloudy insulin; roll it gently.

5. Which class carries a boxed warning for heart failure?

A. Glipizide
B. Pioglitazone
C. Metformin
D. Sitagliptin

B. Pioglitazone Thiazolidinediones cause fluid retention and carry a heart failure warning.

6. Why does glucagon fail in a patient with chronic alcohol use and starvation?

A. No liver glycogen to release
B. Alcohol blocks its receptor
C. It raises insulin levels instead
D. It works only through an IV

A. No liver glycogen to release Glucagon works by emptying liver glycogen. Without stores, IV dextrose is needed.

CHAPTER 9

Cardiovascular Drugs I

Read it in full: **Chapter 9 in the textbook**. Practice it in the lab: **Antiplatelets & Thrombolytics** and **Grow It or Give It**.

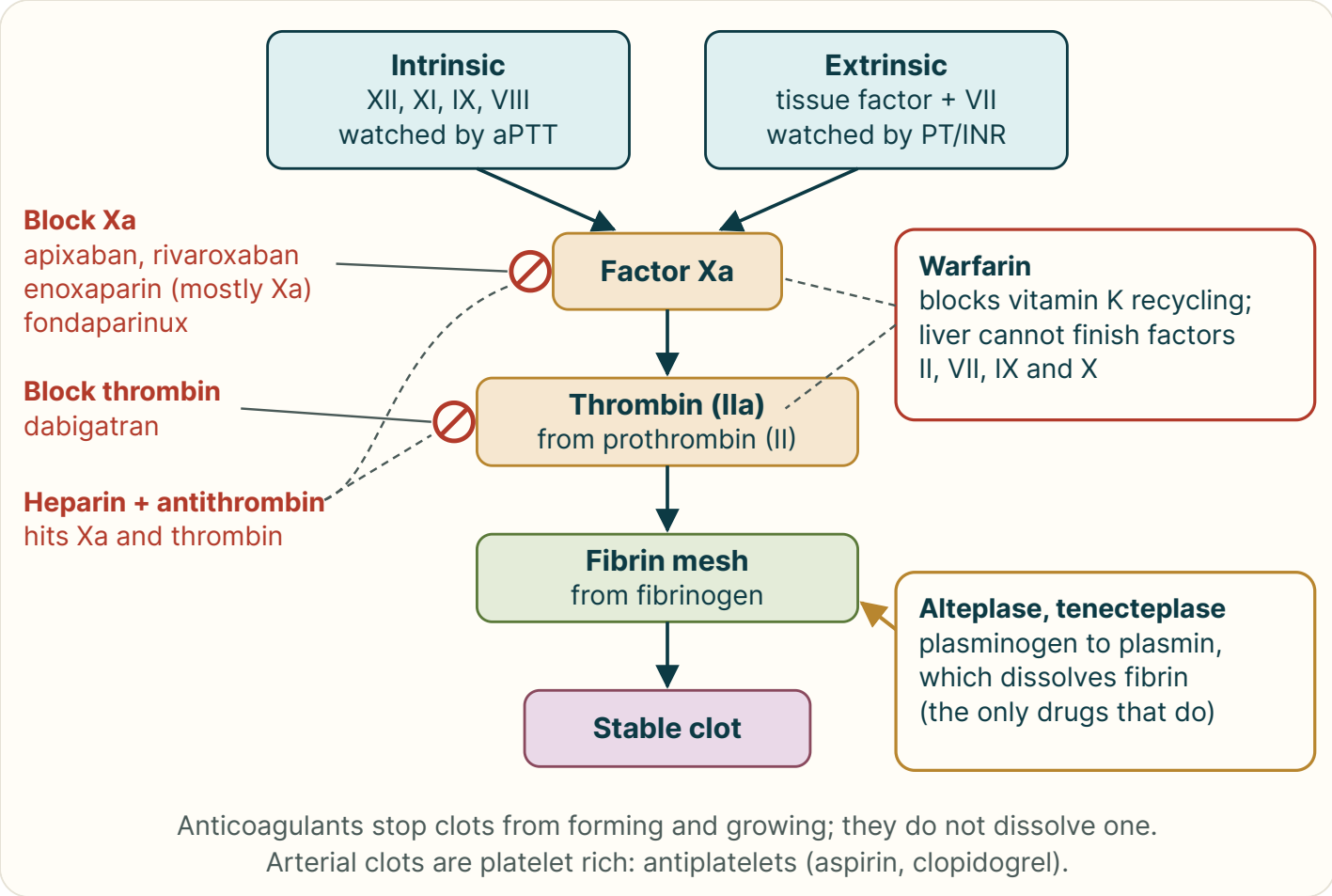
What to know

aPTT monitors heparin (antidote protamine); PT/INR monitors warfarin (INR 2 to 3; vitamin K, plus 4-factor PCC for major bleeding; IV vitamin K no faster than 1 mg/min). HIT drops platelets 50% or more on day 5 to 10 and causes clots; stop all heparin. Enoxaparin: deep SubQ, keep the bubble. Warfarin takes 3 to 5 days, so bridge; teach consistent vitamin K. DOACs: idarucizumab for dabigatran, 4 factor PCC for apixaban and rivaroxaban (andexanet alfa was withdrawn in December 2025).

Arterial clots are platelet-rich (antiplatelets); venous clots fibrin-rich (anticoagulants). Aspirin disables a platelet for 7 to 10 days; chew 162 to 325 mg for suspected MI. Clopidogrel needs CYP2C19; pair with pantoprazole; never stop DAPT after a stent without cardiology. Alteplase: CT first; 3 hours (up to 4.5); lines first; neuro checks.

ESAs: hold above about 11 g/dL; check iron and BP. Filgrastim at least 24 hours after chemo. Transfusion: NS only, two-person check, stay 15 minutes, 4 hour limit; stop first for any reaction; TACO hypertensive, TRALI hypotensive.

BP = CO × SVR. Thiazides: low K+, high glucose and urate. Loops: K+ loss, ototoxic. Spironolactone: high K+. ACE inhibitors: cough, angioedema, high K+, not in pregnancy; ARBs no cough. Amlodipine: ankle edema. Diltiazem and verapamil: bradycardia, constipation. Orthostatic hypotension is a drop of 20 systolic or 10 diastolic within 3 minutes. Ask how many doses were missed.



Every anticoagulant has an address. Xa, thrombin, or the vitamin K factors; only the thrombolytics dissolve fibrin that is already there.

LOCK THESE IN

- Heparin: aPTT, protamine. Warfarin: INR, vitamin K.
- HIT clots; stop all heparin.
- Aspirin lasts 7 to 10 days.
- Alteplase: CT first.
- Transfusion reaction: stop first.
- ACE inhibitor cough; ARB no cough.

Chapter 9 reversal agents

Drug	Reversal
Heparin	Protamine sulfate
Warfarin	Vitamin K; 4-factor PCC
Dabigatran	Idarucizumab
Apixaban, rivaroxaban	4 factor PCC (andexanet withdrawn Dec 2025)
Fondaparinux	None reliable
HIT (alternative)	Argatroban

Blood products

Product	Gives
Packed red cells	Oxygen-carrying capacity
Platelets	Plug; do not refrigerate
Fresh frozen plasma	All clotting factors
Cryoprecipitate	Fibrinogen, VIII, XIII, vWF
Albumin	Volume only

Worked example

EXAMPLE 9.1 · WHEN DOES THE HEPARIN BRIDGE END?

Warfarin and heparin start Monday. INR is 1.6 Wednesday, 2.1 Thursday and 2.4 Friday. When can heparin stop?

STEP 1 · FIND THERAPEUTIC DAYS

2.1 Thursday and 2.4 Friday are both within 2 to 3.

STEP 2 · APPLY THE RULE

Heparin stops once the INR is therapeutic on two consecutive days: **after Friday's result**.

WHY BRIDGE

Warfarin needs 3 to 5 days for old factors to decay.

TRAPS PEOPLE FALL INTO

- **Telling warfarin patients to avoid greens.** Be consistent.
- **Watching HIT overnight.** Stop heparin now.
- **Omeprazole with clopidogrel.** Use pantoprazole.
- **A diuretic for TRALI.** It worsens it.

Chapter 9 self-test · six items

1. A patient on enoxaparin is scheduled for an epidural. What warning applies?

A. Spinal or epidural hematoma
B. Ototoxicity and hearing loss
C. Orange urine and tears
D. Gingival hyperplasia

A. Spinal or epidural hematoma LMWH, fondaparinux and DOACs carry a spinal hematoma warning with neuraxial procedures.

2. Which teaching fits dabigatran?

A. Take it only with vitamin K
B. Check the INR every week
C. Keep it in the original bottle
D. Crush the capsule into food

C. Keep it in the original bottle Dabigatran degrades with moisture; the opened bottle is discarded after 4 months and capsules are never opened.

3. Which antiplatelet is contraindicated after a prior stroke or TIA?

A. Clopidogrel
B. Aspirin
C. Ticagrelor
D. Prasugrel

D. Prasugrel Prasugrel raises intracranial bleeding risk in that group.

4. Which product supplies concentrated fibrinogen?

A. Platelets
B. Cryoprecipitate
C. Albumin
D. Packed red cells

B. Cryoprecipitate Cryoprecipitate is rich in fibrinogen, factor VIII, XIII and vWF.

5. Which antihypertensive should be given at bedtime for the first dose?

A. Chlorthalidone
B. Amlodipine
C. Lisinopril
D. Doxazosin

D. Doxazosin Alpha-1 blockers cause first-dose orthostatic syncope.

6. Which side effect is expected with amlodipine?

A. Constipation
B. Ankle edema
C. Hyperkalemia
D. Dry cough

B. Ankle edema Dihydropyridine vasodilation causes peripheral edema. Cough is ACE inhibitors; constipation is verapamil.

CHAPTER 10

Cardiovascular Drugs II

Read it in full: **Chapter 10 in the textbook**. Practice it in the lab: **Supply vs Demand** and **Heart Failure Drugs, and Why Potassium Rules Digoxin**.

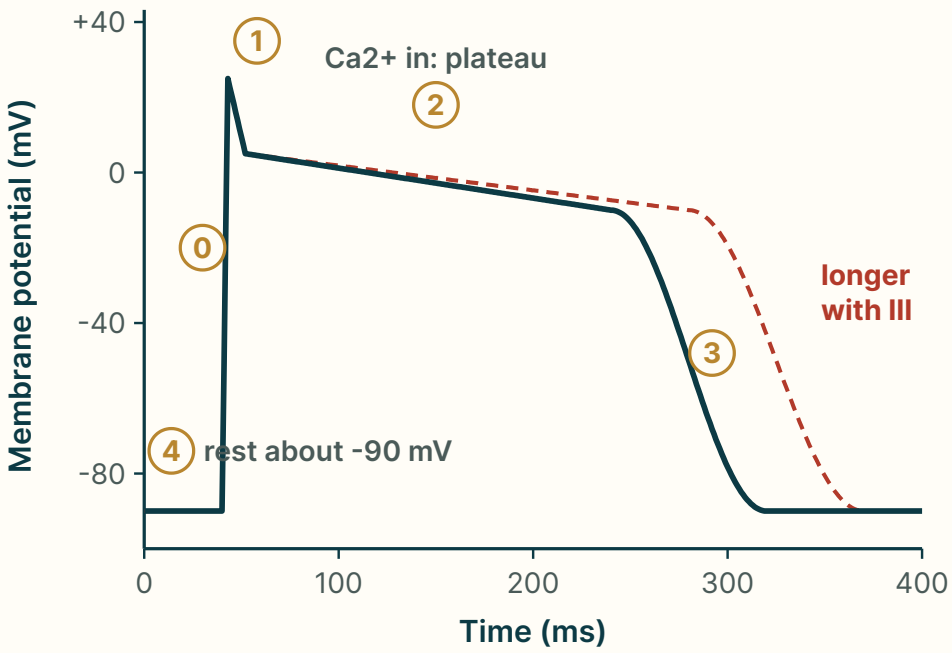
What to know

Statins block HMG-CoA reductase; simvastatin and lovastatin in the evening; CK when muscles hurt; muscle pain with dark urine is rhabdomyolysis. Never gemfibrozil with a statin. Niacin flushing: aspirin 30 minutes before. Bile acid sequestrants: separate other drugs 1 h before or 4 h after.

Nitrates lower preload. SL nitroglycerin: sit, one dose, call 911 at 5 minutes, up to three doses 5 minutes apart; glass bottle; headache expected. No nitrate within 24 h of sildenafil or vardenafil or 48 h of tadalafil. Patches need a 10 to 12 hour break. ACS: chewed aspirin, P2Y12, anticoagulant, beta blocker, high-intensity statin, ACE inhibitor; oxygen only if SpO_2 under 90%.

HFrEF pillars: ARNI/ACEi/ARB (36 hour washout before an ARNI), evidence-based beta blocker, MRA (K+ checks), SGLT2 inhibitor. Diuretics relieve symptoms only; IV furosemide about 20 mg/min max. Digoxin: HF target 0.5 to 0.9 ng/mL; trough at least 6 to 8 h after dose; anorexia first, yellow-green vision; low K+ potentiates; immune Fab antidote; apical pulse a full minute, hold under 60.

Vaughan Williams: I sodium, II beta, III potassium (QT), IV calcium. Amiodarone affects lungs, thyroid, liver, cornea and skin and raises digoxin and warfarin. Adenosine: 6 mg rapid push with a 20 mL flush. Magnesium treats torsades. QTc over 500 or a rise over 60 ms is a call. Daily weight: 2 to 3 lb a day or 5 lb a week means call.



Class I: Na+ block
slows phase 0
wider QRS

Class III: K+ block
lengthens phase 3
longer QT

At the SA and AV nodes
II: beta blockers slow phase 4 and AV conduction
IV: verapamil, diltiazem block the nodal Ca2+ upstroke

Ventricular muscle cell. Every antiarrhythmic is also proarrhythmic: call for a QTc over 500 ms or a rise over 60 ms, and check K+ and Mg2+.

Antiarrhythmics are named for the channel they block. Sodium for phase 0, potassium for phase 3; beta blockers and calcium channel blockers work mainly at the nodes.

LOCK THESE IN

- Rhabdo: muscle pain + dark urine.
- SL NTG: call 911 at 5 min.
- PDE5: 24 h / 48 h nitrate holds.
- Four HFrEF pillars.
- Digoxin: anorexia first; low K+; Fab.
- Magnesium for torsades.

Chapter 10 numbers

Item	Value
Digoxin (HF)	0.5 to 0.9 ng/mL
Apical pulse hold	Under 60 (adult)
QTc alert	Over 500 ms or rise over 60
Nitrate-free interval	10 to 12 h
Weight gain call	2 to 3 lb/day or 5 lb/week
Amiodarone half-life	About 40 to 60 days

Vaughan Williams classes

Class	Channel and example
I	Sodium; procainamide, lidocaine, flecainide
II	Beta; metoprolol, esmolol
III	Potassium; amiodarone, sotalol
IV	Calcium; verapamil, diltiazem
Other	Adenosine; magnesium; atropine

Worked example

EXAMPLE 10.1 · A HEART FAILURE WEIGHT LOG

Mr. Barros weighs 176 lb Monday, 178.5 lb Tuesday, and 181 lb the following Monday. What should he have done, and when?

STEP 1 · DAY CHANGE

178.5 − 176 = **2.5 lb** in one day, inside the 2 to 3 lb rule: call Tuesday.

STEP 2 · WEEK CHANGE

181 − 176 = **5 lb** in a week: also a call.

WHY

Weight rises before edema or crackles appear.

TRAPS PEOPLE FALL INTO

- **Three nitroglycerin doses, then call.** Call at 5 minutes.
- **Routine oxygen in ACS.** Only if SpO2 under 90%.
- **Metoprolol tartrate for HFrEF.** Use succinate.
- **Trusting a normal digoxin level.** Check K+ and the patient.

Chapter 10 self-test · six items

1. Which lipid drug causes flushing that aspirin can blunt?

A. Fenofibrate
B. Niacin (ER)
C. Colesevelam
D. Ezetimibe

B. Niacin (ER) Prostaglandin-mediated flushing is reduced by aspirin 30 minutes before the dose.

2. Why is nitroglycerin avoided in right ventricular infarction?

A. The RV depends on preload
B. It causes bradycardia there
C. It raises afterload sharply
D. It worsens lung edema

A. The RV depends on preload Dropping preload can crash pressure in a preload-dependent right ventricle.

3. Which drug in the ACS bundle is chewed?

A. Metoprolol
B. Lisinopril
C. Clopidogrel
D. Aspirin

D. Aspirin Chewed non-enteric aspirin is absorbed in minutes.

4. Which MRA rarely causes gynecomastia?

A. Spironolactone
B. Triamterene
C. Eplerenone
D. Amiloride

C. Eplerenone Eplerenone is selective; spironolactone often causes gynecomastia.

5. Which antiarrhythmic can cause a lupus-like syndrome?

A. Lidocaine
B. Flecainide
C. Sotalol
D. Procainamide

D. Procainamide Procainamide (class IA) causes drug-induced lupus; check ANA.

6. What should the patient be told before adenosine?

A. Several hours of drowsiness afterward
B. Brief chest pressure and a sense of doom
C. Orange-tinted urine for about a day
D. A metallic taste lasting about a week

B. Brief chest pressure and a sense of doom Adenosine causes a few seconds of chest pressure and flushing with a brief pause.

CHAPTER 11

Diuretics, IV Fluids and Poisoning

Read it in full: **Chapter 11 in the textbook**. Practice it in the lab: **Diuretics** and **Poisons & Their Antidotes**.

What to know

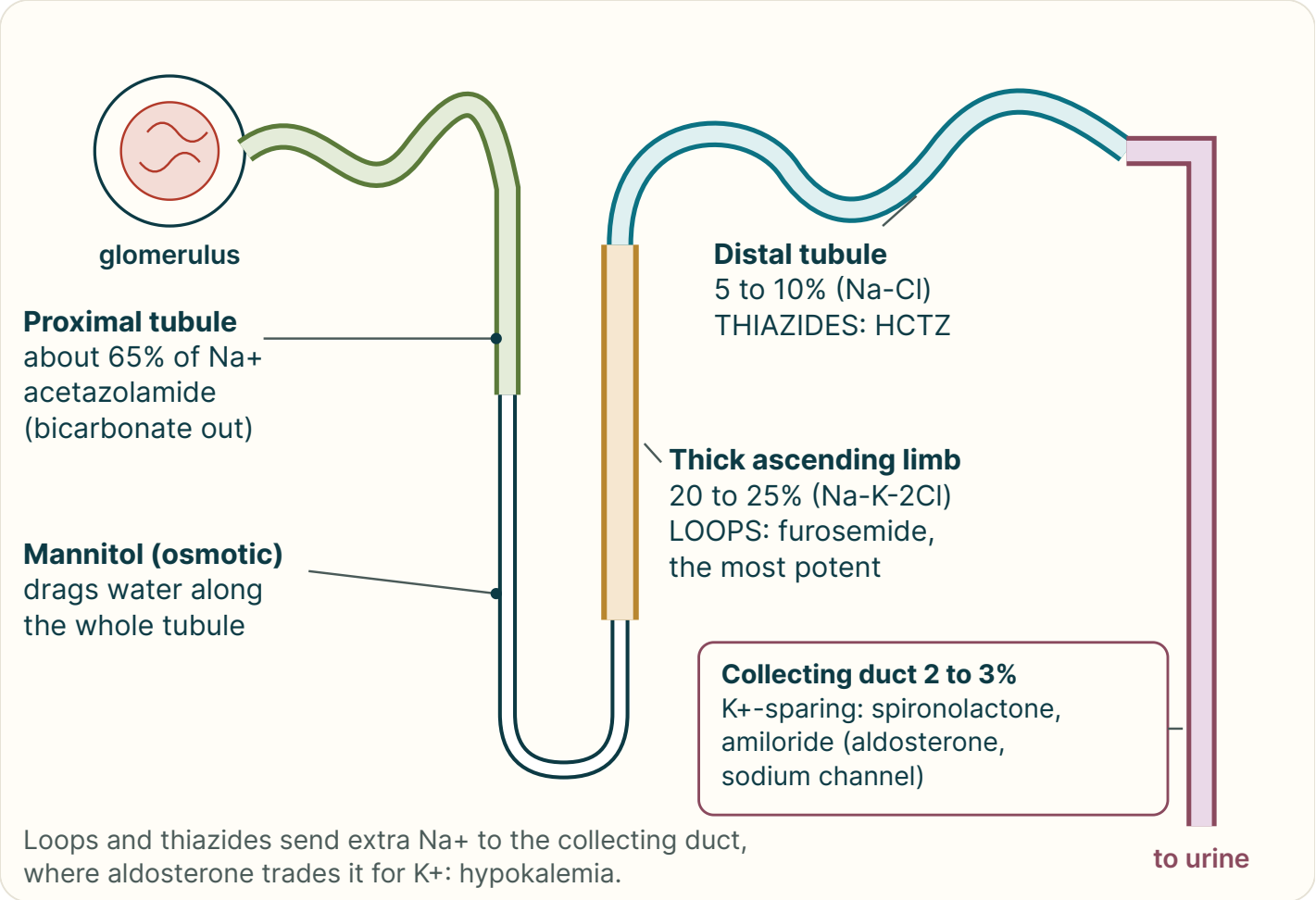
Diuretics block sodium reabsorption: loop (about 20 to 25%) more potent than thiazide (5 to 10%) more potent than potassium-sparing (2 to 3%). Loops waste K+ and are ototoxic if pushed fast; thiazides spare calcium and fail below GFR 30 (metolazone excepted); spironolactone causes hyperkalemia; mannitol needs an in-line filter.

Isotonic stays, hypotonic enters cells, hypertonic exits cells. NS is the only fluid with blood; LR not in liver failure; D5W is not for resuscitation; hypotonic fluids are contraindicated with raised ICP; 3% NaCl corrects no more than about 8 to 10 mEq/L in 24 hours.

Potassium (3.5 to 5.0): never IV push; pump; usually no more than 10 mEq/h peripherally; urine output first. Hyperkalemia: calcium, then insulin with dextrose, then removal. Calcium (8.5 to 10.5): gluconate peripheral, slow, monitor. Magnesium (1.5 to 2.5): fix before potassium; reflexes vanish first in toxicity; calcium gluconate antidote.

Poisoning: ABCs first, Poison Control early, charcoal within about an hour only with a protected airway (not for iron, lithium, alcohols, corrosives), no induced vomiting. Antidotes:

acetylcysteine, naloxone, flumazenil (cautiously), vitamin K, protamine, digoxin immune Fab, atropine plus pralidoxime, deferoxamine.



Potency follows the segment. The more sodium a segment reclaims, the stronger the diuretic that blocks it; downstream of loops and thiazides, potassium is lost.

LOCK THESE IN

- Loop > thiazide > K-sparing.
- Isotonic stays; hypotonic in; hypertonic out.
- KCl never IV push.
- Stabilize, shift, eliminate.
- Mg toxicity: reflexes first.
- Charcoal misses iron and lithium.

Chapter 11 ranges

Item	Range
Potassium	3.5 to 5.0 mEq/L
Calcium	8.5 to 10.5 mg/dL
Magnesium	1.5 to 2.5 mEq/L
Serum osmolality	About 275 to 295 mOsm/kg
Sodium correction	8 to 10 mEq/L per 24 h max
Furosemide IV	About 20 mg/min max

IV fluids

Fluid	Tonicity and rule
0.9% NaCl	Isotonic; only fluid with blood
Lactated Ringer's	Isotonic; not in liver failure, not with blood
D5W	Acts hypotonic; not for resuscitation
0.45% NaCl	Hypotonic; not with raised ICP
3% NaCl	Hypertonic; high-alert

Worked example

EXAMPLE 11.1 · A 20 MEQ POTASSIUM RIDER

A patient needs 20 mEq KCl IV peripherally at the book's 10 mEq/h limit. How long does it take at the fastest?

STEP 1 · DIVIDE

20 ÷ 10 = **2 hours**.

STEP 2 · BEFORE STARTING

Confirm urine output, use a pump, check the site.

NEVER

No IV push, no gravity, no bolus.

TRAPS PEOPLE FALL INTO

- **Thiazide with GFR under 30.** Use a loop.
- **LR with blood.** Calcium clots.
- **Calcium to lower potassium.** It protects the heart only.
- **Ipecac.** Obsolete.

Chapter 11 self-test · six items

1. Which diuretic is used to lower intracranial pressure?

A. Triamterene
B. Amiloride
C. Chlorthalidone
D. Mannitol

D. Mannitol Mannitol is osmotic and draws water out of swollen tissue.

2. Which diuretic can tint urine blue-green?

A. Furosemide
B. Triamterene
C. Mannitol
D. Acetazolamide

B. Triamterene Triamterene can give urine a blue-green tint; it also raises potassium.

3. Why can large volumes of normal saline cause acidosis?

A. Excess potassium
B. Excess lactate
C. Excess chloride
D. Excess glucose

C. Excess chloride Normal saline carries much more chloride than plasma, causing hyperchloremic acidosis.

4. A potassium of 3.0 will not rise despite replacement. What should be checked?

A. Magnesium
B. Calcium
C. Phosphate
D. Sodium

A. Magnesium Low magnesium drives renal potassium wasting; fix magnesium first.

5. What is the antidote for iron poisoning?

A. Acetylcysteine
B. Deferoxamine
C. Flumazenil
D. Protamine

B. Deferoxamine Deferoxamine chelates iron; charcoal does not bind it.

6. Why must protamine be given slowly?

A. It loses all of its potency when pushed fast
B. It clots the IV line when it is given quickly
C. A fast push can cause hypotension and anaphylaxis
D. It converts back into heparin if given fast

C. A fast push can cause hypotension and anaphylaxis Fast protamine can cause hypotension and anaphylactoid reactions.

CHAPTER 12

Respiratory Drugs and Eye/Ear

Read it in full: **Chapter 12 in the textbook**. Practice it in the lab: **Two Targets in the Airway** and **Cough, Cold & Allergy Drugs**.

What to know

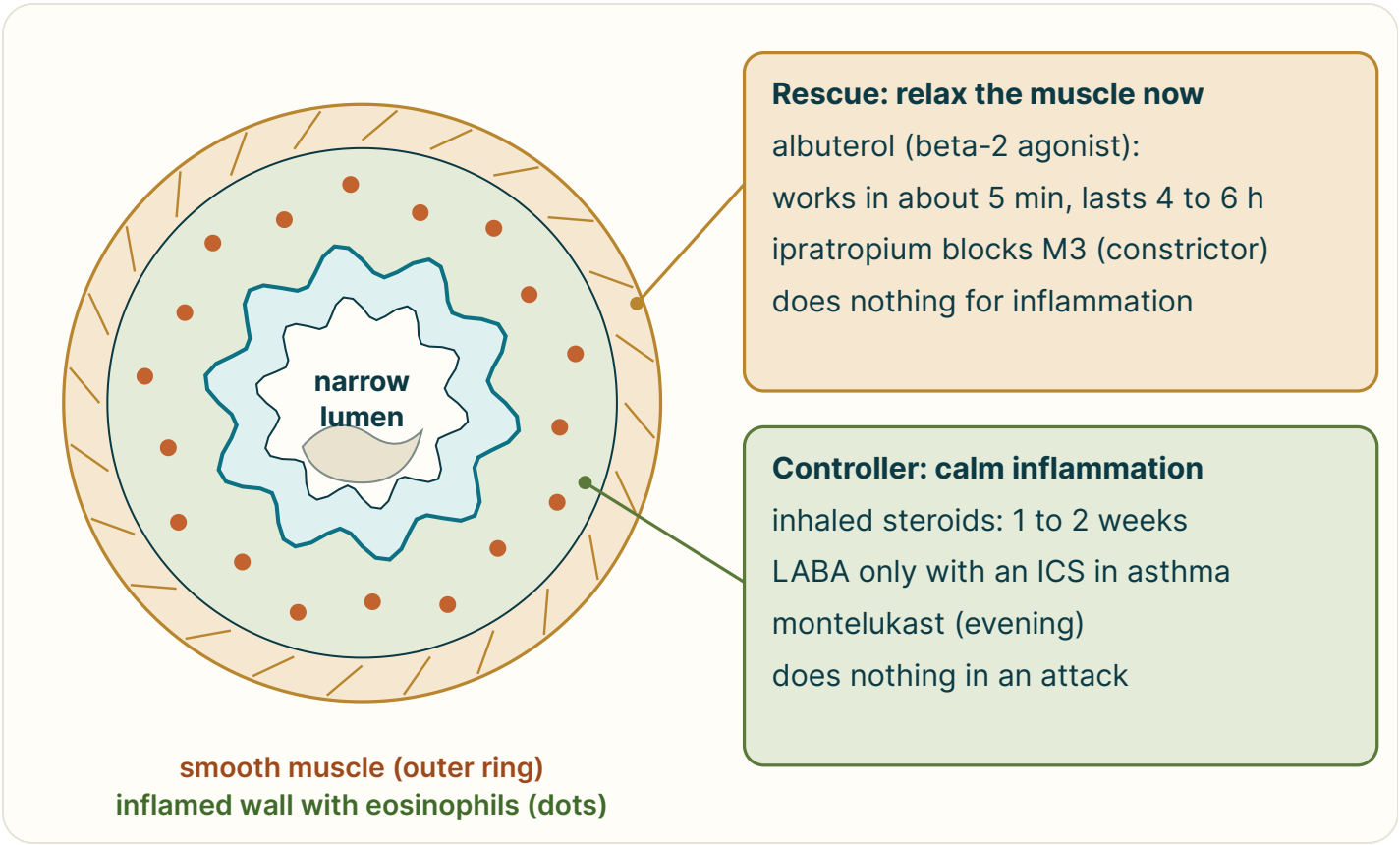
M3 constricts and beta-2 relaxes the airway. Asthma is reversible with inflammation (ICS backbone); COPD is largely irreversible (long-acting bronchodilator backbone; ICS adds pneumonia risk). Rescue drugs act now; controllers act over weeks. A silent chest is ominous.

Albuterol: tremor, tachycardia, low K+, high glucose. LABA never alone in asthma. Ipratropium and tiotropium: dry mouth, keep mist out of eyes. Theophylline 5 to 15 mcg/mL; smoking cessation and ciprofloxacin raise levels. Rescue use more than twice a week or any night waking means poor control.

ICS: rinse and spit, spacer, daily. Montelukast neuropsychiatric warning. Omalizumab anaphylaxis. MDI slow breath and 10 second hold; DPI fast breath. Peak flow green 80 to 100%, yellow 50 to 79%, red under 50%.

Antihistamines do not treat anaphylaxis; first generation sedate (Beers); fexofenadine not with juice. Topical decongestants 3 days max. Benzonatate whole. Codeine not under 12. Latanoprost increases outflow; timolol drops cause bradycardia and bronchospasm; punctal occlusion; 5

minutes between drops; ointment last. Otic drops never in the eye; adult pinna up and back, young child down and back.



Two targets, two jobs. Rescue drugs relax the muscle now; controllers calm the inflamed wall over days to weeks.

LOCK THESE IN

- Rescue vs controller.
- LABA never alone in asthma.
- Theophylline 5 to 15.
- Rinse and spit after ICS.
- Topical decongestant 3 days.
- Punctal occlusion for timolol.

Chapter 12 technique

Task	Rule
MDI	Slow deep breath; hold about 10 s; spacer
DPI	Fast forceful breath; never exhale into it
Two inhalers	Bronchodilator first
Eye drops	One drop; 5 min apart; ointment last
Ear drops (adult)	Pinna up and back; warm drops
Nasal steroid	Aim away from septum

Glaucoma drops

Drug	How it lowers IOP and alert
Latanoprost	More outflow; iris darkening
Timolol	Less production; bradycardia, bronchospasm
Brimonidine	Both; not in infants
Dorzolamide	Less production; sulfa
Pilocarpine	Opens angle; dim vision

Worked example

EXAMPLE 12.1 · PEAK FLOW ZONES

A patient's personal best is 500 L/min. Today's reading is 240. Which zone?

STEP 1 · GREEN

80% of 500 = 400: green is 400 to 500.

STEP 2 · YELLOW

50% = 250; 79% = 395: yellow is 250 to 395.

STEP 3 · TODAY

240 is under 250: **red zone**. Rescue inhaler now and get help.

TRAPS PEOPLE FALL INTO

- **ICS in an attack.** Albuterol is rescue.
- **Quiet chest as improvement.** Possible failure.
- **Diphenhydramine for an older adult's sleep.** Beers list.
- **Otic drops in an eye.** Never.

Chapter 12 self-test · six items

1. Which statement fits COPD compared with asthma?

A. Eosinophils drive the inflammation
B. Obstruction is largely irreversible
C. Inhaled steroids are the backbone
D. Symptoms vanish between attacks

B. Obstruction is largely irreversible COPD obstruction is largely irreversible and neutrophil-driven; long-acting bronchodilators are the backbone.

2. Which mucolytic smells of rotten eggs and needs suction nearby?

A. Guaifenesin
B. Benzonatate
C. Acetylcysteine
D. Dextromethorphan

C. Acetylcysteine Acetylcysteine breaks mucus bonds and can loosen a large volume at once.

3. Which drug must be given before exposure because it is only prophylactic?

A. Prednisone
B. Ipratropium
C. Albuterol
D. Cromolyn

D. Cromolyn Cromolyn stabilizes mast cells and does nothing once symptoms start.

4. Which glaucoma drug is avoided in infants because of apnea?

A. Brimonidine
B. Pilocarpine
C. Timolol
D. Latanoprost

A. Brimonidine Brimonidine can cause CNS depression and apnea in the very young.

5. Which ear drop is contraindicated with a perforated eardrum?

A. A warm sterile saline rinse
B. Neomycin-containing otic drops
C. Ofloxacin otic drops
D. Ciprofloxacin-dexamethasone otic

B. Neomycin-containing otic drops Neomycin reaching the middle ear can permanently damage hearing.

6. Which oral decongestant raises blood pressure and is kept behind the counter?

A. Fexofenadine
B. Phenylephrine
C. Guaifenesin
D. Pseudoephedrine

D. Pseudoephedrine Pseudoephedrine is systemic and can be diverted into methamphetamine production; oral phenylephrine is on open shelves and largely ineffective.

CHAPTER 13

Gastrointestinal Drugs

Read it in full: **Chapter 13 in the textbook**. Practice it in the lab: **The Vomiting Pathway** and **GI Drugs**.

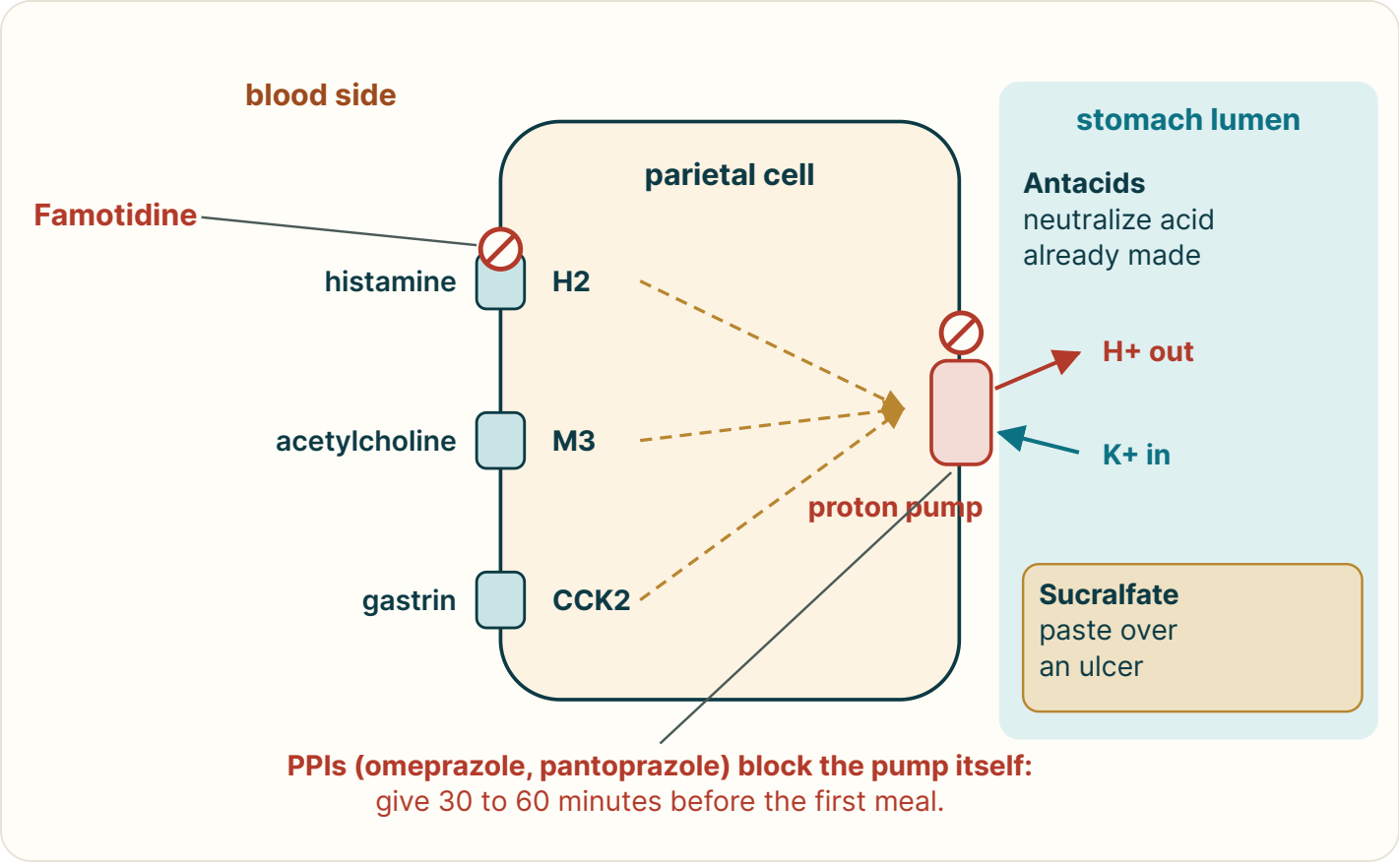
What to know

PPIs block the pump irreversibly: 30 to 60 minutes before the first meal; taper; long-term low Mg and B12, C. difficile, fractures; pantoprazole with clopidogrel. H2 blockers need renal dosing. Antacid spacing is drug specific (levothyroxine 4 h; fluoroquinolones 2 h before or 6 h after). Sucralfate on an empty stomach. Misoprostol not in pregnancy. Bismuth quadruple therapy for H. pylori.

Four roads to vomiting: CTZ, gut 5-HT3, vestibular H1 and muscarinic, cortex. Ondansetron: QT. Metoclopramide: tardive dyskinesia, 12 weeks. Promethazine: gangrene, not under 2. Scopolamine patch 4 h before travel. Antiemetics before chemo. Doxylamine plus pyridoxine in pregnancy.

Bulk laxatives need water; PEG first-line; lactulose to 2 to 3 soft stools; stimulants 6 to 12 h; no laxatives with an acute abdomen. No antimotility drugs with bloody, febrile or C. difficile diarrhea; loperamide megadoses cause torsades.

IBD: steroids induce, others maintain. Sulfasalazine stains orange-yellow and needs folic acid. TPMT/NUDT15 before azathioprine; TB and hepatitis B before anti-TNF. Pancrelipase with every meal and snack on acidic food if opened. Teach red flags: melena, coffee-ground emesis, dysphagia, weight loss.



Three switches, one pump. H2 blockers turn off one switch; PPIs shut the pump that all three switches drive.

LOCK THESE IN

- PPI before breakfast.
- Levothyroxine 4 h from antacids.
- Ondansetron QT; metoclopramide TD.
- No laxative in an acute abdomen.
- No loperamide in C. difficile.
- TPMT before azathioprine.

Chapter 13 safety alerts

Drug	Alert
Promethazine IV	Gangrene; large vein; not under 2
Metoclopramide	Tardive dyskinesia; 12 weeks
Loperamide	Torsades at megadoses
Misoprostol	Pregnancy contraindicated
Linaclotide	Contraindicated under 6
Bismuth	Black stool; salicylate

Laxative onsets

Class	Onset
Bulk-forming	12 to 72 h
PEG 3350	1 to 3 days
Saline (magnesium)	30 min to 6 h
Stimulant oral	6 to 12 h
Stimulant rectal	15 to 60 min

Worked example

EXAMPLE 13.1 · ANTACID AND LEVOTHYROXINE

A patient takes levothyroxine at 0700. When is the earliest an aluminum-magnesium antacid can be taken?

STEP 1 · APPLY THE RULE

At least 4 hours: 0700 + 4 h = **1100**.

WHY

Antacid cations bind levothyroxine in the gut.

TRAPS PEOPLE FALL INTO

- **PPI at bedtime.** Before breakfast.
- **Ondansetron for motion sickness.** Wrong road.
- **Docusate alone for opioid constipation.** Pair with senna.
- **Opening pancrelipase onto pudding.** Acidic food only.

Chapter 13 self-test · six items

1. Which H2 blocker is a strong CYP450 inhibitor that causes gynecomastia?

A. Pantoprazole
B. Nizatidine
C. Cimetidine
D. Famotidine

C. Cimetidine Cimetidine raises warfarin, phenytoin and theophylline levels and is antiandrogenic.

2. Which antacid cation causes constipation?

A. Aluminum
B. Magnesium
C. Sodium
D. Potassium

A. Aluminum Aluminum constipates; magnesium causes diarrhea.

3. Which antiemetic class is first-line for chemotherapy and post-op nausea?

A. Anticholinergics
B. 5-HT3 antagonists
C. Cannabinoids
D. H1 antihistamines

B. 5-HT3 antagonists Ondansetron blocks serotonin at vagal afferents and the CTZ.

4. Which laxative is first-line for chronic constipation?

A. Magnesium citrate solution
B. Oral sodium phosphate
C. Mineral oil (liquid)
D. Polyethylene glycol 3350

D. Polyethylene glycol 3350 PEG is well tolerated and safe long term.

5. Which IBD agent is gut selective and lowers systemic infection risk?

A. Tofacitinib
B. Infliximab
C. Vedolizumab
D. Prednisone

C. Vedolizumab Vedolizumab blocks gut-specific lymphocyte trafficking.

6. A patient on orlistat should supplement which vitamins?

A. B12 and folate
B. C and B6
C. Thiamine and niacin
D. A, D, E and K

D. A, D, E and K Orlistat blocks fat absorption, so fat-soluble vitamins are supplemented at a different time.

CHAPTER 14

Reproductive System Drugs

Read it in full: **Chapter 14 in the textbook**. Practice it in the lab: **Male Hormones & ED Drugs** and **BPH Drugs**.

What to know

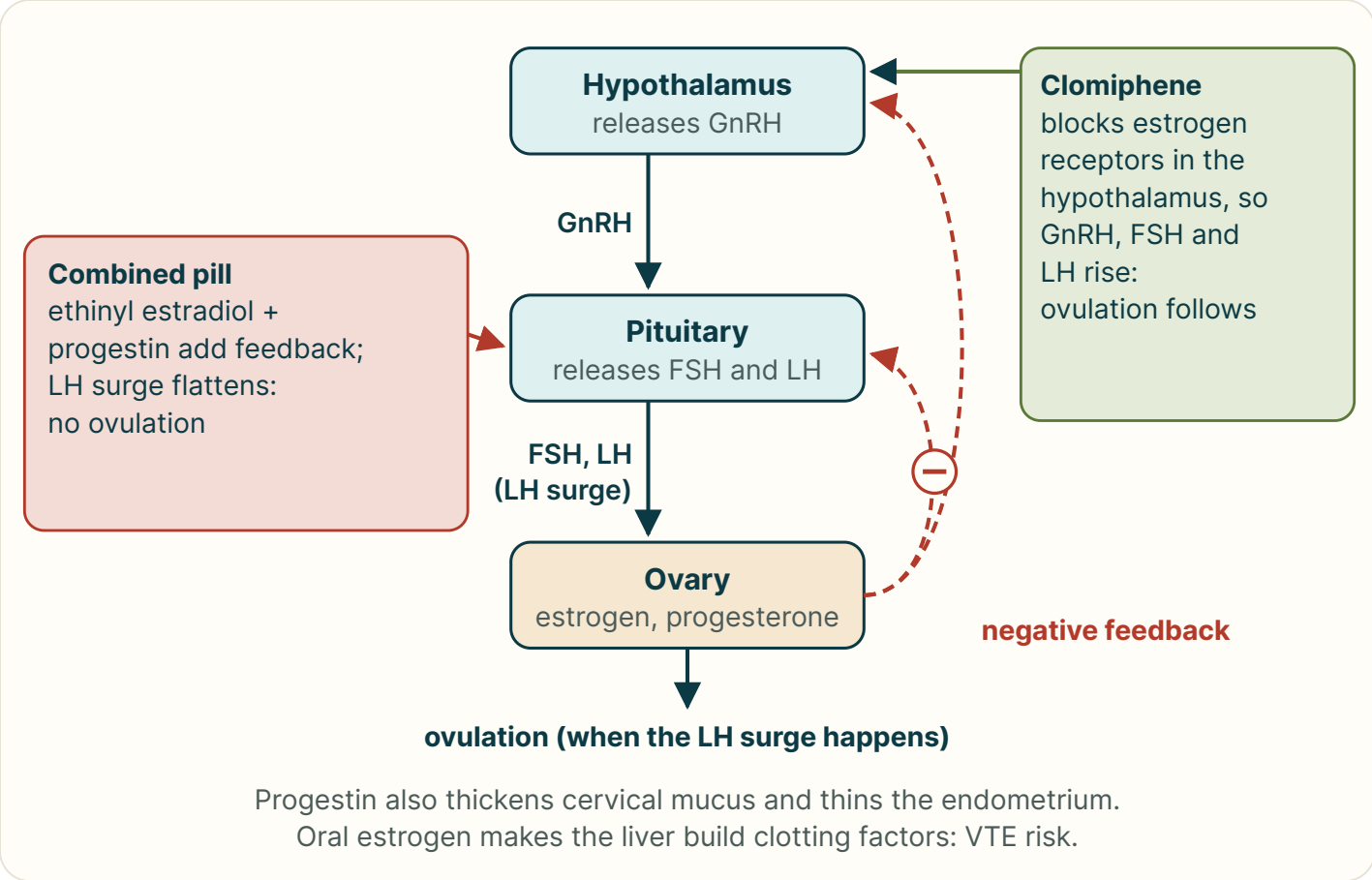
Combined contraceptives suppress the LH surge. Estrogen raises VTE risk: no estrogen with smoking at 35+, migraine with aura, prior VTE, early postpartum; use progestin-only. Teach ACHES. Inducers (rifampin, anticonvulsants, St. John's wort) cause failure; most antibiotics do not. Mini-pill 3 hour window; DMPA bone loss. A uterus requires progestin with estrogen therapy.

Clomiphene raises FSH and LH; visual changes mean stop. Gonadotropins risk OHSS. Oxytocin is high-alert: pump, piggyback, nearest port; tachysystole (more than 5 in 10 minutes) means stop the oxytocin first. Methylergonovine not with hypertension; carboprost not with asthma.

Tocolytics buy about 48 hours for betamethasone (2 doses 24 hours apart). Magnesium: reflexes, then respirations, then cardiac conduction; urine under 30 mL/h means accumulation; calcium gluconate for respiratory or cardiac toxicity.

Testosterone: Schedule III; gel transfer warning; hematocrit hold near 54%; causes infertility. PDE-5 inhibitors plus nitrates are lethal: hold 12 h avanafil, 24 h sildenafil or vardenafil, 48 h tadalafil. Alpha-1 blockers relieve BPH in days (bedtime first dose, IFIS, retrograde ejaculation).

5-ARIs shrink the gland over 3 to 6 months, halve PSA, are teratogenic to handle, and defer blood donation 1 month (finasteride) or 6 months (dutasteride).



Feedback runs both drugs. The pill strengthens the brake so the LH surge never comes; clomiphene hides estrogen from the hypothalamus so the drive rises.

LOCK THESE IN

- No estrogen: smoker 35+, aura, VTE.
- Uterus means progestin.
- Tachysystole: stop oxytocin.
- Magnesium: calcium gluconate.
- Nitrate holds 12/24/48 h.
- 5-ARI: double PSA; teratogenic.

Chapter 14 high-stakes rules

Drug	Rule
Combined pill	ACHES
Oxytocin	Stop first for tachysystole
Magnesium sulfate	RR 12+, urine 30+ mL/h
Testosterone gel	Wash, dry, cover
Tadalafil	No nitrates 48 h
Finasteride	Never crush

ACHES warning signs

Letter	Sign
A	Severe abdominal pain
C	Chest pain or shortness of breath
H	Severe or new headache
E	Eye problems, vision loss
S	Severe leg pain or swelling

Worked example

EXAMPLE 14.1 · BUYING 48 HOURS

Preterm labor is diagnosed Tuesday at 1400. Betamethasone dose 1 is given at 1400. When is dose 2, and when does the book's 48 hour tocolysis window end?

STEP 1 · SECOND DOSE

24 hours later: **Wednesday 1400**.

STEP 2 · 48 HOURS

Tuesday 1400 + 48 h = **Thursday 1400**.

THE GOAL

Tocolytics buy time for steroids and transfer, not a term pregnancy.

TRAPS PEOPLE FALL INTO

- **Asking only "do you get migraines?"** Ask about aura.
- **Estrogen alone with a uterus.** Add a progestin.
- **Oxygen before stopping oxytocin.** Stop it first.
- **Nitroglycerin without asking.** Ask privately about ED drugs and poppers.

Chapter 14 self-test · six items

1. Which contraceptive carries a boxed warning for bone mineral density loss?

A. Combined oral contraceptive
B. Etonogestrel arm implant
C. Levonorgestrel IUD device
D. Medroxyprogesterone injection

D. Medroxyprogesterone injection DMPA can reduce bone density with prolonged use.

2. Emergency contraception works mainly by which action?

A. Delaying or blocking ovulation
B. Killing sperm on contact
C. Thickening the endometrium
D. Ending an implanted pregnancy

A. Delaying or blocking ovulation Emergency contraception is not an abortifacient.

3. Which drug is first-line for ovulation induction in PCOS?

A. Clomiphene
B. Medroxyprogesterone
C. Letrozole
D. Oxytocin

C. Letrozole Letrozole gives higher live-birth rates and fewer multiples than clomiphene in PCOS.

4. Which tocolytic is limited to about 48 hours before 32 weeks because of fetal ductus effects?

A. Betamethasone
B. Indomethacin
C. Nifedipine
D. Magnesium sulfate

B. Indomethacin Indomethacin can constrict the ductus arteriosus and cause oligohydramnios.

5. Which hematocrit on testosterone calls for holding the drug?

A. Near or over 54%
B. Near or under 36%
C. Exactly 45%
D. Any value over 40%

A. Near or over 54% Testosterone raises red cell production; hyperviscosity causes strokes.

6. Which drugs should a man with BPH avoid?

A. Acetaminophen and ibuprofen tablets
B. Decongestants and sedating antihistamines
C. Calcium with vitamin D supplements
D. Loratadine and fexofenadine tablets

B. Decongestants and sedating antihistamines Decongestants tighten the bladder neck and first-generation antihistamines relax the detrusor, risking retention.

ONE PAGE

Cram sheet

The whole course on one sheet. Cover the right columns and rebuild each row from memory. If a row will not come back, go to that chapter's exam guide.

Antidotes and reversal agents

Drug or poison	Antidote	Key point
Opioids	Naloxone	Lasts 30 to 90 min; re-sedation
Benzodiazepines	Flumazenil	Seizure risk in chronic or mixed use
Acetaminophen	Acetylcysteine	Best within 8 to 10 h
Heparin	Protamine sulfate	Give slowly
Warfarin	Vitamin K; 4-factor PCC	IV vitamin K 1 mg/min max
Dabigatran	Idarucizumab	Thrombin inhibitor
Apixaban, rivaroxaban	4 factor PCC (andexanet withdrawn Dec 2025)	Xa inhibitors
Digoxin	Digoxin immune Fab	Low K+ potentiates
Beta blocker overdose	Glucagon	Bypasses the receptor
Vasopressor extravasation	Phentolamine	Infiltrate locally
Organophosphates	Atropine + pralidoxime	Both needed
Pure anticholinergic toxicity	Physostigmine	Never with a TCA or QRS over 100 ms
TCA overdose	Sodium bicarbonate	For a widening QRS
Magnesium toxicity	Calcium gluconate	Reflexes lost first
Iron	Deferoxamine	Charcoal does not bind iron
Malignant hyperthermia	Dantrolene	Rising end-tidal CO_2
Local anesthetic toxicity	IV lipid emulsion	Circumoral numbness, metallic taste
High-dose methotrexate	Leucovorin	Rescue for normal cells

Drug or poison	**Antidote**	**Key point**
Cyclophosphamide bladder injury	Mesna	Plus hydration
Anthracycline extravasation	Dexrazoxane; cold	Vincas: hyaluronidase; warm

Levels, ranges and hold parameters

Item	Target or limit	Act when
Digoxin	0.5 to 2 ng/mL; HF 0.5 to 0.9	Apical pulse under 60 (adult): hold
Lithium	0.6 to 1.2 mEq/L	Over 1.5 toxic
Phenytoin	10 to 20 mcg/mL	Nystagmus, ataxia; check albumin
Valproate	50 to 100 mcg/mL	Liver, pancreas
Theophylline	5 to 15 mcg/mL	Toxic above about 20
INR on warfarin	2 to 3 (some valves 2.5 to 3.5)	Bleeding: vitamin K, PCC
aPTT on heparin	1.5 to 2.5 x control	Per nomogram
Potassium	3.5 to 5.0 mEq/L	KCl never IV push; 10 mEq/h peripheral
Calcium	8.5 to 10.5 mg/dL	Slow IV on a monitor
Magnesium	1.5 to 2.5 mEq/L	Fix before potassium
Glucose	Under 70 mg/dL is hypoglycemia	Rule of 15; D50 or glucagon
ANC	Under 1,000 serious; under 500 severe	Febrile: antibiotics within 1 h
QTc	Over 500 ms or rise over 60	Check K+ and Mg
Orthostatic drop	20 systolic or 10 diastolic in 3 min	Fall precautions
Magnesium sulfate (OB)	RR 12+, urine 30+ mL/h, reflexes present	Stop; calcium gluconate if breathing falls
Testosterone	Hematocrit near 54%	Hold
Sodium correction	8 to 10 mEq/L per 24 h max	Osmotic demyelination

Timing and technique

Drug	Rule	Why
Trough levels	About 30 min before the next dose	Shows accumulation
Steady state	4 to 5 half-lives	Loading dose skips the wait
PPI	30 to 60 min before first meal	Needs active pumps
Levothyroxine	Empty stomach 30 to 60 min before breakfast; binders 4 h	Absorption
Alendronate	Plain water; upright 30 min (ibandronate 60)	Esophagitis
Rapid insulin	With the meal in front of the patient	Peak 1 to 2 h
SL nitroglycerin	Call 911 at 5 min; 3 doses max	Glass bottle
Vancomycin	At least 60 min	Flushing is rate related
IV furosemide	About 20 mg/min max	Ototoxicity
Filgrastim	At least 24 h after chemo	Dividing marrow
Chemo antiemetics	Before chemotherapy	Prevention beats rescue
Alpha-1 blocker first dose	Bedtime	Syncope
Eye drops	5 min apart; ointment last	Washout
Transfusion	Stay 15 min; finish in 4 h; NS only	Hemolytic reactions
Alteplase (stroke)	CT first; within 3 to 4.5 h	Bleeding
Betamethasone	2 doses 24 h apart	Fetal lungs

Never and always

Rule	Drug	Reason
Never IV push	Potassium chloride	Cardiac arrest
Never stop abruptly	Beta blockers, clonidine, AEDs, benzodiazepines, steroids, denosumab	Rebound or crisis
Never daily	Methotrexate for RA	Fatal toxicity
Never intrathecal	Vincristine	Fatal
Never alone in asthma	LABA	Asthma deaths
Never with nitrates	PDE-5 inhibitors (12/24/48 h)	Refractory hypotension
Never in pregnancy	Warfarin, ACE inhibitors, ARBs, misoprostol, isotretinoin, methotrexate	Fetal harm
Never with a tetracycline	Isotretinoin	Pseudotumor cerebri
Never with allopurinol (unadjusted)	Azathioprine, mercaptopurine	Marrow failure
Never antimotility	C. difficile or bloody diarrhea	Toxic megacolon
Never a laxative	Acute abdomen	Perforation
Always screen first	Abacavir (HLA-B*5701), primaquine (G6PD), azathioprine (TPMT), anti-TNF (TB, HBV)	Prevent harm
Always taper	Steroids after 2 to 3 weeks	Adrenal crisis
Always ask	Supplements, ED drugs, poppers, migraine aura	Hidden interactions

Stems that name the class

Stem	Class	Signature
-olol	Beta blocker	Bradycardia; masks hypoglycemia
-pril	ACE inhibitor	Cough, angioedema, high K+
-sartan	ARB	No cough; high K+
-dipine	Dihydropyridine CCB	Ankle edema
-osin	Alpha-1 blocker	First-dose syncope
-statin	HMG-CoA reductase inhibitor	Myopathy
-prazole	Proton pump inhibitor	Before breakfast
-cillin	Penicillin	Ask about real allergy
-xaban	Factor Xa inhibitor	4 factor PCC (andexanet withdrawn Dec 2025)
-mab	Monoclonal antibody	Infusion reactions; infection
-nib	Kinase inhibitor	Oral; adherence

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