PHARMACOLOGY · STUDY GUIDE

Exam 3 Study Guide

This guide covers chapters 5 and 6. Chapter 5 works at the synapse: antidepressants, mood stabilizers, antipsychotics, anxiolytics, antiepileptics and anesthetics. Chapter 6 moves to bone and skin, where how a drug is given and taught matters as much as the drug. Work one chapter at a time. Read the "what to know" paragraphs, copy the tables by hand, then try each worked example with the steps covered. Finish each chapter with its ten self-test items. Any dose or number in a worked example is a practice calculation only, not dosing advice.

WHAT THIS GUIDE COVERS

- Chapter 5 · the synapse and the four key transmitters, SSRIs, SNRIs, TCAs, MAOIs and the tyramine diet, the suicidality warning, serotonin syndrome, lithium, typical and atypical antipsychotics, EPS, NMS, clozapine, benzodiazepines, antiepileptic mechanisms and levels, status epilepticus, general and local anesthesia, malignant hyperthermia and LAST.
- Chapter 6 · bone remodeling, PTH, vitamin D and calcitonin, calcium salts and elemental calcium, IV calcium, bisphosphonate rules, denosumab, raloxifene, anabolic bone drugs, gout flare versus urate lowering, methotrexate and other DMARDs, acne and isotretinoin, psoriasis, topical steroid potency, and burn and wound agents.

CHAPTER 5

Mental Health, Antiepileptic and Anesthetic Drugs

Read it in full: **Chapter 5 in the textbook**. Practice it in the lab: **Antidepressants, Lithium & Serotonin Syndrome** and **Antiepileptics**.

What to know

Every drug here acts at the **synapse**. A transmitter is released, crosses the cleft, binds a receptor, then is cleared by a **reuptake pump** or an **enzyme**. Drugs block a pump (fluoxetine), block an enzyme (phenelzine), block a receptor (haloperidol) or modulate a channel (lorazepam). Name the

step and you can predict the effects. Serotonin runs mood and the gut; dopamine runs reward, movement, prolactin and vomiting; norepinephrine runs drive and blood pressure; GABA is the brake. Acetylcholine is the innocent bystander whose blockade causes dry mouth, constipation, retention, blurred vision and confusion.

SSRIs (fluoxetine, sertraline, escitalopram) block only the serotonin pump and are first-line because they are hard to die from. Expect nausea and headache early and sexual dysfunction later; ask about it directly. **SNRIs** (venlafaxine, duloxetine) add norepinephrine, help neuropathic pain and raise blood pressure. **TCAs** (amitriptyline) also hit histamine, acetylcholine and alpha-1 receptors; in overdose they widen the QRS and cause fatal dysrhythmias, treated with IV sodium bicarbonate. **Bupropion** lowers the seizure threshold; **mirtazapine** sedates and raises appetite.

MAOIs (phenelzine) disable the enzyme that destroys monoamines, including dietary **tyramine**. Aged cheese, cured meats, tap beer, red wine, soy sauce and sauerkraut can trigger a hypertensive crisis with occipital headache and stiff neck. Washout is 2 weeks between an MAOI and other serotonergic drugs, but 5 weeks after fluoxetine.

Mood lifts in **2 to 6 weeks** while side effects come first. The boxed warning for suicidal thinking under age 25 exists because energy returns before mood; assess at every contact. Taper SSRIs and SNRIs to avoid discontinuation syndrome (paroxetine and venlafaxine are worst). Screen for bipolar disorder before starting an antidepressant alone.

Serotonin syndrome comes on within hours of a new serotonergic drug or dose (SSRI plus tramadol, triptans, linezolid, St. John's wort or an MAOI). Triad: mental status change, autonomic instability (fever, tachycardia, diarrhea) and neuromuscular hyperactivity, with **clonus** the most specific sign. Stop the drugs, cool, hydrate, give benzodiazepines, and expect cyproheptadine if severe.

Lithium is high-alert. Maintenance range 0.6 to 1.2 mEq/L; over 1.5 is toxic and over 2.0 an emergency. Draw troughs 12 hours after the evening dose. The kidney handles lithium like sodium, so dehydration, vomiting, a low-salt diet, thiazides, NSAIDs and ACE inhibitors raise the level. Teach 2 to 3 L of fluid and steady salt. Fine tremor and thirst are expected; vomiting,

diarrhea, coarse tremor and slurred speech are early toxicity. There is no antidote; fluids or dialysis. Monitor renal function and TSH.

Typical antipsychotics (haloperidol) block D2 and treat positive symptoms. EPS follows a timeline: acute dystonia in hours to days (airway first, then diphenhydramine or benztropine), akathisia in days to weeks (do not raise the dose), parkinsonism in weeks, tardive dyskinesia in months to years (often irreversible, screen with AIMS). Prolactin rises. **NMS** is fever, lead-pipe rigidity, altered consciousness and high CK; stop the drug, cool, and expect dantrolene or bromocriptine. NMS is slow and rigid; serotonin syndrome is fast and jumpy.

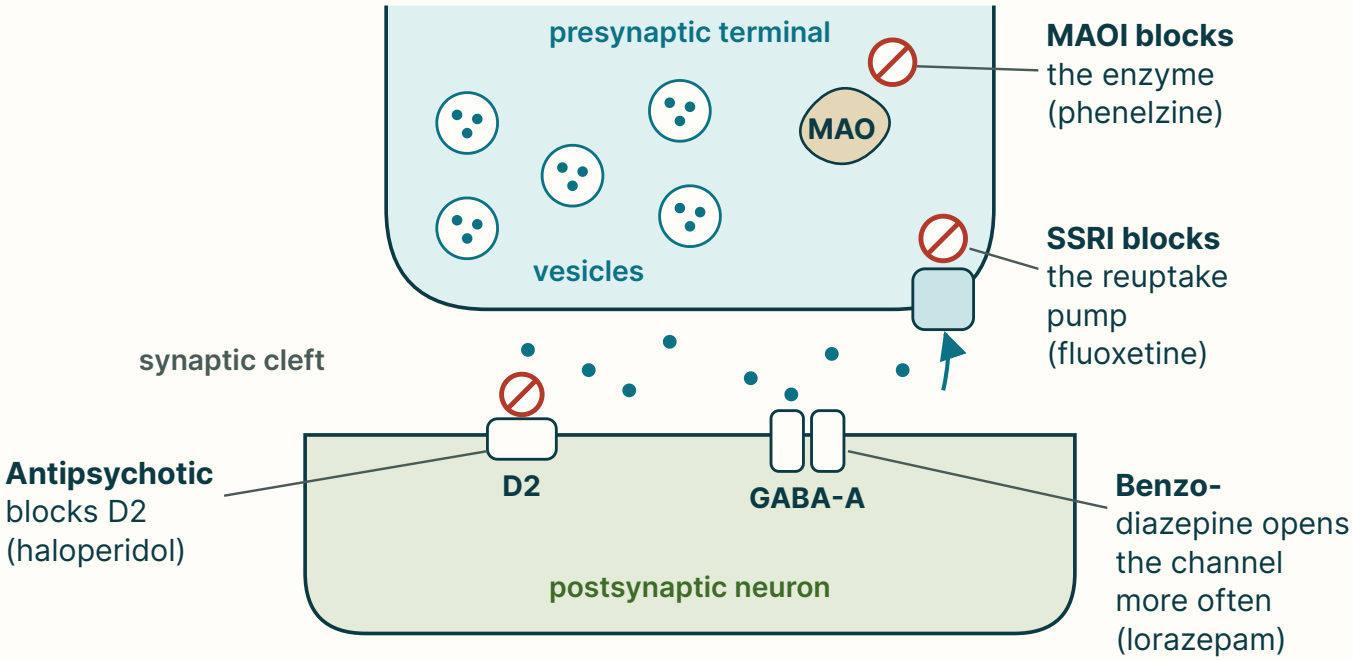
Atypicals (risperidone, olanzapine, quetiapine, aripiprazole, clozapine) block D2 and 5-HT2A: less EPS, some effect on negative symptoms, but metabolic syndrome, so track weight, waist, BP, glucose or A1C and lipids. **Clozapine** is the most effective and needs ongoing ANC monitoring for agranulocytosis; fever or sore throat is urgent. All antipsychotics carry a boxed warning in older adults with dementia-related psychosis.

Benzodiazepines boost GABA's effect (more frequent channel opening). Alone they have a ceiling; with opioids or alcohol the ceiling disappears. Good short term, poor long term: tolerance, dependence, and dangerous withdrawal, so taper. On the Beers list for older adults. Flumazenil reverses but can precipitate seizures. Buspirone treats chronic anxiety without sedation but takes weeks.

Antiepileptics work by slowing sodium channels (phenytoin, carbamazepine, lamotrigine), blocking T-type calcium channels (ethosuximide, absence only), boosting GABA (benzodiazepines, phenobarbital) or binding **SV2A** (levetiracetam). Never stop one abruptly. Phenytoin range 10 to 20 mcg/mL, valproate 50 to 100; with low albumin, believe the toxic patient over a normal total phenytoin level. Phenytoin IV goes only in normal saline, pushed slowly. Carbamazepine: SJS (HLA-B*1502), blood dyscrasias, hyponatremia. Valproate: liver, pancreas, neural tube defects. Lamotrigine: titrate slowly, any rash reported today. Status epilepticus (over 5 minutes) gets an IV benzodiazepine first.

General anesthesia removes the brain; **local anesthesia** blocks sodium channels in one nerve. Balanced anesthesia combines an induction agent, an inhaled agent, an opioid and a

neuromuscular blocker. Neuromuscular blockers paralyze without sedation. Stage II (excitement) carries vomiting and laryngospasm risk and returns on emergence. **Malignant hyperthermia** (volatile agents, succinylcholine) shows a rapidly rising end-tidal CO_2 first; treat with dantrolene. **LAST** starts with circumoral numbness, metallic taste and tinnitus, then seizures and arrest; treat with IV lipid emulsion. After a spinal, the toes return last, so fall risk persists.



Blocking acetylcholine (TCAs, first-generation drugs) adds dry mouth, constipation, urinary retention, blurred vision and confusion.

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

- Pump, enzyme, receptor or channel: name the step, predict the effects.
- Antidepressants: 2 to 6 weeks for mood; suicidality warning under 25; taper to stop.
- MAOI: tyramine crisis; 2 week washout, 5 weeks after fluoxetine.
- Serotonin syndrome: hours, clonus, hyperreflexia. NMS: days, lead-pipe rigidity, high CK.
- Lithium 0.6 to 1.2 mEq/L; over 1.5 toxic; steady salt and 2 to 3 L fluid.
- EPS order: dystonia, akathisia, parkinsonism, tardive dyskinesia. Clozapine: ANC.
- Phenytoin 10 to 20, valproate 50 to 100 mcg/mL; never stop an AED abruptly.
- Malignant hyperthermia: dantrolene. LAST: lipid emulsion.

Key terms and comparisons

Drug or class	Mechanism	Signature risk and action
SSRI (sertraline)	Blocks serotonin reuptake	Nausea early, sexual dysfunction; taper
SNRI (venlafaxine)	Serotonin and NE reuptake	Check BP each visit
TCA (amitriptyline)	Both pumps plus H1, ACh, alpha-1	Overdose widens QRS: sodium bicarbonate
MAOI (phenelzine)	Inhibits monoamine oxidase	Tyramine crisis; washout rules
Lithium	Mood stabilizer	0.6 to 1.2 mEq/L; sodium and fluid balance
Haloperidol	D2 antagonist	EPS; NMS
Olanzapine, clozapine	D2 and 5-HT2A antagonists	Metabolic syndrome; clozapine ANC
Lorazepam	Positive GABA-A modulator	Combination deaths with opioids; taper
Phenytoin	Sodium channel	10 to 20 mcg/mL; saline only; gum overgrowth
Levetiracetam	SV2A	Irritability and mood change
Succinylcholine	Depolarizing blocker	Hyperkalemia; malignant hyperthermia
Bupivacaine	Amide local anesthetic	Most cardiotoxic; LAST

Two look-alike emergencies

Feature	Serotonin syndrome	NMS
Cause	Serotonergic drugs combined	Dopamine-blocking antipsychotic
Onset	Hours	Days
Muscles	Clonus, hyperreflexia, tremor	Lead-pipe rigidity, hyporeflexia
Other	Diarrhea, agitation	Very high fever and CK
Specific treatment	Cyproheptadine	Dantrolene or bromocriptine

Worked examples

WORKED EXAMPLE 1 · A RISING LITHIUM LEVEL

Mr. Ruiz takes lithium and started ibuprofen for back pain and a low-salt diet. He has vomiting, diarrhea and a coarse tremor. His level returns at 1.6 mEq/L. What is happening and what do you do?

STEP 1 · COMPARE TO THE RANGE

Maintenance is 0.6 to 1.2 mEq/L. 1.6 is above 1.5, which the book calls **toxic**.

STEP 2 · FIND THE CAUSE

NSAIDs and a low-salt diet make the kidney hold sodium, and lithium rides the same pathway. Vomiting and diarrhea add dehydration.

STEP 3 · ACT

Hold the lithium, notify the provider, expect IV fluids; at high levels, dialysis. There is no antidote.

STEP 4 · TEACH

Steady normal salt, 2 to 3 L of fluid daily, no NSAIDs without approval, report vomiting or heavy sweating.

WORKED EXAMPLE 2 · TIMING A LITHIUM TROUGH

Lithium is given at 0800 and 2000. When should the morning level be drawn?

STEP 1 · FIND THE EVENING DOSE

The last dose before the draw is at 2000.

STEP 2 · ADD 12 HOURS

2000 + 12 h = **0800**, before the morning dose is given.

WHY

A level drawn soon after a dose reads high and can lead to a wrong dose change.

WORKED EXAMPLE 3 · AN MAOI WASHOUT CALENDAR

A patient's last dose of an antidepressant is March 1. The prescriber plans phenelzine. When is the earliest start if the old drug was sertraline, and if it was fluoxetine?

STEP 1 · SERTRALINE

The standard washout is 2 weeks: March 1 + 14 days = **March 15**.

STEP 2 · FLUOXETINE

Its long half-life needs 5 weeks: March 1 + 35 days = **April 5**.

WHY IT MATTERS

Starting early stacks serotonergic effects and risks serotonin syndrome.

WORKED EXAMPLE 4 · A "NORMAL" PHENYTOIN LEVEL IN A TOXIC PATIENT

Ms. Feld has a total phenytoin of 14 mcg/mL, albumin 2.1 g/dL, and nystagmus, ataxia and slurred speech. What is going on?

STEP 1 · CHECK THE RANGE

14 sits inside 10 to 20 mcg/mL.

STEP 2 · APPLY PROTEIN BINDING

Phenytoin is highly bound to albumin. With low albumin, more drug is free and active even though the total looks normal.

STEP 3 · BELIEVE THE PATIENT

Nystagmus and ataxia are toxicity signs. Report, hold per order and expect a free phenytoin level.

TRAPS PEOPLE FALL INTO

- **Quitting an SSRI after one week.** Benefit takes 2 to 6 weeks; side effects come first and fade.
- **Raising the antipsychotic dose for restlessness.** Ask whether it is in the legs: that is akathisia, a side effect.
- **Mixing up serotonin syndrome and NMS.** Fast and jumpy with clonus versus slow and rigid with high CK.
- **Trusting a normal total phenytoin level with low albumin.** Free drug is high. Believe the toxic patient.
- **Mixing IV phenytoin in dextrose.** It precipitates. Use normal saline and push slowly.

- **Speeding a lamotrigine titration after missed doses.** Restart the titration; fast escalation causes SJS.
- **Letting a post-spinal patient stand when toes move.** Feet recover last; fall risk lasts until fully back.

Chapter 5 self-test · ten items

1. Which drug works by blocking the enzyme that breaks down monoamines?

A. Haloperidol
B. Lorazepam
C. Phenelzine
D. Fluoxetine

C. Phenelzine Phenelzine is an MAOI. Fluoxetine blocks a pump, haloperidol a receptor, and lorazepam modulates a channel.

2. Why do SSRIs commonly cause nausea in the first week?

A. They block acetylcholine in the stomach wall
B. They raise dopamine in the vomiting center
C. They slow emptying by blocking histamine
D. Most of the body's serotonin acts in the gut

D. Most of the body's serotonin acts in the gut The gut is full of serotonin receptors. Nausea usually fades in a week or two.

3. A patient on phenelzine eats aged cheese and develops a severe occipital headache. What is the likely problem?

A. Tyramine-induced hypertensive crisis
B. Neuroleptic malignant syndrome
C. Serotonin syndrome from the cheese
D. Lithium toxicity from the salt

A. Tyramine-induced hypertensive crisis With MAO blocked, tyramine reaches the blood and releases stored norepinephrine, driving a hypertensive crisis.

4. Which sign is most specific for serotonin syndrome?

A. Diarrhea
B. Clonus
C. Fever
D. Agitation

B. Clonus Fever, diarrhea and agitation occur in many conditions. Clonus, often worst in the legs, is the most specific sign.

5. Which change is most likely to raise a lithium level?

A. Eating a normal salt diet
B. Starting acetaminophen for pain
C. Drinking 3 L of water daily
D. Starting a thiazide diuretic

D. Starting a thiazide diuretic Thiazides, NSAIDs, ACE inhibitors and low sodium make the kidney hold lithium along with sodium.

6. Two days after starting haloperidol, a patient's neck twists and eyes roll upward. What comes first?

A. Assess and protect the airway
B. Start an AIMS screening exam
C. Raise the haloperidol dose
D. Give a beta blocker by mouth

A. Assess and protect the airway Acute dystonia can progress to laryngospasm. Airway first, then diphenhydramine or benztropine.

7. A patient on clozapine has a sore throat and fever. What is needed urgently?

A. A fasting lipid panel today
B. A urine drug screen panel
C. An absolute neutrophil count
D. A serum lithium level

C. An absolute neutrophil count Clozapine can cause agranulocytosis. Fever and sore throat need an ANC now.

8. Which antiepileptic works by binding the SV2A vesicle protein?

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

B. Levetiracetam Levetiracetam reduces transmitter release through SV2A. Ethosuximide blocks T-type calcium channels; phenytoin slows sodium channels; phenobarbital boosts GABA.

9. A patient on lamotrigine reports a new rash on day 10. What should the nurse do?

A. Recheck it at the next visit
B. Double the next dose
C. Report it the same day
D. Apply hydrocortisone cream

C. Report it the same day Lamotrigine and carbamazepine are linked to SJS and TEN. Any new rash is reported the day it appears.

10. During a nerve block, a patient says her lips are numb and she tastes metal. What is the priority?

A. Stop injecting and prepare lipid emulsion
B. Inject faster to finish the block quickly
C. Give dantrolene as a rapid IV push
D. Reassure her that this is expected

A. Stop injecting and prepare lipid emulsion These are early signs of local anesthetic systemic toxicity. Stop, call for help, support the airway, and get IV lipid emulsion.

CHAPTER 6

Bone and Skin Drugs

Read it in full: **Chapter 6 in the textbook**. Practice it in the lab: **Bisphosphonates** and **Gout & Antiarthritis Drugs**.

What to know

Bone is remodeled constantly. **Osteoclasts** resorb and release calcium; **osteoblasts** build. Osteoblasts send **RANKL** to drive osteoclasts and **osteoprotegerin** to block it. Estrogen restrains RANKL, so bone loss speeds up after menopause. Serum calcium is held at roughly 8.5 to 10.5 mg/dL total.

PTH raises calcium: it pulls calcium from bone, makes the kidney keep calcium and dump phosphate, and activates vitamin D. **Calcitonin** lowers it by blocking osteoclasts. Vitamin D is activated in two steps: the liver makes 25-hydroxyvitamin D (the stored form the lab measures), and the kidney makes **calcitriol**. A patient with advanced kidney disease needs calcitriol, not ordinary D3.

Only **elemental** calcium counts. Calcium carbonate is about 40% elemental, needs acid and food, and works poorly with PPIs. Calcium citrate is about 21% elemental and dissolves without acid. The gut absorbs only about 500 to 600 mg at a time, so split larger targets. Separate calcium from levothyroxine, tetracyclines, fluoroquinolones and iron. IV calcium gluconate is preferred peripherally; calcium chloride has about three times the calcium and is a severe vesicant for central lines. Give IV calcium slowly with cardiac monitoring, especially with digoxin, and never with bicarbonate or phosphate in the line.

Low calcium makes nerves twitchy: tingling, cramps, Chvostek and Trousseau signs, tetany, seizures, prolonged QT. High calcium makes everything sluggish: stones, bones, groans, thrones and psychiatric overtones, with a shortened QT.

Bisphosphonates (alendronate, risedronate, ibandronate, IV zoledronic acid) bind bone and kill osteoclasts. Oral absorption is under 1% and they burn the esophagus, so: first thing in the morning, empty stomach, full glass of plain water, upright at least 30 minutes (60 for ibandronate), nothing else by mouth for that time. Hold if the patient cannot sit up or has esophageal disease. Correct low calcium and vitamin D first. Teach two long-term signals: thigh or groin pain (atypical femoral fracture) and jaw problems (ONJ, so dental work goes first). Zoledronic acid needs a renal check and can cause a flu-like reaction after the first dose.

Denosumab blocks RANKL every 6 months, is not renally cleared, carries a boxed warning for severe hypocalcemia in advanced CKD, and must not be stopped without a replacement because rebound vertebral fractures follow. **Raloxifene** (a SERM) builds bone and protects breast but carries a boxed warning for VTE and fatal stroke; stop 72 hours before immobilization. **Teriparatide** and **abaloparatide** build bone with daily injections (first doses can cause orthostatic hypotension). **Romosozumab** builds bone for 12 months but carries a boxed warning for MI and stroke.

Gout is two jobs. **Flare**: NSAID, corticosteroid or **colchicine**, which stops neutrophil migration. GI upset is the first sign of colchicine toxicity, so stop it; CYP3A4 and P-gp inhibitors (clarithromycin, verapamil, cyclosporine) can make it fatal. **Urate lowering**: **allopurinol** blocks xanthine oxidase, starts low, aims for urate under 6 mg/dL, needs 2 to 3 L of fluid, and causes early flares that are covered with prophylaxis. Any rash means stop and report. Allopurinol with azathioprine or mercaptopurine causes marrow suppression. Febuxostat carries a cardiovascular boxed warning. Probenecid increases excretion. Pegloticase needs G6PD screening. Avoid aspirin in gout.

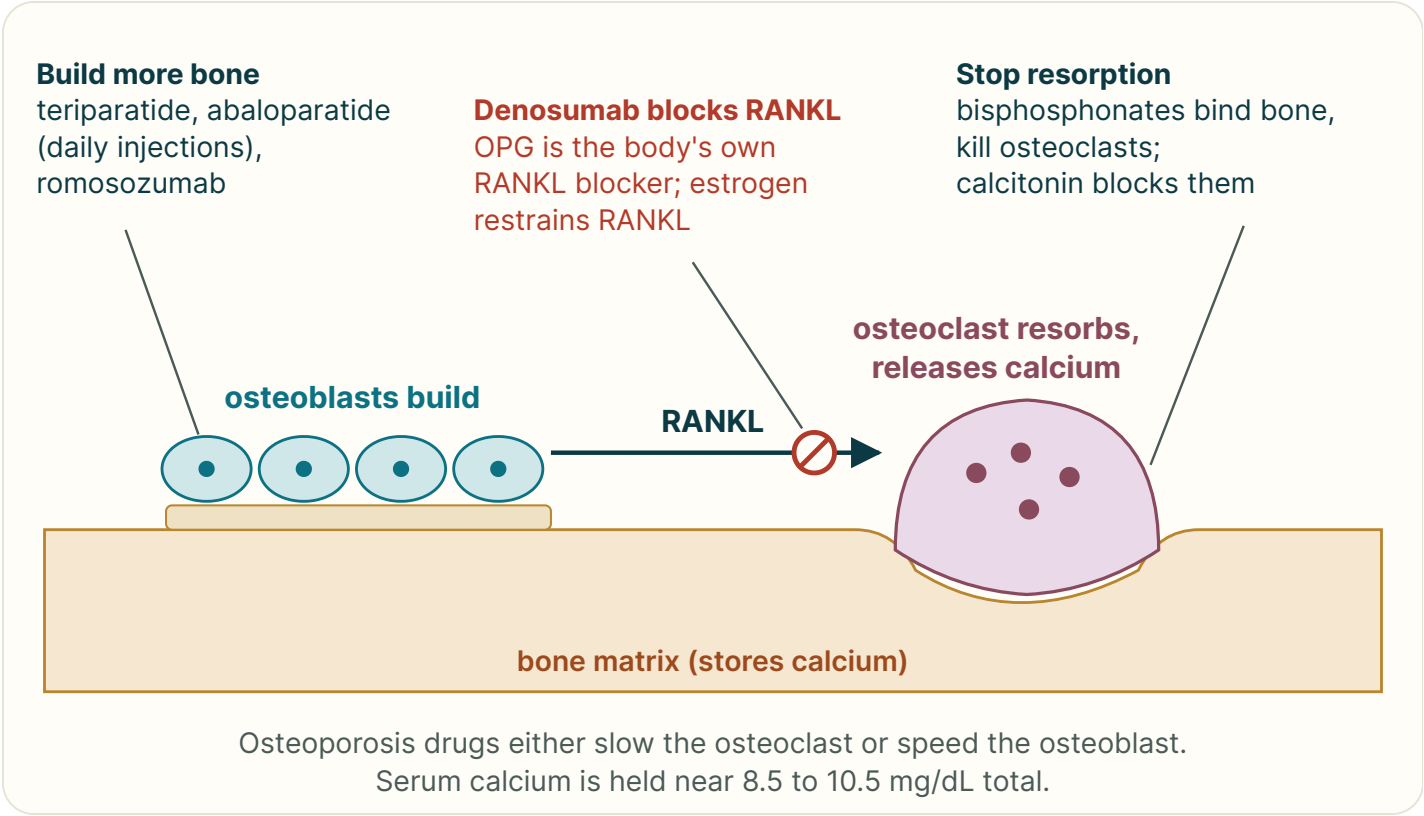
DMARDs slow rheumatoid arthritis rather than just soothing it and take weeks to months. **Methotrexate** is **weekly**, never daily, with folic acid; monitor CBC, LFTs and creatinine; no alcohol; contraindicated in pregnancy; mouth ulcers are the earliest warning; avoid TMP-SMX; leucovorin is the rescue. Hydroxychloroquine needs a baseline eye exam, then yearly screening from year 5 (sooner if higher risk). Sulfasalazine turns urine orange-yellow. Leflunomide is a long-lived teratogen. **Biologics** need TB and hepatitis B screening, no live vaccines, and holding during infection. JAK inhibitors carry cardiovascular, clot and cancer warnings.

Acne drugs hit four problems. Benzoyl peroxide kills bacteria without resistance and bleaches fabric. Topical retinoids unplug follicles, worsen skin at first and cause photosensitivity. Topical antibiotics are always paired with benzoyl peroxide. **Isotretinoin** hits all four and is a severe teratogen managed through **iPLEDGE**: two contraceptive methods from a month before to a month after, monthly pregnancy tests, no blood donation, lipid and LFT monitoring, and never with a tetracycline (pseudotumor cerebri). Psoriasis uses topical steroids, calcipotriene (weekly maximum, hypercalcemia), phototherapy and biologics; acitretin forbids pregnancy for 3 years.

Topical steroid strength depends on **potency** (class 1 superpotent, such as clobetasol, to class 7 low, such as hydrocortisone 1%), **vehicle** (ointment stronger than cream stronger than lotion), **quantity** (one fingertip unit, about 0.5 g, covers two adult palms) and **occlusion and time**. Keep potent steroids off face, groin and axilla; watch for atrophy and HPA suppression, especially in children. A diaper is an occlusive dressing.

Burn **eschar** is avascular, so antimicrobials go on the wound. **Silver sulfadiazine**: transient leukopenia, not in sulfa allergy, infants under 2 months or near-term pregnancy. **Mafenide**:

penetrates eschar and cartilage (ears, nose), painful, causes metabolic acidosis, so watch for tachypnea. **Silver nitrate**: keep moist, stains black, causes low sodium and chloride. Nanocrystalline silver is moistened with sterile water, not saline. **Collagenase** is inactivated by silver and iodine. Moist wounds heal faster. Premedicate 30 minutes before dressing changes and give acute burn analgesia IV.



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

LOCK THESE IN

- PTH raises calcium; calcitonin lowers it. Kidney failure: give calcitriol.
- Carbonate 40% elemental with food; citrate 21%, no acid needed; 500 to 600 mg per dose max.
- Alendronate: empty stomach, plain water, upright 30 min (ibandronate 60).
- Thigh pain on a bisphosphonate: report. Dental work before therapy for ONJ.
- Denosumab: never stop without a replacement; hypocalcemia warning in advanced CKD.
- Colchicine GI upset: stop. Allopurinol rash: stop. Allopurinol + azathioprine: marrow failure.
- Methotrexate weekly with folic acid; mouth ulcers first; no pregnancy.
- Burns: sulfadiazine drops WBC, mafenide drops pH, silver nitrate drops sodium.

Key terms and comparisons

Agent	Key fact	Nursing alert
Calcium carbonate	About 40% elemental	With food; poor with PPIs
Calcium citrate	About 21% elemental	No acid needed
Calcium gluconate / chloride	About 9% / about 27% elemental	Chloride: central line, vesicant
Calcitriol	Active vitamin D	For CKD; hypercalcemia comes faster
Alendronate	Antiresorptive	Upright 30 min; atypical fracture; ONJ
Denosumab	Anti-RANKL every 6 months	No abrupt stop; check calcium
Raloxifene	SERM	VTE and stroke; stop 72 h before immobility
Teriparatide	Anabolic PTH analog	Orthostasis with first doses
Colchicine	Blocks neutrophil migration	GI upset = toxicity
Allopurinol	Xanthine oxidase inhibitor	Rash: stop; urate under 6 mg/dL
Methotrexate	DMARD	Weekly; folic acid; CBC, LFTs
Isotretinoin	Systemic retinoid	iPLEDGE; no tetracycline

Topical steroid and burn agent rules

Item	Rule	Why
Class 1 to 2 (clobetasol)	Not on face, groin, axilla; about 2 weeks	Atrophy, HPA suppression
Class 6 to 7 (hydrocortisone)	Face, eyelids, infants	Safest on thin skin
Vehicle	Ointment > cream > lotion	Occlusion raises potency
Fingertip unit	About 0.5 g covers two palms	Teaches quantity
Silver sulfadiazine	Check WBC	Leukopenia days 2 to 3
Mafenide	Premedicate; watch breathing	Metabolic acidosis
Silver nitrate	Keep wet; check sodium	Hyponatremia, hypochloremia
Collagenase	No silver or iodine on the same wound	They inactivate it

Worked examples

WORKED EXAMPLE 1 · ELEMENTAL CALCIUM MATH

A calcium carbonate tablet contains 1,250 mg of salt. A calcium citrate tablet contains 950 mg of salt. Using the book's percentages, how much elemental calcium does each give, and how many of each would supply 1,200 mg elemental? (Practice numbers.)

STEP 1 · CARBONATE

1,250 × 0.40 = **500 mg** elemental per tablet.

STEP 2 · CITRATE

950 × 0.21 = **about 200 mg** (199.5) per tablet.

STEP 3 · TABLETS FOR 1,200 MG

Carbonate: 1,200 ÷ 500 = 2.4 tablets. Citrate: 1,200 ÷ 199.5 = about 6 tablets.

STEP 4 · SPLIT THE DOSES

No more than about 500 to 600 mg absorbs at once, so the day is divided into two or three doses.

WHICH ONE?

For a patient on omeprazole, citrate is the right salt even though it takes more tablets.

WORKED EXAMPLE 2 · TEACHING AN ALENDRONATE MORNING

Mrs. Haddad takes alendronate at 0600. Walk through her morning.

STEP 1 · THE DOSE

0600, empty stomach, full glass (6 to 8 oz) of plain water. No coffee, juice, milk or mineral water.

STEP 2 · STAY UP

Sit or stand upright until at least **0630**. No lying back down.

STEP 3 · THEN EAT

Breakfast, coffee and other pills wait until 0630. If it were ibandronate, the wait is 60 minutes, to 0700.

STEP 4 · REPORT

New heartburn, painful swallowing, thigh or groin ache, or jaw problems.

WORKED EXAMPLE 3 · HOW MUCH TOPICAL STEROID?

A rash covers an area equal to six adult palms. The cream is applied twice daily for 14 days. How much is needed per application and in total? (Practice calculation.)

STEP 1 · FIND FINGERTIP UNITS

One FTU covers two palms, so six palms needs 6 ÷ 2 = 3 FTU.

STEP 2 · CONVERT TO GRAMS

3 × 0.5 g = **1.5 g** per application.

STEP 3 · TOTAL

1.5 g × 2 per day × 14 days = **42 g**.

CHECK THE RULES

If the drug were clobetasol, the area could not include face or folds, and the labeled weekly limit applies.

WORKED EXAMPLE 4 · A GOUT PATIENT STARTING ALLOPURINOL

Mr. Petrov, after his flare settles, starts allopurinol. He also takes azathioprine after a kidney transplant. Two weeks later he calls about a new rash. What are the issues?

STEP 1 · THE INTERACTION

Allopurinol blocks metabolism of azathioprine, risking life-threatening marrow suppression unless the azathioprine dose is cut. Flag it to the prescriber.

STEP 2 · THE RASH

Stop allopurinol and report today: it is a leading cause of SJS, TEN and DRESS.

STEP 3 · THE EXPECTED FLARE

Early flares are expected as urate mobilizes; prophylactic colchicine or an NSAID covers the first months.

STEP 4 · TEACH

2 to 3 L of fluid daily; target urate under 6 mg/dL.

TRAPS PEOPLE FALL INTO

- **Giving calcium carbonate to a patient on a PPI.** Carbonate needs acid. Use citrate.
- **Giving cholecalciferol in advanced kidney disease.** The kidney cannot activate it. Calcitriol is used.
- **Letting a patient lie down after alendronate.** Upright at least 30 minutes, or esophagitis follows.
- **Stopping denosumab with no plan.** Rebound resorption causes vertebral fractures.
- **Using allopurinol to treat today's flare.** Urate lowering does nothing for the acute attack.
- **Pushing through colchicine diarrhea.** GI upset is the first sign of toxicity. Stop it.
- **Covering hydrocortisone with a diaper.** A diaper is occlusive and multiplies absorption.

Chapter 6 self-test · ten items

1. Which hormone lowers serum calcium by blocking osteoclasts?

A. Calcitonin

B. Calcitriol

C. Estrogen

D. Parathyroid hormone

A. Calcitonin Calcitonin tones calcium down. PTH and calcitriol raise it.

2. A patient on dialysis needs vitamin D. Which form makes sense?

A. Calcifediol (25-OH D)
B. Calcitriol (vitamin D)
C. Cholecalciferol (D3)
D. Ergocalciferol (D2)

B. Calcitriol (vitamin D) The kidney performs the final activation step. In kidney failure, calcitriol is given already active.

3. Why should IV calcium be given slowly with monitoring in a patient on digoxin?

A. Digoxin inactivates calcium in the line
B. Calcium blocks digoxin absorption in the gut
C. Calcium raises the risk of digoxin dysrhythmias
D. Calcium lowers digoxin levels to subtherapeutic

C. Calcium raises the risk of digoxin dysrhythmias Calcium potentiates digoxin at the heart. A fast push can trigger lethal dysrhythmias.

4. A patient took alendronate with coffee and went back to bed. What is the main risk?

A. Kidney stones caused by the coffee
B. An atypical femoral fracture that day
C. Hypercalcemia within the next hour
D. Esophagitis and a poorly absorbed dose

D. Esophagitis and a poorly absorbed dose Oral bisphosphonates are corrosive and absorb poorly. Coffee and lying down cause both problems.

5. Mrs. Tanaka asks what she must remember about her twice-yearly denosumab shot. Which teaching is accurate?

A. Avoid it if her kidney function is normal
B. Take it daily on an empty stomach with water
C. Never stop it without another antiresorptive
D. Stop it 72 hours before any long car trip

C. Never stop it without another antiresorptive Stopping denosumab causes rebound resorption and vertebral fractures. The 72 hour rule belongs to raloxifene.

6. A patient on colchicine has diarrhea and vomiting. What is the correct advice?

A. Add an antidiarrheal and continue
B. Stop the colchicine and call
C. Double the next dose
D. Keep taking it with food

B. Stop the colchicine and call GI symptoms are the first sign of colchicine toxicity, not a side effect to push through.

7. What is the target serum urate on allopurinol?

A. Under 6 mg/dL
B. Under 10 mg/dL
C. Under 15 mg/dL
D. Under 2 mg/dL

A. Under 6 mg/dL Allopurinol is titrated slowly to a serum urate under 6 mg/dL.

8. Which methotrexate order for rheumatoid arthritis should be questioned?

A. Folic acid 1 mg daily
B. CBC and LFTs monitored
C. 15 mg by mouth weekly
D. 15 mg by mouth daily

D. 15 mg by mouth daily At RA doses methotrexate is weekly. Daily dosing has caused fatal mucositis and pancytopenia.

9. Which is required for a patient taking isotretinoin who can become pregnant?

A. Two forms of contraception and monthly tests
B. One form of contraception during therapy only
C. A pregnancy test before the first dose only
D. No blood donation only while taking it

A. Two forms of contraception and monthly tests iPLEDGE requires two methods from a month before to a month after, monthly negative tests, and no blood donation during and for a month after.

10. A burn patient on mafenide becomes tachypneic. What is the likely cause?

A. Leukopenia from marrow suppression
B. Hyponatremia from electrolyte loss
C. Metabolic acidosis from the mafenide
D. An allergic reaction to silver salt

C. Metabolic acidosis from the mafenide Mafenide inhibits carbonic anhydrase. Fast breathing is respiratory compensation for a falling pH.

Cram sheet

Everything from chapters 5 and 6 in one place. Cover the right column and see if you can rebuild each row.

Mental health, seizures and anesthesia

Item	Fact	Note
Antidepressant onset	2 to 6 weeks	Side effects first; suicidality under 25
TCA overdose	Wide QRS	Sodium bicarbonate
MAOI	Tyramine diet	Washout 2 weeks; 5 after fluoxetine
Serotonin syndrome	Hours; clonus	Stop, cool, benzodiazepines, cyproheptadine
Lithium	0.6 to 1.2 mEq/L	Over 1.5 toxic; trough 12 h after dose
EPS timeline	Dystonia, akathisia, parkinsonism, TD	Benztropine or diphenhydramine for dystonia
NMS	Fever, rigidity, high CK	Dantrolene or bromocriptine
Clozapine	Agranulocytosis	ANC monitoring
Benzodiazepines	GABA-A frequency	Taper; flumazenil with caution
Phenytoin	10 to 20 mcg/mL	Saline only; slow push; check albumin
Valproate	50 to 100 mcg/mL	Liver, pancreas, neural tube defects
Status epilepticus	Over 5 minutes	IV benzodiazepine first
Malignant hyperthermia	Rising end-tidal CO_2	Dantrolene
LAST	Circumoral numbness, metallic taste, tinnitus	Lipid emulsion

Bone, joints, skin and burns

Item	Fact	Note
Serum calcium	About 8.5 to 10.5 mg/dL	PTH up, calcitonin down
Elemental calcium	Carbonate 40%, citrate 21%	500 to 600 mg per dose
Bisphosphonate	Empty stomach, water, upright 30 min	Ibandronate 60 min
Denosumab	Every 6 months	No abrupt stop
Raloxifene	VTE, stroke	Stop 72 h before immobility
Romosozumab	12 months	No MI or stroke in past year
Colchicine	1.2 mg then 0.6 mg 1 h later	GI upset = stop
Allopurinol	Urate under 6 mg/dL	Rash = stop; not with azathioprine
Methotrexate	Weekly; folic acid	Mouth ulcers first sign
Biologics	TB and hepatitis B screen	No live vaccines
Isotretinoin	iPLEDGE	No tetracycline; no blood donation
Fingertip unit	About 0.5 g = two palms	Ointment strongest vehicle
Burn agents	SSD: WBC; mafenide: pH; silver nitrate: Na	Premedicate 30 min before dressing

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