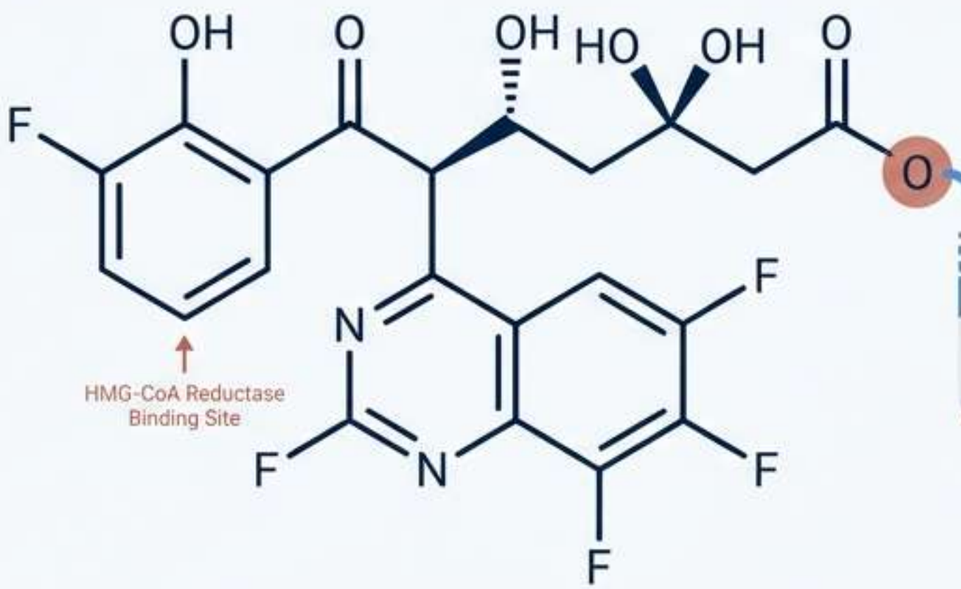
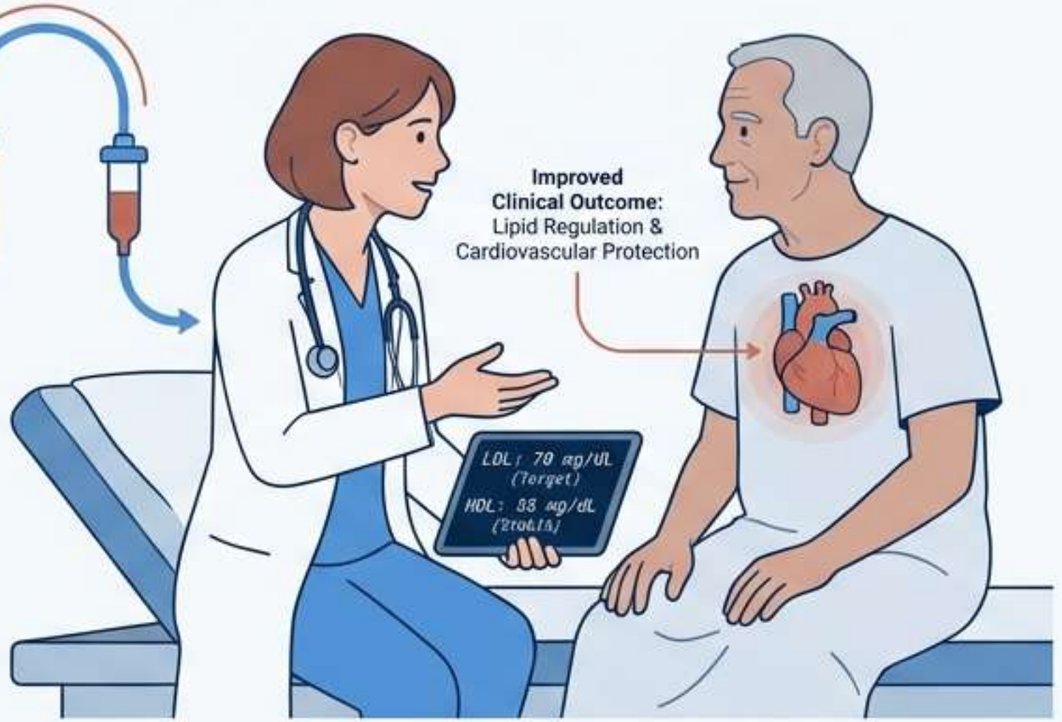
Pharmacology: From Molecule to Bedside

A comprehensive guide to Nomenclature, Pharmacokinetics, Metabolism, and Rational Prescribing.

The Molecule

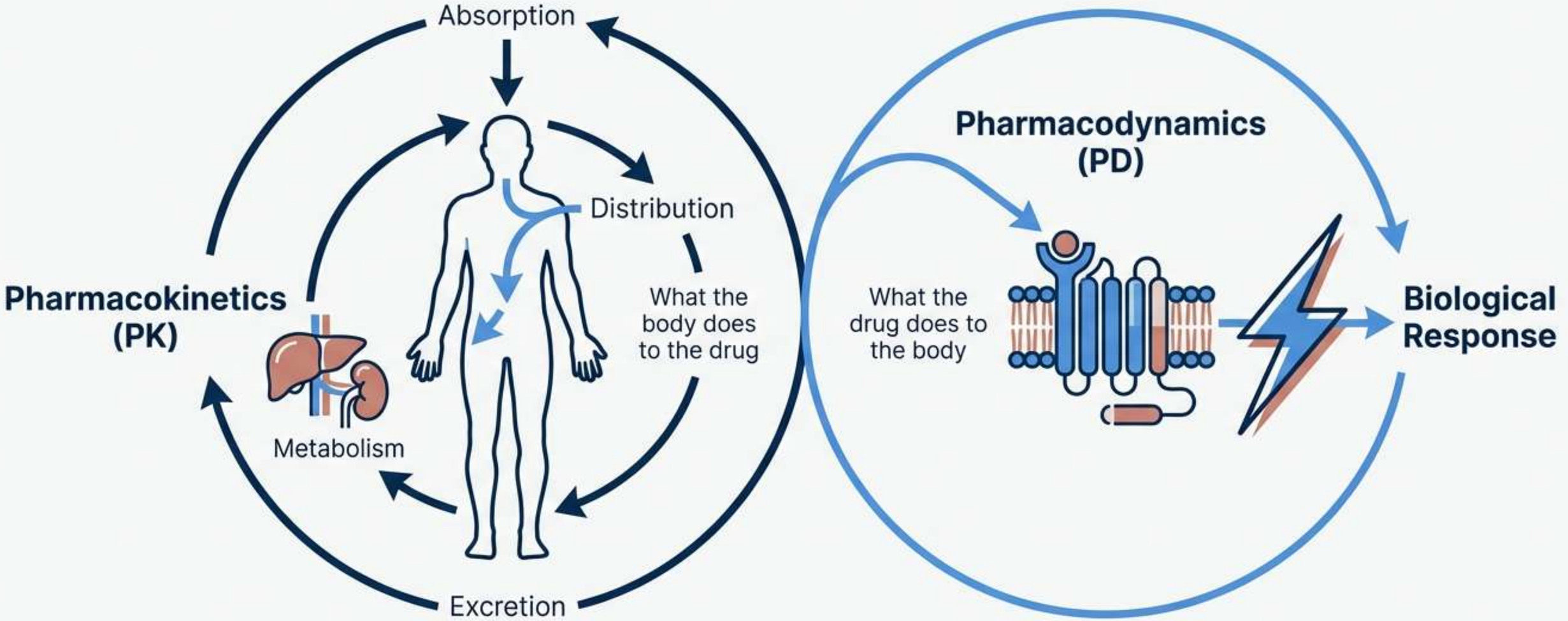


The Bedside



Pharmacology is the translation of chemical potential into clinical outcome.

The Two Pillars: Pharmacokinetics vs. Pharmacodynamics



"Only the dose makes the poison" — Paracelsus

Decoding the Code: Systematic Drug Nomenclature

Chemical Name

N-acetyl-p-aminophenol

Scientific description based on molecular structure (IUPAC). Precise but unwieldy.

Generic Name (INN/USAN)

Paracetamol (Acetaminophen)

The non-proprietary standard. Uses specific stems to denote class. The language of science.

Trade Name

Tylenol / Panadol

Brand marketing. Capitalized, proprietary, and variable by region.

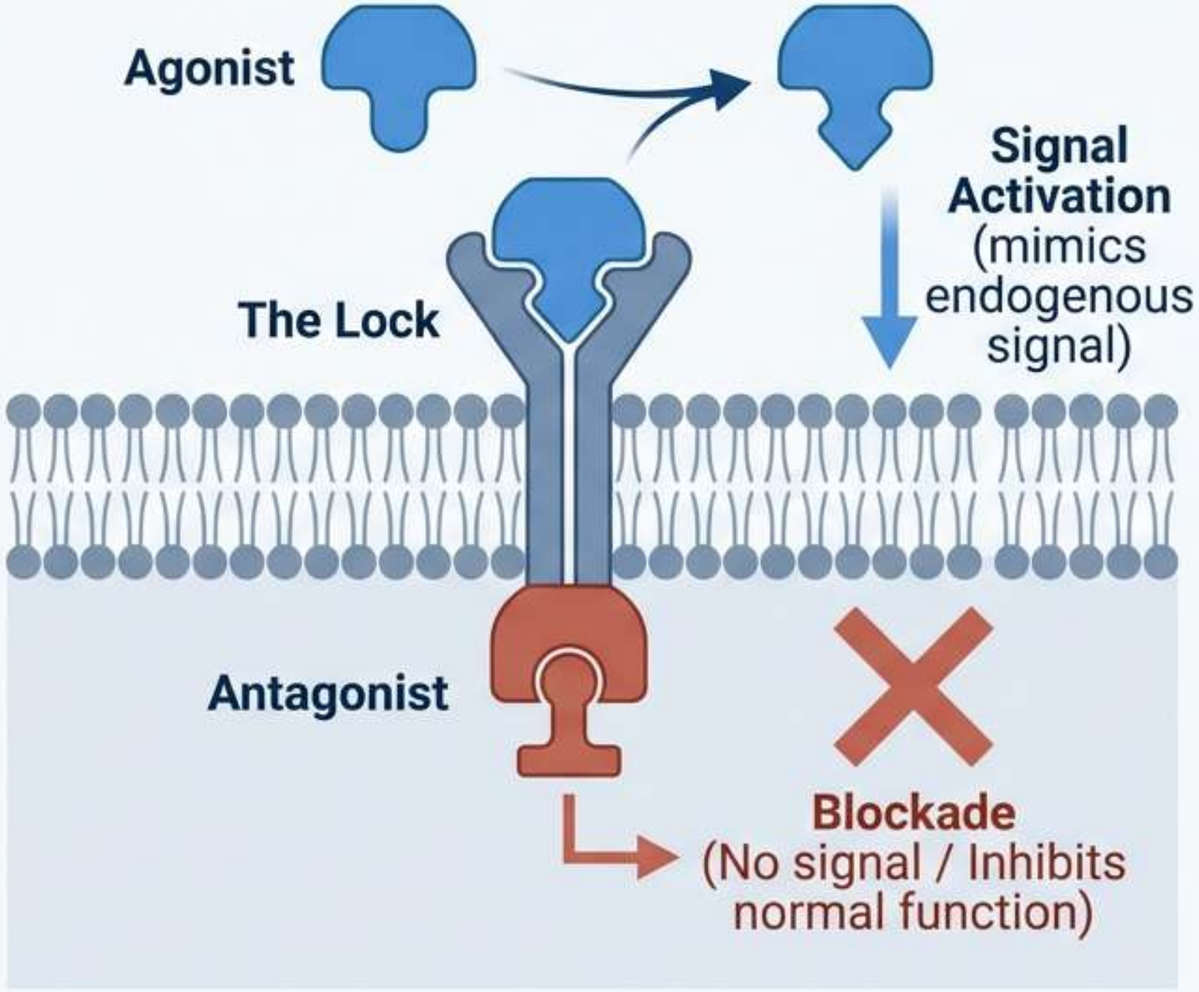
Harmonization: WHO and USAN Council coordinate generic names to prevent global medication errors.

The Pharmacologist's Rosetta Stone

Stem/Affix	Class & Mechanism
-vir	Antivirals (e.g., Aciclovir, Oseltamivir)
-mab	Monoclonal Antibodies (e.g., Trastuzumab). Note: **-xi-** (chimeric), **-zu-** (humanized).
-statin	HMG-CoA Reductase Inhibitors (e.g., Atorvastatin). Lowers cholesterol.
-olol	Beta-Blockers (e.g., Atenolol). Antihypertensive/Anti-arrhythmic.
-prazole	Proton Pump Inhibitors (e.g., Omeprazole). Reduces gastric acid.
-cillin	Penicillin-derived Antibiotics (e.g., Amoxicillin).
-sartan	Angiotensin Receptor Antagonists (e.g., Losartan).

Insight: You can predict a drug's mechanism and class just by its stem.

Pharmacodynamics: The Lock & Key Mechanism

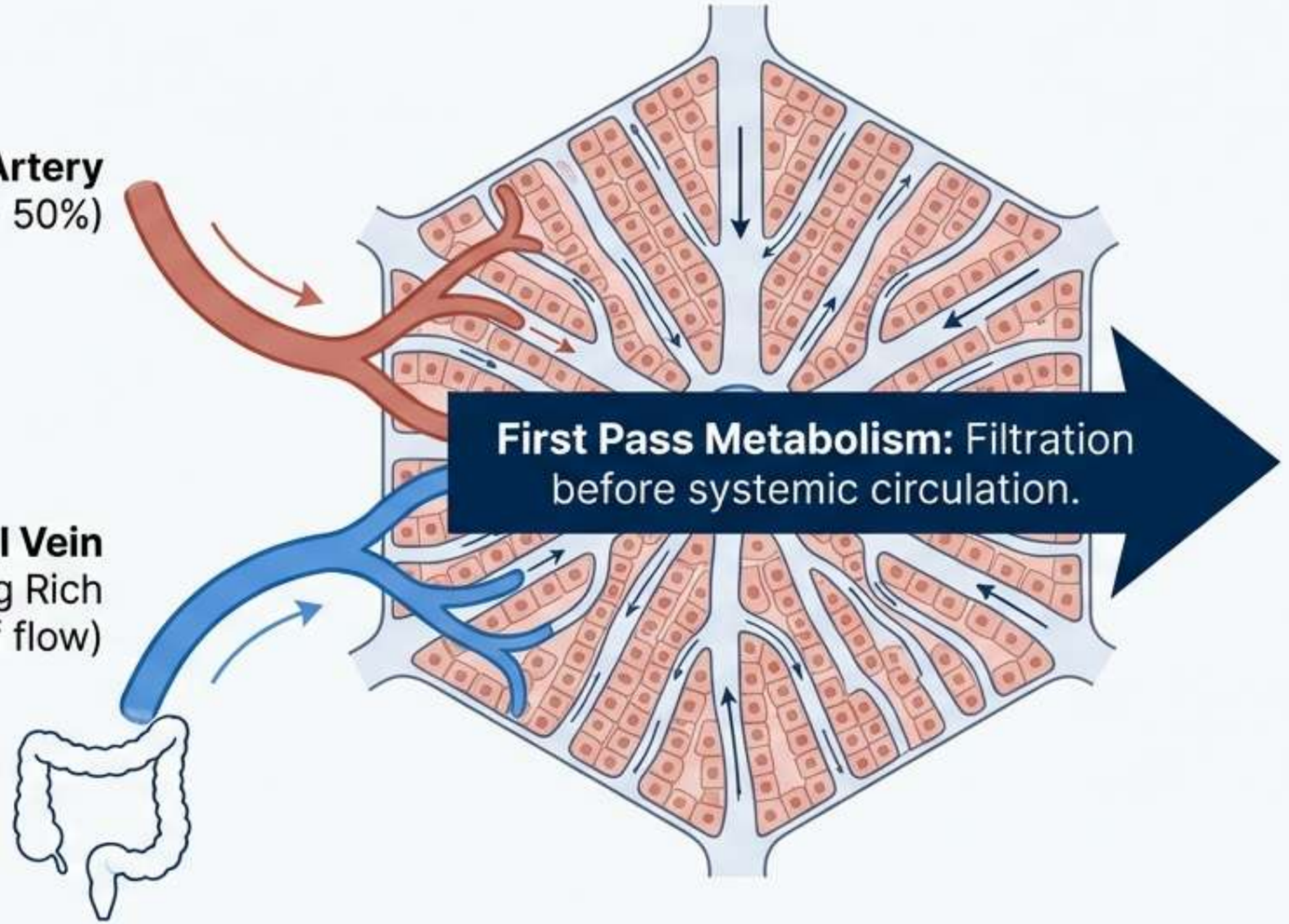


1. Binding: Determined by affinity (strength of attraction) and specificity.
2. Signal Transduction: The molecular cascade triggered by the conformational change.
3. Response: The physiological outcome (e.g., pain relief, heart rate reduction).

The Metabolic Powerhouse: Liver Anatomy

Hepatic Artery
(Oxygen Supply - 50%)

Portal Vein
(Nutrient & Drug Rich - 75% of flow)



Key Functions

- **Metabolic:** Phase 1 & 2 drug processing
- **Synthetic:** Albumin, Clotting Factors
- **Storage:** Glycogen, Vitamins

The Engine Room: Cytochrome P450 System

Polymorphism (The Genetic Variable)

Example: CYP2D6 metabolizes Codeine into Morphine.

'Ultra-rapid metabolizers' convert too fast (toxicity risk); **'Poor metabolizers'** get no relief.

Drug Interactions

Inducers: Speed up metabolism (e.g., Rifampicin).

Inhibitors: Slow down metabolism (e.g., Ciprofloxacin).

When the Engine Stalls: Pharmacology in Liver Disease

System Failure

Absorption

Reduced by splanchnic vasoconstriction.

Distribution

Low Albumin = Higher "free" drug levels (Toxicity risk).

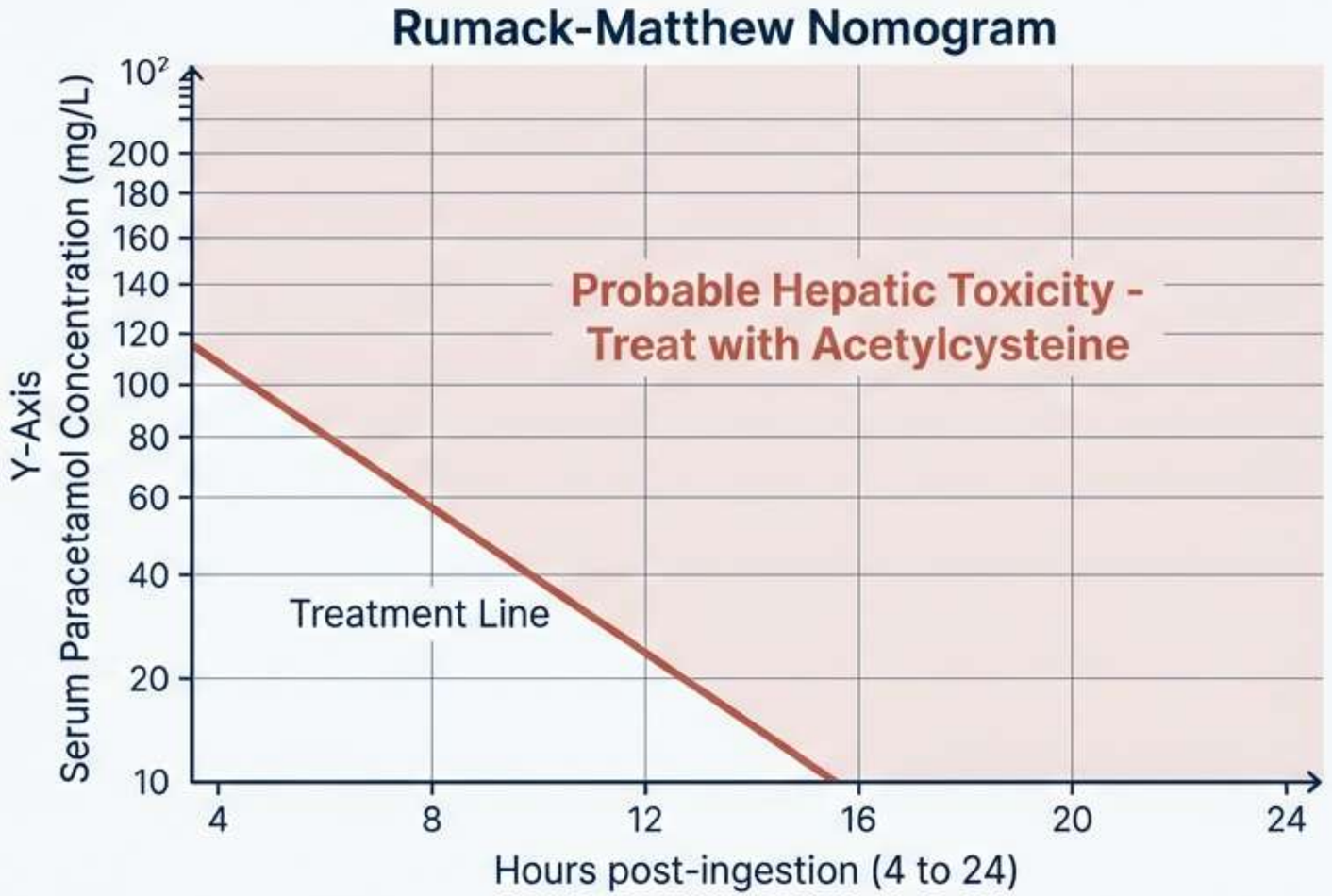
Ascites = Increased volume of distribution.

Elimination

Portovenous shunting bypasses the liver (Reduced First Pass).

Dosing Strategy: "Start low, go slow." Avoid NSAIDs. Use caution with Opioids.

Critical Care: Paracetamol Toxicity



Key Facts

- **Mechanism:** Glutathione exhaustion leading to necrosis.
- **Toxic Threshold:** >7.5g (adults).
- **Antidote:** Acetylcysteine (1-hour infusion protocol).

Swiss Medical Editorial

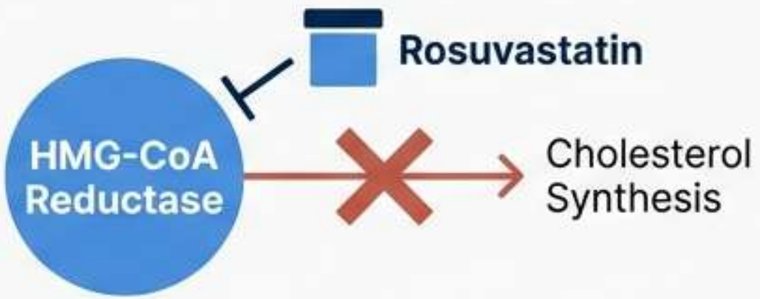
Case Study: Chronic Management with Rosuvastatin

PATIENT PROFILE

Name: John
Age: 58
Diagnosis: Hyperlipidemia

MONTH 0

High LDL → **Prescription:** Rosuvastatin 10mg PO daily



Mechanism:
HMG-CoA Reductase Inhibitor

MONTH 3

LDL improved but not at target
Action: Titrate to 20mg

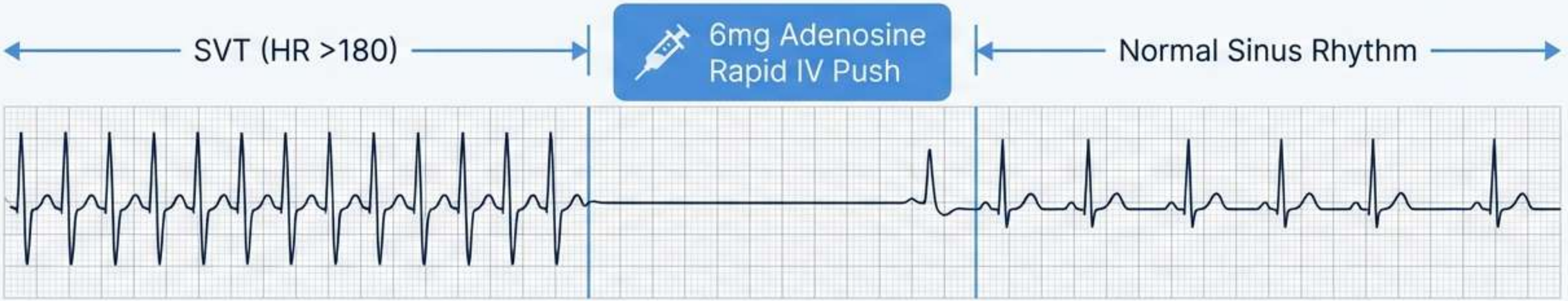
MONITORING ALERT

Safety Check: Monitor Liver Enzymes (AST/ALT) and Muscle Aches (**Rhabdomyolysis risk**).

LESSON

Balancing efficacy with “engine” stress.

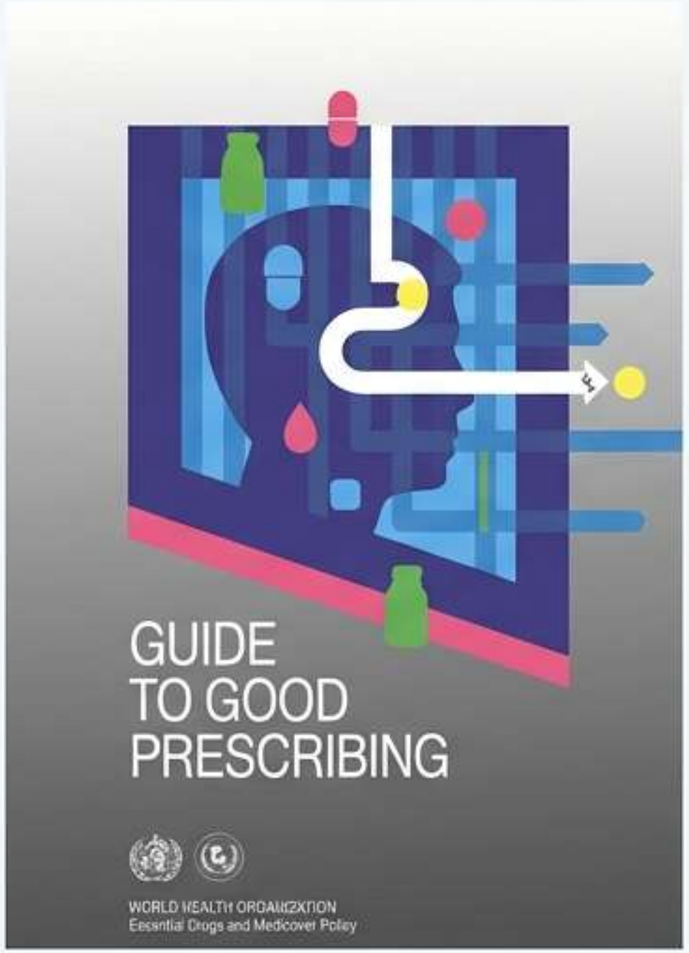
Case Study: Acute Intervention with Adenosine



- **Patient:** Sarah, 42yo. **Symptoms:** Palpitations, SOB.
- **Mechanism:** Slows AV node conduction.
- **Pharmacokinetics:** Half-life <10 seconds. Requires immediate saline flush.

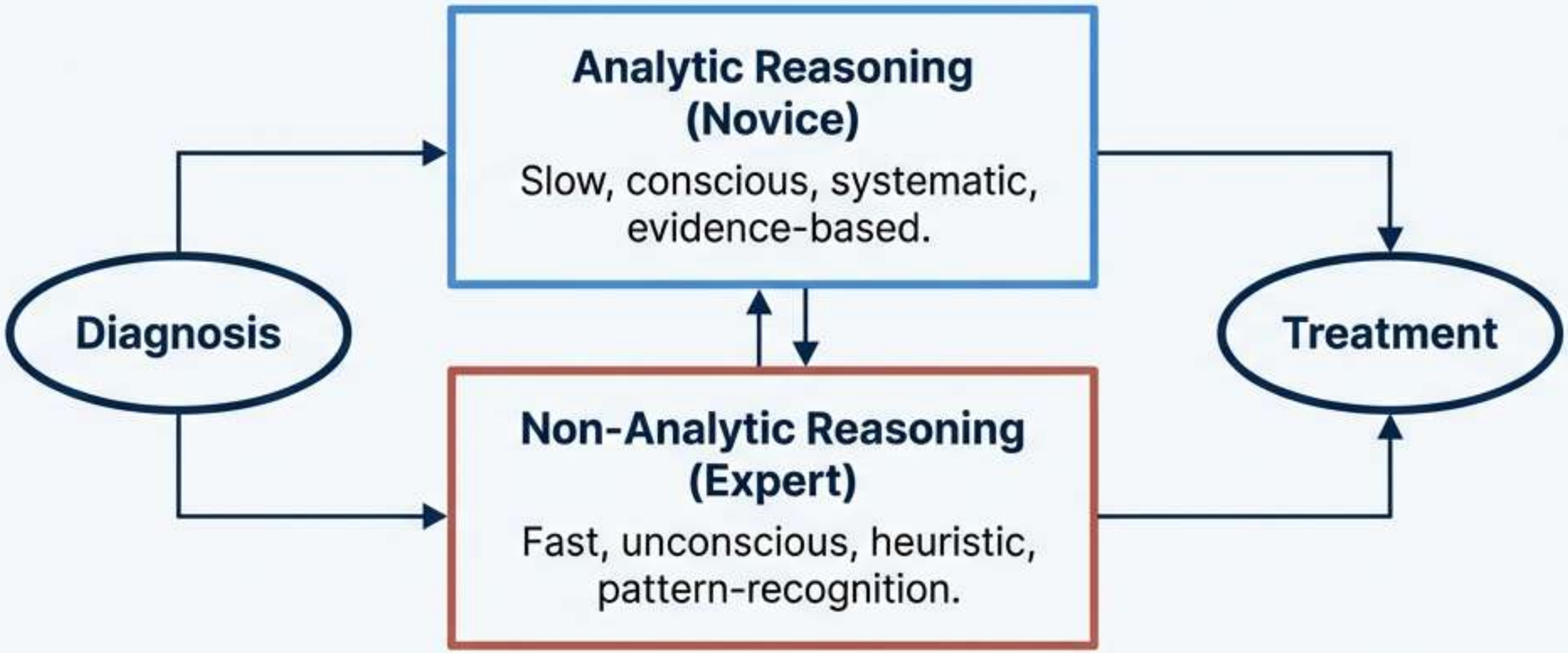
The WHO Guide to Good Prescribing: A 6-Step Model

A 6-Step Model



1. Define the patient’s problem (Diagnosis).
2. Specify the therapeutic objective.
3. Choose the Treatment (Select ‘P-Drug’ & Verify suitability for ‘*this* patient).
4. Start treatment (Write prescription).
5. Give information, instructions, and warnings.
6. Monitor treatment (Stop? Continue? Modify?).

The Psychology of Prescribing: The "Evoked Set"



Goal: Train the expert brain to habitually check for "Red Lights" (Contraindications).

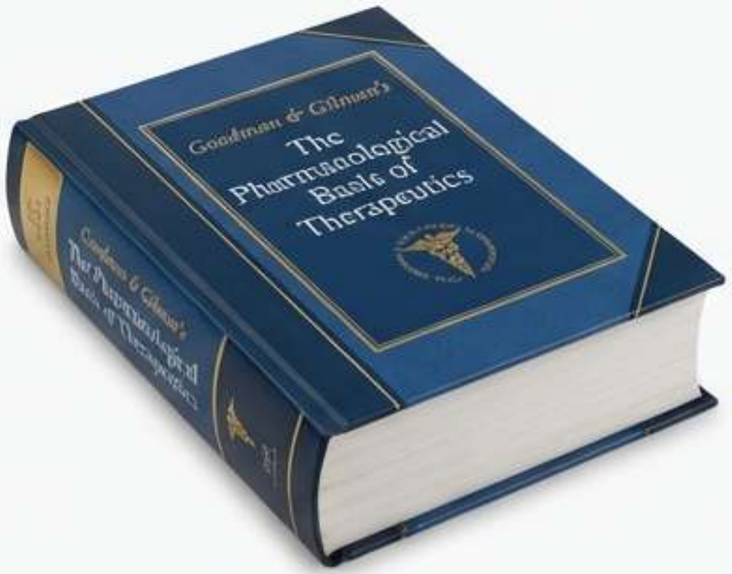
Evoked Set

The small number of treatments a doctor immediately recalls for a condition.

Mastery & Resources: The ‘Blue Bible’

Established 1941

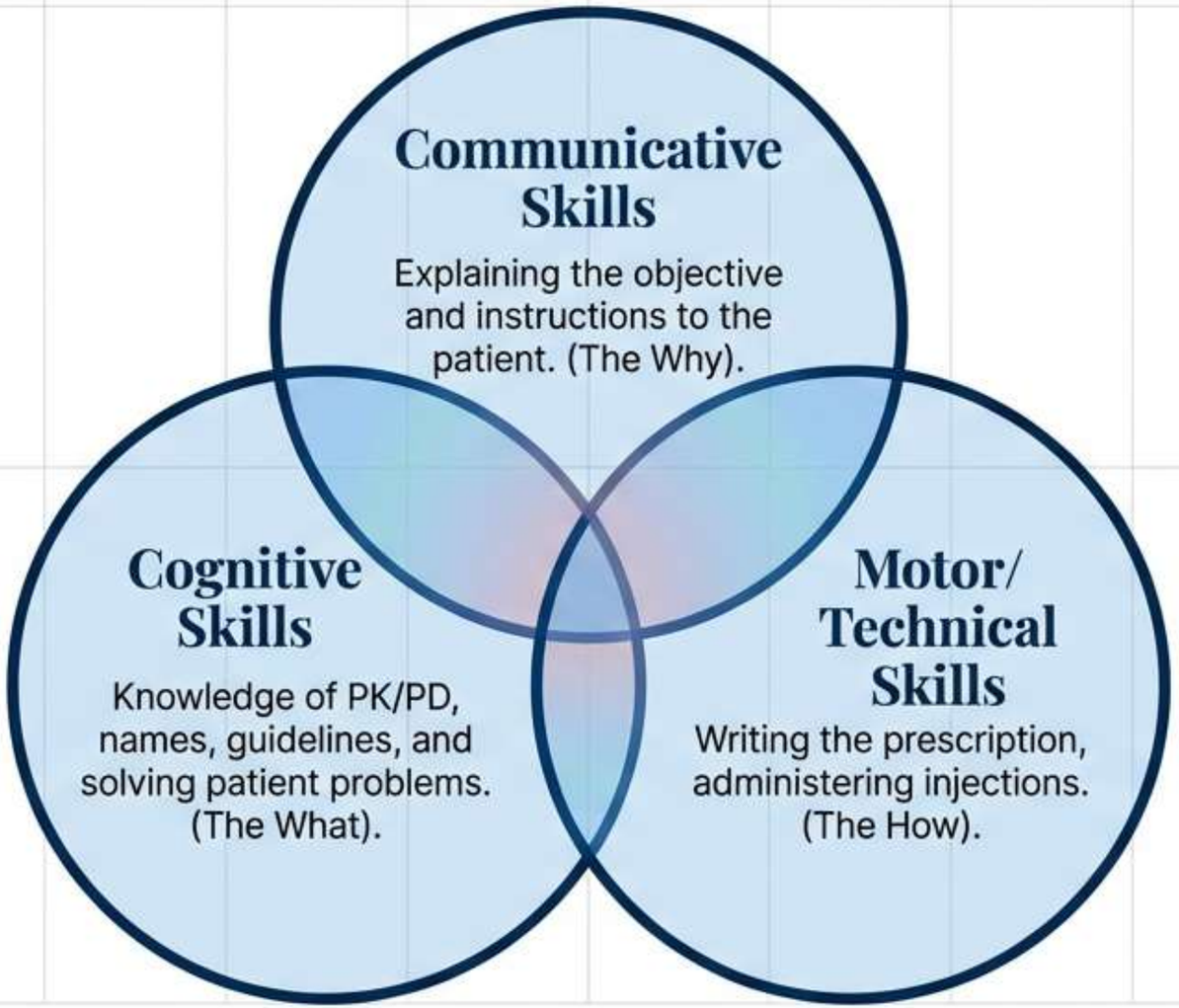
The Gold Standard



Connects Pharmacodynamics to Pharmacotherapy

The definitive reference for clinical decision making.

Summary: The Trinity of Therapeutic Competence



Rational prescribing is not just knowing the drug; it is knowing the patient.