COMPLETE LECTURE NOTES · LECTURES 1–34

Pharmacology

How Drugs Work

From receptor theory to the drug classes, built around mechanism and adverse effects

Principles of drug action · Agonists & antagonists · The autonomic nervous system · Pharmacokinetics & pharmacogenomics · Inflammation, immunity & biologics · Respiratory, cardiovascular, gastrointestinal, endocrine & CNS pharmacology · Anti-cancer & anti-infective drugs · Toxicology · Drug discovery

- Every drug class as a structured card: target, mechanism, use, adverse effects
- Mechanism-of-action and adverse-effect boxes throughout
- Annotated dose–response and antagonist curves
- Nerve terminal diagrams with numbered sites of drug action
- Exam-focus callouts, common mix-ups and SAQ technique
- Self-test questions with answers, plus a full glossary and drug index

Organised lecture by lecture

How these notes work

The notes follow the lecture sequence: 30 content lectures grouped into eight parts, from receptor theory through to drug discovery, plus an appendix on exam technique. Each lecture opens with a list of its topics and closes with a set of **takeaways**. Each part ends with a **self-test**, and the answers are at the back.

This subject is assessed on **mechanism**, not on memorised drug names. The lecturer gives the same framework repeatedly, and these notes are built around it:

● THE FRAMEWORK BEHIND EVERY ANSWER

For a drug's mechanism of action: what is the molecular **target** → where is that target **located** → does enough drug **reach** it → what happens on **modulation** of the target → what is the **effect**?

For an adverse drug reaction: what is the **mechanism** of the adverse effect → how does it **limit the drug's use** → how could you **reduce** it?

Almost every short-answer question in this subject is one of these two chains applied to a drug you have met.

The recurring boxes each do one job:

▶ MECHANISM OF ACTION

The mechanism written out as a chain: target, location, what changes, and the resulting effect.

▲ ADVERSE EFFECTS

Adverse effects explained *by* the mechanism — the same drug acting at a different target or in a different tissue.

◆ EXAM FOCUS

Content flagged in lectures as examinable, or the comparison a short-answer question is likely to be built on.

○ DON'T MIX UP

Pairs of terms that are easy to confuse, set side by side.

■ CLINICAL APPLICATION

How the pharmacology plays out in a patient: why a drug is chosen, combined or avoided.

● KEY CONCEPT

A principle that recurs across the whole subject.

Drug class cards

Each major drug class is summarised as a card, so the same information appears in the same place every time:

Example drug class what kind of drug it is	
Target	The molecule it binds, and which receptor subtype or enzyme
Mechanism	What happens when the target is engaged, through to the tissue effect
Clinical use	What it is actually prescribed for
Adverse effects	Explained by the mechanism, not just listed
Watch for	Interactions, contraindications and the reason behind them

Reading the diagrams

Diagrams use one colour scheme throughout: **violet is a drug**, **blue is a target** (receptor, channel, carrier or enzyme), **teal is a mediator or second messenger**, **amber is a physiological effect**, **grey is a process** and

crimson is an adverse effect or pathology. An arrowhead means "leads to"; a **flat bar** means "inhibits".

Five ideas that run through the whole subject

1. **A drug does nothing unless it binds.** Everything starts with a drug and a target: a **r**eceptor, **i**on channel, **c**arrier or **e**nzyme — RICE.
2. **All drugs have more than one action.** There is no such thing as a perfectly specific drug. Usefulness tracks binding-site selectivity, and loss of selectivity is where adverse effects come from.
3. **Affinity before efficacy.** Affinity decides whether a drug binds; efficacy decides whether binding does anything. The two are independent, and so are potency and efficacy.
4. **The dose makes the poison.** Botulinum toxin is a medicine at the right dose in the right place; paracetamol is a hepatotoxin at the wrong one.
5. **Selectivity is about location as much as molecule.** The same receptor in a different tissue gives you a side effect; the same drug delivered to a different place gives you a therapy.

How to use these notes

1. **Read a lecture with the boxes, not around them.** The coloured boxes are not decoration — the mechanism and adverse-effect boxes are the shape an exam answer should take, so read them as worked models.
2. **Cover the right-hand column of every drug card** and reconstruct it from the drug name. If you can produce target, mechanism, clinical use and the three main adverse effects, you know that class.
3. **Do the self-test at the end of each part before reading the answers.** Write in sentences. The questions are deliberately phrased the way short-answer questions are.
4. **Work across the subject, not down it.** The β_2 receptor in the adrenergic lecture is the same one in asthma and in cardiovascular pharmacology. The drug class index at the back is laid out to make those links visible.

Contents

Part I · Principles of Drug Action 5

L1 What Pharmacology Is 6
L2 From Plants to Rational Drug Design 8
L3 Drug Targets 10
L4 How Drugs Interact with Receptors 14
L5 Antagonists 18

Part II · The Autonomic Nervous System 23

L6 The Autonomic Nervous System 23
L7 Adrenergic Mechanisms 27
L8 Cholinergic Mechanisms 32

Part III · Pharmacokinetics & Individual Variation 37

L9 Pharmacokinetics: Absorption & Distribution 38
L10 Pharmacogenomics & Precision Medicine 41
L11 Metabolism & Excretion 44

Part IV · Inflammation, Immunity & Biologics 48

L12 Immunopharmacology 49
L13 Eicosanoids & NSAIDs 52
L14 Biologics 56
L15 Cell & Gene Therapies 59

Part V · Systems Pharmacology 62

L16 Drugs for Gastrointestinal Disorders 63
L17 Drugs to Treat Asthma 68
L19 Cardiovascular Drugs I: The System & β-blockers 73
L20 Cardiovascular Drugs II: Lowering TPR 76
L22 Drugs for Diabetes 79
L23 Drugs for Obesity 83

Part VI · Special Topics 86

L21 Drugs in Sport 87
L24 Medicinal Cannabinoids 90
L25 Mechanisms of Toxicity 92
L26 Anti-Cancer Drugs 94
L27 Anti-Infective Drugs 98
L28 Venoms 101

Part VII · CNS Pharmacology 104

L29 Introduction to CNS Pharmacology 105
L30 Drugs for Neurodegenerative Disease 107
L31 Drugs of Dependence 110
L33 Drugs for Depression 113

Part VIII · Drug Discovery Now 118

L32 Drug Discovery Now 118

Appendix A · Exam technique 122

Appendix B · Drug class index 124

Appendix C · Glossary 128

Appendix D · Self-test answers 131