B.PHARM THEORY

BP105T INTRODUCTION TO PHARMACOGNOSY

Unit V — Phyto-therapeutic Agents

Pills & Python Notes

From-zero teaching standard: every technical term is defined before use.

Syllabus coverage: Unit V (7 hours).

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UNIT V — PHYTO-THERAPEUTIC AGENTS

CHAPTER 19: ADAPTOGENS, IMMUNOMODULATORS AND HEPATOPROTECTIVES

19.1 Learning Objectives

After studying this chapter, the student will be able to:

1. Define adaptogen, immunomodulator, and hepatoprotective in simple words.
2. State the biological source (botanical name, family, part used), major constituents, and uses of Ashwagandha, Tulsi, and Amla.
3. State the biological source, major constituents, and uses of Milk thistle and Kutki.
4. Explain the difference between an adaptogen and an immunomodulator.
5. Give pharmacy counselling points for patients using these drugs.

19.2 Introduction — Medicines That Help the Body Help Itself

Most medicines you know attack something directly — an antibiotic kills bacteria, a painkiller blocks pain signals. The drugs in this chapter work differently: they **support the body's own defences**. Think of it like this: instead of fighting the enemy yourself, you train and feed the soldiers. This chapter covers three such groups:

- **Adaptogens** — help the body *adapt* to stress (physical, mental, or chemical) and return to normal balance.
- **Immunomodulators** — *modulate* (adjust) the immune system — strengthening it when weak, calming it when overactive.
- **Hepatoprotectives** — *protect the liver* (hepato = liver) from damage by toxins, alcohol, or drugs.

All five drugs in this chapter — Ashwagandha, Tulsi, Amla, Milk thistle, and Kutki — are among the most widely used plant drugs in India and the world.

19.3 Definitions (from zero)

- **Adaptogen:** a natural substance that helps the body resist stress and restores normal function. It does not push the body in one direction; it *normalizes* — like a thermostat that cools when hot and warms when cold.
- **Immunomodulator:** a substance that *modifies* the immune response. An **immunostimulant** boosts immunity (useful in frequent infections); an **immunosuppressant** calms it down (useful in allergy/autoimmune conditions). Many plant drugs do a bit of both — they *balance*.
- **Hepatoprotective:** a substance that protects liver cells from damage and helps the liver recover. The liver is the body's chemical factory and filter — it processes everything we eat and drink, so it is easily damaged by alcohol, drugs, and toxins.
- **Antioxidant:** a substance that neutralizes **free radicals** — unstable, damaging molecules produced during stress, pollution, and normal metabolism. Many drugs in this chapter are antioxidants; this partly explains their protective effects.

Terminology alert. *Adaptogen ≠ stimulant*. A stimulant (like caffeine) pushes you up and then you crash. An adaptogen helps the body handle stress without the push-and-crash cycle. Examiners test this distinction.

19.4 Adaptogens and Immunomodulators

19.4.1 Ashwagandha — the stress herb

- **Biological source:** dried roots (and sometimes leaves) of *Withania somnifera*, family **Solanaceae** (the potato/tomato family). The name means "smell of horse" — the fresh root has a characteristic horse-like odour.
- **Major constituents: withanolides** — a group of steroidal lactones (steroid-like chemicals with a lactone ring). Withaferin A is the best-known member. The roots also contain alkaloids.
- **Uses:** traditionally used as an **adaptogen** — for stress, anxiety, fatigue, and general weakness; as a **rejuvenative tonic (rasayana in Ayurveda)**; reported immunomodulatory and antioxidant activity; traditionally used to support strength and sleep quality. It is one of the most researched Ayurvedic drugs in modern times.

19.4.2 Tulsi — holy basil

- **Biological source:** fresh or dried leaves (also whole aerial parts) of *Ocimum tenuiflorum* (synonym *Ocimum sanctum*), family **Lamiaceae** (the mint family). Worshipped in Indian households; called "holy basil."
- **Major constituents: volatile oil** rich in **eugenol** (the same compound that gives clove its smell), plus ursolic acid and flavonoids.
- **Uses:** traditionally used as an **adaptogen** and **immunomodulator**; in cough, cold, and respiratory complaints (tulsi tea); reported antioxidant, antimicrobial, and anti-stress activity; a household remedy across India for fevers and infections.

19.4.3 Amla — Indian gooseberry

- **Biological source:** dried or fresh fruits of *Phyllanthus emblica* (synonym *Emblica officinalis*), family **Euphorbiaceae**. One of the richest natural sources of **vitamin C** among fruits.
- **Major constituents: vitamin C (ascorbic acid)**, **emblicanin A and B** (tannin-type antioxidants), gallic acid, and other tannins. Note: much of amla's antioxidant power comes from its tannins, not vitamin C alone.
- **Uses:** traditionally used as a **rejuvenative tonic** and **immunomodulator**; supports digestion; reported antioxidant activity; a key ingredient of the famous Ayurvedic formulation **Triphala** (amla + baheda + harde) and **Chyawanprash**. Used in hair oils and general health tonics.

Exam favourite — Triphala: three fruits — Amla (*Phyllanthus emblica*), Baheda (*Terminalia bellirica*), Harde (*Terminalia chebula*). Amla is the one from this chapter.

19.5 Hepatoprotectives

19.5.1 Milk thistle — the liver shield

- **Biological source:** dried ripe seeds (fruits) of *Silybum marianum*, family **Asteraceae** (the sunflower/daisy family). A European plant with white-veined leaves; legend says the white veins are the Virgin Mary's milk — hence the name.
- **Major constituents: silymarin** — not one chemical but a *mixture* of flavonolignans, chiefly **silybin** (also spelled silibinin), silychristin, and silydianin.
- **Uses:** the best-known plant **hepatoprotective** in Western herbal medicine; traditionally used to support the liver in jaundice and liver complaints; reported antioxidant activity protecting liver cells from toxins. Standardized silymarin extracts are among the world's top-selling herbal products.

19.5.2 Kutki — the Himalayan bitter

- **Biological source:** dried rhizomes (underground stems) of *Picrorhiza kurroa*, family **Scrophulariaceae**. A small herb of the Himalayas (you met it in Unit II, Chapter 10, as an endangered species).
- **Major constituents: picroside I and picroside II**, and **kutkoside** — intensely bitter iridoid glycosides. The bitterness is characteristic: "kutki" preparations are famously bitter.
- **Uses:** traditionally used as a **hepatoprotective** and bitter tonic; in Ayurveda for liver disorders, jaundice, and fevers; reported immunomodulatory activity. Because the **rhizome** is harvested (killing the plant), wild populations declined — the conservation story from Chapter 10.

19.6 Comparison Table (exam favourite)

Drug	Family	Part used	Headline constituent	Category
Ashwagandha	Solanaceae	Roots	Withanolides	Adaptogen
Tulsi	Lamiaceae	Leaves	Eugenol (volatile oil)	Adaptogen, immunomodulator
Amla	Euphorbiaceae	Fruits	Vitamin C, emblicanin A & B	Immunomodulator, tonic
Milk thistle	Asteraceae	Seeds	Silymarin (silybin)	Hepatoprotective
Kutki	Scrophulariaceae	Rhizomes	Picrosides I & II, kutkoside	Hepatoprotective

19.7 Analogy

Adaptogens are like a **good coach**: they don't play the match for you, they train your body to handle any opponent — heat, pressure, exhaustion. Immunomodulators are like a **volume knob for the immune system** — turning it up when the music is too soft (frequent infections), steadying it when distorted. Hepatoprotectives are like a **helmet for the liver** — the liver takes hits from alcohol, drugs, and toxins every day, and these drugs cushion the blows.

19.8 Pharmacy Relevance

- **Counselling:** patients taking ashwagandha for stress should know it is *not* a sleeping pill or instant energizer — benefits build over weeks; advise against use in pregnancy without medical advice (standard caution for herbal adaptogens).
- **Formulations:** ashwagandha churna/capsules, tulsi tea/drops, amla powder (Triphala, Chyawanprash), standardized **silymarin** capsules/tablets, kutki-containing liver tonics.
- **Quality angle:** silymarin products are *standardized extracts* — the label states the silymarin percentage. A pharmacist should prefer standardized products over crude powder for dose uniformity (links to Unit III quality control).
- **Interaction awareness:** patients on liver-metabolized prescription drugs who also take hepatoprotective herbs should inform their doctor — the pharmacist is the right person to ask.

19.9 India Context

Ashwagandha, tulsi, amla, and kutki are pillars of **Ayurveda** and the AYUSH industry; India is a major cultivator and exporter of ashwagandha roots and amla products. Tulsi grows in millions of Indian courtyards — the original household medicine chest. The **Ayurvedic Pharmacopoeia of India** lays down quality standards for all four Indian drugs in this chapter.

19.10 High-Yield Points

- Adaptogen = helps body **adapt to stress** (ashwagandha, tulsi); immunomodulator = **adjusts immunity** (tulsi, amla); hepatoprotective = **protects liver** (milk thistle, kutki).
- Ashwagandha: *Withania somnifera*, Solanaceae, roots — **withanolides**.
- Tulsi: *Ocimum tenuiflorum*, Lamiaceae, leaves — **eugenol**.
- Amla: *Phyllanthus emblica*, Euphorbiaceae, fruits — **vitamin C, emblicanin A & B**; ingredient of **Triphala**.
- Milk thistle: *Silybum marianum*, Asteraceae, seeds — **silymarin (silybin)**; Western liver herb.
- Kutki: *Picrorhiza kurroa*, Scrophulariaceae, rhizomes — **picrosides, kutkoside**; endangered Himalayan drug (Unit II link).

19.11 Common Confusions

- **Adaptogen vs stimulant:** adaptogens normalize stress responses; stimulants push activity up temporarily.
- **Silymarin vs silybin:** silymarin is the *mixture*; silybin is its *chief component*.
- **Amla's vitamin C:** its antioxidant power is not vitamin C alone — **emblicanin tannins** contribute heavily.
- **Kutki part used:** the **rhizome** (underground stem), not the root — and harvesting it kills the plant, which is why it is endangered.

19.12 Common Mistakes

- Writing tulsi's family as Solanaceae (it is **Lamiaceae**, the mint family).
- Calling milk thistle an Indian Ayurvedic drug — it is a **European/Western herbal** drug.
- Promising cures: write "traditionally used for" / "reported hepatoprotective activity," never "cures hepatitis."
- Confusing kutki (*Picrorhiza kurroa*) with chirata (*Swertia chirayita*) — both Himalayan bitters, different plants and parts.

19.13 Mnemonic

"A Tough Army Marches Kutki-forward" — **A**shwagandha, **T**ulsi, **A**mla (adaptogen/immuno trio), **M**ilk thistle, **K**utki (liver pair). Or by constituent: **"With EuGenol, Vitamin C, Silybin, Picrosides"** — **W**ithanolides, **E**ugenol, **V**itamin C, **S**ilymarin, **P**icrosides.

19.14 Chapter Summary

- **Adaptogens** (ashwagandha, tulsi) help the body resist stress; **immunomodulators** (tulsi, amla) balance immunity; **hepatoprotectives** (milk thistle, kutki) shield the liver.
- Ashwagandha (*Withania somnifera*, Solanaceae, roots): **withanolides** — adaptogen, rejuvenative tonic.
- Tulsi (*Ocimum tenuiflorum*, Lamiaceae, leaves): **eugenol** — adaptogen, immunomodulator, cold/cough remedy.
- Amla (*Phyllanthus emblica*, Euphorbiaceae, fruits): **vitamin C, emblicanin A & B** — immunomodulator, Triphala ingredient.
- Milk thistle (*Silybum marianum*, Asteraceae, seeds): **silymarin** — Western hepatoprotective.
- Kutki (*Picrorhiza kurroa*, Scrophulariaceae, rhizomes): **picrosides, kutkoside** — Ayurvedic hepatoprotective bitter; endangered in the wild.

19.15 One-Minute Revision

- 3 categories: adaptogen (stress) / immunomodulator (immunity) / hepatoprotective (liver).
- Withanolides–Eugenol–Vitamin C–Silymarin–Picrosides.
- Triphala = amla + baheda + harde.
- Kutki = rhizome harvested → plant dies → endangered.

19.16 Questions

MCQs

1. The chief active constituent group of ashwagandha roots is: (a) eugenol (b) withanolides (c) silymarin (d) picrosides
2. Tulsi belongs to the family: (a) Solanaceae (b) Lamiaceae (c) Asteraceae (d) Euphorbiaceae
3. Silymarin is obtained from the seeds of: (a) *Picrorhiza kurroa* (b) *Silybum marianum* (c) *Phyllanthus emblica* (d) *Withania somnifera*
4. Triphala contains all of the following EXCEPT: (a) amla (b) baheda (c) harde (d) kutki
5. Kutki is endangered mainly because: (a) its leaves are plucked (b) its rhizome is harvested, killing the plant (c) it is insect-pollinated (d) it grows too slowly

Viva

1. Define adaptogen, immunomodulator, and hepatoprotective with one example each.
2. How does an adaptogen differ from a stimulant?
3. What is silymarin, and what is its chief component?
4. Why is amla's antioxidant activity not attributed to vitamin C alone?
5. Name the three fruits of Triphala with botanical names.

Application-based

1. A patient on long-term medication for a liver condition asks whether milk thistle capsules are "completely safe because herbal." How do you counsel?
2. A manufacturer wants a uniform ashwagandha product. Why would a withanolide-standardized extract be preferable to simple root powder?

Answers: 1-(b), 2-(b), 3-(b), 4-(d), 5-(b)

19.17 References

- Evans WC. *Trease and Evans Pharmacognosy.* 16th ed. London: Saunders Elsevier; 2009.
- Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy.* Pune: Nirali Prakashan.

CHAPTER 20: CARDIOVASCULAR, ANTIDIABETIC, ANTI-INFLAMMATORY AND CNS DRUGS

20.1 Learning Objectives

After studying this chapter, the student will be able to:

1. State the biological source, major constituents, and uses of Garlic and Arjuna (cardiovascular).
2. State the biological source, major constituents, and uses of Gymnema and Fenugreek (antidiabetic).
3. State the biological source, major constituents, and uses of Turmeric and Boswellia (anti-inflammatory/analgesic).
4. State the biological source, major constituents, and uses of Brahmi (CNS drug).
5. Explain the pharmacist's counselling role for patients using these drugs alongside prescription medicines.

20.2 Introduction — Plants for the Heart, Sugar, Joints and Brain

Four of the commonest long-term health concerns — **heart disease, diabetes, joint pain, and memory/nerve problems** — all have plant drugs traditionally used to manage them. This chapter covers seven such drugs in four groups:

- **Cardiovascular drugs** — support the heart and blood vessels (Garlic, Arjuna).
- **Antidiabetics** — help manage blood sugar (Gymnema, Fenugreek).
- **Anti-inflammatory and analgesic drugs** — reduce inflammation (swelling, redness, heat) and pain (Turmeric, Boswellia).
- **CNS drugs** — act on the central nervous system: brain and spinal cord (Brahmi).

20.3 Definitions (from zero)

- **Cardiovascular:** relating to the **heart (cardio) and blood vessels (vascular)**. Cardiovascular drugs support heart function, blood pressure, or cholesterol balance.
- **Antidiabetic:** a drug that helps **control blood sugar (glucose)** in diabetes — a condition where the body cannot properly regulate glucose.
- **Anti-inflammatory:** reduces **inflammation** — the body's redness-swelling-heat-pain response to injury or disease (as in arthritis, the joint inflammation disease).
- **Analgesic:** a **pain-reliever** (an- = without, -algesic = pain).
- **CNS (central nervous system):** the **brain and spinal cord** — the body's control centre. CNS drugs affect memory, mood, alertness, or nerve function.

> **Terminology alert.** These plant drugs are *supportive* — traditionally used *alongside* lifestyle measures and, where prescribed, modern medicines. They do not replace insulin, blood-pressure tablets, or a doctor's advice. Write "traditionally used in the management of" — never "cures diabetes."

20.4 Cardiovascular Drugs

20.4.1 Garlic — the pungent protector

- **Biological source:** fresh or dried **bulbs** (the familiar cloves) of *Allium sativum*, family **Liliaceae** (classical textbook family; modern taxonomy places it in Amaryllidaceae). One of humanity's oldest cultivated medicinal plants.
- **Major constituents:** the intact clove contains **alliin** (odourless); when the clove is crushed, an enzyme converts alliin into **allicin** — the pungent, sulphur-containing compound responsible for garlic's smell and much of its activity. Aged garlic also contains other sulphur compounds.
- **Uses:** traditionally used to support **cardiovascular health** — reported to help maintain healthy cholesterol and blood-pressure levels; also traditionally used for its **antimicrobial** properties and as a general tonic. Garlic oil capsules and tablets are common dosage forms.

20.4.2 Arjuna — the bark for the heart

- **Biological source:** dried **stem bark** of *Terminalia arjuna*, family **Combretaceae**. Named after the hero Arjuna of the Mahabharata; a large deciduous tree of Indian riverbanks.
- **Major constituents: triterpenoid saponins** including **arjunolic acid** and **terminolic (terminaic) acid**, plus tannins and flavonoids.
- **Uses:** the classical Ayurvedic **cardiac tonic** — traditionally used to support heart function and in conditions of chest discomfort; reported antioxidant activity. Arjuna bark powder and *Arjunarishta* (a fermented Ayurvedic preparation) are traditional dosage forms.

20.5 Antidiabetic Drugs

20.5.1 Gymnema — the sugar destroyer

- **Biological source:** dried **leaves** of *Gymnema sylvestre*, family **Asclepiadaceae** (classical textbook family; modern taxonomy merges it into Apocynaceae). "Gymnema" comes from the Hindi *gurmar* — "sugar destroyer."
- **Major constituents: gymnemic acids** — a group of triterpenoid saponins. They temporarily suppress the taste of sweetness on the tongue — chew the leaf and sugar tastes like sand for an hour.
- **Uses:** traditionally used in the **management of diabetes** — reported to help maintain healthy blood-sugar levels and reduce sugar craving; a classic Ayurvedic antidiabetic herb.

20.5.2 Fenugreek (Methi) — seed and spice

- **Biological source:** dried ripe **seeds** of *Trigonella foenum-graecum*, family **Fabaceae** (the legume/pea family). The familiar kitchen spice *methi*.
- **Major constituents: trigonelline** (an alkaloid), **diosgenin** (a steroidal sapogenin — also a starting material for steroid drug manufacture), **galactomannan** (a soluble fibre/mucilage), and proteins.
- **Uses:** traditionally used to help maintain **healthy blood-sugar and cholesterol levels**; the soluble fibre slows sugar absorption from food; also traditionally used as a digestive and lactation-support herb. Because it is a food spice, it has a long safety history in culinary amounts.

20.6 Anti-inflammatory and Analgesic Drugs

20.6.1 Turmeric (Haldi) — the golden rhizome

- **Biological source:** dried **rhizomes** (underground stems) of *Curcuma longa*, family **Zingiberaceae** (the ginger family). The golden-yellow kitchen spice.
- **Major constituents: curcumin** — the yellow pigment, a diarylheptanoid — along with related **curcuminoids** (demethoxycurcumin, bisdemethoxycurcumin) and **volatile oil** (turmerone).
- **Uses:** traditionally used as an **anti-inflammatory** in joint complaints and sprains (the classic *haldi-doodh*, turmeric milk); as a digestive and wound-healing aid; reported antioxidant activity. One practical pharmacy point: curcumin is **poorly absorbed** on its own — traditional and modern formulations combine it with black pepper (piperine) or fats to improve absorption.

20.6.2 Boswellia (Shallaki) — the frankincense resin

- **Biological source:** the **oleo-gum-resin** (a natural mixture of oil, gum, and resin) obtained from the bark of *Boswellia serrata*, family **Burseraceae**. The Indian frankincense tree; the resin is called *shallaki* in Ayurveda.
- **Major constituents: boswellic acids** — a group of pentacyclic triterpenic acids, of which **11-keto-β-boswellic acid (KBA)** and **acetyl-11-keto-β-boswellic acid (AKBA)** are the most studied.
- **Uses:** traditionally used as an **anti-inflammatory and analgesic** in **arthritis and joint pain**; reported to support joint comfort and mobility. Standardized boswellic-acid extracts are common in joint-care formulations.

20.7 CNS Drugs

20.7.1 Brahmi — the memory herb

- **Biological source:** the dried **whole plant** of *Bacopa monnieri*, family **Scrophulariaceae** (classical textbook family; modern taxonomy places it in Plantaginaceae). A small creeping herb of wetlands and riverbanks.
- **Major constituents: bacosides** — a group of triterpenoid saponins (bacoside A and bacoside B are the best known).
- **Uses:** the classical Ayurvedic **brain tonic (medhya rasayana)** — traditionally used to support **memory, concentration, and mental clarity**; reported anxiolytic (anxiety-reducing) and antioxidant activity; traditionally used in formulations for students and the elderly.

> **Confusion guard.** "Brahmi" in some regions also refers to *Centella asiatica* (gotu kola, mandukaparni) — a *different* plant. In this syllabus and standard textbooks, Brahmi = *Bacopa monnieri*. If an examiner writes "Brahmi (*Bacopa monnieri*)", there is no ambiguity — but know the confusion exists.

20.8 Comparison Table (exam favourite)

Drug	Family	Part used	Headline constituent	Category
Garlic	Liliaceae	Bulb	Allicin (from alliin)	Cardiovascular
Arjuna	Combretaceae	Stem bark	Arjunolic acid, terminolic acid	Cardiovascular
Gymnema	Asclepiadaceae	Leaves	Gymnemic acids	Antidiabetic
Fenugreek	Fabaceae	Seeds	Trigonelline, diosgenin, galactomannan	Antidiabetic
Turmeric	Zingiberaceae	Rhizome	Curcumin	Anti-inflammatory, analgesic
Boswellia	Burseraceae	Oleo-gum-resin	Boswellic acids (KBA, AKBA)	Anti-inflammatory, analgesic
Brahmi	Scrophulariaceae	Whole plant	Bacosides	CNS (memory tonic)

20.9 Analogy

Think of the body's long-term problems as a house needing maintenance: **garlic and arjuna are the plumbers** keeping the pipes (blood vessels) clear and the pump (heart) strong; **gymnema and fenugreek are the fuel managers** keeping the sugar supply steady; **turmeric and boswellia are the repair crew** calming the inflamed, creaking joints; and **brahmi is the librarian** keeping the brain's records organized and easy to find.

20.10 Pharmacy Relevance

- **Counselling — the golden rule:** patients with diabetes, hypertension, or heart disease who take these herbs must **not stop their prescription medicines**. Herbs are supportive; stopping metformin or blood-pressure tablets because "garlic will handle it" is dangerous. The pharmacist must say this clearly.
- **Formulations:** garlic oil capsules, arjuna churna/*arjunarishta*, gymnema tablets, fenugreek seed powder, curcumin capsules (often with piperine), boswellia standardized extracts, brahmi syrup/tablets (*Brahmi vati*, *Saraswatarishta*).
- **Quality angle:** curcumin and boswellic-acid products are sold as **standardized extracts** (e.g., "95% curcuminoids") — teach patients to read the label, not just the brand name.
- **Interaction awareness:** garlic in large doses may increase bleeding tendency — patients on blood thinners (warfarin, aspirin) should inform their doctor; gymnema/fenugreek may add to blood-sugar lowering — watch for low-sugar symptoms.

20.11 India Context

Turmeric, fenugreek, garlic, and brahmi are kitchen-and-courtyard plants — India's original home pharmacy. Arjuna and gymnema are Ayurvedic classics; boswellia resin has been traded from India since ancient times. India is the world's largest producer of turmeric and a major exporter of curcumin and boswellia extracts. The **Ayurvedic Pharmacopoeia of India** sets quality standards for these drugs.

20.12 High-Yield Points

- Garlic: *Allium sativum*, Liliaceae, bulb — **alliin → allicin** (on crushing); cardiovascular support.
- Arjuna: *Terminalia arjuna*, Combretaceae, stem bark — **arjunolic acid**; Ayurvedic cardiac tonic.
- Gymnema: *Gymnema sylvestre*, Asclepiadaceae, leaves — **gymnemic acids**; "sugar destroyer."
- Fenugreek: *Trigonella foenum-graecum*, Fabaceae, seeds — **trigonelline, diosgenin**; fibre slows sugar absorption.
- Turmeric: *Curcuma longa*, Zingiberaceae, rhizome — **curcumin**; anti-inflammatory; poor absorption improved by piperine/fat.
- Boswellia: *Boswellia serrata*, Burseraceae, oleo-gum-resin — **boswellic acids (KBA, AKBA)**; joint pain.
- Brahmi: *Bacopa monnieri*, Scrophulariaceae, whole plant — **bacosides**; memory tonic (medhya rasayana).

20.13 Common Confusions

- **Brahmi vs gotu kola:** Brahmi = *Bacopa monnieri*; gotu kola/mandukaparni = *Centella asiatica* — different plants, regional name overlap.
- **Allicin vs alliin:** alliin (odourless, in intact clove) → allicin (pungent, formed on crushing).
- **Curcumin vs turmeric:** curcumin is the *pigment constituent*; turmeric is the *whole rhizome drug*.
- **Arjuna vs Terminalia family:** Combretaceae — not to be confused with the Euphorbiaceae of amla, though both genera are *Terminalia*-adjacent in Triphala (baheda and harde are *Terminalia* species in Combretaceae too).

20.14 Common Mistakes

- Writing garlic's family as Lamiaceae (it is **Liliaceae** — the onion family group).
- Promising disease cures: "lowers cholesterol" as a guaranteed claim — write "**reported to help maintain** healthy cholesterol levels."
- Forgetting that boswellia's drug is the **oleo-gum-resin**, not leaves or bark powder.
- Saying gymnema "destroys sugar in the blood" — it suppresses sweet *taste* and is traditionally used in diabetes management; keep textbook wording.

20.15 Mnemonic

"GArlic Keeps Good Flow; Gymnema Fenugreek Fight Sugar; Turmeric Boswellia Battle Joints; Brahmi Boosts Brain" — or shorter, by constituent: **"Allicin, Arjunolic, Gymnemic, Trigonelline, Curcumin, Boswellic, Bacosides"** — **A-A-G-T-C-B-B**.

20.16 Chapter Summary

- **Cardiovascular:** Garlic (*Allium sativum*, Liliaceae, bulb; **allicin**) and Arjuna (*Terminalia arjuna*, Combretaceae, bark; **arjunolic acid**) traditionally support heart and vessel health.
- **Antidiabetic:** Gymnema (*Gymnema sylvestre*, Asclepiadaceae, leaves; **gymnemic acids**) and Fenugreek (*Trigonella foenum-graecum*, Fabaceae, seeds; **trigonelline, diosgenin**) traditionally help manage blood sugar.
- **Anti-inflammatory/analgesic:** Turmeric (*Curcuma longa*, Zingiberaceae, rhizome; **curcumin**) and Boswellia (*Boswellia serrata*, Burseraceae, oleo-gum-resin; **boswellic acids**) traditionally relieve inflammation and joint pain.
- **CNS:** Brahmi (*Bacopa monnieri*, Scrophulariaceae, whole plant; **bacosides**) — the Ayurvedic memory tonic.
- All are **supportive**, not replacements for prescription medicines — the pharmacist's key counselling message.

20.17 One-Minute Revision

- Heart: garlic (allicin) + arjuna (arjunolic acid).
- Sugar: gymnema (gymnemic acids) + fenugreek (trigonelline, diosgenin).
- Joints: turmeric (curcumin) + boswellia (boswellic acids).
- Brain: brahmi (bacosides).
- Never stop prescription medicines for herbs.

20.18 Questions

> **MCQs**

1. Allicin is formed from alliin when garlic cloves are: (a) boiled (b) crushed (c) dried in sun (d) frozen
2. Arjuna bark belongs to the family: (a) Combretaceae (b) Fabaceae (c) Zingiberaceae (d) Burseraceae
3. The "sugar destroyer" leaf drug containing gymnemic acids is: (a) fenugreek (b) gymnema (c) brahmi (d) tulsi
4. Curcumin is the yellow pigment of: (a) boswellia resin (b) turmeric rhizome (c) garlic bulb (d) arjuna bark
5. Bacosides are the headline constituents of: (a) *Bacopa monnieri* (b) *Centella asiatica* (c) *Boswellia serrata* (d) *Terminalia arjuna*

Viva

1. Explain the alliin → allicin conversion and its significance.
2. Why is the boswellia drug called an oleo-gum-resin?
3. What is the practical problem with curcumin absorption, and how is it addressed in formulations?
4. Differentiate Brahmi (*Bacopa monnieri*) from gotu kola.
5. What counselling would you give a diabetic patient starting gymnema capsules?

Application-based

1. A patient on warfarin wants to start high-dose garlic capsules for cholesterol. What is your advice as a pharmacist?
2. A joint-care product claims "95% curcuminoids." What does standardization mean here, and why does it matter?

Answers: 1-(b), 2-(a), 3-(b), 4-(b), 5-(a)

20.19 References

- Evans WC. *Trease and Evans Pharmacognosy.* 16th ed. London: Saunders Elsevier; 2009.
- Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy.* Pune: Nirali Prakashan.

CHAPTER 21: ANTIMICROBIAL/ANTIVIRAL, GASTROINTESTINAL, DERMATOLOGICAL, WOMEN'S HEALTH AND RESPIRATORY DRUGS

21.1 Learning Objectives

After studying this chapter, the student will be able to:

1. State the biological source, major constituents, and uses of Giloy, Neem, and Andrographis (antimicrobial/antiviral).
2. State the biological source, major constituents, and uses of Psyllium (gastrointestinal).
3. State the biological source, major constituents, and uses of Aloe (dermatological).
4. State the biological source, major constituents, and uses of Chasteberry and Shatavari (women's health).
5. State the biological source, major constituents, and uses of Vasaka (respiratory).

21.2 Introduction — The Everyday Medicine Cabinet

This final chapter is the **everyday medicine cabinet** of plant drugs: the herbs for infections and immunity (Giloy, Neem, Andrographis), digestion (Psyllium), skin (Aloe), women's health (Chasteberry, Shatavari), and breathing (Vasaka). Five therapeutic groups, eight drugs — each one a household name in India or world herbal medicine.

21.3 Definitions (from zero)

- **Antimicrobial:** a substance that **kills or stops the growth of microbes** (bacteria, fungi). **Antiviral** is the specific term for agents acting against **viruses**. Plant antimicrobials are traditionally used for minor infections and to support immunity — they are not substitutes for antibiotics in serious infections.
- **Gastrointestinal (GI):** relating to the **stomach and intestines** — the digestive tract. GI drugs relieve constipation, acidity, or digestive discomfort.
- **Dermatological:** relating to the **skin** (derma = skin). Dermatological agents soothe burns, wounds, and skin irritation.
- **Expectorant:** a drug that helps **bring out phlegm/mucus** from the airways by coughing — the key action of respiratory herbs like vasaka.
- **Laxative:** a drug that **relieves constipation** by promoting bowel movement. A **bulk-forming laxative** (like psyllium) works by absorbing water and swelling — purely physical, not chemical.

21.4 Antimicrobial and Antiviral Drugs

21.4.1 Giloy — the immunity stem

- **Biological source:** dried **stems** of *Tinospora cordifolia*, family **Menispermaceae**. A climbing shrub called *guduchi* in Ayurveda — "the one who protects."
- **Major constituents: tinosporin** and related **berberine-type alkaloids**, **cordifolioside** (a phenylpropanoid glycoside), and diterpenoid lactones.
- **Uses:** traditionally used as an **immunomodulator** and in fevers and infections; reported antimicrobial and antipyretic (fever-reducing) activity; a staple of Ayurvedic formulations for general immunity and convalescence.

21.4.2 Neem — the village pharmacy

- **Biological source: leaves, bark, and seed oil** of *Azadirachta indica*, family **Meliaceae** (the mahogany family). Called "the village pharmacy" — almost every part is used.
- **Major constituents: azadirachtin** (the famous insecticidal tetranortriterpenoid from seeds), **nimbin** and **nimbidin** (bitter principles from bark/leaves).
- **Uses:** traditionally used as an **antimicrobial** — for skin infections, wounds, and dental care (neem twigs as toothbrushes); seed oil and extracts as **insecticides and pesticides** in agriculture; reported blood-purifying and antipyretic uses in traditional medicine.

21.4.3 Andrographis — the king of bitters

- **Biological source:** dried **whole plant / leaves** of *Andrographis paniculata*, family **Acanthaceae**. Called *kalmegh* in India and "king of bitters" — intensely bitter.
- **Major constituents: andrographolide** — a diterpenoid lactone, the headline bitter principle — plus related diterpenoids.
- **Uses:** traditionally used in **fevers, colds, and liver complaints**; reported antimicrobial, immunomodulatory, and hepatoprotective activity; a common ingredient in traditional cold-and-flu and liver formulations.

21.5 Gastrointestinal Drugs

21.5.1 Psyllium (Isabgol) — the gentle bulk laxative

- **Biological source:** dried **seeds**, and especially the **seed husk**, of *Plantago ovata*, family **Plantaginaceae**. The familiar *isabgol* of every Indian household.
- **Major constituents: mucilage** — a soluble fibre (arabinoxylan-type polysaccharide) concentrated in the husk. This is one of the rare drugs where the *physical property* (swelling in water) is the medicine.
- **Uses:** a **bulk-forming laxative** — the husk absorbs water, swells, and gently promotes bowel movement; traditionally used for **constipation** and to regulate bowel habit. Because it acts physically, it is among the gentlest laxatives — but it must be taken **with plenty of water**, or the swelling husk can cause choking or blockage.

> **Pharmacy-critical point.** "Take with a full glass of water" is not optional advice for psyllium — it is a **safety instruction**. This is a favourite viva/application question.

21.6 Dermatological Agents

21.6.1 Aloe — the burn plant

- **Biological source: leaves** of *Aloe barbadensis* (synonym *Aloe vera*), family **Liliaceae** (classical textbook family; modern taxonomy places it in Asphodelaceae). The leaf yields two distinct products — know both.
- **Major constituents:**
- **Aloe latex** (the bitter yellow sap under the rind): **aloin** (also called **barbaloin**) — an anthraquinone glycoside with **purgative (strong laxative)** action.
- **Aloe gel** (the clear inner pulp): **mucilage/polysaccharides** (e.g., acemannan-type) — soothing and moisturizing.
- **Uses:** the **gel** is traditionally used on **burns, sunburn, wounds, and skin irritation** as a soothing, moisturizing agent — the classic "burn plant." The **latex (aloin)** is a stimulant purgative, used far more cautiously. Confusing gel and latex is the classic student error.

21.7 Drugs Used in Women's Health

21.7.1 Chasteberry — the women's herb of the West

- **Biological source:** dried ripe **fruits** of *Vitex agnus-castus*, family **Verbenaceae** (classical textbook family; modern taxonomy places it in Lamiaceae). A Mediterranean shrub; "chasteberry" from the traditional belief that it calms libido.
- **Major constituents: iridoid glycosides** — **agnuside** and **aucubin** — plus flavonoids (casticin).
- **Uses:** traditionally used in **women's health** — for premenstrual complaints and to support a regular menstrual cycle; reported hormonal-balancing activity in traditional Western herbal medicine. One of the few women's-health herbs with a strong European tradition.

21.7.2 Shatavari — the women's herb of Ayurveda

- **Biological source:** dried **roots** of *Asparagus racemosus*, family **Liliaceae** (classical textbook family; modern taxonomy places it in Asparagaceae). "Shatavari" means "she who has a hundred husbands" — symbolizing feminine vitality.
- **Major constituents: shatavarins** — a group of **steroidal saponins** — plus flavonoids and mucilage.
- **Uses:** the classical Ayurvedic **women's tonic** — traditionally used as a rejuvenative for the female reproductive system, to support lactation, and for general strength; reported immunomodulatory and antioxidant activity.

21.8 Respiratory Drugs

21.8.1 Vasaka — the cough leaf

- **Biological source:** fresh or dried **leaves** of *Adhatoda vasica*, family **Acanthaceae**. A common shrub across India; the name *vasaka* is synonymous with cough relief in Ayurveda.
- **Major constituents: vasicine** (a quinazoline alkaloid) and **vasicinone** — its oxidation product.
- **Uses:** traditionally used as an **expectorant** — helping bring out phlegm — in **cough, bronchitis, and asthma**; the backbone of the famous Ayurvedic cough syrup **Vasavaleha** and countless cough formulations. Vasicine's bronchodilator-type activity made it a lead for modern respiratory drug research.

21.9 Comparison Table (exam favourite)

Drug	Family	Part used	Headline constituent	Category
Giloy	Menispermaceae	Stems	Tinosporin, berberine-type alkaloids	Antimicrobial, immunomodulator
Neem	Meliaceae	Leaves, bark, seed oil	Azadirachtin, nimbin	Antimicrobial, insecticide
Andrographis	Acanthaceae	Whole plant	Andrographolide	Antimicrobial, bitter tonic
Psyllium	Plantaginaceae	Seeds/husk	Mucilage	Bulk laxative (GI)
Aloe	Liliaceae	Leaves (gel + latex)	Aloin/barbaloin (latex); polysaccharides (gel)	Dermatological; purgative (latex)
Chasteberry	Verbenaceae	Fruits	Agnuside, aucubin (iridoids)	Women's health
Shatavari	Liliaceae	Roots	Shatavarins (steroidal saponins)	Women's health tonic
Vasaka	Acanthaceae	Leaves	Vasicine, vasicinone	Expectorant (respiratory)

21.10 Analogy

This chapter is a **hospital with five wards**: the **infection ward** (giloy, neem, andrographis) guards the gates against microbes; the **digestive ward** (psyllium) keeps traffic moving gently; the **skin ward** (aloe) runs the burns-and-wounds dressing room; the **women's ward** (chasteberry, shatavari) offers specialized traditional care; and the **chest ward** (vasaka) clears the airways so patients can breathe easy.

21.11 Pharmacy Relevance

- **Counselling — psyllium:** "one spoon in a **full glass of water**, drink immediately, and drink more water through the day." Never let a patient take it dry.
- **Counselling — aloe:** gel for skin is gentle; **latex (aloin) is a strong purgative** — warn against internal use of whole-leaf products in pregnancy (standard caution).
- **Formulations:** giloy tablets/juice, neem capsules/toothpaste/soaps, andrographis tablets (cold-flu formulas), isabgol husk sachets, aloe vera gel/juice, shatavari kalpa/powder, vasaka cough syrups (*Vasavaleha*).
- **Quality angle:** aloe products vary wildly — a "vera juice" may be mostly water. Teach label reading: look for aloe content and whether latex (aloin) has been removed for skin products.
- **Interaction awareness:** neem and andrographis are bitters often combined with other medicines — advise patients to tell their doctor about all herbal products.

21.12 India Context

Giloy, neem, andrographis (*kalmegh*), isabgol, aloe (*ghritkumari*), shatavari, and vasaka are deeply Indian — growing wild or cultivated across the country, and all standardized in the **Ayurvedic Pharmacopoeia of India**. India is a major producer of **psyllium husk** (Gujarat/Rajasthan belt) for world export. Chasteberry is the exception — a **Mediterranean/Western** herb included for the women's-health category.

21.13 High-Yield Points

- Giloy: *Tinospora cordifolia*, Menispermaceae, stems — **tinosporin**; immunomodulator, fevers.
- Neem: *Azadirachta indica*, Meliaceae, leaves/bark/seed oil — **azadirachtin**; antimicrobial, insecticide; "village pharmacy."
- Andrographis: *Andrographis paniculata*, Acanthaceae, whole plant — **andrographolide**; "king of bitters."
- Psyllium: *Plantago ovata*, Plantaginaceae, seed husk — **mucilage**; bulk laxative; **take with plenty of water**.
- Aloe: *Aloe barbadensis*, Liliaceae, leaves — **gel** (soothing polysaccharides) vs **latex** (**aloin/barbaloin**, purgative).
- Chasteberry: *Vitex agnus-castus*, Verbenaceae, fruits — **agnuside, aucubin**; women's health (Western herb).
- Shatavari: *Asparagus racemosus*, Liliaceae, roots — **shatavarins**; Ayurvedic women's tonic.
- Vasaka: *Adhatoda vasica*, Acanthaceae, leaves — **vasicine**; expectorant; *Vasavaleha*.

21.14 Common Confusions

- **Aloe gel vs aloe latex:** gel = soothing skin agent; latex = purgative. Different part of the leaf, opposite uses.
- **Chasteberry vs shatavari:** both women's-health drugs, but chasteberry is **Western** (fruits, iridoids) and shatavari is **Ayurvedic** (roots, saponins).
- **Giloy part used:** the **stem**, not leaves or roots.
- **Psyllium action: physical** (swelling), not chemical — hence "bulk-forming."

21.15 Common Mistakes

- Calling neem's family Lamiaceae or Fabaceae — it is **Meliaceae**.
- Writing that psyllium can be taken dry — always **with plenty of water** (safety).
- Saying aloe latex and gel are the same thing.
- Promising cures for infections: plant antimicrobials are **supportive**; serious infections need proper medical treatment.
- Confusing vasaka (*Adhatoda vasica*, Acanthaceae) with vasaka-like names — write the botanical name fully.

21.16 Mnemonic

"GNeem Andro fights germs; Psyllium pushes gently; Aloe dresses skin; Chaste-Shatavari care for women; Vasaka vents the chest" — or by constituent initials: **"Tinosporin, Azadirachtin, Andrographolide, Mucilage, Aloin, Agnuside, Shatavarins, Vasicine"** — **T-A-A-M-A-A-S-V**.

21.17 Chapter Summary

- **Antimicrobial/antiviral:** Giloy (*Tinospora cordifolia*, Menispermaceae, stems; **tinosporin**), Neem (*Azadirachta indica*, Meliaceae; **azadirachtin**), Andrographis (*Andrographis paniculata*, Acanthaceae; **andrographolide**) — traditional support in infections, fevers, and immunity.
- **GI:** Psyllium (*Plantago ovata*, Plantaginaceae, husk; **mucilage**) — bulk-forming laxative; always with water.
- **Dermatological:** Aloe (*Aloe barbadensis*, Liliaceae, leaves) — **gel** soothes skin; **latex (aloin)** is purgative.
- **Women's health:** Chasteberry (*Vitex agnus-castus*, Verbenaceae, fruits; **agnuside**) — Western tradition; Shatavari (*Asparagus racemosus*, Liliaceae, roots; **shatavarins**) — Ayurvedic tonic.
- **Respiratory:** Vasaka (*Adhatoda vasica*, Acanthaceae, leaves; **vasicine**) — expectorant; *Vasavaleha*.

21.18 One-Minute Revision

- Germs: giloy (tinosporin) + neem (azadirachtin) + andrographis (andrographolide).
- Gut: psyllium husk (mucilage) + full glass of water.
- Skin: aloe gel (soothe) vs latex (purge).
- Women: chasteberry (West) + shatavari (Ayurveda).
- Chest: vasaka (vasicine) — expectorant.

21.19 Questions

MCQs

1. The "king of bitters" containing andrographolide is: (a) giloy (b) neem (c) andrographis (d) vasaka
2. Psyllium husk acts as a laxative by: (a) chemical irritation (b) bulk formation through mucilage swelling (c) killing gut bacteria (d) blocking sugar absorption
3. Aloin (barbaloin) is found in: (a) aloe gel (b) aloe latex (c) psyllium husk (d) vasaka leaves
4. Shatavarins are steroidal saponins from the roots of: (a) *Vitex agnus-castus* (b) *Asparagus racemosus* (c) *Adhatoda vasica* (d) *Tinospora cordifolia*
5. Vasicine, the expectorant alkaloid, comes from: (a) tulsi (b) vasaka (c) brahmi (d) kutki

Viva

1. Differentiate aloe gel and aloe latex in source and use.
2. Why must psyllium always be taken with plenty of water?
3. Compare chasteberry and shatavari as women's-health drugs.
4. What is azadirachtin, and why is neem called the village pharmacy?
5. Define expectorant and bulk-forming laxative with one example each.

Application-based

1. A patient buys whole-leaf aloe juice for daily drinking, believing "aloe is aloe." What do you explain about gel vs latex?
2. A mother asks for something gentle for her child's occasional constipation. Why might psyllium be suggested, and what exact instructions do you give?

Answers: 1-(c), 2-(b), 3-(b), 4-(b), 5-(b)

21.20 References

- Evans WC. *Trease and Evans Pharmacognosy.* 16th ed. London: Saunders Elsevier; 2009.
- Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy.* Pune: Nirali Prakashan.

UNIT V INFOGRAPHIC CONCEPT — "THE PHYTO-THERAPEUTIC WHEEL"

Layout: a circular wheel divided into 11 segments (one per drug class), each segment a coloured wedge with an icon, the class name, and its 1–3 drugs:

1. 🛡️ **Adaptogens** — Ashwagandha, Tulsi
2. 💪 **Immunomodulators** — Tulsi, Amla, Giloy
3. 🫁 **Hepatoprotectives** — Milk thistle, Kutki
4. ❤️ **Cardiovascular** — Garlic, Arjuna
5. 🩸 **Antidiabetics** — Gymnema, Fenugreek
6. 🦵 **Anti-inflammatory** — Turmeric, Boswellia
7. 🧠 **CNS** — Brahmi
8. 🦠 **Antimicrobial** — Giloy, Neem, Andrographis
9. 🌾 **Gastrointestinal** — Psyllium
10. ✨ **Dermatological** — Aloe
11. 🤰 **Women's health** — Chasteberry, Shatavari
12. 🌬️ **Respiratory** — Vasaka

Centre of the wheel: "20 drugs · 11 classes · one principle: support the body's own defences." **Outer ring (running footnote):** each drug's headline constituent (withanolides, eugenol, silymarin, allicin, curcumin, bacosides, vasicine…).

UNIT V REFERENCES (COMBINED)

- Evans WC. *Trease and Evans Pharmacognosy.* 16th ed. London: Saunders Elsevier; 2009.
- Tyler VE, Brady LR, Robbers JE. *Pharmacognosy.* 9th ed. Philadelphia: Lea & Febiger; 1988.
- Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy.* Pune: Nirali Prakashan.
- Ayurvedic Pharmacopoeia of India (for quality standards of the Indian drugs in this unit).