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Introduction to Pharmacognosy

BP105T — B.Pharm Semester I

Rapid Revision Notes

One-night-pass companion: every topic, only the core

As per PCI B.Pharm (NEP 2020) syllabus

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Unit I — Fundamentals of Pharmacognosy

What is pharmacognosy

Pharmacognosy is the scientific study of crude drugs obtained from natural sources — their history, cultivation, collection, processing, storage, identification, evaluation, and therapeutic use.

- The word comes from Greek: pharmakon (drug) + gnosis (knowledge). The term was first used by C. A. Seydler in 1815 in *Analecta Pharmacognostica*.
- A crude drug is a natural product (plant, animal, mineral) used as a drug in its raw or simply processed form — before any chemical purification.

Remember: Pharmacognosy = pharmakon + gnosis. Seydler, 1815. This is a guaranteed 2-mark question.

History, present status, scope and development

- Earlier days: pharmacognosy was mostly about identifying and describing crude drugs by their shape, colour, and taste.
- Present status: after a mid-20th-century dip (when synthetic drugs ruled), it revived strongly. Reasons: resistance to synthetic drugs, side-effect concerns, WHO support for traditional medicine, and blockbusters like taxol and artemisinin proving nature still invents better molecules than the lab.
- Scope — where a pharmacognosist works: (1) Industry — herbal formulation, QC of raw materials, standardization of extracts; (2) Research — drug discovery from natural sources; (3) Regulation — pharmacopoeial standards, adulteration testing, GMP for herbals; (4) Traditional medicine — scientific validation of Ayurveda, Unani, Siddha, Homoeopathy.

Sources of drugs

Six natural sources — learn one example of each. The examiner will ask "give one example from each source."

Source	Example
Plants — whole plant or parts (leaf, bark, root, seed)	Senna leaf (laxative), Cinchona bark (quinine)
Animals — animal products or organs	Honey (demulcent), cod-liver oil (vitamins A & D)
Microbial — antibiotics from bacteria/fungi	Penicillin (<i>Penicillium notatum</i>)
Marine — drugs from sea organisms	Agar (from red algae <i>Gelidium</i>)

Source	Example
Mineral — inorganic substances used as drugs	Kaolin (adsorbent in diarrhoea), talc
Plant tissue culture — plant cells grown in the lab	Shikonin from Lithospermum cell culture

- Plant tissue culture advantage: uniform, contamination-free supply; works for slow-growing or endangered plants; no seasonal dependence. Limitation: expensive, and scale-up from flask to factory is hard.

Mnemonic: six sources — Plants, Animals, Microbial, Marine, Mineral, Plant tissue culture. Say it as "Pharmacist Always Makes Money Mixing Potions."

Historical milestones in drug discovery

Straight from the syllabus — learn drug → source → discoverer/year → use. Favourite 5-mark question.

Drug	Source	Milestone
Morphine	Opium (<i>Papaver somniferum</i>)	Sertürner, 1804 — first alkaloid ever isolated; proved plant activity sits in one chemical. Strong analgesic.
Quinine	Cinchona bark	Pelletier & Caventou, 1820 — first effective antimalarial.
Aspirin	Willow bark (salicin)	Hoffmann at Bayer, 1897 — acetylated salicylic acid; first semi-synthetic blockbuster.
Warfarin	Spoiled sweet clover (dicoumarol)	Karl Link — traced cattle bleeding disease to dicoumarol. Anticoagulant.
Penicillin	<i>Penicillium notatum</i> mould	Fleming, 1928; developed by Florey & Chain. Started the antibiotic era.
Cephalosporin	<i>Cephalosporium acremonium</i> (Sardinian seawater fungus)	Brotzu; developed by Florey & Abraham. Broad-spectrum antibiotics.
Taxol (paclitaxel)	Pacific yew bark (<i>Taxus brevifolia</i>)	Wani & Wall, 1971 — anticancer (ovarian, breast).
Artemisinin	Sweet wormwood (<i>Artemisia annua</i> , "qinghao")	Tu Youyou; Nobel Prize 2015 — backbone of ACT malaria therapy.

Mnemonic: M-Q-A-W-P-C-T-A → "Most Questions Are Worth Points — Check Total Answers."
Morphine, Quinine, Aspirin, Warfarin, Penicillin, Cephalosporin, Taxol, Artemisinin.

Herbal and traditional pharmacopoeias

A pharmacopoeia is an official book of drug standards — it fixes how a drug is identified, tested, and how pure it must be. The six the syllabus names:

- 1 Indian Pharmacopoeia (IP) — Indian Pharmacopoeia Commission, Ghaziabad; monographs on herbal + synthetic drugs.
- 2 British Herbal Pharmacopoeia (BHP) — standards for herbal medicines used in the UK.
- 3 United States Pharmacopoeia - Herbal Medicines and Dietary Supplements (USP) — quality standards for US botanicals and supplements.
- 4 Ayurvedic Pharmacopoeia of India (API) — Govt. of India (Ministry of AYUSH); monographs on Ayurvedic raw drugs and formulations.
- 5 Unani Pharmacopoeia of India (UPI) — standards for Unani (Greco-Arab) medicines.
- 6 American Herbal Pharmacopoeia (AHP) — non-profit; detailed monographs on North American botanicals.

Official, non-official, codified, non-codified drugs

- Official drugs: listed in an official pharmacopoeia (IP, BP, USP). Example: Senna (in IP).
- Non-official drugs: not in any pharmacopoeia but still used. Example: many folk remedies.
- Codified drugs: described in classical, codified texts — Charaka Samhita, Sushruta Samhita (Ayurveda) or official pharmacopoeias. Identity and use are documented in an authoritative book.
- Non-codified drugs: used in folk/tribal medicine, known through oral tradition, not written in any classical text.

Remember: Official = in the pharmacopoeia. Codified = written in a classical book. A drug can be codified but non-official — in Charaka Samhita but not in IP.

Classification of crude drugs

Classification = arranging crude drugs into groups so they are easy to study. Six systems — learn basis + example + one merit + one limitation of each. Almost guaranteed as a 5–10 mark question.

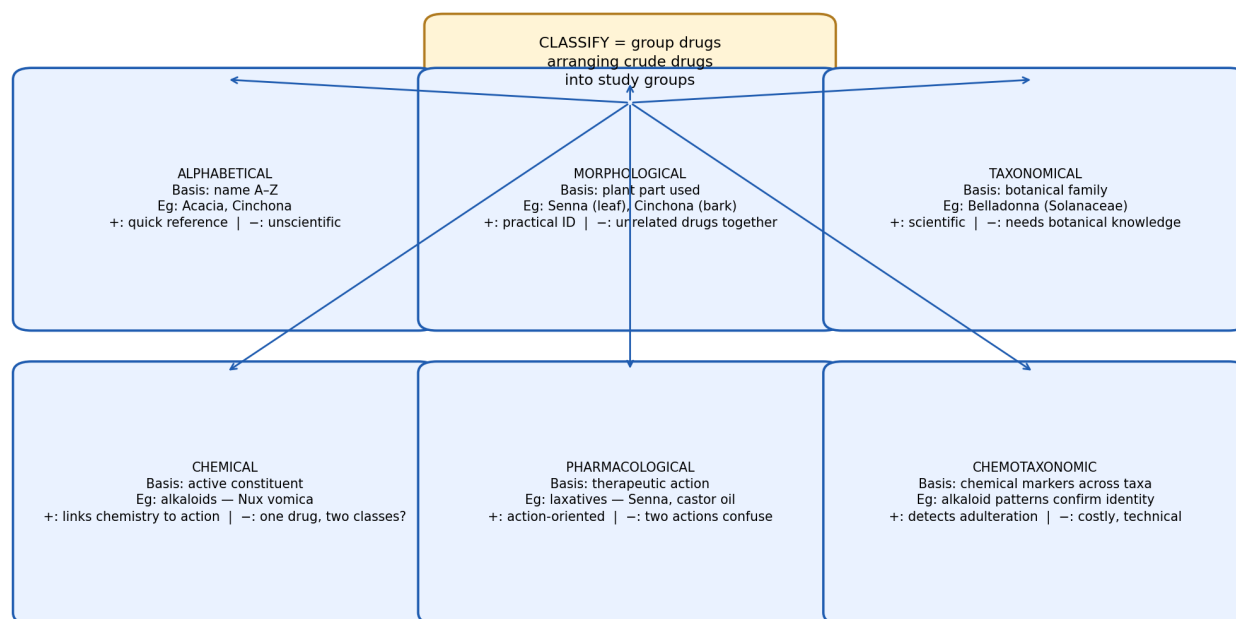
System	Basis	Example	Merit	Limitation
Alphabetical	Latin/English name, A-Z	Acacia, Benzoin, Cinchona	Easiest quick reference, like a dictionary	No relationship between neighbouring drugs; unscientific
Morphological	Plant part used (organized vs unorganized)	Leaves: Senna; Barks: Cinchona; Roots: Rauwolfia; Unorganized: gums, resins, oils	Useful for practical study and identifying plant parts	Chemically unrelated drugs sit together
Taxonomical	Botanical classification (family, genus, species)	Solanaceae: Belladonna, Datura	Scientific; shows evolutionary relationships	Chemically different drugs of one family get grouped together
Chemical	Main active constituent	Alkaloids: Nux vomica; Glycosides: Senna; Volatile oils: Clove	Connects chemistry to action — best for pharmacists	One drug may contain two constituent classes; morphology is lost
Pharmacological	Therapeutic action	Laxatives: Senna, Castor oil; Cardiotonics: Digitalis	Directly action-oriented — useful for doctors and pharmacists	Drugs with two actions confuse the system
Chemotaxonomic	Chemistry as a taxonomic marker — chemical patterns across plant taxa	Uses alkaloid/glycoside patterns to confirm plant identity	Modern and scientific; helps detect adulteration	Needs advanced analysis; expensive for routine use

Mnemonic: A-M-T-C-P-C → "A Morning Tea Clears Pain Completely": Alphabetical, Morphological, Taxonomical, Chemical, Pharmacological, Chemotaxonomic.

- Most useful in practice: chemical and pharmacological — they connect constituent to action, exactly the source → constituent → use pattern of exams.

CLASSIFICATION OF CRUDE DRUGS

Six systems — basis, example, one merit / limitation



Most useful for pharmacy students: **CHEMICAL + PHARMACOLOGICAL (constituent → action)**

Crude drug classification systems at a glance

Very short questions (2 marks)

- 1 Who coined the term pharmacognosy and in which year?
- 2 Define a crude drug with one example.
- 3 Give one example each of a drug from animal and marine sources.
- 4 In which year did Sertürner isolate morphine?
- 5 What is the difference between an official and a codified drug?

Short questions (5 marks)

- 1 Describe the sources of drugs with one example of each.
- 2 Write a note on the chemical classification of crude drugs with its merits and limitations.
- 3 Write a short note on the scope of pharmacognosy.

Long questions (10 marks)

- 1 Describe the six systems of classification of crude drugs with their merits and limitations.
- 2 Write a detailed note on the historical milestones in drug discovery from morphine to artemisinin.

How to approach these answers

- Very-short Q1: just the name + year + work title; one line is enough.
- Very-short Q4: only "1804, Sertürner"; don't add extra facts.
- Short Q1: make a six-row table (source → example); one line each.

- Short Q2: basis, two examples, one merit, one limitation — then close.
- Long Q1: intro line, then each system as a mini-point (basis, example, merit, limitation); draw the classification figure.
- Long Q2: eight drugs in order with drug → source → discoverer → use; conclude with artemisinin's Nobel.

Unit II — Cultivation, Collection, Processing and Storage of Drugs of Natural Origin

Methods of plant cultivation

Medicinal plants are cultivated (not just wild-collected) so supply is steady and quality uniform.

- Sexual propagation (seeds): cheap, easy for large areas. Limitation: genetic variation — every seedling differs, so constituent content varies. Example: Senna, Isabgol.
- Asexual / vegetative propagation: cuttings, grafting, layering, suckers. Genetically identical plants → uniform constituent content. Example: mint stolons, sugarcane setts.
- Micropropagation (tissue culture): plantlets grown from small tissue pieces in sterile lab conditions. Used for rare or disease-free planting material.

Remember: Wild plants often have higher constituent content (stress boosts secondary metabolites), but cultivated plants give reliable quality. For industry, cultivation wins.

WHO Good Agricultural and Collection Practices (GACP)

The syllabus writes "WHO / GAP / GCP guidelines." The correct standard for medicinal plants is WHO's Good Agricultural and Collection Practices (GACP) — GCP properly belongs to clinical trials, but quote the syllabus phrase if asked.

- Site selection: soil free of heavy metals, pesticides, industrial pollutants; clean irrigation water.
- Seeds/propagation material: botanically identified, disease-free, from authenticated sources.
- Cultivation: no banned pesticides; fertilizer use recorded; crop rotation to protect soil.
- Collection: correct species, correct part, correct season and time of day; trained collectors who don't mix in similar-looking species.
- Post-harvest: proper drying, cleaning, grading; storage protected from moisture, pests and light.
- Documentation: every batch traceable — where grown, when harvested, how processed.

Remember: "Quality starts in the field." GACP = site, seed, cultivation, collection, drying, storage, documentation.

Factors influencing cultivation, collection and storage

The classic "factors affecting quality of crude drugs" answer. Group them:

- Environmental (before harvest): altitude and climate (Cinchona needs tropical highlands); soil pH, minerals, drainage (liquorice's glycyrrhizin varies with soil); light and photoperiod.
- Biological: plant age and growth stage — constituents peak at one stage (Belladonna alkaloids highest at flowering); pests and diseases cut yield and add toxins.
- At collection: time of collection — season and even time of day (volatile-oil plants are collected in the morning when oil content is highest; barks in spring); correct part only, no adulterant species mixed in.
- Post-harvest: drying — too slow → fungal growth; too fast/hot → loss of volatile oils and breakdown of glycosides. Shade-dry leaves and flowers; sun-dry barks and roots. Storage — moisture causes mould, light degrades constituents, insects eat stored drugs. Store cool, dry, airtight, dark.

Plant hormones and their applications

Phytohormones used to improve medicinal plant cultivation:

Hormone	Main application
Auxins (IBA, NAA)	Rooting of stem cuttings — faster, uniform propagation
Gibberellins	Breaking seed dormancy; increasing stem growth and flowering
Cytokinins	Shoot multiplication in tissue culture; delaying leaf ageing
Absciscic acid	Stress tolerance, dormancy control
Ethylene	Fruit ripening; stimulating latex flow in some plants

Mnemonic: Auxins → Anchor (roots); Gibberellins → Germinate (dormancy broken); Cytokinins → Clone (shoots multiply in tissue culture).

Polyploidy, mutation and hybridization

Plant-breeding tools to raise the quantity of active (secondary) metabolites:

- Polyploidy: doubling chromosome sets with colchicine. Polyploid plants are often bigger and richer in secondary metabolites. Example: tetraploid *Datura/Artemisia* strains with higher alkaloid/artemisinin content.
- Mutation: inducing changes with radiation or chemicals (EMS), then selecting high-yield mutants. Example: high-morphine mutants of opium poppy.
- Hybridization: crossing varieties/species to combine traits — e.g., high yield of one parent with high constituent content of the other. Example: *Cinchona* hybrids richer in quinine.

Remember: Secondary metabolites ARE the drug. All breeding here has one goal — make the plant produce more of them.

Conservation, value addition and eco-pharmacognosy

- In-situ conservation: protecting plants in their natural habitat — national parks, sanctuaries, biosphere reserves, sacred groves.
- Ex-situ conservation: protecting plants outside their habitat — botanical gardens, seed banks, gene banks, cryopreservation, tissue-culture repositories.
- Value addition: instead of selling raw dried herbs cheaply, process into standardized extracts, powders, capsules, essential oils — more income for growers, better quality for buyers.
- Eco-pharmacognosy: using ecological knowledge to harvest medicinal plants sustainably — take without destroying the population, so the resource survives.

Endangered examples from the syllabus:

- *Kutki (*Picrorhiza kurroa*):* Himalayan hepatoprotective herb; over-collected from the wild, now threatened. Needs cultivation and regulated collection.
- *Chirata (*Swertia chirata*):* Himalayan bitter tonic; wild populations declining under heavy demand.

Mnemonic: In-situ = in nature. Ex-situ = exit nature (gardens, banks, labs).

Very short questions (2 marks)

- 1 Expand GACP.
- 2 Name two plant hormones and give one use of each in medicinal plant cultivation.
- 3 What is in-situ conservation?
- 4 Name the two endangered medicinal plants mentioned in the syllabus.
- 5 Why is shade drying preferred for leaves and flowers?

Short questions (5 marks)

- 1 Explain the WHO GACP guidelines for medicinal plants.

- 2 Describe the factors influencing the quality of crude drugs during cultivation, collection and storage.
- 3 Differentiate in-situ and ex-situ conservation with examples.

Long questions (10 marks)

- 1 Describe the methods of plant cultivation and the factors affecting collection, processing and storage of crude drugs.
- 2 Write notes on polyploidy, mutation and hybridization with reference to secondary metabolites, giving one example of each.

How to approach these answers

- Very-short Q2: two hormones, one use each — table of two rows, done.
- Very-short Q4: just the two names (Kutki, Chirata); add one line each on why endangered.
- Short Q1: list the six GACP heads (site, seed, cultivation, collection, post-harvest, documentation) with one line each.
- Short Q3: two-column table + one example per column.
- Long Q1: split into cultivation methods first, then factors (environmental, biological, collection, post-harvest); close with storage conditions.
- Long Q2: one subhead per technique with definition, mechanism, and example; end with the "secondary metabolites are the drug" line.

Unit III — Quality Control of Drugs of Natural Origin (WHO Guidelines)

Adulteration of drugs of natural origin

Adulteration = partial or complete substitution of a genuine drug with spurious, inferior, or foreign material — or mixing such material into the genuine drug. It lowers therapeutic effect and can cause poisoning. Quality control exists to catch it.

Type	What happens	Example
Substitution with inferior varieties	Cheaper related species replaces the genuine drug	Other Cassia species sold as <i>Senna alexandrina</i>
Substitution with exhausted drugs	Drug already used for extraction (actives removed) mixed back in	Exhausted clove or fennel (volatile oil already distilled out)
Artificially manufactured substitutes	Fake drug made to look genuine	Artificial invert sugar as honey; paraffin wax in beeswax
Harmful adulterants	Toxic material added, often for weight	Lead shot in opium; stones in liquorice root

Type	What happens	Example
Adulteration by admixture	Genuine drug mixed with inferior material	Stems mixed into leaf drugs; excess foreign organic matter

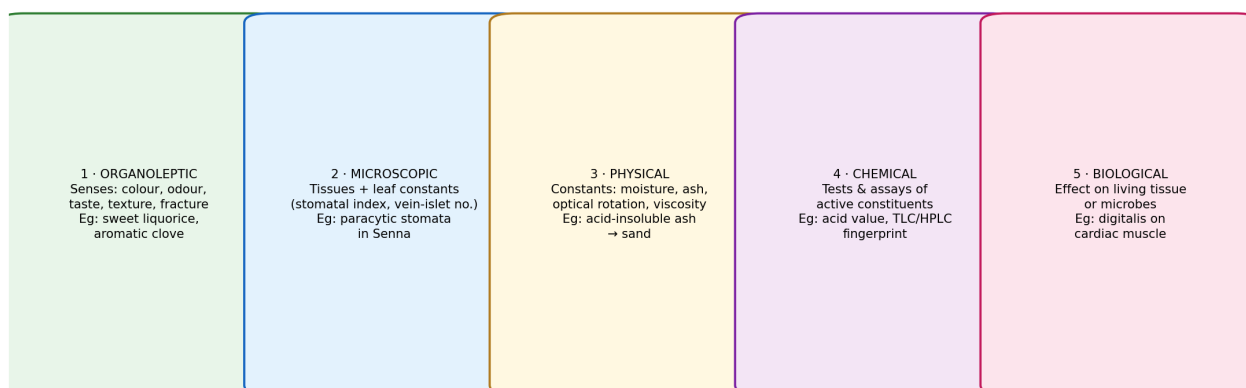
Mnemonic: I-E-A-H-A → "In Every Adulterated Herb, Adulterants hide": Inferior varieties, Exhausted drugs, Artificial substitutes, Harmful adulterants, Admixture.

Evaluation of drugs — the five methods

Evaluation = testing a crude drug to confirm identity, purity and quality.

- 1 Organoleptic evaluation: using sense organs — colour, odour, taste, size, shape, texture, fracture. Example: liquorice tastes sweet; clove smells strongly aromatic. Quick and cheap, but subjective.
- 2 Microscopic evaluation:
 - Qualitative: tissue structure — stomata type, trichomes, calcium oxalate crystals, fibres. Confirms identity (Senna leaf shows paracytic stomata and unicellular trichomes).
 - Quantitative (leaf constants): numbers that don't change with environment — stomatal number, stomatal index, vein-islet number, veinlet termination number, palisade ratio. Detect adulteration in powdered leaf drugs.
- 1 Physical evaluation: moisture content, melting point, viscosity, optical rotation, refractive index, ash values — constants that reveal impurity.
- 2 Chemical evaluation: chemical tests and assays for active constituents — acid value and saponification value for fixed oils, alkaloid assays, TLC/HPLC fingerprinting.
- 3 Biological evaluation: testing the drug's effect on living organisms/tissues when chemistry isn't enough — digitalis on cardiac muscle; microbiological assay of antibiotics.

Mnemonic: O-M-P-C-B → "Only My Physics Class Bores": Organoleptic, Microscopic, Physical, Chemical, Biological.

EVALUATION OF CRUDE DRUGS — FIVE METHODS*Identity + purity + quality • every method catches a different adulteration*

Flow: crude drug sample → all five methods → pass / fail vs pharmacopoeial standard

The five evaluation methods of crude drugs

Physicochemical parameters (WHO) — what each one detects

"Define and give significance of..." is the repeat question. Any four make a short note.

Parameter	What it measures	Significance
Extractive values (water/alcohol-soluble)	Constituents extracted by a solvent	Low value → exhausted or adulterated drug
Moisture content	Water in the drug	High moisture → fungal growth, enzyme activity, spoilage
Foreign organic matter	Plant parts not part of the drug	Measures cleanliness of collection
Ash values (total, acid-insoluble, water-soluble)	Inorganic residue after burning	High acid-insoluble ash → sand/silica contamination
Bitterness value	Bitterness vs quinine standard	Quality check for bitter drugs (Gentian, Chirata)
Foaming index	Frothing power of a water decoction	Detects saponins
Haemolytic potential	Ability to burst red blood cells	Another saponin check
Swelling index	Volume increase in water	Detects mucilage/gums (Isabgol, Agar)
Viscosity	Thickness of a liquid	Quality of gums and mucilages
Optical rotation	Rotation of plane-polarized light	Identifies optically active drugs
Refractive index	Bending of light through the drug	Purity check for fixed and volatile oils
Acid value	Free fatty acids in an oil/fat	High value → rancidity
Saponification value	Alkali needed to saponify the oil	Average fatty-acid molecular weight; detects oil adulteration

DNA barcoding

- Definition: identifying a plant species from a short, standard DNA sequence — like a supermarket barcode identifies a product. Common regions: rbcL, matK, ITS.
- Why it matters: identifies powdered or processed drugs where microscopy fails; catches substitution with look-alike related species; works on tiny or degraded samples.
- Limitation: needs a lab, a reference database and trained staff — not a field test.

Very short questions (2 marks)

- 1 Define adulteration of crude drugs.
- 2 Name the five methods of evaluation of crude drugs.
- 3 What are leaf constants? Name any three.
- 4 What does a high acid-insoluble ash value indicate?
- 5 What is DNA barcoding used for in herbal drug quality control?

Short questions (5 marks)

- 1 Describe the types of adulteration of drugs of natural origin with one example of each.
- 2 Explain the five methods of evaluation of crude drugs.
- 3 Write a note on any four physicochemical parameters used in quality control of herbal drugs.

Long questions (10 marks)

- 1 Discuss adulteration of drugs of natural origin and explain how the evaluation methods detect it.
- 2 Describe the physicochemical parameters used in quality control of crude drugs as per WHO guidelines.

How to approach these answers

- Very-short Q1: one-line definition + one example (exhausted clove).
- Very-short Q3: define leaf constants in one line, then list three.
- Short Q1: five-row table (type → example); nothing more.
- Short Q2: one paragraph per method with one example each; draw the five-methods figure.
- Long Q1: first half = adulteration types with examples; second half = which evaluation method catches which adulteration (table format works well).
- Long Q2: group parameters (extractive, ash, moisture, oil constants) and give significance of each; mention DNA barcoding as the modern addition.

Unit IV — Introduction to Metabolites of Plant Origin; Traditional Systems of Medicine

Primary vs secondary metabolites

Plant metabolites = chemical compounds produced by plant metabolism. Two groups:

Feature	Primary metabolites	Secondary metabolites
Role	Growth, development, reproduction — keep the plant alive	Defence, signalling — help the plant survive threats
Distribution	In all plants	Restricted to certain families/species
Quantity	Large	Small
Drug value	Mostly nutritional	Most plant drugs come from here
Examples	Carbohydrates, proteins, lipids	Alkaloids, glycosides, flavonoids, tannins, terpenoids, volatile oils, resins

PRIMARY vs SECONDARY METABOLITES

Feature	PRIMARY	SECONDARY
Role	Growth, development, reproduction	Defence, signalling, survival
Distribution	In ALL plants	Only in certain families / species
Quantity	Large	Small
Drug value	Mostly nutritional	MOST plant drugs come from here
Examples	Carbohydrates, proteins, lipids	Alkaloids, glycosides, flavonoids, tannins, terpenoids, volatile oils, resins

Remember: secondary metabolites ARE the drug — breeding aims to increase them.

Primary and secondary metabolites compared

The metabolite classes — definition + test + drug example

Chemical tests here are classic 2-mark questions. Learn one test and one drug per class.

- Carbohydrates: polyhydroxy aldehydes/ketones; energy source. Drugs: acacia and tragacanth (suspending agents), agar (laxative). Test: Molisch's test.
- Proteins: polymers of amino acids; enzymes are proteins. Drugs: gelatin (capsule shells), papain from papaya (digestant). Test: Biuret test.
- Lipids (fixed oils, fats, waxes): esters of fatty acids with glycerol. Drugs: castor oil (laxative), beeswax (ointment base). Tests: saponification value, acid value; spot test (translucent stain on paper).
- Alkaloids: nitrogen-containing basic compounds of plant origin with strong physiological action. Drugs: morphine (analgesic), quinine (antimalarial), reserpine (antihypertensive). Tests: Mayer's, Dragendorff's, Wagner's, Hager's — all give precipitates.
- Glycosides: sugar (glycone) + non-sugar part (aglycone) on hydrolysis. Drugs: senna — sennosides (laxative); digitalis — digoxin (cardiotonic). Tests: Bornträger's (anthraquinone glycosides), Keller-Kiliani (cardiac glycosides).
- Flavonoids: polyphenolic, often yellow pigments; antioxidant, anti-inflammatory. Drugs: rutin (capillary protectant), quercetin. Test: Shinoda test ($\text{Mg} + \text{HCl} \rightarrow \text{pink/red}$).
- Tannins: polyphenols that precipitate proteins — astringent. Drugs: catechu, myrobalan. Tests: ferric chloride (blue-black), gelatin (white precipitate).
- Terpenoids: built from isoprene units; huge class. Drugs: menthol (carminative, cooling), camphor.
- Volatile oils: aromatic, steam-distillable oils, mostly terpenoids. Drugs: clove oil (dental analgesic), eucalyptus oil (expectorant). Property: evaporate at room temperature, characteristic odour.
- Resins: solid/semi-solid plant exudates; insoluble in water, soluble in alcohol. Drugs: benzoin (expectorant), asafoetida (carminative).

Mnemonic for alkaloid tests: "My Dear Wife is Happy" — Mayer's, Dragendorff's, Wagner's, Hager's.

Traditional systems of medicine — AYUSH and TCM

AYUSH = India's officially recognized traditional systems: Ayurveda, Yoga & Naturopathy, Unani, Siddha, Homoeopathy. (Sowa-Rigpa is also recognized.)

Basic principles of treatment — one line each:

- Ayurveda: balances the three doshas (Vata, Pitta, Kapha); treatment by herbs, diet, Panchakarma detoxification, lifestyle.
- Unani: balances the four humours (blood, phlegm, yellow bile, black bile); treatment by regimental therapy, diet, herbal drugs.
- Siddha: South Indian system; balances three humours (Vata, Pitta, Kapha); uses herbs plus herbo-mineral preparations.

- Homoeopathy: "like cures like" — highly diluted remedies chosen by symptom similarity (law of similars, single remedy, minimum dose).
- TCM (Traditional Chinese Medicine): balances Yin-Yang and Qi flowing through meridians; treatment by herbal formulas, acupuncture, cupping, diet.

Dosage forms in AYUSH medicines

Kwatha (decoction), Churna (powder), Vati/Gutika (tablets/pills), Asava and Arishta (fermented liquids), Taila (medicated oils), Ghrita (medicated ghee), Bhasma (calcined herbo-mineral preparations), Lehya/Avaleha (confections), Arka (distillates).

Mnemonic: "Keep Calm, Village Aunties Take Ghee Before Lunch, Always" — Kwatha, Churna, Vati, Asava/Arishta, Taila, Ghrita, Bhasma, Lehya, Arka.

Role of pharmacognosy in allopathy and traditional systems

- In allopathy: supplies lead compounds (morphine, taxol, artemisinin); standardizes herbal raw materials; detects adulteration.
- In AYUSH/TCM: gives scientific backing — correct botanical identification of classical drugs, quality standards for pharmacopoeial monographs, safety testing of formulations.

Very short questions (2 marks)

- 1 Define secondary metabolites with one example.
- 2 Give the chemical tests for alkaloids.
- 3 Expand AYUSH.
- 4 Name any two AYUSH dosage forms.
- 5 Give the chemical test for tannins.

Short questions (5 marks)

- 1 Differentiate primary and secondary metabolites with examples.
- 2 Classify secondary metabolites with one drug example of each class.
- 3 Write a note on the role of pharmacognosy in allopathy and traditional systems of medicine.

Long questions (10 marks)

- 1 Describe the classes of plant metabolites — alkaloids, glycosides, flavonoids, tannins, terpenoids, volatile oils and resins — with examples and their chemical tests.
- 2 Explain the basic principles of treatment in the AYUSH systems of medicine and describe the types of AYUSH dosage forms.

How to approach these answers

- Very-short Q2: just list the four reagents (Mayer's, Dragendorff's, Wagner's, Hager's); mention "all give precipitates".
- Very-short Q3: write the full expansion; nothing more.
- Short Q1: comparison table of five rows (role, distribution, quantity, drug value, examples).
- Short Q2: list each class with one definition-phrase and one drug; tests where asked.
- Long Q1: one subhead per class — definition, example drug, chemical test; close with why secondary metabolites matter.
- Long Q2: first half = five systems with their one-line principle; second half = dosage forms with one-word meaning each.

Unit V — Phyto-therapeutic Agents

Revise every drug as biological source (botanical name, family, part used) → major constituents → uses. That three-step pattern answers nearly every question in this unit.

Adaptogens and immunomodulators

Adaptogens help the body resist stress; immunomodulators strengthen immune response.

Drug	Biological source	Major constituents	Uses
Ashwagandha	Dried roots of <i>Withania somnifera</i> , Solanaceae	Withanolides (withaferin A), alkaloids	Adaptogen, anti-stress, immunomodulator; strength and stamina
Tulsi (holy basil)	Leaves of <i>Ocimum sanctum</i> , Lamiaceae	Eugenol, ursolic acid, rosmarinic acid	Immunomodulator, adaptogen; cold, cough, respiratory disorders
Amla (Indian gooseberry)	Dried fruits of <i>Phyllanthus emblica</i> , Euphorbiaceae	Vitamin C, tannins (emblicanin A & B), gallic acid	Immunomodulator, antioxidant, Rasayana; in Triphala and Chyawanprash

Hepatoprotectives

Drug	Biological source	Major constituents	Uses
Milk thistle	Seeds/fruits of <i>Silybum marianum</i> , Asteraceae	Silymarin (silybin, silychristin, silydianin)	Hepatoprotective — hepatitis, cirrhosis, liver damage

Drug	Biological source	Major constituents	Uses
Kutki	Dried rhizomes/roots of <i>Picrorhiza kurroa</i> , Scrophulariaceae	Picroside I & II, kutkoside (iridoid glycosides)	Hepatoprotective, bitter tonic; jaundice, liver disorders

Cardiovascular drugs

Drug	Biological source	Major constituents	Uses
Garlic	Bulbs of <i>Allium sativum</i> , Liliaceae	Allicin (from alliin by alliinase), ajoene	Hypolipidemic, antihypertensive, antiplatelet; atherosclerosis
Arjuna	Dried stem bark of <i>Terminalia arjuna</i> , Combretaceae	Arjunolic acid, tannins, flavonoids	Cardiotonic; angina, heart failure support, hyperlipidemia

Mnemonic: "Garlic Allin, Arjuna Acid" — the two "A" constituents for the two cardio drugs.

Antidiabetics

Drug	Biological source	Major constituents	Uses
Gymnema (Gurmar, "sugar destroyer")	Leaves of <i>Gymnema sylvestre</i> , Asclepiadaceae	Gymnemic acids (triterpene saponins)	Antidiabetic; cuts sugar absorption and sweet-taste sensation
Fenugreek (methi)	Seeds of <i>Trigonella foenum-graecum</i> , Fabaceae	Trigonelline, diosgenin, 4-hydroxyisoleucine, mucilage	Antidiabetic, hypolipidemic; lactation support

Anti-inflammatory and analgesics

Drug	Biological source	Major constituents	Uses
Turmeric (haldi)	Dried rhizomes of <i>Curcuma longa</i> , Zingiberaceae	Curcumin (curcuminoids), volatile oil	Anti-inflammatory, analgesic, antioxidant; arthritis, wound healing
Boswellia (salai guggul)	Gum resin of <i>Boswellia serrata</i> , Burseraceae	Boswellic acids (esp. AKBA)	Anti-inflammatory; osteoarthritis, rheumatoid arthritis, asthma

CNS drugs

Drug	Biological source	Major constituents	Uses
Brahmi	Whole plant of <i>Bacopa monnieri</i> , Scrophulariaceae	Bacosides A & B (saponins)	Nootropic — memory enhancer; anxiety, epilepsy; Medhya Rasayana

Remember: In pharmacognosy and the IP, Brahmi = *Bacopa monnieri*. In some regional traditions "Brahmi" also means gotu kola (*Centella asiatica*) — mention both if the examiner asks, to be safe.

Antimicrobials and antivirals

Drug	Biological source	Major constituents	Uses
Giloy (guduchi)	Stems of <i>Tinospora cordifolia</i> , Menispermaceae	Tinosporin, berberine, cordifolioside	Immunomodulator, antipyretic; recurrent infections
Neem	Leaves/bark of <i>Azadirachta indica</i> , Meliaceae	Azadirachtin, nimbin, nimbidin	Antimicrobial, insecticidal; skin diseases, dental care
Andrographis (kalmegh, "king of bitters")	Whole plant of <i>Andrographis paniculata</i> , Acanthaceae	Andrographolide (diterpene lactone)	Antimicrobial, hepatoprotective, immunostimulant

Gastrointestinal drugs

Drug	Biological source	Major constituents	Uses
Psyllium (isabgol)	Dried seeds/husk of <i>Plantago ovata</i> , Plantaginaceae	Mucilage (arabinoxylan) — high swelling index	Bulk laxative — constipation; also diarrhoea, hyperlipidemia

Dermatological agents

Drug	Biological source	Major constituents	Uses
Aloe (ghritkumari)	Dried leaf juice of <i>Aloe barbadensis</i> , Liliaceae	Aloin (barbaloin), aloe-emodin, mucilage	Burns, wounds, moisturizer; also a stimulant laxative

Drugs used in women's health

Drug	Biological source	Major constituents	Uses
Chasteberry	Dried fruits of <i>Vitex agnus-castus</i> , Verbenaceae	Agnuside, casticin, essential oil	PMS, menstrual irregularities; prolactin regulation
Shatavari	Dried roots of <i>Asparagus racemosus</i> , Liliaceae	Shatavarins (steroidal saponins)	Galactagogue (lactation), menopausal support, rejuvenative

Respiratory drugs

Drug	Biological source	Major constituents	Uses
Vasaka (adulsa)	Leaves of <i>Adhatoda vasica</i> , Acanthaceae	Vasicine, vasicinone (quinazoline alkaloids)	Expectorant, bronchodilator; cough, asthma, bronchitis

Remember: Vasaka's vasicine led to the synthetic bronchodilator bromhexine — a classic "natural lead to modern drug" exam point.

Very short questions (2 marks)

- 1 Give the biological source and one use of Ashwagandha.
- 2 Name the major active constituents of Turmeric.
- 3 Give the biological source of Vasaka and its therapeutic uses.
- 4 What are bacosides? Name the drug that contains them.
- 5 Name two hepatoprotective drugs with their biological sources.

Short questions (5 marks)

- 1 Write short notes on Ashwagandha and Tulsi (biological source, constituents, uses).
- 2 Write short notes on Garlic and Arjuna as cardiovascular drugs.
- 3 Describe the antidiabetic drugs of the syllabus — Gymnema and Fenugreek.

Long questions (10 marks)

- 1 Describe the biological source, major constituents and uses of any five drugs from the syllabus's adaptogen and hepatoprotective classes.
- 2 Write detailed notes on the antimicrobial and antiviral drugs of the syllabus — Giloy, Neem and Andrographis.

How to approach these answers

- Very-short Q1: botanical name + family + part + one use; keep it to two lines.
- Very-short Q5: drug name + botanical name each; no constituents needed.
- Short Q1: one mini-table or two short paragraphs per drug (source → constituents → uses).
- Short Q3: Gurmar's "sugar destroyer" logic first, then each drug's source → constituents → uses.
- Long Q1: pick any five; same three-step pattern for each; finish with one line comparing adaptogens vs hepatoprotectives.
- Long Q2: three subheads (Giloy, Neem, Andrographis), each as source → constituents → uses; close with their shared immunomodulatory angle.

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