

Unit 3: Ethnobotany and Ethnopharmacology

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3.1 Ethnobotany in herbal drug evaluation

Ethnobotany is the study of the relationship between people and plants: how communities name, select, prepare and use plants for medicine, food, ritual and material life. Its place in herbal drug evaluation is at the very start of the pipeline, because traditional use is the oldest screening programme in pharmacognosy, run over centuries on human subjects, and its records, properly read, tell the evaluator three things no laboratory can generate quickly: that a plant has been used by many people over long periods, for a recognisable set of complaints, prepared in a recognisable way. Evaluation uses ethnobotanical information as evidence to be weighed, not as proof to be quoted. A use report gains weight when independent communities use the same plant for the same purpose, when the traditional preparation resembles the product to be tested, and when the plant's known chemistry offers a plausible mechanism. It loses weight when reports are single, vague or gathered carelessly. The fieldwork discipline matters accordingly: plants are identified botanically and voucher specimens deposited in a herbarium, so that the species behind a use report can be verified forever after, uses are recorded with the healer's own detail of part, preparation and dose form, and the record distinguishes what was observed from what was inferred. An ethnobotanical claim without a voucher specimen is, for evaluation purposes, a rumour attached to a name.

Modern field method adds simple quantification to this discipline, and the evaluator should know its shape. Use reports are counted and compared: agreement among independent informants on a plant for a given complaint is treated as stronger evidence than a single report, and indices built on that agreement are used to rank species for laboratory follow up, turning a pile of interviews into a priority list. Preparation is recorded with the same care as identity, because the evaluator who ignores it ends up testing the wrong material: a drug taken traditionally as a fresh juice, a water decoction and a fermented preparation are three chemically different products wearing one name, and the screening of Unit 5 is only a test of the tradition when the tested extract corresponds to the recorded preparation. Evaluation, in short, begins in the field with the same habits it ends with in the laboratory: identify the material, record the method, and distrust any result whose specimen cannot be produced.

3.2 Impact of ethnobotany in traditional medicine

Within traditional medicine itself, ethnobotany works in both directions. It documents and thereby protects knowledge that lives in memory and practice and dies with its holders, converting fragile oral transmission into records that communities and researchers can return to. It feeds back into the systems it studies: identification of the correct species behind a classical drug name, resolution of the disputed source plants that classical texts leave behind, and quality standards for the raw drugs of Ayurveda, Siddha and Unani all draw on ethnobotanical fieldwork among the communities who collect and use the plants. It also disciplines traditional practice from inside, by detecting dangerous substitutions and toxic look alikes in local trade, the field end of the adulteration problem of Unit 2. The two classical success stories of the discipline show its reach when the loop closes into modern medicine: the antimalarial artemisinin, developed from the Chinese traditional use of *Artemisia annua* after the ancient preparation instructions were read with ethnobotanical care, and reserpine, isolated from *Rauvolfia serpentina*, a plant of the Ayurvedic tradition, which carried a traditional remedy for agitation and snakebite into the pharmacopoeias of the world. Neither drug would have been found by random screening on any realistic budget of time; both began as somebody's recorded

knowledge of a plant.

3.3 New developments in herbals

The syllabus asks for new developments in herbals, and the honest survey is of directions rather than marvels. Standardisation has deepened from single marker assays toward fingerprint based control, in which the whole chromatographic pattern of an extract is matched, so that mixture products are defined by their profile and not by one convenient peak, the analytical philosophy behind Unit 4. Clinical evidence is slowly accumulating for the major traditional systems, with trial methods adapted to whole system practice and to standardised extracts, while pharmacovigilance systems for herbal medicines extend the safety net that Unit 1 found thin. Cultivation and biotechnology, the subjects of Semester 1 and of MPG201T, are being applied to endangered and variable species so that supply stops depending on wild collection, and conservation status now enters procurement decisions. Regulatory development continues along the line of Section 1.5, with traditional use frameworks spreading and pharmacopoeias expanding their herbal monographs. Finally, the information tools have changed the scale of the work: databases of traditional knowledge, of which India's Traditional Knowledge Digital Library is the landmark example, digitise classical formulations to defeat wrongful patents and to make the record searchable, and molecular identification, the DNA methods of Unit 2, has entered routine quality practice. The examination answer should present these as connected developments in one project, making herbal medicine documented, standardised, tested and traceable, rather than as a catalogue of novelties.

3.4 Bioprospecting tools for drug discovery

Bioprospecting is the systematic search of biological material for compounds and activities of commercial and medical value, and ethnobotany is its compass. The tools form a working kit. At the front end are collection strategies, ranging from random collection of diverse species, through phylogenetic collection of relatives of known producers, to ethnobotanically directed collection, which follows use reports and consistently yields the highest rate of active leads per sample in screening programmes. Field tools are documentation tools: voucher specimens, geographic and habitat records, and structured interviews recorded with the knowledge holders. Laboratory tools begin with extract libraries, in which prepared extracts of collected species are held ready for the screening methods of Unit 5, followed by bioassay guided fractionation, in which activity is tracked through separation until the responsible constituent is isolated, and dereplication, the early identification of known compounds by spectroscopic and database matching, which stops effort being wasted on rediscovering the familiar. The legal and ethical instruments are tools of the kit as surely as the chromatograph: access and benefit sharing under the Convention on Biological Diversity and its Nagoya Protocol, and in India the Biological Diversity Act, govern collection and use of traditional knowledge, requiring consent and fair return to the communities whose knowledge directed the search. A bioprospecting programme that ignores them is not merely unethical but legally fragile, a point examiners increasingly test.

Bioprospecting: knowledge to candidate



The compass is ethnobotany; the legal frame is benefit sharing

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Figure: The bioprospecting flow. Traditional knowledge directs selection, the voucher specimen fixes identity, consent and benefit sharing frame collection, and screening with guided fractionation produces the candidate.

The discovery flow runs as follows.

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Traditional knowledge and field survey
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Species selected, voucher specimen deposited
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Collection with consent and benefit sharing terms
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Extract library prepared and documented
|
Screening for activity (Unit 5 methods)
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Bioassay guided fractionation, dereplication
|
Active constituent isolated and characterised
|
Development candidate, or return to source knowledge
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3.5 Role of ethnopharmacology in drug evaluation

Ethnopharmacology is the interdisciplinary study of the biologically active agents used by peoples in traditional practice: it takes the ethnobotanical record as its starting hypothesis and submits it to pharmacological method. Its role in drug evaluation can be stated as four functions. It prioritises: from thousands of used plants it ranks candidates for the expensive business of screening and isolation, using strength and consistency of traditional use, and the fit between the traditional preparation and the test system, as ranking evidence. It designs better experiments: the traditional route of administration, preparation and combination tells the pharmacologist what to test, in what form, and against which endpoint, so that a plant used as a water decoction for stomach complaints is not absurdly tested as a hexane extract in a cancer screen and declared inactive. It interprets safety: long use at traditional doses is real, if uncontrolled, human exposure data, which ethnopharmacology reads carefully for the harms it does and does not rule out, remembering Unit 1's lesson that concentrated modern products outrun the traditional exposure. And it validates or retires claims: where experimental and clinical work confirms a use, the therapy graduates toward the validated status of Section 1.3; where careful work fails to find the

claimed activity, ethnopharmacology records the negative honestly, which protects patients and purifies the tradition itself. In short, ethnobotany finds the claims and ethnopharmacology examines them, and this subject's Units 2 and 5 supply the examining instruments.

3.6 Reverse pharmacology

Reverse pharmacology is the discovery path that runs opposite to the conventional one, and it is fittingly an Indian contribution to drug discovery method, developed and named in the context of Ayurvedic research. Conventional discovery moves from molecule to man: a compound is found or designed, tested in cells and animals, and only at the end given to patients, with most candidates dying on the way. Reverse pharmacology begins where conventional discovery ends, with a documented clinical experience: a traditional formulation with a record of use and observed effects in patients. The path then runs backward through the laboratory, first systematising the clinical observation, in what its proponents describe as the experiential stage, then testing the formulation in exploratory studies for activity, dose behaviour and safety signals, and finally carrying it into experimental work to find mechanisms, active fractions and constituents, the stage at which it rejoins and can feed the conventional pipeline with a candidate already carrying human evidence. The direction is the whole point, and the comparison should be statable in one line each way: conventional pharmacology asks whether a molecule that works in the laboratory is safe and useful in man; reverse pharmacology asks how a remedy that appears to work in man does its work, and whether the effect survives controlled examination.

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graph TD; A[Documented traditional use and clinical observation] --> B[Experiential stage: records systematised, outcomes defined]; B --> C[Exploratory stage: activity, dose and safety studied]; C --> D[Experimental stage: mechanism, fractions, constituents]; D --> E[Validated therapy or development candidate];
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The method suits herbal drugs for the reason Unit 1 established: their evidence problem is inverted. A new synthetic molecule has laboratory data and no human record; a classical herbal formulation has a human record and thin laboratory data, and reverse pharmacology is the disciplined way of supplying the missing half without discarding the half that exists. Its disciplines are those of this whole subject: the formulation must be standardised before it is studied, the clinical observations must be recorded to research standard rather than anecdote, and failure at any stage is reported, else the method degenerates into a ceremony for confirming what was believed at the start. Properly run, it converts the ethnopharmacological hypothesis of Section 3.5 into a development programme, and it closes Unit 3 by joining the field knowledge of its first sections to the screening science of Unit 5.

Reverse pharmacology: the backward path



Conventional discovery runs molecule to man; this path runs man to mechanism

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Figure: Reverse pharmacology. The path starts in the clinic with documented traditional use and runs backward through experiential, exploratory and experimental stages to mechanism, the reverse of the conventional molecule to man direction.

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