ME-01 The dispensary's grammar: infusion, decoction, tincture, syrup, oxymel, salve, poultice, suppository

HEALING after the FALL, research library, ME-01

Researched 10 October 2026 by Claude Opus agent for THRIVING after the FALL, Book Four. Library document, unverified.

Findings

1. The lineage: what each pharmacopoeia kept and what it dropped

These forms are called galenicals because they descend by an unbroken chain of books from Galen of Pergamon (129 to about 216 CE), who organised his pharmacology by drug type, by treatment type such as plasters and laxatives, and by body part from the head down (Explore Galen, Warwick, undated). Before him Pedanius Dioscorides (about 40 to about 90 CE) wrote the five-volume *De Materia Medica*. Galen's compound remedies outlasted his physiology and formed the backbone of Western pharmacology until the Industrial Revolution. I could not read Beck's 2005 translation of Dioscorides and so I do not quote it [VERIFY].

The first English pharmacopoeia was the *Pharmacopoeia Londinensis* of the Royal College of Physicians, issued under royal proclamation on 7 May 1618, withdrawn for typographical errors and reissued corrected on 7 December 1618 (Royal College of Physicians history blog, undated). It was a political instrument, since James I had created the Society of Apothecaries in 1617 and the Pharmacopoeia restored the College's grip by making its list the only lawful one. Louella Vaughan calls it "a mighty weapon dressed up as a book". It carried oil of St John's wort beside linctus of fox lungs, and the official formulas for the Mithridatium of Damocrates, Venice Treacle and London Treacle (historyofmedicine.com, Garrison-Morton 1817). Nine editions followed to 1718, and the College stopped publishing in 1864 when the *British Pharmacopoeia* merged London, Edinburgh and Dublin, by which time the goat's urine and the moss from a human skull were gone.

What each revision dropped is the useful part. By 1898 the British Pharmacopoeia had cut the decoctions back to three, of aloes, pomegranate and logwood (anonymous review, *Bristol Medico-Chirurgical Journal* 1898, search extract). The 1914 revision removed the Concentrated Liquors, the eightfold-strength liquids pharmacists diluted into an instant infusion, on the argument that they did not have the properties of a freshly made preparation (Davis 1914, bibliographic record and search extract only) [VERIFY]. The British Pharmaceutical Codex, published 1907 and revised 1911, 1923 and 1934, kept the galenical formulary alive in Part III of the 1934 "imperial dispensatory", then issued seven supplements between 1940 and 1945 to authorise alternative formulae where ingredients had grown scarce (Wikipedia, British Pharmaceutical Codex, citing the volumes).

Three lessons. The forms that survived every revision are the ones needing no factory. What went first was the convenience product and the many-ingredient antidote, and what went last was the aqueous forms, because those were made at the bedside rather than sold: King's says decoctions "are seldom ordered from the pharmacist, but are made a matter of domestic management" (Felter and Lloyd 1898, *Decocta*). And the ratio held steady for three centuries at roughly one part of drug to twenty of water.

2. The solvent logic: what each menstruum pulls out, including the poison

A menstruum is any fluid used to extract, whether ethanol, water, honey, vinegar or oil (7Song, undated). Choosing one decides what you get and which toxin you concentrate.

Alkaloids. In the living plant most alkaloids exist as salts of organic acids. The salts are water-soluble, the free bases sparingly soluble in water but readily soluble in non-polar solvents (Semmelweis University, Pharmacognosy, alkaloid lecture notes, 2016), so classical practice extracts with acidified water or acidified hydroalcohol. A splash of vinegar, or a hydroalcoholic menstruum, gets more alkaloid out than plain hot water. That is a warning as much as a technique, because the narrow-margin plants are the alkaloidal ones (ME-02).

Resins and volatile oils. Rectified spirit of specific gravity 0.820, about 92 to 93 per cent ethanol by volume, suits drugs insoluble in water such as resins and volatile oils, while diluted spirit suits drugs soluble in both (Felter and Lloyd 1898, *Tincturae*). I found no modern study of resin yield against ethanol strength, so this is the pharmacopoeial rule rather than a measurement [VERIFY].

Tannins come out in water and need no alcohol. In *Quercus infectoria* galls water gave 75.0 micrograms per millilitre of gallotannin against methanol's 46.8 (*Pharmacognosy Journal*, undated, search extract). Oak bark runs 8 to 20 per cent tannins, and the EMA states that the content depends on time of harvest, age of branches and assay method (EMA HMPC 2010, *Quercus cortex*). That eightfold swing is why every ratio needs a tolerance beside it.

Mucilage. The older monographs hold that boiling water takes up starch and sugars from marshmallow root while cold water takes mucilage without starch (*Dispensatory of the United States*, *Althaea*). A Ukrainian study extracted the root polysaccharide at 60 degrees at 1:25 but ran no cold arm (Lviv Polytechnic repository, undated). I found no cold against hot measurement, so the cold rule for marshmallow, mallow, linseed and slippery elm rests on tradition [VERIFY].

Volatile oils are lost to heat. Kowalski and colleagues distilled oil from commercial teas and from the matching raw herb and found peppermint tea bags at mean 0.94 per cent v/w against raw leaf at mean 1.96, and chamomile tea at 0.33 to 0.59 against raw flower at 0.41 to 0.74 (Kowalski, Baj, Kowalska and Pankiewicz 2015, *PLoS ONE* 10(6):e0130714). Half the oil is gone before the water touches it. King's rule follows: volatile agents go in after the pot leaves the fire, and it stays closed until cold. I found no trial of covered against uncovered brewing, so the lid rule is mechanism and tradition [VERIFY].

Heat-labile actives. Bilia and colleagues, with an *Artemisia annua* cultivar at 0.52 per cent artemisinin, found that boiling water poured over the leaf and cooled 15 minutes before filtering recovered 57.5 per cent of the artemisinin and 8.2 per cent of the flavonoids, while a 60 per cent v/v tincture recovered 40 per cent and 29.5 per cent (Bilia et al. 2006, *Natural Product Communications* 1:1111 to 1115, abstract and repository summary). For a heat-sensitive active an infusion left to cool beats a decoction, and the decoction is for roots, barks, seeds and tannins.

The solvent that pulls out the toxin. Comfrey's hepatotoxic pyrrolizidine alkaloids are water-extractable. Transfer into infusions runs 16 to 28 per cent in one study (Sciensano, *Food Chemistry* 2018) and 30 to 68 per cent, mean 49, in another, where infusion pH and compound polarity, not brewing time, were the drivers (*Food Chemistry* 2025, abstract), and solvent and technique alone changed measured pyrrolizidine content by up to 1110 ppm (Kaltner et al. 2020). I found no published transfer figure for a comfrey ethanol tincture and will not state one. The EMA's comfrey root monograph covers an ethanol-extracted external preparation, caps exposure at 0.35 micrograms per day and limits a course to 10 days (EMA, *Symphyti radix*). The village rule is that comfrey is never taken by mouth in any form by anyone, and ME-11 carries the external detail.

3. The water forms

The standard is consistent across two centuries and two countries. The British Pharmaceutical Codex 1911 gives the general infusion as 5 parts of coarsely powdered drug to 100 of water, that is 1 in 20, made with boiling distilled

water, left 15 minutes in a pre-warmed earthenware vessel, with individual monographs running up to 2 hours and with starchy drugs infused at ordinary temperature (BPC 1911, *Infusa*). King's gives the United States standard as 50 g of coarsely cut herb per 1000 cc, again 1 in 20, with boiling water standing half an hour under a tight cover, and names senna, gentian and rhubarb as better made cold (Felter and Lloyd 1898, *Infusa*). On vessels it is explicit: glazed earthenware or porcelain with lids, never metal, because of "a liability to chemical alteration from metallic influence", and the water clear and soft.

On keeping, King's is blunt. Infusions do not keep, and boiling-water infusions take up starch which encourages souring and mould, while cold-water infusions spoil less readily. The Codex gives the only extension available without refrigeration: fill bottles to within half an inch of the top, heat in a boiling water bath 10 minutes, plug tightly with cotton wool, and the infusion "may be safely preserved by this method for at least a week".

The decoction standard is equally fixed. The BPC 1911 general process boils 5 of the bruised drug with 120 of distilled water for 10 minutes and makes the strained volume up to 100, again 1 in 20 finished. King's directs that the drug be sliced, bruised or powdered to suit its character, in earthenware, glass or enamel-lined iron, that boiling not continue too long, that the vessel stay covered, and that the decoction be strained before it cools. The brief's 20 to 30 minutes is the modern herbalist's figure rather than the official 10. Both are defensible, since 10 minutes at a steady boil takes most of the tannin out of finely bruised bark while a coarse root needs longer, and the lid and the made-up volume matter more than the difference. A fomentation is an infusion or decoction applied hot on cloth, and its dose is temperature and time, so it belongs in the harm test.

4. The alcohol forms

A tincture is a preparation in which the volume of menstruum exceeds the weight of herb, and a fluid extract is one at 1:1 or stronger, a definition shared across the British, European, German and United States pharmacopoeias (Low Dog, *Clinician's Brief*, undated, search extract) [VERIFY]. A 1:5 is about twice the strength of a 1:10. The ratio is always herb weight against liquid volume, and the rule that prevents most catastrophes is to keep one system of units on both sides (7Song, *Herbal Pharmacy - Tinctures: Preparation and Ratios*).

The historical ratios vary more than modern herbals admit. King's gives the National Formulary general process as 125 g of drug to 1000 mL, that is 1 in 8, and the United States Pharmacopoeia fresh-herb process as 500 g to 1000 cc, 1 in 2 (Felter and Lloyd 1898, *Tincturae*). The modern practitioner standard, 1:2 fresh in about 95 per cent and 1:5 dried in about 60 per cent, is attributed by Henriette Kress to Michael Moore's *Materia Medica*, and fluid extracts before the 1880 USP were 1 troy ounce of drug to 1 fluid ounce of finished extract, later 1000 g to 1000 cc (*American Journal of Pharmacy* 1883, search extract). The brief's standard is fair, with a historical range from 1:2 to 1:10 around it.

King's directs maceration of 14 days in a closed bottle with occasional agitation, then pressing and filtration. Percolation, in which the drug is moistened 24 to 36 hours before the menstruum is run through, is the more efficient because maceration offers neither agitation nor fresh solvent (University of Mustansiriyah lecture notes, undated). Two weeks is the pharmacopoeial figure and the right village default, because a percolator is equipment and a jar is not.

Yield is given as an instruction, not a number: percolate until the required volume has passed, or press the marc and make up. Home-herbalist claims about what pressing recovers contradict each other [VERIFY]. The honest rule is that an unpressed marc holds roughly a quarter to a third of the menstruum, and that the preparer must either make the volume back up or write the true volume on the label, because a 1:5 that yielded 70 per cent is stronger than 1:5.

King's requires well-closed bottles, cool and dark, because light and air harm tinctures and evaporation changes their strength. Modern stability work is less generous than "keeps for years". A tincture of *Lychnophora passerina* was stable only 6 months at 25 degrees in sealed glass protected from light (*Revista Brasileira de Ciências Farmacêuticas*, abstract), and hydroalcoholic extracts of two *Mikania* guaco species lost more than 5 per cent of their coumarin

marker under every condition across a 6-month accelerated and a 12-month long-term study, so no two-year shelf life could be assigned (*Brazilian Journal of Pharmaceutical Sciences* 2020, 56:e17194, abstract). The village rule: microbiologically safe for years, pharmacologically reliable for one to two, narrow-margin plants remade every season.

The ethanol concentration said to make a preparation self-preserving is quoted as 15 to 20 per cent w/w and as 15 to 30 per cent v/v, and I found it in no pharmacopoeia [VERIFY]. A 1:5 in 40 per cent clears every version of the threshold, a 1:5 in 25 per cent has little margin, and one made in wine or cider at 10 to 12 per cent has none and is perishable.

5. The sugar and honey forms

Syrup is a preservation technology before it is a medicine. The British official syrup is 1000 g of refined sugar with distilled water to produce 1500 g, specific gravity 1.330 at 15.5 degrees, which is 66.7 per cent sucrose by weight (*Dispensatory of the United States*, *Syrupus*, British formula). The United States syrup is 850 g in enough water to make 1000 mL, specific gravity about 1.313 at 25 degrees (Felter and Lloyd 1898, *Syrupus*, which gives 1.317). Two thirds is the British Codex standard and the one to carry.

King's explains the choice: "If the sugar be in too small amount the syrup will ferment, if in too large amount the sugar will crystallize" (Felter and Lloyd 1898, *Syrupi*). That is a water-activity statement in older language. Most spoilage bacteria need a water activity above about 0.90, moulds reach down to about 0.7, and the osmotolerant yeasts that ferment honey stop at about 0.61 to 0.62, so a 66 per cent syrup sits where bacteria and most moulds cannot grow but those yeasts still can if it takes up water. King's answer is to bottle hot and seal, and after cooling to shake the bottle so that condensation from the cork mixes in rather than standing as a dilute layer at the neck, where a yeast colony starts. Honey self-preserves at about 0.6 and is hygroscopic, so honey standing open drifts towards fermentation.

Oxymel is the oldest form here that now has an experiment behind it. The Hippocratic *Regimen in Acute Diseases* treats it as a medicine in its own right, valued for bringing up phlegm and easing the breath, and warns that prepared too sharp it may fail to raise the phlegm and do harm. The official formulas are: British Pharmacopoeia 1898, 800 g of clarified honey heated to liquefaction with 100 cc of acetic acid and 100 cc of water, at specific gravity 1.320. German Pharmacopoeia 1872, 1 part acetic acid of specific gravity 1.040 to 40 parts clarified honey. French Codex, 4 parts virgin honey to 1 of white wine vinegar (all in Felter and Lloyd 1898, *Oxymel*), where its uses are a gargle for sore throat and a vehicle for ipecacuanha and squill.

The medieval record is larger than most herbals admit. A survey of 40 manuscripts holding 418 recipes from the ninth to the fifteenth centuries found 151 mentions of vinegar, honey, oxymel or hydromel in recipes for wounds, ulcers, fistulas, mouth and gum infections and eye and skin conditions, against nine mentions of garlic, and gives "oxymel simple" as 1 part honey to 2 of vinegar, warmed, with squill, *Drimia maritima*, for the compound version (Harrison et al. 2023, *Microbiology* 169(7):001351). The same paper's laboratory work is the first honest test. Its vinegars assayed from 2.4 to 8.3 per cent acetic acid, and against *Pseudomonas aeruginosa* and *Staphylococcus aureus* biofilms in a synthetic wound model acetic acid gave EC50 values of 0.33 to 0.56 per cent, while one pomegranate vinegar reached 0.28 and 0.01 per cent. Combining 0.5 per cent acetic acid equivalent with 30 per cent w/v medical-grade honey showed synergy against *S. aureus*. Every result is in vitro, and the authors say in vivo work is needed before clinical use. That is the honest position: an ancient form with a plausible mechanism, a real synergy in a dish, and no trial in a person.

6. The fat forms

A cerate is wax or spermaceti combined with fatty matter, and King's fixes its consistency as "intermediate in consistence between the ointment and the plaster, about the consistence of cold butter" (Felter and Lloyd 1898, *Cerata*). It is melted over a water bath and stirred constantly while cooling, which stops it separating. The ointment ratio is

in King's under *Unguenta*: "about one-fifth part of yellow wax is added to the lard", that is 1 of wax to 5 of fat, with yellow wax less liable to rancidity than white.

Rancidity, not microbial growth, is the limiting factor. King's recommends about 1 fluid drachm of tincture of benzoin per pound of lard, and directs that cerates be made in small quantities and kept cool in closely covered jars. Tallow, plant oils and the salve plants with trials belong to ME-11. The dangerous part of the fat forms, the infused oil, is in the harm test.

7. The applied and inserted forms

A poultice, or cataplasm, is a soft mass of a vehicle such as bread, bran, linseed, slippery elm or crushed herb, spread on cloth and applied warm. King's own *Cataplasmata* page returned a 404 and I found no other primary general text, so I give harm parameters rather than a formula [VERIFY].

The suppository is the one form here with precise pharmacopoeial numbers. King's gives cacao butter, *Oleum theobromatis*, as the preferred base, with about one fifth or one eighth of wax or spermaceti in warm weather (Felter and Lloyd 1898, *Suppositoria*). The United States Pharmacopoeia weights are a cone-shaped rectal suppository of about 1 g, that is 15.5 grains, a pencil-shaped urethral suppository of about 1 g, and a globular vaginal pessary of about 3 g. The melt is cooled to 35 degrees before the medicament goes in, poured into chilled metal moulds, given 2 to 3 minutes to set and rarely more than 5, then released by thumb pressure, since setting too long splits them. They are stored cool, and not carried in a pocket.

Cocoa butter is polymorphic, which is why the temperature rule matters. Published melting points are alpha 23 degrees, beta prime 28, beta 34.5 and gamma 18.9 (University of Alberta pharmaceutics teaching material, undated). Melt at not more than 36 degrees and cool slowly and it sets as stable beta. Overheat and cool and you get gamma melting at about 15 degrees or alpha at about 20, a suppository that melts in the hand and never reaches the rectum, and a base heated above 38 degrees needs 1 to 4 days of storage to revert. Camphor, phenol, essences and balsams depress the melting point, and up to 4 per cent of wax may be added to compensate.

The alternative base is glycerol-gelatin: licensed United Kingdom glycerin suppositories are glycerol 70 per cent w/w with gelatin and purified water (electronic Medicines Compendium), and a teaching formula gives 14 per cent w/w gelatin, raised to 18 per cent in hot climates. These bases are hygroscopic and, because they contain water, far more liable to microbial contamination. For a village the choice is simple: a fatty base keeps and needs no preservative, a glycerol-gelatin base is a laxative in its own right and spoils.

A lotion keeps as an infusion does, which is to say days, and a powder keeps as the dried herb does, which ME-04 covers, with one addition: powdering multiplies the surface open to air, moisture and insects. Powder what you will use within weeks.

8. Measures, yields and labour

What measures work without a scale, and with what error. Badly, is the answer. Household spoons collected from 25 homes in Attica, Greece, gave 71 teaspoons of 2.5 to 7.3 mL and 49 tablespoons of 6.7 to 13.4 mL, so a parent using the largest domestic teaspoon would give 192 per cent more than one using the smallest (reported in *Pharmacy Times*, primary publication not located) [VERIFY]. A separate set of 53 teaspoons brought from home by doctors and nurses measured 4.2 to 12.9 mL, only one at exactly 5 mL, against the 5 mL standard teaspoonful defined by the American Pharmaceutical Association in 1902.

The drop is almost as bad, and the profession knew it two centuries ago. The minim was introduced in the 1809 *Pharmacopoeia* of the Royal College of Physicians of London to replace the drop, because drop size varies with the viscosity and specific gravity of the liquid. The modern convention rounds a drop to 0.05 mL, that is 20 per millilitre, while a minim is about 0.0616 mL, so a dose written in minims and read as drops is about 20 per cent out before any

dropper variation, and practical drop counts are quoted from 15 to 40 per millilitre (ME-02). A scale, even a crude lever balance, is the one piece of equipment that turns a folk recipe into a reproducible medicine, and until the village has one the ratios should be realised by volume of loosely filled dried herb, with the error written on the label.

From the procedures, an infusion costs about 20 minutes of attention, a decoction 30 to 45 minutes, a litre of tincture about 2 hours over a fortnight, a syrup about an hour, 50 suppositories about 2 hours, and a salve 1 to 4 hours. These are my own estimates [VERIFY].

9. The microbiological life of each form

The dried herb is not sterile and brewing does not make it so. Surveys find total aerobic mesophilic counts of 10^3 to 10^6 cfu per gram in Polish sachet teas. The largest survey, by the Canadian Food Inspection Agency across 2,680 dried herb and 1,178 dried tea samples from 2014 to 2018, found over 99.8 and over 99.5 per cent satisfactory, with elevated *Bacillus cereus* at 10^4 to 10^6 cfu/g in five teas and *Salmonella* in one.

Boiling water does not reliably fix this. A NASA study inoculated chamomile tea bags with *B. cereus* and brewed them with 100-degree and with 68-degree water, finding no significant reduction in overall microbial load, p equals 0.535, and no complete kill of the organism. The German Federal Institute for Risk Assessment therefore advises that herbal teas always be made with water at a rolling boil and infused at least five minutes (BfR 2005).

Ranking the forms: infusion and decoction, hours to one day at room temperature and two days cool, with hot-water infusions souring faster than cold, extended to at least a week if bottled hot and water-bath sterilised 10 minutes (BPC 1911). Syrup at 66 per cent, months to years sealed. Honey and oxymel, years, limited by moisture uptake. Tincture at 25 per cent ethanol or above, microbiologically years, chemically one to two. Fatty salve and cerate, months to a year or two, limited by rancidity. Infused oil carrying any water-bearing material, days, and lethal thereafter. Cocoa butter suppository, months cool. Glycerol-gelatin suppository, weeks.

Evidence grades

Form or claim	Tradition says	Record shows	Grade
Infusion 1:20, off the boil, 10 to 15 min	Standard for leaf and flower	BPC 1911 and King's both give 1 in 20, 15 to 30 min, neither keeps	B
Decoction 1:20, simmer 10 to 30 min, covered	Standard for root, bark, seed	BPC 1911 10 min, King's "not too long", covered, strained hot	B
Cold maceration for mucilage	Cold water takes mucilage, not starch	Tradition, no yield trial found	C
Tincture 1:5 dried, 1:2 fresh, 14 days	Keeps for years	Pharmacopoeial ratios. Stability studies show marker loss at 6 to 12 months	B for method, C for "keeps years"
Alcohol gets what water cannot	Resins and alkaloids need spirit	Artemisinin: tincture best for flavonoids, infusion best for artemisinin	B
Syrup at 66.7 per cent w/w resists spoilage	Sugar preserves	Water-activity data and the standard agree	A for the chemistry

Form or claim	Tradition says	Record shows	Grade
Oxymel for wounds and throat	Hippocratic and medieval standard	Harrison 2023, acetic acid and honey synergy in vitro against biofilms. No human trial	C
Salve, wax to oil 1:5	Standard stiffness	King's gives one fifth of yellow wax to lard	B for the ratio
Suppository, 1 g rectal, 3 g vaginal, mixed at 35 degrees	Standard	USP weights and polymorph melting points are measured	A for the physics, B for the practice
Poultice and fomentation	Draws, soothes, relieves	No controlled evidence. Burns well documented	D for benefit, B for harm
Boiling water sterilises a herbal tea	Hot water makes it safe	NASA chamomile work, no significant reduction, p=0.535	X
Comfrey internally	Healing herb	Pyrrolizidine hepatotoxicity. EMA 0.35 micrograms per day, external only	X

Means ledger

Rung	What it can make	What changes in the outcome
Hands and knowledge alone	Chewed leaf, bruised poultice, cold maceration, expressed juice	Dose unknown, keeping nil, contamination uncontrolled. All of it used within the hour
The hearth	Infusion, decoction, fomentation, poultice, oxymel, honey electuary, syrup, vinegar maceration, warm-infused salve	Repeatable within the limits of the spoon. Syrup and oxymel are the first preparations that keep beyond a week. No reliable ratio without a scale
Garden and still	Tinctures at a stated ratio and strength, cerates and ointments at 1:5, cocoa-butter or tallow-wax suppositories, water-bath sterilised bottled infusions, percolation	The scale turns recipes into doses. Ethanol opens the resinous and alkaloidal plants and buys a year or two of shelf life. This is where a pharmacopoeia becomes possible
Village dispensary, 300 people	All the above to a written formulary, with logbook, labelled jars and batch records	Reproducibility across batches and preparers. Narrow-margin plants restricted to one named preparer. Errors become traceable, the largest safety gain
District infirmary, 3,000 people	Percolation at scale, a true balance, filtration, specific gravity and alcohol strength by hydrometer	Dose can be checked rather than assumed. No chemical assay, so potency variation remains the governing problem (ME-02)

Rung	What it can make	What changes in the outcome
A hospital before the Fall	Assayed standardised extracts, pure compounds, sterile parenterals, stability data	Dose is known to a few per cent rather than within a factor of eight

Harm test

Alcohol in children. The EMA reflection paper on ethanol in herbal medicinal products used in children, EMA/HMPC/85114/2008, final January 2010, cites the French position that a single paediatric dose should not raise blood ethanol above 0.125 g per litre. It estimates that about 0.3 g per kg of absolute ethanol may cause acute toxic reactions in children and that mortality may rise to 50 per cent at a blood concentration of 1 g per litre, and a draft EMA document is reported to warn at a single dose of 6 mg per kg (Springer review of German pharmacovigilance data, 2016, secondary) [VERIFY]. The village rule: no ethanol tincture under about six years unless there is no alternative, and then the dose goes into near-boiling water for two minutes, or is remade as syrup or honey. No tincture at all under one year.

Alcohol and the alcoholic. Any ethanol-containing medicine can trigger the disulfiram reaction in someone taking disulfiram, and small amounts suffice. For a person in recovery without disulfiram the risk is relapse, so the dispensary should hold a vinegar, honey or glycerine version of each common tincture and offer it without question.

Honey in infants. No honey under 12 months, including in a syrup, an oxymel, an electuary or a dressing a child might lick. Surveys find *Clostridium botulinum* spores in a substantial minority of samples: 21.6 per cent of 102 Polish small-apiary samples, 15.4 per cent of 39 Silesian samples and 12.5 per cent of 48 retail samples in Ankara, with a 2016 to 2022 review reporting a range of 0.5 to 68 per cent across studies. Roughly 15 per cent of infant botulism cases are attributed to honey [VERIFY, secondary]. No domestic heating destroys the spores.

Botulism in oil infusions. This is how this chapter kills. The Vancouver outbreak of 1985 centred on the White Spot Restaurant at 1616 Georgia Street, 34 cases in two clusters from meals eaten between 26 July and 5 September. Type B toxin was found in the serum of three patients, seven needed ventilators and none died (CDC, *MMWR* 1985). The vehicle was chopped garlic in soybean oil left unrefrigerated for months, and a second outbreak in 1989 led the United States FDA to require acidification of commercial garlic-in-oil. Solomon and Kautter showed in 1988 that types A and B produced toxin in bottled chopped garlic in soybean oil within 15 to 20 days at 35 degrees, and throughout 75 days at room temperature, while the garlic still looked and smelled acceptable. Home-bottled garlic in oil was implicated in California in 1991, Florida in 1999 and Denmark in 2003.

The mechanism applies to every herbal oil. Oil excludes air, the plant brings water and spores, and the spores germinate in anaerobic, low-acid, moist pockets. Validated household guidance is to heat the oil to 82 degrees before adding herbs and discard after 4 days refrigerated, or to soak fresh garlic or herbs in citric acid solution for 24 hours to reach pH 4.2 or lower, validated only for garlic, basil, oregano and rosemary (Nummer et al. 2011, University of Georgia Extension C1334, 2024, and NC State guidance). Domestic drying does not reliably lower water activity far enough to be a guarantee. The village rule: dry the plant properly, warm-infuse at 40 to 60 degrees, strain so that no solids and no water remain, and discard any oil showing cloudiness, bubbles or sediment.

Lead from glazed pots. Acid draws lead out of glaze. Old uranium-glazed American dinnerware filled with acetic acid at household vinegar strength released up to 350 micrograms of lead per millilitre, against the United States FDA limit of 3 micrograms per millilitre (Sheets and Turpen, abstract), a Mexican study of traditionally cured earthenware found leaching up to 378.18 ppm against a national limit of 0.5 ppm (Pure Earth 2025), and a fatal case from earthenware containers was reported by Klein and colleagues in the *New England Journal of Medicine* in 1970 (cited by CDC, original not read). The rule is absolute: vinegar, oxymel, acid infusions, syrups and anything citrus are made and kept in glass or stainless steel, never in salvaged glazed earthenware or decorated crockery of unknown origin.

Copper and other metals. The WHO provisional drinking water guideline is 2 mg per litre and the United States EPA goal 1.3. Water at 3 to 5 mg per litre has caused nausea, abdominal pain and vomiting while 1 mg per litre did not, and children have been poisoned by food prepared in copper or brass pots (National Academies, *Copper in Drinking Water*, 2000). King's names copper, brass, iron and zinc as vessels to avoid and prefers earthenware, glass or enamel-lined iron. A metallic taste means discard the batch.

Burns from fomentations. Moritz and Henriques established in 1947 that burn injury is a product of temperature and time (*American Journal of Pathology* 23(5):695 to 720, read in secondary summaries). Below about 44 degrees the risk to a healthy adult is effectively nil, at 49 degrees a second-degree burn takes about 10 minutes, and at 70 degrees one second is enough, thresholds repeated in the INSPQ review. Children burn roughly four times faster, and the United Kingdom HSE sets 44 degrees as the ceiling where vulnerable people are at risk. A fomentation is tested on the preparer's own inner wrist and never applied to a patient with impaired sensation, diabetes, paralysis or confusion, nor to a sleeping patient.

Irritant poultices. A second-degree burn followed mustard applied to an arthritic knee, the authors recommending a maximum of 15 minutes (*Case Reports in Medicine* 2012), and mustard powder used for chest congestion produced second-degree burns of the lower neck and chest (*Dermatology Online Journal* 2017). A Korean series described deep second-degree burns in a woman who left mustard paste on wrist, knee and ankle for 5 hours, with two garlic burns in the same report, all three having applied the remedy longer than recommended. Mustard, garlic, ranunculus and capsicum go over a thin barrier of oiled cloth, are watched continuously, and come off at 15 minutes or at the first report of burning, not at the first visible redness.

Misidentification. These forms do not protect against a wrong plant, and a tincture of the wrong root is a worse poison than a tea of it because alcohol extracts more alkaloid. The ME-04 labelling rule applies to everything made here: name, part, place, date, preparer, and ratio and solvent strength.

Red flags

Signs that the grammar has run out and the patient needs what the village cannot give.

- Botulism after any oil infusion, honey or home preserve: descending symmetrical weakness beginning with double vision, drooping lids, slurred speech and difficulty swallowing, in a fully alert patient without fever. There is no antitoxin and no ventilator. Nurse flat with the airway protected, feed by whatever route is still safe, and say honestly that those who survive the first fortnight usually recover fully.
- Infant botulism: a baby under one year who grows floppy, feeds poorly, loses head control and has a weak cry after any honey. The same answer, worse odds.
- Acute liver failure after repeated internal comfrey, ragwort, coltsfoot or any pyrrolizidine plant: jaundice, a tender enlarged liver, abdominal swelling with fluid. Stop it, destroy the batch, and find everyone else who was given it.
- Lead poisoning from a salvaged vessel: colicky abdominal pain, constipation, anaemia, wrist or foot drop, and in a child failure to thrive with loss of acquired skills. Find and destroy the pot. There is no chelation.
- A full-thickness burn from a fomentation or an irritant poultice, especially over a joint or on a child: white, leathery or painless skin. This needs the wound care of WO-01 onwards and may need grafting the village cannot do.
- Ethanol poisoning of a small child who drank from a tincture bottle: unrousable sleep, cold clammy skin, slow breathing, and a convulsion from low blood sugar. Keep warm, keep the airway open, give sugar by mouth if the child can take it, and expect either recovery over hours or death. Tincture bottles live locked and high.
- Rapidly spreading rash, swelling of lips and tongue, or wheeze after any preparation: anaphylaxis. Stop, and record the plant on the patient's card for life.

The case against

The strongest case against this chapter has three parts and all three are fair.

First, these forms cannot deliver a known dose. The problem is not the form but the raw material: oak bark varies 8 to 20 per cent in tannin by harvest time, branch age and assay (EMA HMPC 2010), and peppermint tea bags vary sixfold in essential oil between brands (Kowalski et al. 2015). A perfectly executed 1:5 tincture of a plant whose active content varies eightfold is of unknown strength. Edzard Ernst has made this argument for decades, and here he is correct. The reply is that the forms hold one variable still while another moves, and that a village with a logbook and one preparer per narrow-margin plant is managing the variation rather than ignoring it (ME-02).

Second, the shelf lives in the popular herbals are not supported. "Tinctures keep for years" is repeated everywhere, and the stability work says otherwise. Microbiologically safe is not the same as still a medicine, and nobody ever assayed the dusty bottles of the old apothecary.

Third, boiling water is not sterilisation. The NASA chamomile work found no significant reduction in microbial load from brewing at 100 degrees. For a healthy adult this is rarely relevant. For a newborn, a famine-weakened patient or a post-measles child it is not, and a book that recommends herbal teas to those patients without saying so is doing harm.

The counter-case is equally real. These forms are what nearly every human being who ever took a medicine took, and they need no electricity, no cold chain and no industry. The oxymel has a mechanism demonstrated against wound biofilms, the syrup's preservation is simple physical chemistry, and the suppository is the only route that works when a patient is vomiting and there is no needle. The old forms are neither safe because they are old nor useless because they are not standardised. They are a grammar whose rules must be written down and followed with a scale, a label and a logbook.

10-line summary of robust findings

1. The ratio that survived three centuries is 1 part of drug to 20 of water, for infusion and decoction alike, in BPC 1911 and in King's 1898.
2. Infusion is for leaf and flower in water just off the boil, covered, 10 to 30 minutes, and does not keep beyond a day unless bottled hot and water-bath sterilised 10 minutes, which buys a week.
3. Decoction is for root, bark and seed, boiled covered 10 minutes officially and 20 to 30 in modern practice, strained before cooling, with volatiles added off the heat.
4. A tincture is any preparation where menstruum volume exceeds herb weight, a fluid extract is 1:1 or stronger, and 1:5 dried in 25 to 60 per cent ethanol for 14 days is the default.
5. Alcohol strength selects the chemistry: high for resins and volatile oils, acidified water for alkaloids, cold water for mucilage, while boiling destroys heat-labile actives.
6. Syrup is 66.7 per cent sucrose by weight at specific gravity 1.330, where bacteria and most moulds cannot grow but osmotolerant yeasts still can.
7. Oxymel runs from 1 part acid in 40 of honey to 4 of honey in 1 of vinegar, and its only real evidence is Harrison 2023, in vitro.
8. Ointment and cerate stiffness is about 1 part wax to 5 of fat, and their enemy is rancidity rather than microbes.
9. Suppository weights are 1 g rectal and 3 g vaginal, and cocoa butter must be melted below 36 degrees and mixed at 35 or it sets in an unstable form.
10. The forms that kill are the oil infusion, through botulism, and the hot or irritant application, through burns.

Open questions

- No head-to-head measurement of mucilage yield from marshmallow root cold against hot. The cold rule rests on tradition.

- No published pyrrolizidine transfer rate for a comfrey ethanol tincture, so whether tincture concentrates or dilutes the toxin relative to tea is unknown.
- No controlled measurement of volatile oil retention covered against uncovered, despite the rule being universal.
- The ethanol concentration that makes a preparation self-preserving appears in no pharmacopoeia I reached.
- Marc retention has no authoritative number in the sources I found, only conflicting home-herbalist estimates.
- What the 1934 Codex specifically dropped is not established by the sources I reached.
- Whether a 20 to 30 minute decoction extracts materially more than the official 10 minutes has no trial behind it.
- Four leads in the brief could not be read: WHO 2011 *Quality control methods for herbal materials*, Hirt and M'Pia, the Hesperian medicine-making pages and the ICS-UNIDO handbook. Nothing here rests on them.

Sources to read in full

1. Felter and Lloyd, *King's American Dispensatory*, 1898, the general articles *Infusa*, *Decocta*, *Tincturae*, *Syrupi*, *Oxymel*, *Cerata*, *Unguenta*, *Suppositoria*. The most complete practical account of these forms in English.
2. *The British Pharmaceutical Codex*, 1911, *Infusa* and *Decocta*, for the ratios, the earthenware rule and the water-bath sterilisation that buys a week.
3. Harrison, Blower, de Wolf and Connelly 2023, the only modern experimental work on oxymel, with its medieval manuscript survey.
4. Kowalski, Baj, Kowalska and Pankiewicz 2015, for the real numbers on volatile loss and brand variation.
5. Bilia et al. 2006 on *Artemisia annua*, showing that the choice of form changes which constituent you get.
6. CDC *MMWR* 1985 on the Vancouver outbreak with Solomon and Kautter 1988, before any infused oil is made.
7. EMA/HMPC/85114/2008 on ethanol in herbal products used in children, for the blood-ethanol limits.
8. Moritz and Henriques 1947, for the arithmetic behind every fomentation rule in this book.
9. University of Georgia Extension C1334, 2024, the only validated household procedure for infused oils.

At the bedside after the Fall

For a household. The minimum dispensary is a covered enamel or earthenware pot, a kettle, a sieve, clean cloth and glass jars with tight lids, making infusion, decoction and poultice. With honey and vinegar it can also make oxymel and honey electuaries, its first preparations that keep. It needs a dozen reliably identified plants, honey or sugar, vinegar, clean water, fuel and a way to write on jars. The first failure to expect is the sour jug, an infusion left overnight in a warm kitchen and drunk next day, the vomiting then blamed on the illness. The second is a scald from a fomentation applied to a sleeping or confused patient.

For a village of 300. Add a scale even if crude, ethanol from the still, beeswax, a reliable boiling water bath, stoppered bottles, suppository moulds, and a written formulary with one page per form. Name one preparer for the narrow-margin plants and keep a logbook with batch numbers. Standing stock should be six to ten tinctures at 1:5 in 40 per cent, a litre of simple syrup, a jar of oxymel, two or three salves, labelled tins of dried herb, and fifty suppositories on a fat base. The first failure to expect is the unlabelled jar, which ME-04 names as the commonest fatal error in the record, and the second is a batch of herbal oil made from damp plant material that poisons a family months later.

For a district of 3,000. Add a hydrometer for alcohol and syrup density, a proper balance, a percolator, filtration, a cool dark store, and records that trace a batch to every patient who received it. It can standardise on density rather than on faith, and it can afford to destroy stock. The first failure to expect is drift, the formulary on the wall and the practice in the room slowly separating, and the answer is to re-measure the standard preparations against the written sheet once a season.

Records at every rung: plant, part, where gathered, date, who gathered, who prepared, ratio, solvent strength, batch number, date made, date opened, and a line for every patient who received it.

Protocols

P1. Infusion, standard

1. Weigh 5 g of dried leaf or flower, cut or coarsely rubbed, per 100 mL of finished infusion. Without a scale use 1 level tablespoon of dried leaf per 200 mL cup and write "by volume, unweighed" on the record.
2. Warm an earthenware, porcelain or glass vessel with hot water and empty it. Never copper, brass, bare iron or zinc.
3. Bring soft clean water to a rolling boil and pour it over the herb.
4. Cover at once with a tight lid. Infuse 10 to 15 minutes, up to 30 for tougher leaf. Tolerance plus or minus 5 minutes.
5. Strain, and make the volume back up to the nominal figure with hot water.
6. For a newborn, elderly, malnourished or immune-weakened patient, use a full rolling boil, infuse at least 5 minutes, and use within 1 hour.
7. Keeping: 12 hours at room temperature, 24 hours cool. Discard if cloudy, sour-smelling, slimy or carrying a film.
8. To keep a week: fill clean bottles to within 1 cm of the top while hot, stand them in a boiling water bath 10 minutes, plug tightly, label with the date, and discard at 7 days.

P2. Cold infusion, for mucilage

1. Weigh 5 g of cut marshmallow root, mallow leaf, linseed or slippery elm per 100 mL of cold water.
2. Stand covered in glass or china at room temperature 1 to 8 hours, stirring occasionally.
3. Strain through cloth. The liquid should be visibly slippery.
4. Use within 12 hours. Cold infusions sour less readily than hot but they are not sterile.

P3. Decoction, standard

1. Weigh 5 g of bruised, sliced or coarsely powdered root, bark or seed per 100 mL of finished decoction, starting with about 120 mL of water per 5 g to allow for evaporation.
2. Use earthenware, glass, enamel-lined iron or tin. Never copper, brass, bare iron or zinc.
3. Bring to the boil and simmer covered: 10 minutes for finely bruised bark and seed, 20 to 30 for hard coarse root. Tolerance plus or minus 5 minutes.
4. If the preparation contains aromatic or volatile material, take the pot off the heat first, then add it, and keep the pot closed until cold.
5. Strain while hot, passing clean hot water through the strainer to make the volume back up.
6. Keeping: 24 hours at room temperature, 2 days cool. Discard at any sign of souring or film.

P4. Tincture by maceration, 1:5 dried

1. Decide and write down the ratio and strength before starting. Default 1:5 in 40 per cent ethanol, 1:5 in 60 to 70 per cent for resinous or aromatic drugs, 1:2 in 90 to 95 per cent for fresh plant.
2. Weigh the dried herb and cut or grind it to a coarse powder.
3. Calculate the menstruum: grams of herb times 5 gives millilitres for a 1:5. Keep units matched.
4. Make the menstruum to strength. For 500 mL of 40 per cent from 95 per cent spirit, take about 210 mL of spirit and make up to 500 mL with clean water, mixed before it goes on the herb.
5. Put herb and menstruum in a clean glass jar with a tight lid, the herb fully covered. Top up on day 2 if the herb swells above the liquid.
6. Macerate 14 days, shaking daily, out of direct sunlight. Tolerance 12 to 21 days.
7. Strain through cloth, then press the marc hard. Record the volume recovered.

8. Either make the volume back up with fresh menstruum of the same strength, or write the true volume and ratio on the label.
9. Stand 2 days, then decant off any sediment.
10. Bottle in dark glass, filled nearly full, tightly stoppered, cool and dark. Label with plant, part, ratio, ethanol per cent, batch, date and preparer.
11. Keeping: full strength for 1 year, usable for 2. Remake narrow-margin plants every season.

P5. Simple syrup, 66 per cent

1. Weigh 1000 g of clean sugar.
2. Add about 400 mL of clean water and heat gently, stirring, until fully dissolved. Do not boil hard, and a skin on the surface means it has been reduced too far.
3. Strain through clean cloth while hot.
4. Make the total weight up to 1500 g with hot water. Specific gravity should be about 1.330 at 15 degrees if you have a hydrometer.
5. Bottle hot into clean bottles, filled nearly to the top, and seal.
6. After cooling, shake each bottle so condensation from the neck mixes in rather than standing as a dilute layer.
7. Keeping: months to years sealed and cool. Discard if it ferments, fizzes, smells of alcohol or grows a film.
8. For a medicated syrup replace part of the water with a strained infusion or decoction, keeping the sugar at two thirds of the finished weight, and expect only a few months.

P6. Oxymel

1. Simple oxymel, the Hippocratic and medieval form: 1 part honey to 2 parts vinegar by volume, warmed together until mixed, not boiled.
2. Official British form, stronger and sweeter: 800 g of clarified honey warmed until liquid with 100 mL of strong vinegar and 100 mL of water.
3. Medicated: steep the herb in the vinegar 2 to 4 weeks, strain, then add the honey.
4. Vessels: glass or unglazed stoneware only, because the acid takes lead out of glaze and copper out of metal.
5. Keeping: 6 to 12 months cool and sealed. Discard if it ferments.
6. Never to a child under 12 months.

P7. Infused oil and salve

1. Use fully dried plant material only. If it bends rather than snaps it is not dry enough.
2. Warm method: cover the herb with oil in a jar standing in water at 40 to 60 degrees for 2 to 4 hours, no hotter. Solar method: a sealed jar in the sun 2 to 4 weeks, shaken daily.
3. Strain through cloth, stand 2 days, and decant off any watery or cloudy bottom layer. No water and no plant solids may remain.
4. Discard without tasting any oil that is cloudy, bubbling, sour-smelling or carrying a sediment layer.
5. Never infuse fresh garlic, fresh green herb or anything damp into oil that will be kept.
6. For a salve, melt 1 part beeswax into 5 parts infused oil by weight over a water bath at the lowest heat that melts the wax, 1 to 4 for a firmer salve. Stir constantly while cooling.
7. Test stiffness on a cold plate and adjust with more oil or wax while still molten.
8. Pour into clean dry jars, label, and keep cool and covered.
9. Keeping: 6 to 18 months. Discard when it smells of old fat, or if water has got in.

P8. Suppository and pessary

1. Base: cocoa butter, or tallow with about one fifth of beeswax if cocoa butter is unavailable.

2. Melt in a water bath at not more than 36 degrees. Past 38 degrees you get unstable crystals and a suppository that melts in the hand, and it then needs 1 to 4 days of storage to recover.
3. Cool the melt to 35 degrees before mixing in the medicament, which must be a very fine powder or a small volume of concentrated extract.
4. Pour into moulds chilled until moisture forms on the outside.
5. Rectal suppositories are cone-shaped and about 1 g. Vaginal pessaries are globular and about 3 g.
6. Allow 2 to 3 minutes to set, rarely more than 5, because longer causes splitting.
7. Release by thumb pressure and inversion, wrap, and store cool.
8. Keeping: months in a cool store. Tell the patient not to carry them in a pocket.

P9. Fomentation and poultice

1. Prepare the infusion or decoction as in P1 or P3.
2. Soak folded cloth, wring it out, and test on your own inner wrist. It must feel comfortably warm, not hot. Aim below 44 degrees.
3. Apply 10 to 20 minutes, renewing as it cools. Cover with dry cloth to hold heat rather than raising the temperature.
4. Never apply to a sleeping, confused or paralysed patient, to anyone with numb skin or diabetes, or to a small child without continuous supervision.
5. For a poultice, mix the bruised herb or the vehicle, bread, bran, linseed or slippery elm, with hot water to a spreadable paste, spread it about 1 cm thick on cloth, and apply with the cloth between paste and skin.
6. Irritant poultices, mustard, garlic, capsicum and ranunculus, go over oiled cloth, are watched continuously, and come off at 15 minutes or at the first complaint of burning, whichever is sooner.
7. Lift and check the skin every 5 minutes, and stop at the first white, grey or blistered patch.

P10. Checking and condemning a batch

1. Look for cloudiness, films, bubbles, a layer that was not there before, or mould at the neck.
2. Smell for sour, yeasty, unexpectedly alcoholic or the stale fatty smell of rancidity.
3. Taste only non-toxic preparations, and only a trace on the lip. A metallic taste means a metal vessel and the batch goes.
4. Read the label. No label, or an incomplete one, and the batch goes whatever it looks like.
5. Record the condemnation with batch number and reason, because the pattern of failures tells you what to change.

Numbers to carry

1. **1 in 20.** Five parts of drug to one hundred of water, for infusion and decoction alike.
2. **15 minutes covered, 10 minutes boiling.** The official infusion and decoction times, with 20 to 30 minutes of simmering allowed for hard roots and barks.
3. **1 day, 2 days, 1 week.** An infusion keeps a day, a decoction two days cool, either a week if bottled hot and held in a boiling water bath 10 minutes.
4. **1:5 in 40 per cent, 14 days.** The default tincture. 1:2 in 95 per cent for fresh plant, 60 to 70 per cent for resins.
5. **Two thirds sugar.** Syrup is 66.7 per cent sucrose by weight, 1000 g of sugar made to 1500 g, specific gravity 1.330.
6. **1 part wax to 5 of oil.** Salve and ointment stiffness, or 1 to 4 for firmer.
7. **35 degrees in, 36 degrees maximum.** Cocoa butter is mixed at 35 and never heated above 36. Rectal suppository 1 g, vaginal pessary 3 g.

8. **44 degrees.** The ceiling for any hot application. At 49 degrees a second-degree burn takes 10 minutes, at 70 degrees one second. Children burn four times faster.
9. **No honey under 12 months, no tincture under 6 years, no comfrey by mouth ever.** The three absolute prohibitions.
10. **4 days, or dry and strained.** A herbal oil containing moisture keeps 4 days refrigerated. A dried, fully strained and clear oil keeps months. A cloudy or bubbling oil is thrown out without tasting.

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