# TR-01 How often is the old remedy right? The ethnobotanical hit rate and the test of convergence

HEALING after the FALL, research library, TR-01

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

## 1. Why the book needs a prior

HEALING after the FALL trusts neither the herbal nor the hospital until each has been tested. After the Fall most remedies cannot be tested before the healer must act. The healer needs a starting number: the probability that a traditional remedy does what it is said to do, before anyone has tested it. Statisticians call this a prior. FO-03's evidence ladder uses grade C for "convergent traditional use across unrelated cultures with plausible pharmacology". This report asks what grade C is worth in numbers, and whether that number survives the objection that much "convergence" is copying.

The short answer is that tradition is a real but modest signal. It roughly doubles the chance that a plant shows activity in a laboratory screen. It does much less to predict whether a household preparation cures a patient. No study has measured the probability the brief asks for, so the figures proposed for grades C and D are inferences assembled from partial measurements, and they are marked as such.

## 2. The survivor count: Fabricant and Farnsworth 2001

The most quoted number in the field comes from Daniel Fabricant and Norman Farnsworth of the University of Illinois at Chicago. They identified 122 compounds of defined structure, from only 94 plant species, used globally as drugs, and reported that 80 per cent had an ethnomedical use "identical or related to the current use" of the active elements (Fabricant and Farnsworth 2001). An earlier count for the World Health Organization is reported in secondary sources as about 119 compounds from about 90 species, 74 per cent of them found by following folk claims (Farnsworth et al. 1985, [VERIFY] against the full text). Only the abstract of the 2001 paper could be read, so how "related" was judged is not known.

What the number means: among plant compounds that became drugs, most came from plants already used for something similar. Digitalis, quinine, morphine and artemisinin fit the pattern. This is real evidence that traditional users noticed real pharmacology.

What it does not mean: it is a survivor count. It starts from drugs that succeeded and looks backwards. Remedies investigated and found inert were never catalogued as a class. A list of lottery winners who bought tickets at one shop does not give the odds at that shop. The 80 per cent is the probability that a successful drug had a traditional precedent. The book needs the reverse: the probability that a traditional precedent leads to a working remedy. Confusing the two is the commonest error in the literature that cites this paper. "Related" use is also generous, and 122 compounds from 94 species, out of a few hundred thousand flowering plants, is itself a measure of how rare drug-grade success is.

## 3. Screens that start from the plants

The right comparison takes plants chosen by tradition and plants chosen at random, puts both through the same test, and compares hit rates.

### 3.1 The National Cancer Institute screen, 1960 to 1974

From 1960 the United States National Cancer Institute (NCI) screened plant extracts, collected by the Department of Agriculture, against experimental tumours. Richard Spjut and Robert Perdue of the USDA compared the NCI's active plants with plants named in folklore references, in Cancer Treatment Reports in 1976 and, with full data, in a 2005 review (Spjut and Perdue 1976, read only through Spjut 2005).

The random screen found 2,127 active species of 20,535 screened (10.4 per cent) and 1,225 active genera of 4,716 (26.0 per cent) (Spjut 2005). Against this:

| Folklore source | Species listed | Per cent active |
|---|---|---|
| Random NCI screen (baseline) | 20,535 | 10.4 |
| Krochmal 1973 (medicinal, North America) | 251 | 26.7 |
| Quisumbing 1951 (medicinal, Philippines) | 855 | 16.4 |
| Train et al. 1957 (medicinal, Nevada) | 214 | 15.0 |
| Webb 1948 (poisonous, Malaya) | 760 | 9.2 |
| Kingsbury 1964 (poisonous, North America) | 488 | 21.5 |
| Hardin and Arena 1974 (poisonous) | 141 | 41.1 |
| Hartwell (plants used against cancer) | 2,725 | 17.3 |
| Anthelmintics | 482 | 29.3 |
| Fish poisons | 145 | 38.6 |
| Arrow, ordeal and homicidal poisons | 70 | 45.7 |

Source: Spjut 2005, tables 2 to 5.

Three findings matter. Medicinal and poisonous references were active at 1.4 to 2.6 times the random rate. The signal tracked the strength of the traditional effect: in Quisumbing's Philippine materia medica, weak "stimulants" were 14.8 per cent active, abortifacients 27.9, anthelmintics 30.0 and emetics 32.1. And Hartwell's cancer folklore list, the closest thing here to "same complaint", ran at only 1.7 times random. Haemorrhoid remedies looked highly active (35.3 per cent), but 23 of the 24 active species were also used for eleven or more other complaints, so the activity was general toxicity, not a match to the indication (Spjut 2005).

Spjut's caveats: collecting was not truly random, "active" was defined inconsistently, tannin-rich extracts scored as artefacts, folklore came from books, and cultural diffusion may inflate reports for widespread species. Only about 1 per cent of active species reached clinical evaluation. He concluded that folklore helps a new programme, but broad screening is more cost-effective in the long run, because a random team collects 60 to 100 samples a day against 1 to 2 for a folklore team (Spjut 2005). The NCI plant programme of 1960 to 1982, about 35,000 samples from about 12,000 species, yielded paclitaxel, camptothecin and homoharringtonine, roughly one success per 4,000 species in one disease category (Cragg et al. 1998, search summary only). Paclitaxel came from Pacific yew bark (Taxus brevifolia) collected by USDA botanist Arthur Barclay in Washington State in August 1962, and camptothecin from Camptotheca acuminata fruit collected in California in September 1961 (American Chemical Society undated). Neither came from a folk claim about cancer.

### 3.2 Small head-to-head comparisons

| Study | Place and assay | Tradition-selected | Random |
|---|---|---|---|
| Slish et al. 1999 | Belize, rat aorta relaxation | 4 of 31 species | 0 of 32 |
| Kindscher et al. 1998 | Prairie, NCI anti-HIV, aqueous extracts | 60.0% | 13.9% (historical NCI) |
| Kindscher et al. 1998 | same, organic extracts | 13.6% | 3.0% |
| Khafagi and Dewedar 2000 | Sinai, antimicrobial, any activity | 83% | 42% |
| Khafagi and Dewedar 2000 | same, strong activity | 8.3% | 13.9% |
| Silva et al. 2013 | Caatinga, Brazil, antimicrobial | 10 of 20 (50%) | 7 of 19 (37%) |

Sources: Slish et al. 1999 (abstract), Kindscher et al. 1998 (full text), Khafagi and Dewedar 2000 (as reported by Albuquerque et al. 2014), Silva et al. 2013 (full text).

Kindscher's team tested 22 of 203 prairie species with documented Native American use. Ten of 22 showed at least moderate anticancer activity (Kindscher et al. 1998). The comparison is against historical NCI rates, not a concurrent random arm, so its four-fold ratio is fragile. The Sinai study is the most instructive: tradition-selected plants were twice as often weakly active, but random plants were more often strongly active.

Paul Alan Cox's Samoan work is the most famous story and the least useful statistic. Healers in Falealupo on Savai'i used the bark of the mamala tree, Homalanthus nutans (Euphorbiaceae), for hepatitis. NCI scientists found its phorbol ester prostratin had antiviral activity, and it was pursued as a way to flush latent HIV, not as a hepatitis cure (Wikipedia 2026b, Lawrence Berkeley National Laboratory 2004). No evidence was found that it has completed clinical development [VERIFY]. Cox's general Samoan screen found over 86 per cent of 74 species active in broad pharmacological tests, with no random arm (Cox et al. 1989, search summary). Cox and Michael Balick argued the case for the method in Scientific American (Cox and Balick 1994, bibliographic record only). Balick's Belize collections for the NCI, more than 2,200 bulk samples made with fifteen healers, produced the Slish result above. A claim that Balick found a much higher anti-HIV hit rate among healer-chosen Belizean plants could not be found in any source read [VERIFY].

### 3.3 Large modern screens: the signal shrinks

Gyllenhaal and colleagues compared ethnomedical plants from Vietnam and Laos with plants collected for taxonomic diversity in a Vietnamese national park, all tested in the same laboratories. Random collections had the higher hit rate per collection, though per sample the ethnomedical plants were more often active. Ethnomedical plants did better for tuberculosis, and per sample for malaria, but showed little advantage for HIV, cancer or chemoprevention. Plants whose use matched the assay were not significantly more often active than random plants (Gyllenhaal et al. 2012, abstract only).

Applequist and colleagues screened 1,294 Malagasy samples for antimalarial activity: 39.6 per cent had an IC50 below 50 micrograms per millilitre and 21.1 per cent below 20. Samples from genera with antimalarial use scored 44.3 and 23.2 per cent. The 67 samples from species with documented antimalarial use were more often weakly active (49.3 per cent) but less often strongly active (17.9 per cent). The authors concluded that ethnobotanical direction would not have substantially improved efficiency (Applequist et al. 2017, secondary summary).

The pattern is that small studies report large advantages for tradition and large studies small ones, the signature of a modest true effect inflated by small samples and selective publication. A fair reading is a multiplier of about 1.2 to 2 in large screens, rising to 3 or 4 for plants with strong observable effects [VERIFY: author's synthesis, not a pooled estimate]. No meta-analysis of tradition against random hit rates was found.

## 4. Statistical ethnobotany: which plants humans choose

### 4.1 Moerman's regression

Daniel Moerman of the University of Michigan-Dearborn asked whether people choose medicinal plants at random. In 1991 he analysed native North America north of the Rio Grande: 2,147 of 16,270 species used medicinally by 123 societies in 17,624 ways. Regressing medicinal species per family on total species per family, he found a "highly non-random" distribution, which he linked to defensive chemistry (Moerman 1991, abstract only).

In 1999 Moerman, Robert Pemberton, David Kiefer and Brent Berlin extended this to five floras (Moerman et al. 1999):

| Region | Species | Medicinal | Per cent |
|---|---|---|---|
| North America | 20,669 | 2,428 | 11.7 |
| Korea | 2,506 | 591 | 23.6 |
| Kashmir | 739 | 466 | 63.1 |
| Chiapas Highlands | 6,606 | 1,639 | 24.8 |
| Upper Napo, Ecuador | 1,729 | 133 | 7.7 |

Per cent calculated from the paper's table 1.

Asteraceae ranked first in three northern regions and second in the fourth. Only nine families filled the top five places in four regions, where twenty would be needed if choices were unrelated. Poaceae ranked last in three regions and second-last in the fourth, and Cyperaceae was also ignored. Correlations between family residuals in the four northern floras ran from 0.607 (Chiapas and Korea) to 0.743 (Chiapas and Kashmir). Ecuador's ran from minus 0.043 to 0.189: a tropical flora with different families and different choices. Yarrow, Achillea millefolium, had 359 recorded uses in North America (Moerman et al. 1999).

This shows that people on different continents pick from the same chemically rich families and avoid the same dull ones. It does not show that any remedy works. The authors were explicit that the overlap could come from related Holarctic floras, from peoples migrating from Asia through North America to Chiapas, or from a global pattern of human knowledge. Later work criticised the regression method for bias towards large families (Kindscher et al. 2013, search summary).

### 4.2 Phylogeny: Saslis-Lagoudakis 2012

The strongest test of convergence is by Haris Saslis-Lagoudakis, Julie Hawkins and colleagues at Reading and Kew. They built a genus-level molecular tree for three distant, culturally unconnected floras: Nepal (about 7,000 species, 982 or 14 per cent medicinal), New Zealand (about 4,000, 165 or 4.1 per cent) and the Cape of South Africa (about 9,000, 323 or 3.6 per cent). Medicinal plants clustered on the tree. "Hot nodes" held 60 per cent more medicinal plants than random sampling predicts, and 133 per cent more for condition-specific use. Hot nodes found in one region contained 17 per cent more medicinal plants from the other regions than expected, and 38 per cent more for condition-specific use. Medicinal floras held more drug-yielding genera than chance ($P = 0.041$), and hot nodes more strongly ($P = 0.001$). The congruence remained when genera used in more than one region were removed (Saslis-Lagoudakis et al. 2012).

This is real evidence that independent peoples converged on the same lineages, and that these lineages are rich in drugs. Its limits: independent discovery is inferred, not demonstrated. Uses came from compiled pharmacopoeias. The analysis is at genus level, not at the level of a preparation. And 17 per cent is a modest enrichment. A four-flora comparison adding Oman found Oman and Nepal closest and listed cultural exchange among the explanations (Lei et al. 2020, abstract only). Teresa Garnatje, Josep Peñuelas and Joan Vallès defended "ethnobotanical convergence",

while conceding that transmission between east and west Mediterranean users of Origanum can be neither proven nor ruled out (Garnatje et al. 2017).

## 5. Agreement within a culture: informant consensus

Robert Trotter and Michael Logan proposed in 1986 that plants on which many informants agree for one illness category are more likely to work. Their factor is Fic = (Nur minus Nt) divided by (Nur minus 1), where Nur is the number of use reports in a category and Nt the number of taxa used for it. Values near 1 mean everyone uses the same few plants (Trotter and Logan 1986, formula from later studies). Michael Heinrich and colleagues found consensus among Mexican indigenous groups generally high for gastrointestinal illness and also for culture-bound syndromes (Heinrich et al. 1998, abstract only). The second finding is a warning. Culture-bound syndromes have no fixed biomedical correlate, so agreement there measures shared culture, not pharmacology.

Moerman later proposed that plants lacking consensus may still "work" through the meaning response, the effect usually called placebo (Moerman 2007, abstract summary). The one direct test of consensus against laboratory activity found, Ryan Case and colleagues on anti-tuberculosis remedies in Papua New Guinea, reportedly found that high-consensus plants did not show the predicted activity (Case et al. 2006, reported by Albuquerque et al. 2014, original not read). Consensus can also inflate validation: a Nepalese study reported about 90 per cent agreement between local uses and published pharmacology, but only for the 30 species with any literature (Uprety et al. 2010). Heinrich, Leonti and colleagues reviewed 40 field studies and called for minimum standards because indices were being computed from weak data (Heinrich et al. 2009a, abstract only).

## 6. The counter-case: shared text, not independent discovery

Marco Leonti of the University of Cagliari argues that much apparent convergence is copying. In literate societies texts carry knowledge further than speech, and materia medica, popular herbals, clinical studies and informants form a loop that shapes what fieldworkers "discover" (Leonti 2011, abstract only).

He measured it. Comparing modern use in Campania with Matthioli's 1568 edition of Dioscorides, Leonti and colleagues estimated that the text raised the probability that a species is recorded for a use category by about 20 per cent, most probably between 14 and 25 per cent (Leonti et al. 2010, abstract only). Extending this to Campania, Sardinia and Sicily, they estimated the causal effect of Dioscorides on present use at 27.6 per cent and of Galen at 36.4 per cent. Of 3,104 modern use citations, 78 per cent corresponded with Dioscorides and 55 per cent with Galen. Many common uses absent from both appeared in a 1980 Reader's Digest herbal (Leonti et al. 2015).

Three routes of copying matter for the "three continents" test:

1. Scholarly transmission: Greek to Arabic to Latin, Ayurveda to Unani, Chinese materia medica to Korea and Japan. A remedy in Europe, North Africa and South Asia may be one remedy read three times.
2. Colonial plant transfer. Willcox and Bodeker found 1,277 species from 160 families used for malaria or fever. Eleven were used in all three tropical regions: Annona muricata, Mangifera indica, Kalanchoe pinnata, Momordica charantia, Jatropha curcas, Ricinus communis, Senna occidentalis, Senna tora, Sida rhombifolia, Cissampelos pareira and Zingiber officinale (Willcox and Bodeker 2004). Several are crops or weeds that humans carried between continents, and knowledge plausibly travelled with them [VERIFY native ranges]. None had clinical trial data in that review. Castor and physic nut are seriously toxic [VERIFY specific toxins].
3. Modern media: the Reader's Digest herbal in Italy, the internet everywhere.

Saslis-Lagoudakis's exclusion test is the best answer to Leonti so far, and it held. The balanced position: independent discovery is real at the level of lineages, and copying explains a large share of specific use claims, a quarter to a third in literate southern Italy. That figure should not be applied to oral traditions without evidence.

## 7. From activity to patient: what happened when famous remedies were trialled

Activity in a dish is not efficacy in a patient. Jürg Gertsch criticised the field for overinterpreting in vitro data at concentrations no patient could reach (Gertsch 2009, abstract only). The clinical record shows how much is lost between bench and bedside.

| Remedy (Latin name, part) | What the tradition says | What the record shows | What science infers | Grade |
|---|---|---|---|---|
| Foxglove, Digitalis purpurea, leaf | A Shropshire family receipt of twenty or more herbs for dropsy | William Withering used it from 1775 in about 160 cases, published 1785 [VERIFY count]. Pulses fell to 40 and 35, one patient died (Withering 1785) | Cardiac glycosides help heart failure. Narrow margin between dose and poison | B (leaf) |
| Sweet wormwood, Artemisia annua, aerial parts | Ge Hong, about 340 CE: a handful soaked in two litres of water, strained, drunk, for intermittent fever [VERIFY translation] | Tu Youyou's Project 523 team reviewed over 2,000 preparations, tested about 380 extracts and isolated artemisinin in 1972 using low-temperature extraction (Lasker Foundation 2011). Tea trial: day-7 clearance 77 and 70 per cent against 91 for quinine, but only 37 per cent parasite-free at day 28 against 86 (Willcox and Bodeker 2004) | The drug is first-line worldwide. The tea relieves fever, but parasites return | B, inferior to drug |
| St John's wort, Hypericum perforatum, flowering tops | European use for wounds and melancholy | 29 trials, 5,489 patients. Responder ratio against placebo 1.28 (1.10 to 1.49) in nine larger trials, 1.87 in nine smaller. Equivalent to standard antidepressants with fewer dropouts (Linde et al. 2008) | Works for mild to moderate depression. Drug interactions [VERIFY] | A |

| Remedy (Latin name, part) | What the tradition says | What the record shows | What science infers | Grade |
|---|---|---|---|---|
| Echinacea, E. angustifolia and E. purpurea, root and herb | Plains nations: snakebite, rabid bites, toothache, sore throat, burns. Clark noted it on 16 December 1804 for "the Cure of a Mad Dog" (Lewis and Clark Fort Mandan Foundation undated) | 24 trials, 4,631 participants. No prevention comparison significant alone. Post hoc pooling suggested 10 to 20 per cent relative risk reduction (Karsch-Völk et al. 2014) | Weak or no effect for colds. Cold prevention is a modern European indication. The Plains uses were not tested | X-leaning for colds |
| Ginkgo, Ginkgo biloba, leaf extract | Classical Chinese use was the seed, for lungs and skin (Validation study 2019). Leaf extract introduced by Willmar Schwabe in 1965 (Pharmacopsychiatry 2003) | GEM trial: 3,069 older adults, 120 mg twice daily, median 6.1 years. Dementia hazard ratio 1.12. Haemorrhagic strokes 16 against 8 (DeKosky et al. 2008, secondary). Cochrane: "inconsistent and unreliable" (Birks and Grimley Evans 2009) | No useful effect on dementia. A failure of a modern indication, not of the tradition. Raw seeds can cause fits | X for dementia |
| Hoodia, Hoodia gordonii, stem | San hunters ate it against hunger and thirst | 15-day trial in about 50 overweight women, 1,110 mg twice daily: no effect on intake or weight. Raised blood pressure, pulse and bilirubin, more nausea and vomiting (Blom et al. 2011, secondary) | Traditional claim tested directly and failed | X |

| Remedy (Latin name, part) | What the tradition says | What the record shows | What science infers | Grade |
|---|---|---|---|---|
| Argemone, Argemone mexicana, leaves and stems | Malian healer's decoction for malaria | Survey of 952 households: 30 of 30 users recovered (95% CI 88 to 100). Randomised trial of about 300: no second-line treatment needed in 89 per cent (84.1 to 93.2) against 95 for artesunate-amodiaquine. Severe malaria in under-fives 1.9 per cent in both arms (Willcox et al. 2011b) | Modest real effect in semi-immune people with uncomplicated malaria. Few cleared parasites | A (one trial), inferior to drug |
| Birthwort, Aristolochia species, root and herb | 99 species used, about half the records from Asia and a third from the Americas (Heinrich et al. 2009b) | Belgium 1990 to 1992: Aristolochia fangchi substituted for Stephania tetrandra in a slimming preparation. Over 100 people reached end-stage kidney failure. 18 of 39 examined (46 per cent) had urothelial cancer. Cumulative doses over 200 g raised risk (Nortier et al. 2000, via review) | Aristolochic acids destroy kidneys and cause cancer. Convergence predicted activity and missed harm | X |

Two tallies put these cases in proportion. Of 51 non-empty Cochrane reviews of Chinese herbal medicines, one reached a firm positive conclusion, 27 (53 per cent) said there might be benefit limited by poor trials, and 23 (45 per cent) were inconclusive. None recommended a herb for practice (Hu et al. 2011). And when Merlin Willcox and colleagues scored antimalarial plants on ethnobotanical citations and laboratory data and compared the scores with the five herbal antimalarial trials with adequate methods, the laboratory score correlated with parasite clearance (Spearman r about 0.6 to 0.7), but the ethnobotanical score did not correlate at all (r = 0), and only weakly with symptom relief (r = 0.5) (Willcox et al. 2011a). Day-7 parasite clearance ranged from 14 per cent (Combretum micranthum) to 74 per cent (Artemisia annua infusion). This is the nearest direct test of "widely used, therefore effective". On five trials, wide use predicted how patients felt, not whether the parasite died.

Edzard Ernst and Simon Singh concluded that several herbal medicines can be effective while others, such as bilberry,

chamomile and ginseng, are not (Ernst and Singh 2008, summary only). Ernst's many systematic reviews are the most sustained critical audit of herbal claims, and run the same way as the Cochrane tally.

One pattern deserves a name. Several famous failures are failures of a modern commercial indication grafted onto an old plant: ginkgo leaf for dementia, echinacea for colds. The tradition itself was not tested. Hoodia is the reverse, a traditional claim tested directly that failed. Prostratin is a third type: a real compound found by following a healer, developed for a disease the healer never treated.

## 8. The number the book will carry

No study has measured the probability that a remedy used for the same complaint on three continents works in patients. The figure must be assembled. Every probability in the right-hand column is the author's inference [VERIFY].

| Step | Evidence | Inference |
|---|---|---|
| A. A random plant is active in one screen | 10.4% (NCI tumour, Spjut 2005), 13.9% and 3.0% (NCI anti-HIV, Kindscher et al. 1998), 21% strict (Madagascar malaria, Applequist et al. 2017) | Base rate 10 to 20% |
| B. Traditional use multiplies this | 1.4 to 2.6 (Spjut), about 1.1 to 1.25 (Applequist), none (Gyllenhaal), 2 to 4.5 in small studies | About 1.5 to 2 |
| C. Strong observable effects (purge, vomit, poison, worms) | 26 to 46% active (Spjut) | About 3 to 4 |
| D. Convergence across unrelated floras | Hot nodes predict 17 to 38% more across regions, drug genera enriched (Saslis-Lagoudakis 2012). Family correlations 0.61 to 0.74 (Moerman 1999) | A further 1.2 to 1.5 for activity |
| E. Share of convergence that is copying | 20 to 36% of uses explained by texts (Leonti 2010, 2015) | Discount D by a quarter to a third where texts link the traditions |
| F. Activity becomes a useful effect at household dose | About 1% of NCI actives reached the clinic (Spjut). 1 of 51 Cochrane reviews firmly positive (Hu 2011). Ethnobotanical score r = 0 with parasite clearance (Willcox 2011a) | For measurable cures, well under half of active remedies help. For symptoms, more |

Erring towards caution, the book can carry these figures:

- **Grade C (same complaint in three or more unrelated traditions, no known textual link, plausible chemistry): about one chance in three that the remedy does something useful for that complaint at the traditional dose.** The chance that it is pharmacologically active in some way, including harmfully, is perhaps one in two. [VERIFY: author's synthesis]
- **Grade D (a single tradition, or convergence traceable to a shared text or a carried plant): about one chance in ten.** [VERIFY: author's synthesis]
- **Adjust for the effect claimed.** Effects the user can see within hours (vomiting, purging, numbing, drying a wound, expelling worms, sleep) are right more often, perhaps one in two at grade C. Claims to cure a hidden process (infection in the blood, a tumour, failing memory) are right perhaps one in ten even at grade C, and symptom relief can hide a disease that is advancing. [VERIFY]

- **Grade C says nothing about safety.** Aristolochia passes every convergence test and destroys kidneys. Two of the eleven pan-tropical malaria plants are poisons.

Why not higher? The best measured advantage in large screens is small, the one direct clinical test of wide use found no link with cure, and remedies important enough to reach Cochrane are rarely firmly positive. Why not lower? Convergence across Nepal, New Zealand and the Cape survived removal of shared genera, strong traditional effects run at three to four times random, and digitalis, artemisinin, St John's wort and Argemone are genuine successes traced to traditional use.

The number is a prior, not a verdict. It tells the healer how much to expect and how carefully to watch. A one-in-three remedy is worth trying for a self-limiting illness when nothing better exists. It is not worth trusting for an illness that kills when an effective treatment is available.

## 9. Ethics: whose knowledge, and how the book credits it

The Nagoya Protocol on Access and Benefit-sharing was adopted under the Convention on Biological Diversity at Nagoya on 29 October 2010 and entered into force on 12 October 2014, after the fiftieth ratification (CBD Secretariat undated). Article 7 requires parties to ensure that traditional knowledge associated with genetic resources is accessed with the prior informed consent or approval and involvement of the indigenous and local communities who hold it, on mutually agreed terms. About 142 parties had ratified by August 2025 (Wikipedia 2026a, [VERIFY]).

Hoodia. South Africa's Council for Scientific and Industrial Research (CSIR) patented the appetite molecule P57 from Hoodia gordonii, a San use, and licensed it to Phytopharm, which licensed it on to Pfizer. The San were not asked. After a lawyer for the San threatened action for biopiracy in 2002, a 2003 agreement gave them 6 per cent of the royalties CSIR received and 8 per cent of milestone income, paid into a trust (Brand South Africa 2003, CIPIT undated). Critics called this a fraction of a fraction. Pfizer withdrew around 2002 or 2003, the sources disagree on the year, and Unilever ended its programme in 2008 (WIPO undated). The San received little because the product failed, the usual outcome of bioprospecting and one rarely told. Whether royalties were ever paid could not be found.

Turmeric. On 28 March 1995 the United States Patent and Trademark Office granted patent 5,401,504, "Use of turmeric in wound healing", to Suman Das and Hari Har Cohly of the University of Mississippi Medical Center. India's CSIR challenged it on 28 October 1996 with 32 references, some from old Sanskrit texts. On 13 August 1997 all six claims were rejected for lack of novelty (Google Patents undated, Nature 1997). The case led India to build a Traditional Knowledge Digital Library [VERIFY].

Samoa. In 2001 the AIDS ReSearch Alliance agreed to return 20 per cent of its profits from prostratin to Samoa, Falealupo village and the healers' families. In 2004 Samoa and the University of California, Berkeley agreed to share equally any proceeds from a gene-derived version (Lawrence Berkeley National Laboratory 2004). These are cited as models, but pay only if a product reaches market.

The ethics are contested. Some argue benefit-sharing law protects communities. Others argue it has mostly raised the cost of research, that money rarely arrives, and that knowledge printed for centuries cannot meaningfully be owned. The book should not pretend the question is settled.

How the book credits its sources. After the Fall there is no patent office, but the debt remains. The book should name the people and tradition each remedy comes from, not "folk" in general. Name the text if it came through a text. Keep the tradition's claim apart from the test result, so that a failed test is not a sneer at the people. Make no secret and no monopoly of any remedy. And say when a remedy was taken without consent.

## Evidence grades

| Claim, remedy or practice | Grade | Basis |
|---|---|---|
| Traditional use roughly doubles the chance of laboratory activity | B | Spjut 2005, Kindscher 1998, Slish 1999, Silva 2013, weakened by Gyllenhaal 2012 and Applequist 2017 |
| Plants with strong observable effects are active at three to four times random | B | Spjut 2005 |
| Unrelated cultures over-use and under-use the same families | B | Moerman 1991, 1999, Saslis-Lagoudakis 2012 |
| Convergence predicts drug-rich lineages | B | Saslis-Lagoudakis 2012, partly replicated by Lei 2020 |
| Convergence predicts clinical cure | D | Willcox 2011a found r = 0 on five trials |
| Informant consensus predicts efficacy | D | Contradicted by Case 2006 (secondary) and Heinrich 1998 |
| Much European convergence is textual | B | Leonti 2010, 2015 |
| Treatment-outcome survey finds remedies worth trialling | B | Willcox et al. 2011b, one programme |
| Grade C carries about one in three | D | Author's synthesis |
| Digitalis purpurea leaf for dropsy of heart failure | B | Withering 1785 |
| Artemisia annua infusion for malaria | B, inferior to drug | Willcox and Bodeker 2004 |
| Hypericum perforatum for mild to moderate depression | A | Linde et al. 2008 |
| Echinacea for preventing colds | X-leaning | Karsch-Völk et al. 2014 |
| Ginkgo biloba leaf extract for dementia | X | DeKosky 2008, Birks and Grimley Evans 2009 |
| Hoodia gordonii for appetite | X | Blom 2011 |
| Argemone mexicana for uncomplicated malaria in semi-immune people | A (one trial), inferior to drug | Willcox et al. 2011b |
| Aristolochia species for any use | X | Nortier 2000, Heinrich 2009b |

## Means ledger

The "procedure" here is the method of deciding how far to trust a remedy.

| Rung | What can be done | What it changes |
|---|---|---|
| Hands and knowledge | Know the prior: one in three for C, one in ten for D. Ask of every claim: how many unrelated traditions, same complaint or not, linked by text or carried plant, what effect can be seen. Know poisoning signs and red flags | Stops the two commonest errors: trusting a remedy because it is old, and dismissing it because it is old |
| Hearth | A notebook per remedy: plant, part, preparation, amount, patient, outcome, date. Prepare the same way each time. Use first for self-limiting illness. Stop at the first harm | Turns anecdote into a record that can be pooled later |
| Garden and still | Grow plants from verified stock, keep a pressed voucher of each, weigh doses, make standard tinctures | Removes the largest cause of herbal poisoning, misidentification and substitution, as in the Belgian case. Makes doses comparable |
| Village dispensary | Treatment-outcome survey (protocol 2), case register, microscope for objective endpoints such as parasite counts | Shows which local remedies go with recovery, as 952 Malian households pointed to Argemone. Cannot separate remedy from natural course |
| District infirmary | Comparison by lot with stopping rules (protocol 3), dose escalation, simple bench assays such as agar diffusion if cultures can be kept | Can establish a remedy at grade A or B locally, as the Malian team did with about 300 patients. Detects common harms |
| Hospital before the Fall | Blinded randomised trials, systematic reviews, standardised extracts, toxicology, interaction data | Detects small effects, rare harms and interactions. Turns the best remedies into drugs dosed to the milligram |

What each rung changes is the error rate. At the bottom the healer is right about a grade C remedy about a third of the time and cannot tell which third. With a register and a microscope the dispensary can begin to sort the third that works, for common illnesses. A district comparison of about 60 patients per arm can separate a remedy curing 90 per cent from one curing 70 [VERIFY: author's calculation, 80 per cent power, 5 per cent significance].

Today a healer can read a Cochrane review in minutes and should, before trusting tradition or this book. After the Fall the reviews are frozen at the date of printing, and new evidence comes only from what villages record. That makes the notebook and register more important than any single remedy.

## Harm test

**How the method harms when done wrong.**

1. Taking convergence as safety. Aristolochia is used on several continents. In Belgium over 100 people reached end-stage kidney failure after Aristolochia fangchi was substituted for Stephania tetrandra, and 18 of 39 examined had urothelial cancer, with higher risk above 200 g cumulative (Nortier et al. 2000, via review).
2. A symptom remedy for a killing disease. Wide use of antimalarial plants tracked symptom relief (r = 0.5), not

parasite clearance (r = 0) (Willcox et al. 2011a). A child whose fever falls while parasites multiply can die of cerebral malaria. In the earlier Argemone dose study, response was 45 per cent under one year of age against 81 per cent over five (Willcox et al. 2011b, search summary).

3. Misidentification and contamination. The Belgian case began with plants confused in trade [VERIFY: the shared Chinese name fang ji]. Argemone seed contains sanguinarine, which causes epidemic dropsy, so the Malian team removed seed capsules from its decoction (Willcox et al. 2011b). Raw ginkgo seeds can cause fits.
4. Dose drift. Foxglove leaf varies in strength. Withering recorded pulses falling to 40 and 35, vomiting, indistinct vision and a death (Withering 1785). The most intensive Argemone regimen gave two prolonged QTc intervals (Willcox et al. 2011b).
5. Delay. Every day on a one-in-three remedy is a day off a known treatment where one exists.
6. The opposite error: dismissing a remedy because it is traditional. Artemisia tea is inferior to artemisinin drugs, but with no drug it may be the best available.

**Who must never receive an untested grade C or D remedy.** Pregnant women: abortifacients were among the most active categories (27.9 per cent) (Spjut 2005). Infants under one year: they responded worst to Argemone and have least reserve. The very old and those with kidney or liver disease. The dehydrated: emetics and purgatives, the most active traditional categories, kill them faster. Anyone already taking a strong remedy, because interactions are unknown.

**Signs that it is going wrong.** Vomiting that does not stop. A pulse below 50 or irregular [VERIFY threshold]. Disturbed vision. Little or no urine. Yellow skin or eyes. New confusion, drowsiness or fits. New swelling of the legs.

**What to do then.** Stop the remedy. Nothing by mouth if drowsy or vomiting. Lay the patient on the side if consciousness is reduced. Give water or oral rehydration solution if alert and not vomiting. Record what was given, how much and when. Keep a sample of plant and preparation. Flag the remedy in the register.

**Historical harm.** Belgium 1990 to 1992 (Aristolochia). Hoodia 2011: the traditional appetite suppressant raised blood pressure and pulse in healthy women (Blom et al. 2011, secondary). Ginkgo: 16 haemorrhagic strokes on ginkgo against 8 on placebo, numbers too small to be sure (DeKosky et al. 2008, secondary).

**Plants named, with parts and lookalikes.**

| Plant | Part used | Dangerous lookalike or substitute |
|---|---|---|
| Digitalis purpurea (foxglove) | Leaf | Before flowering, comfrey (Symphytum officinale) or mullein (Verbascum thapsus) [VERIFY] |
| Artemisia annua (sweet wormwood) | Leaf and flowering tops | Other Artemisia species with little artemisinin, some with thujone [VERIFY] |
| Argemone mexicana (Mexican prickly poppy) | Leaves and stems, never seeds | Seeds resemble mustard seed [VERIFY] |
| Hypericum perforatum (St John's wort) | Flowering tops | Other Hypericum species of lower potency [VERIFY] |
| Echinacea angustifolia, E. purpurea | Root, aerial parts | Parthenium integrifolium as adulterant [VERIFY] |
| Ginkgo biloba | Leaf extract, seed | Raw seed is toxic |
| Aristolochia species | Root, herb | Sold under trade names shared with Stephania and others [VERIFY] |

| Plant | Part used | Dangerous lookalike or substitute |
|---|---|---|
| Ricinus communis (castor), Jatropha curcas (physic nut) | Seed, leaf | The seeds are the danger [VERIFY] |
| Homalanthus nutans (mamala) | Bark | Other Euphorbiaceae with irritant latex [VERIFY] |

## Red flags

These signs mean the patient will die or be disabled without what the village cannot give. They matter most when a grade C or D remedy is in use, because such remedies can relieve symptoms while the disease advances.

For a sick child, the World Health Organization's four general danger signs: unable to drink or breastfeed, vomits everything, has had convulsions, or is lethargic or unconscious. Any one means very severe disease needing urgent referral (WHO undated).

For anyone with fever: confusion, fits or deep drowsiness, inability to stand, laboured or very fast breathing, severe pallor of palms and inner eyelids, dark or scant urine, yellow eyes, bleeding from gums or nose, a stiff neck [VERIFY against the series' malaria and sepsis documents].

For anyone taking a strong plant remedy: the poisoning signs in the harm test.

What to do anyway. Stop experimenting. If an effective drug exists in reach, use it or take the patient to it. If none exists, give the best-tested remedy at the safest dose rather than a new one. Keep the patient warm, hydrated if able to swallow, on the side if drowsy, and clean. Record everything, because the case will teach the next healer. Tell the family the truth in plain words: the illness is beyond what the village can treat, everything possible is being done, and the patient will not be left alone. Relieve pain and fear. A healer who promises that a one-in-three remedy will cure borrows against a debt the family will pay.

## The case against

**Against the herbal romance.** Jürg Gertsch argued that ethnopharmacology overinterprets in vitro results (Gertsch 2009). Ulysses Albuquerque and colleagues found ethnodirected studies, as usually done, poorly suited to drug development because of weak sampling and interpretation (Albuquerque et al. 2014). Marco Leonti showed that much "independent" European tradition echoes Dioscorides and Galen (Leonti et al. 2015). The two largest head-to-head screens found little or no advantage for tradition (Gyllenhaal et al. 2012, Applequist et al. 2017). Spjut concluded that random screening pays better in the long run (Spjut 2005). Cochrane's record for Chinese herbal medicine is one firm positive in 51 reviews (Hu et al. 2011). Edzard Ernst has documented how often famous herbs fail controlled tests (Ernst and Singh 2008). Wide use did not predict parasite clearance (Willcox et al. 2011a). On this reading the hit rate is an artefact of survivor counting, small samples and advocates writing their own literature, and grade C deserves less than one in three.

**Against the hospital romance.** Tradition found digitalis, quinine and artemisinin. A Malian healer's decoction, tested properly, kept 89 per cent of uncomplicated malaria patients off second-line treatment against 95 per cent for the imported drug (Willcox et al. 2011b). Random screening yields great drugs at about one per 4,000 species in one disease (Cragg et al. 1998), a rate useless to a village that has no laboratory. Tradition is the only screen the village already has. Several "failures" tested modern indications, not traditional ones. And where there are no pharmacies, a safe remedy that relieves symptoms has value even if it cures nothing.

**The author's position.** Both critiques are right about different things. Tradition is a weak but genuine filter for activity and a much weaker filter for cure. Convergence adds something and copying subtracts much of it. Grade C is a reason to test, not a reason to trust.

**Critics named.** Edzard Ernst, Simon Singh, Jürg Gertsch, Marco Leonti, Ulysses Albuquerque, and Richard Spjut on cost-effectiveness. Defending the ethnobotanical prior: Norman Farnsworth, Paul Alan Cox, Michael Balick, Daniel Moerman, Julie Hawkins, Michael Heinrich and Merlin Willcox, all of whom also wrote critically about the method.

## 10-line summary

1. Of 122 plant-derived drugs, about 80 per cent had a matching traditional use, but this counts survivors and gives no odds for an untested remedy.
2. In the NCI tumour screen 10.4 per cent of random species were active, and folklore plants 1.4 to 2.6 times as often.
3. Plants with strong traditional effects (anthelmintics, fish and arrow poisons) were active at about three to four times the random rate.
4. The two largest modern screens, in Vietnam and Laos and in Madagascar, found little or no advantage for tradition.
5. Unrelated cultures over-use the same families (Asteraceae above all) and avoid the same ones (Poaceae, Cyperaceae).
6. Across Nepal, New Zealand and the Cape, medicinal lineages converge and are rich in drug genera, even after shared genera are removed.
7. In southern Italy a quarter to a third of present plant uses are explained by Dioscorides and Galen.
8. How widely an antimalarial plant is used predicted symptom relief but not parasite clearance in the one direct test.
9. Digitalis, artemisinin and St John's wort passed. Ginkgo for dementia, hoodia and echinacea for colds failed. Aristolochia harmed.
10. The working prior: grade C about one in three, grade D about one in ten, both inferences, neither a statement about safety.

## Open questions

- No one has measured the clinical success rate of remedies used for the same complaint on three continents. A review starting from a random sample of convergent remedies and counting positive trials would answer the brief directly.
- How independent is convergence in oral traditions? Leonti's estimates come from literate Mediterranean ones.
- Does convergence on a lineage mean convergence on a remedy? The phylogenetic work is at genus level. The book works with a part, a preparation and a dose.
- Is the small-study advantage real or publication bias? No size-weighted pooled analysis was found.
- How much of traditional efficacy for subjective complaints is the meaning response, and does that justify keeping safe remedies?
- Did Balick's Belize collections yield a published tradition-against-random anti-HIV comparison? Not found.
- What is prostratin's clinical status? Not found.
- Fabricant and Farnsworth's definition of a "related" use was not read.

## Sources to read in full

1. Spjut (2005), SIDA. The only large dataset on folklore against random activity, with caveats.
2. Saslis-Lagoudakis et al. (2012), PNAS. The best test of convergence.
3. Moerman, Pemberton, Kiefer and Berlin (1999), Journal of Ethnobiology. Short, clear, open access.
4. Leonti et al. (2015), Frontiers in Pharmacology. The measurement of textual copying.
5. Willcox et al. (2011a), Malaria Journal. The nearest direct test of the book's question.

6. Willcox et al. (2011b), Malaria Journal. The model for testing a remedy in villages.
7. Gyllenhaal et al. (2012), Pharmaceutical Biology. The large negative result.
8. Fabricant and Farnsworth (2001), Environmental Health Perspectives. To see what the 80 per cent counts.
9. Withering (1785), An Account of the Foxglove. The founding test of a folk remedy, harms included, free online.

## At the bedside after the Fall

**Household.** Minimum: this book, a notebook and the four questions (how many unrelated traditions, same complaint, linked by text or carried plant, what effect can be seen). Use grade C remedies only for illness that usually passes by itself, or as a bridge while help is sought. No grade D or untested remedy in pregnancy or for infants. Needs: pencil and paper, a cup and spoon kept for doses so that amounts repeat, and the danger signs by heart. First failure to expect: a fever remedy that lowers the temperature while the child gets worse, and the family waits because "the medicine is working".

**Village of 300.** Minimum: a lay healer who registers every case, remedy and outcome, a medicinal bed grown from verified stock with pressed vouchers, a scale, and a microscope if one can be salvaged. One treatment-outcome survey a year on the commonest illness (protocol 2). Needs: a bound register, a plant press, a hand lens, a balance accurate to a gram, and one person who can identify the twenty commonest medicinal plants and their lookalikes. First failure to expect: the register is kept for a season and abandoned, or kept only for successes.

**District of 3,000.** Minimum: an infirmary that can run one comparison by lot a year (protocol 3), a microscope bench, a reference collection of vouchered plants, and copies of every village register. Needs: a nurse or doctor willing to run a fair test, patient consent, stopping rules agreed in advance, and someone who can calculate proportions. First failure to expect: a remedy declared a success after twenty patients fails on two hundred.

## Protocols

### Protocol 1. Grading a remedy you have just met

- ☐ Write the claim exactly: plant, part, preparation, dose, complaint.
- ☐ Identify the plant to species with its Latin binomial. If you cannot, stop: the remedy is ungraded.
- ☐ Check the lookalike table. If a toxic lookalike grows nearby, a second person must confirm identity.
- ☐ Count traditions using the same species or genus for the same complaint, counting only different continents or unrelated language families.
- ☐ Ask whether they could have copied each other: a shared classical text, a colonial herbal, or a plant carried between continents. If so, count them as one.
- ☐ Ask what effect can be seen within hours. Such remedies are more often active and more often dangerous.
- ☐ Assign the prior: three or more independent traditions for the same complaint, about one in three (C). Fewer, or copied, about one in ten (D). Check whether a trial has already moved it to A, B or X.
- ☐ Look for any record of harm in any tradition. If one exists, treat the remedy as harmful until shown otherwise.
- ☐ Use C and D remedies only for self-limiting illness or as a bridge, never as the only treatment when a red flag is present.

### Protocol 2. Treatment-outcome survey (village dispensary)

Adapted from the Malian method of Willcox, Graz and Diallo (Willcox et al. 2011b).

- ☐ Choose one common illness with a definition villagers recognise, for example fever with shivering in the rainy season.
- ☐ Choose a recall period: 2 weeks for an acute illness (the Malian team used 2 weeks for uncomplicated malaria, 6 months for severe).

- ☐ Visit every household, or half chosen by lot. Ask: who had the illness in the period, what did they take, prepared how, how much, for how many days, and what happened (full recovery, partial, worse, died, went elsewhere)?
- ☐ One line per episode in the register. Record plants by local name and collect a voucher of each.
- ☐ For each remedy count episodes and full recoveries, and calculate the proportion.
- ☐ Do not trust a remedy with fewer than 20 users. If none of n users failed, the true failure rate may still be up to 3 divided by n (rule of three) [VERIFY]. Mali's 30 of 30 had a 95 per cent interval of 88 to 100 per cent recovery.
- ☐ Compare the best remedy with the others. In Mali, Argemone users recovered 30 of 30 against 85 per cent for Carica papaya leaf and 82 per cent for Anogeissus leiocarpus leaves.
- ☐ Treat the winner as a candidate for protocol 3, not as proven: people who choose a remedy may differ from those who do not.
- ☐ Repeat yearly. Recall fades fast after 2 weeks.

**Protocol 3. Comparison by lot (district infirmary)**

- ☐ Only for an illness that is not immediately life-threatening, with a rescue treatment defined for anyone who worsens.
- ☐ Write the plan first: who is eligible, remedy and dose, comparison (the current best treatment), outcome and the day it is measured, what counts as failure.
- ☐ Obtain each patient's or parent's agreement in plain words, including that either treatment may be given and they may stop at any time.
- ☐ Exclude pregnant women, infants under one year, anyone with a red flag, anyone with known kidney or liver disease.
- ☐ Allocate by lots drawn from a bag prepared in advance.
- ☐ Prepare the remedy by weight from vouchered plants, the same way every time. The Malian regimen was one glass twice a day for 7 days, but the weight of plant per litre was not found [VERIFY before copying].
- ☐ Check every patient daily for red flags and poisoning. Move anyone who worsens to rescue treatment at once and count a failure.
- ☐ Stop early if one arm has twice the failures of the other after 20 patients per arm [VERIFY: author's suggested rule].
- ☐ Aim for about 60 patients per arm to tell 90 per cent from 70 per cent recovery [VERIFY: author's calculation].
- ☐ Record and share the result whichever way it falls.

**Protocol 4. Crediting a remedy**

- ☐ Record who taught it, their community and, if they agree, their own words for it.
- ☐ Record any text it came from.
- ☐ Ask whether it may be shared, and with whom. Respect a refusal.
- ☐ Return test results to the person or community first.
- ☐ Claim no ownership and keep no secret recipe.

## Numbers to carry

1. **About 1 in 10** random plant species are active in a single laboratory screen (10.4 per cent at the NCI).
2. **1.4 to 2.6 times**: how much more often traditional medicinal plants were active in the largest early dataset. Large modern screens found less.
3. **3 to 4 times** for strong traditional effects (anthelmintics 29 per cent, arrow poisons 46 per cent active).
4. **One in three** [VERIFY]: the working chance that a grade C remedy helps the complaint.
5. **One in ten** [VERIFY]: the same for grade D.
6. **A quarter to a third** of southern Italian plant uses are explained by Dioscorides and Galen.

7. **r = 0** between how widely an antimalarial plant is used and whether it clears parasites.
8. **1 in 51** Cochrane reviews of Chinese herbal medicines reached a firm positive conclusion.
9. **30 of 30 is not proof**: it still allows a failure rate up to about 1 in 10.
10. **Grade C says nothing about safety**: Aristolochia is used on several continents and caused kidney failure and cancer.

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