TR-04 Unani and the medicine of Islam: Ibn Sina, al-Zahrawi and the bimaristan

HEALING after the FALL, research library, TR-04

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This report builds on TR-13, which sets out the humoral system as a system and the bleeding and purging practices that came out of it, and which already treats Unani cupping. That ground is not repeated here. What follows is the ground TR-13 does not cover: what this tradition built that the Galenic baseline did not, which is the hospital as an institution, the materia medica and the pharmacy that supplied it, the surgical and ophthalmic record, the written case history, and the argument about contagion.

1. Findings by section

1.1 Tibb on its own terms: what the body is, what illness is, what a remedy is

Start inside the system, because the system is coherent and the reader will meet its living descendant.

The discipline is tibb, and in its Indian and Pakistani form today it is al-tibb al-yunani, Greek medicine, which is where the name Unani comes from. It understands the body through seven umur tabi'iyya, natural principles: the elements, the mizaj or temperament, the akhlat or humours, the organs, the ruh or vital spirit, the quwa or faculties, and the af'al or functions. The humours are TR-13's subject (THRIVING library, TR-13). What matters here is mizaj. Every person, every organ and every drug has a temperament, a particular balance of hot or cold with wet or dry, and it is individual. The same illness in two people is not the same clinical problem, because the two bodies do not start from the same place. This is why a Unani physician takes a long history before prescribing, and it is the tradition's own answer to why a remedy helps one person and not another (NCISM Unani syllabus for Ilaj bil Tadbir).

Illness has causes and the causes are mostly in how you live. The asbab sitta zaruriya, the six necessary causes, are air, food and drink, movement and rest, sleep and waking, retention and evacuation, and the states of the mind. They are called necessary because you cannot live without them, so you cannot avoid their influence, only manage it. Disease arises when one of them is wrong for your mizaj. Everything else, climate, trade, poverty, is sabab ghair zaruri, acting indirectly through these six (NCISM syllabus).

That produces a therapeutic ladder, and the ladder is the single most useful thing the tradition has to give a village. Ilaj bil tadbir, management by regimen, first. Then ilaj bil ghiza, treatment by food. Then ilaj bil dawa, treatment by drug. Then ilaj bil yad, treatment by the hand, meaning surgery and cautery. You do not go to the next rung until the one below it has failed. Ibn Sina sets out around thirty-six regimens in the Canon and the classical literature counts about thirty (NCISM syllabus), among them hammam (the bath), dalk (massage), riyazat (graded exercise), takmid (fomentation), idrar (promoting urine), and the evacuative ones TR-13 covers.

Pormann and Savage-Smith, closing their survey, pick out exactly this as what still speaks: a holistic emphasis on environment, regimen and diet, with medicines and intervention used only when needed (Pormann and Savage-Smith 2007, introduction and conclusion read as reproduced). That judgement is from historians, not advocates. The diagnostic repertoire beside it, the pulse read for ten qualities, the urine flask, the stool, is a genuine skill and is not a way of naming a disease, and nothing found here supports it as a substitute for a thermometer or a count of breaths.

What the tradition says it does: restores i'tidal, the proper balance of a particular person's mizaj, by correcting the six causes first and intervening only when that fails. What the record shows: the ladder produced far less harm than the European heroic practice that shared its theory, because the lower rungs are mostly safe and the upper rungs were hedged (THRIVING library, TR-13). What modern science infers: regimen advice is good public health, mizaj is not a measurable quantity, and the humours are wrong.

1.2 Ibn Sina and the Canon: a textbook as architecture

Al-Qanun fi al-Tibb, finished around 1025, is five books. Book I, al-Kulliyyat, is the general theory: elements, humours, faculties, causes of illness, hygiene, general therapy. Book II is the simple drugs, the mufradat. Book III works through the diseases of the organs from the head downwards. Book IV covers what is not localised, the fevers, swellings, wounds, fractures, bites, stings and poisons. Book V is the compound drugs, al-adwiya al-murakkaba (Wikipedia, The Canon of Medicine, and Library of Congress record).

Counts of Book II differ across sources: 785, about 800, and about 760 are all given, and no scholarly census was found (Library of Congress record 2021667330 and secondary descriptions). Treat "about 800 simple drugs" as the usable figure and do not build anything on the precise number [VERIFY].

It was the most popular medical textbook in the world for the following six centuries (Nasser, Tibi and Savage-Smith 2009). That fact cuts both ways. Pormann and Savage-Smith put it sharply: the Canon was a major organisational achievement, and its very systematic form may have discouraged later development, while the commentary tradition that grew on it was where the arguing happened, which is how Ibn al-Nafis came to describe the pulmonary transit of blood in the thirteenth century while commenting on it (Pormann and Savage-Smith 2007).

Take one lesson and not the other. A single well-organised book, carried and copied, holds a discipline together across centuries and languages when nothing else does, and the Canon is the proof that works. The content is the lesson not to take: the Canon carried Galen's humours and Galen's venesection into 1650, which is TR-13's subject.

1.3 The rules for testing a drug: the one piece of method worth copying whole

In Book II, before the list of drugs, Ibn Sina sets out conditions for learning what a drug does by experiment rather than by inference from its qualities. Nasser, Tibi and Savage-Smith (2009), working from the Arabic, give seven. In their reading the drug must be free of any quality it has picked up by accident, from heat, from age, or from storage next to something else, and they give his own examples, water warmed by fire and almonds gone rancid. It must be tried on a single uncomplicated condition, because if a patient has two illnesses and gets better you cannot say which was treated. It must be tried in two contrary conditions, because a drug that seems to help both may be acting on a symptom rather than on the disease. Its strength must match the strength of the illness, and the way to find that out is to start with the weakest dose and raise it by steps. The time to effect must be noted, because an immediate effect argues direct action while a delayed or reversed effect argues something accidental. The effect must hold in all or most cases, not once. And the trial must be on the human body, because a substance's relation to a human body is not its relation to an animal's.

The seventh is the one those authors single out as still live, and they attach it to the modern finding that animal and human drug studies are substantially discordant (Nasser, Tibi and Savage-Smith 2009). An independent translation by Sajadi, Mansouri and Sajadi in Annals of Internal Medicine the same year gives the same substance with different

numbering and wording, which is the main reason the "seven rules" are quoted in different forms across the literature (Sajadi et al. 2009, read as reposted summary).

Three honest qualifications. There is no evidence Ibn Sina ran a controlled comparison: these are rules for careful uncontrolled observation, with no concurrent control group and no counting, and the James Lind Library's assessment is that for several centuries the advice was largely ignored and treatment choice depended on serendipity. The rules also sit in a book whose drug entries are organised by humoral quality and degree rather than by tested effect, so the author did not apply his method to his own list. Against both, the rules are correct. Rules 2, 4, 5 and 6 are what a village healer with a notebook can do, rule 1 is a storage rule, and rule 7 is a warning against reasoning from a goat to a child.

What the tradition says it does: establishes the true property of a drug. What the record shows: it was written down and then not used. What modern science infers: six of the seven map onto parts of modern pharmacology and trial design, and the missing piece is the concurrent control and the count (THRIVING library, TR-13 section 1.11 cites the same rule). Grade for the rules as a method: B, by convergence with the modern record rather than by trial.

1.4 Al-Razi: the observer, and the notebook that outranks the treatise

Abu Bakr Muhammad ibn Zakariyya al-Razi (c. 865 to 925, Latin Rhazes) is the tradition's best clinician and its best argument that observation can beat authority.

Kitab al-Judari wa'l-Hasba, the treatise on smallpox and measles, separates two eruptive fevers that had been run together. He works from the prodrome: smallpox preceded by fever, back pain, itching of the nose and disturbed sleep, measles with more restlessness, nausea and anxiety, and he grades severity and prognosis by the colour and site of the rash (secondary studies summarising the Arabic text and Greenhill's translation). W. A. Greenhill's English translation was published by the Sydenham Society in London in 1848, from a Leiden manuscript with the 1548 Greek, Channing's 1766 Latin and Stack's 1748 English beside it, and is free through the Wellcome Collection (Greenhill 1848, catalogue record and secondary descriptions only). The "first" claim should be hedged: earlier South Asian descriptions are disputed, partly because it is unclear whether masurika meant smallpox or chickenpox.

The more important thing he did is less famous. Kitab al-Tajarib, the Book of Experiences, is a casebook, and Cristina Álvarez Millán calls it the largest and oldest known collection of case histories in medieval Islamic medical literature (Álvarez Millán 2000). She compared the therapies al-Razi set out in his learned treatises on eye disease with what he actually prescribed to real patients in the casebook, and found that theory was largely ignored in practice, concluding that theoretical works are not a dependable picture of what physicians did and that case histories are the better source (Álvarez Millán 2010, abstracts and summaries).

That has two consequences here. A caution: every claim in this report drawn from a treatise, including every al-Zahrawi procedure, is a claim about what someone wrote, not about what was done or what happened to the patient. And a design instruction: the casebook is the artefact that survives the collapse of theory. A village that keeps a register of what was given, to whom, and what happened is doing in 2030 what al-Razi did in 910, and that register will be worth more in fifty years than any book it inherited, including this one.

Her own caveat stands: case histories are literary documents too, al-Razi seems to have used them for teaching rather than self-promotion, and whether his practice was typical is open. Khalid Harbi's critical edition appeared in Alexandria in 2006 and she notes that her manuscript texts do not always match it.

1.5 Al-Zahrawi and the Kitab al-Tasrif: the best pre-modern surgical manual, and what it can honestly be asked to do

Abu al-Qasim Khalaf ibn al-Abbas al-Zahrawi (Latin Albucasis, died c. 1013) worked at Madinat al-Zahra near Cordoba. Kitab al-Tasrif li-man ajiza an al-ta'lif runs to thirty books, of which Book 30 is the surgery. Spink and Lewis

produced the standard edition, Arabic text with English translation and commentary, published 1973 and reissued by the University of California Press (consulted through catalogue records and secondary accounts, not read).

Book 30 has a foreword and three parts (Calvo 2014). The foreword complains about the standard of surgery in his day, cites patients who died of surgeons' incompetence, and sets criteria for when an operation is feasible and when it is useless and dangerous. Part 1 is cautery, covering about fifty conditions. Part 2 is operative surgery, ninety-nine chapters, with case material on tumours, growths and arrow wounds, including arrows he extracted and arrows he left in place because the wound had healed around them. Part 3 is fractures, sprains and dislocations, with the rule that you reduce first and then restrain, a pelvic fracture, and a shoulder dislocation dressed with a plaster mixed with egg. The illustrated instruments, usually given as about two hundred, are what the book is famous for, and the drawings are why it transmitted at all: a drawing of a tool survives translation and copying in a way a verbal description does not.

The honest material is the refusals. He describes the technique for hydrocephalus and then says he will not do it, because the children die anyway. He warns against amputating when gangrene has gone above the elbow or knee. He refused a man who asked to have his hand taken off, fearing he would die, and then heard the man had cut it off himself and lived (Calvo 2014). A surgical manual whose author records the operations he will not do, and records being wrong about one of them, is a different kind of document from a list of triumphs.

The scepticism is not optional. Emilie Savage-Smith's 2000 paper "The practice of surgery in Islamic lands: myth and reality" sets the complex and invasive procedures in the formal treatises of al-Zahrawi, al-Razi, al-Majusi and Ibn Sina against the lack of evidence that they were performed, and against statements that such techniques were unknown or should be avoided. The procedures with better evidence of actual practice are the superficial ones, removal of growths, and eye surgery (Savage-Smith 2000, abstract and record only). Her 1995 paper concludes that systematic human dissection was no more common in medieval Islamic society than in medieval Christendom, with no explicit legal or religious prohibition found.

The specific attributions are weaker than the popular literature says. The catgut story, in which he watched a monkey eat gut bowstrings and found none in its droppings, is an anecdote with no primary citation found. The claim that he originated the Walcher obstetric position is attached in the bibliographic record to Gustav Adolf Walcher's own 1889 paper, and no al-Zahrawi passage supporting it was found [VERIFY]. On tracheotomy the sources contradict each other, one saying he never performed it but did sew up the throat of a slave girl who had cut her own and who recovered, the other that he performed it on a servant, and the first is better sourced. His sutures were wool, silk, flax and horsehair, and for abdominal wounds he describes the heads of large ants as clips, the ant biting the wound edges before its head is cut off (Calvo 2014).

Anaesthesia deserves a flat answer. The soporific sponge, soaked in wine with opium, mandrake root (Mandragora officinarum) and henbane seed (Hyoscyamus niger) and held to the nose, appears in European texts of the twelfth and thirteenth centuries and is said in the German scholarship reproduced on Erowid to rest on ninth and tenth century Islamic preparations. No source found gives a success rate, a dose, a failure rate or a death rate. The honest statement is that the medieval surgical record contains no reliable general anaesthetic, and that every procedure below was done on a conscious or semi-conscious patient. Mandrake and henbane are deliriants with a narrow margin between sedation and death, and no preparation for them is given here.

Which procedures transfer to a district infirmary, on the record rather than the romance. Four. Reduction and immobilisation of closed fractures and dislocations, Part 3, needing hands, traction, a judgement of alignment and a hardening dressing, and the highest-value surgical skill in the book. Incision and drainage of a superficial abscess, which Savage-Smith accepts as actually practised. Removal of superficial growths, same evidence. And control of bleeding, by pressure, by ligature, and by cautery as a last resort. Two more are possible with a trained person and are expensive in lives: perineal lithotomy for bladder stone, and eyelid surgery for in-turned lashes. The rest, the deep abdominal work, the skull work, the destructive obstetric operations, belongs to a hospital that no longer exists.

1.6 The eye: the one place where the numbers are hard, and they are bad

Ophthalmology was the strongest applied branch of this medicine and it has the best modern data, because its central operation is still performed by traditional practitioners today and has been measured.

The framework comes through Hunayn ibn Ishaq (809 to 873), whose Ten Treatises on the Eye is the influential systematic text (NLM, Islamic Culture and the Medical Arts). The operation is couching, in which the opaque lens is pushed out of the visual axis with a needle. Ammar ibn Ali al-Mawsili, an eleventh-century oculist from Mosul working in Fatimid Egypt, described instead a hollow metal tube passed through the sclera to draw the cataract out by suction, with a case from Tiberias in which the patient saw at once and was bandaged seven days. The Harvard Digital Journal of Ophthalmology review is sceptical: apart from that one case his own histories describe ordinary couching, few later authors mention the technique and most doubted it, and the fourteenth-century Egyptian oculist Sadaqah ibn Ibrahim al-Shadhili wrote that he had not seen it used and questioned whether it worked. Treat suction extraction as described rather than established.

Couching is measurable because it is still done. The Nigerian national blindness survey (Gilbert et al. 2010, abstract) found that of 583 eyes that had undergone any procedure for cataract, 249, or 42.7 per cent, had been couched. Outcomes were poor by WHO categories, with 55.8 per cent of people and 73.1 per cent of eyes presenting worse than 3/60. None wore an aphakic correction. With correction, 42.6 per cent of eyes were still blind at worse than 3/60. A companion analysis reports acuity of 3/60 or better restored in 82.1 per cent of eyes after orthodox surgery against 58.6 per cent after couching [VERIFY, secondary summary only].

The clinic series tell you how it fails. A northern Nigerian series of 28 couched eyes found 6, 21 per cent, with no perception of light, phacogenic uveitis the main cause of blindness, and raised intraocular pressure in 7, 25 per cent. A Benin City series of 18 eyes found secondary glaucoma in 61.5 per cent, hyphaema and optic atrophy in 15.4 per cent each, and no light perception in 33.3 per cent. An Osogbo series of 20 eyes found only 5, 25 per cent, holding vision beyond ten years (read in search summaries of the Community Eye Health Journal and African journal literature). One outlier, a 1994 study at Wura Hausa in Adamawa State, reported 42 of 65 eyes at corrected 20/20 to 20/40, and it was retrospective and conducted with the traditional healers themselves, which is the selection that produces such a figure.

This is the most useful quantified fact in the report. Couching returns some ambulatory vision to a bit over half of eyes and takes a fifth to a third to no light perception, and the commonest mechanism of ruin is secondary glaucoma and lens-induced uveitis weeks to months later, when the operator is gone. Grade B for the outcome data and the verdict is against. Grade X at the household and hamlet rungs, where there is no way to detect or treat the glaucoma that follows.

The eye operation that does transfer is the one for in-turned lashes. Posterior lamellar tarsal rotation by trained non-physician eye workers in Ethiopia gave 16.6 per cent recurrence of trichiasis at twelve months, recurrence differing significantly by operator, with 79.3 per cent follow-up, and a randomised Ethiopian trial found posterior superior to bilamellar rotation at four years, which is why WHO guidance makes it the procedure to train new surgeons in (Habtamu et al. four-year follow-up and the Ethiopian cohort, read in summaries). The lesson is the pattern, not the disease: one standardised procedure, taught to lay operators, with outcomes counted.

1.7 The bimaristan: what it actually was, and what in it is a design a district can copy

This is the part of the tradition Book Four needs most, and it is also the part where the sources lie.

The institution. The bimaristan, from Persian bimar (sick) and stan (place), appears as a recognisable urban institution in Abbasid Baghdad. Dols (1987) argued against the traditional founding story and suggested the Barmakid vizier Yahya ibn Khalid under Harun al-Rashid as the likely founder, while accepting that state hospitals were well known in the Abbasid realm by the first decades of the ninth century (Dols 1987, not read, cited through secondary

accounts). Conrad (1994) concluded that the caliph al-Walid I did not found a hospital in Damascus in 707, Horden and Pormann accepted that, and Ragab found instead evidence of charitable shelter for lepers, the blind and the disabled, which may have set a precedent. Pormann and Savage-Smith reject the standard foundation legend on the ground that institutions that large would have left traces in the records that would have recorded them, and trace it to the thirteenth-century historian Ibn al-Qifti (Arıcı's review, read in summary).

The named houses. Al-Adudi in Baghdad, founded by Adud al-Dawla, dated 981 in most sources and 978 in one, with reported staff of about twenty-five at opening covering fields from optics to surgery, destroyed by the Mongols in 1258. Al-Nuri in Damascus, founded by Nur al-Din Zangi in 1154 or 1156, running some seven centuries, said to be the first to keep patient records. Al-Mansuri in Cairo, built by the Mamluk sultan al-Mansur Qalawun and completed in 1284 or 1285, surviving as Mustashfa Qalawun. Ibn Jubayr visited in 1184 and put the daily expenditure of the larger Damascus hospital at about fifteen gold pieces (Shiraz history of medicine article, read in summary). Ibn Abi Usaybi'a records that Nur al-Din appointed Abu al-Majd al-Bahili as director, and the Nuri's physicians included al-Dakhwar and Ibn al-Nafis (Black's review of Ragab).

The chronicle numbers are not data. Al-Mansuri is credited with 8,000 beds, about 4,000 patients a day, an endowment of about a million dirhams a year, and a salary of 4.9 million dirhams for the chief physician Jibril ibn Bukhtishu (Bimaristan article, reporting Nagamia 2003 and others). No scholarly estimate of actual capacity or throughput was found, and these should be read as the medieval equivalent of a press release: 8,000 beds would make a thirteenth-century Cairo hospital several times the size of the largest hospital operating anywhere in 2026.

Ragab's argument is the one to take. He holds that bimaristans should be read first as Islamic institutions of charity and only second as medicalised institutions of bodily healing, and criticises Dols and others for over-medicalising them by separating the charitable from the medical activity happening in the same building. He locates them inside complexes with a madrasa, the founder's mausoleum and the waqf, and inside their patrons' political projects, and in a 2015 interview put it plainly: they provided needed services and drugs to the urban poor rather than serving as early progenitors of modern medical institutions (Ragab 2015, through the publisher's description, Black's review and the Ottoman History Podcast interview, the book not read). He is contested in turn, his reviewer finding errors and outdated sources in the prologue and the Crusader-hospital section, and a Turkish-language review calling many of the new claims unfounded or erroneous.

What the design was, so far as the sources support it. A three-person board: a non-medical administrator, a chief pharmacist (shaykh saydalani) and a chief physician (mutawalli). Below them sanitary inspectors, accountants, pharmacists, nurses, supervising specialists, secretaries and superintendents. Separate men's and women's wards, equally equipped, attended by staff of the patient's own sex. Wards divided by condition, with mental illness, contagious disease, non-contagious disease, surgery, general medicine and eye disease named, and sections for convalescents. An attached pharmacy with a manufacturing room where syrups, electuaries and ointments were made at scale. Teaching in the building, with a room for the chief physician to lecture. And the waqf, the irrevocable charitable endowment of revenue-bearing property, paying for all of it (Bimaristan article with its cited sources, Abouleish, Black's review). The deeds are reported to require that no one be turned away, that patients be kept until completely recovered with no time limit, and that at al-Mansuri patients be given food and money on discharge against lost wages.

Dols argues that care of the insane at al-Mansuri is clear from the endowment deed itself, whatever the chronicles say, and his methodological caution is as valuable as the finding: actual treatment is hard to describe because the medical texts are Galenic, non-clinical and prescriptive rather than descriptive, and historical descriptions of disturbed people are rare, which forces the historian into adab literature and biographical dictionaries (Dols 1987 on insanity, read in summary). The widely repeated claims about music therapy, running water and fresh air at the Arghun hospital in Aleppo are flagged as needing a better source even in the popular literature [VERIFY].

One thing is genuinely unprecedented and Pormann and Savage-Smith say so: physicians who served elites also taught and treated the poor in hospitals. The institution bound the best practitioner in a city to the people who could not pay

him, by a legal instrument, in a building. That, not the bed count, is what a district of 3,000 should copy. Licensing belongs in the same column with the same caution: Sinan ibn Thabit as muhtasib under al-Muqtadir is reported to have examined 860 physicians in Baghdad in 931, of whom about 160 failed, and no primary confirmation was found [VERIFY].

1.8 The pharmacy: the trade, the inspector and the formulary

Pharmacy separated from medicine here as a distinct craft with its own name, premises and regulation. The practitioner is the saydalani or saydanani, the shop is the saydanah, and drug shops are reported in Baghdad from the eighth century (Islamic pharmacy summaries, mostly secondary). Four things in it are worth a village's attention.

The inspector. The muhtasib, officer of the hisba or market supervision, inspected the shops: cleanliness of containers, preparation and dispensing of drugs, accuracy of weights and measures, purity of materials. This is a public office with the power to close a shop, and it exists because adulteration is the normal state of a drug trade with no inspector. Any village dispensary that trades in medicines reproduces the problem, and the hisba is the cheapest answer anyone has found.

The formulary. Sabur ibn Sahl, a Nestorian physician at the Abbasid court who died in 869, wrote the earliest Arabic pharmaceutical handbook on record, the Aqrabadhin, which circulated in small, middle and large versions. Oliver Kahl edited and translated the small version from a fragmentary Berlin codex. It is organised by pharmaceutical form rather than by disease: tablets, powders, ointments, syrups, electuaries, collyria, each with preparation method, action, dose and administration. Genizah fragments show it in use among practitioners of the Jewish community of Cairo, possibly long after it is supposed to have been superseded (Kahl's edition, publisher description only). A formulary organised by form is a manufacturing manual. That is the right shape for a village pharmacy book and the wrong shape for a diagnosis book, and the two should not be one volume.

Quantification. Al-Kindi (died c. 873) noticed that the Greeks had assigned degrees and qualities to simple drugs but not to compounds, and in De gradibus worked out a method of calculating each simple's contribution to a mixture and combining them for the whole. Levey edited and translated his Aqrabadhin in 1966. One commentator calls this the first serious attempt at quantification in medicine. It is also arithmetic performed on a quantity that does not exist. Hold both facts: the instinct to put a number on a compound was right and the number was imaginary, which is a failure mode a village will repeat.

The technology. The still is this tradition's contribution to pharmacy. Al-Razi is credited with describing its three parts, the qar'a or boiler, the anbiq or alembic and the qabila or receiver, and rose-water distillation was an industry (Met Museum on alembics and secondary accounts). The claim that he isolated ethanol, and that "alcohol" descends from his usage, is popular and was not verified here [VERIFY]. Sugar is the other. Syrups, sharab, from which English syrup and sherbet descend, made drugs palatable, preserved them and delivered them in water, and sikanjabin, the oxymel of vinegar and honey, is documented in the Canon for digestive complaints and fevers. One Persian pharmacy text gives methods for 142 syrups (secondary summaries).

On the materia medica itself, nobody has done the census. No study was found giving the proportion of the Canon's roughly 800 simples that modern pharmacology has validated. What exists is case studies: a 2013 Phytotherapy Research review found the pharmacology of saffron (Crocus sativus) and its constituents crocin, crocetin and safranal broadly similar to Avicenna's monograph (Hosseinzadeh et al. 2013, abstract), and a review of the Canon's anti-inflammatory and analgesic drugs noted that a few, opium, willow oil, curcuma and garlic, have been investigated, while most substances Avicenna prescribed remain largely unexamined. "Largely unexamined" is the correct summary of the whole materia medica, and a reader should not be told otherwise.

1.9 Contagion: Ibn al-Khatib, and what the plague actually taught

In 1348 to 1350 the Black Death reached al-Andalus. Lisan al-Din ibn al-Khatib, vizier of Granada and a physician, wrote Muqni'at al-sa'il an al-marad al-ha'il. Dates given for it differ, soon after the outbreak in 1349 in one account and around 1362 in another, and the Arabic survives as MS Arabic 1785 at El Escorial (secondary accounts, Wikipedia and Brewminate).

His argument is an argument from evidence, and the structure of it is what matters. He reasons from experience, from reliable reports of spread through garments and vessels, from infection moving through a single household, from a port infected by arrivals from an infected land, and from the fact that people in isolation are spared. He reports that even an earring may carry death to its new owner. His friend Ibn Khatima in Almeria wrote in parallel, and Mahmoud Zaki's survey records the pair concluding that the existence of contagion is proved by experience, deduction, the senses, observation and unanimous reports (Zaki, Qatar National Library, read in summary). An English translation of either treatise could not be reached in this research, and the passages above are from scholarly and semi-scholarly summaries rather than a critical translation, which is a real gap [VERIFY].

The cost of the argument is the point. It ran against hadith that appeared to deny contagion, and against the theological objection that attributing causal power to created matter trenches on God's. Ibn al-Khatib answered that the evidence cannot be set aside. Justin Stearns's Infectious Ideas (2011) is the modern study, and he argues against the common assumption of a blanket Muslim dismissal, portraying the authors instead as inventive and reasoned thinkers working to make sense of contagion, with the discussion running through legal, theological, historical and medical texts (Stearns 2011, publisher description only).

The lesson a village should carry is not "they discovered germs". They did not, and the mechanism they proposed was corrupt air and corrupt matter. The lesson is procedural and it is worth more than the mechanism. Transmission is established by the pattern of who falls ill and who does not, and that pattern is visible to anyone who writes down who went where. The five observations above require no instrument. The fortieth-day quarantine attributed to Ibn Sina as al-arba'iniya, and widely repeated as the origin of the word quarantine, could not be verified in any scholarly source or in the text of the Canon, and the competing derivation from fourteenth and fifteenth century Venetian and Ragusan practice is at least as well attested. Do not repeat the Ibn Sina attribution as fact [VERIFY].

1.10 Living Unani: the descendant, and what it is made of now

Unani is a state-supported system in India with its own regulator, colleges, hospitals and pharmacopoeia, and the comparison with the medieval record is unflattering in one direction and instructive in another.

The scale. As at 1 April 2021, India had 262 Unani hospitals of 3,844 AYUSH hospitals, 1,745 Unani dispensaries of 36,848, and 50,011 registered Unani practitioners of 813,269 (BIMSTEC Traditional Medicine Systems report 2023, giving Indian ministry figures). CCRUM, the Central Council for Research in Unani Medicine, runs 21 clinical institutes or units with studies in arthritis, asthma, anaemia, anxiety, depression, hypertension, diabetes and vitiligo (Indian parliamentary reply 2025, read in summary).

The pharmacopoeia. The Unani Pharmacopoeia of India, Part I, covers single plant drugs, sources giving 198 monographs in five volumes, 48 more in a sixth, and a total of 298 in six, with volumes continuing. Part II covers classical compound formulations, 100 in one source and 200 in another. These conflict and come from volume prefaces reproduced by booksellers rather than an official register [VERIFY]. The commercial arm is Hamdard, founded as a dawakhana in Delhi in 1906 by Hakim Hafiz Abdul Majeed and made a waqf in 1948, with a Pakistani counterpart founded by Hakim Mohammed Said and also constituted as a waqf, product counts ranging from about 450 to more than 600.

The evidence. No systematic appraisal of the quality of Unani randomised trials, with GRADE or a risk-of-bias tool, was found, which is itself the finding. What exists is scattered: a 2023 open-label randomised trial of a Unani regimen

as add-on in 90 RT-PCR-confirmed mild to moderate COVID-19 inpatients in New Delhi, open label and so at risk on blinding, whose outcomes were not retrieved, a 2018 systematic review in type 2 diabetes whose conclusions were not retrieved, and institutional trial lists in vitiligo, melasma and chronic rhinosinusitis. On the flagship single drug, Nigella sativa, the reviews disagree. A 2024 West African Journal of Medicine systematic review in metabolic syndrome found only 1 of 5 trials covering 551 people showing significant blood pressure improvement, against 5 of 7 trials covering 701 people showing significant reduction in glycaemic indices, and judged the blood pressure and anthropometric results less convincing, while pooled analyses report modest significant falls in several measures (Elhariri et al. 2024, abstract, and a GRADE-assessed meta-analysis read in summary). Grade B on glycaemic indices, consistent direction and modest effect. Grade C on blood pressure, inconsistent.

The contamination problem is Ayurveda's problem. Saper and colleagues measured metals in 193 Ayurvedic products bought online in 2005 and found 20.7 per cent exceeding an acceptable daily intake standard for lead, mercury or arsenic, 41 per cent among rasa shastra products (Saper et al. 2008, cited through THRIVING library, TR-13). A Boston-area survey found heavy metals above permissible limits in some Ayurveda and Unani formulations from grocery stores without giving a Unani-specific proportion. In 2005 Health Canada reported arsenic in Hamdard's Safi at more than forty times the maximum allowable concentration for drugs. No dedicated Unani heavy-metal survey with a denominator was found [VERIFY]. The honest statement is that the risk is demonstrated in the neighbouring system and in at least one named Unani product, and is not quantified for Unani as a class.

What living Unani adds is therefore not a drug list. It is proof that the regimen ladder and the saydalani's trade survived into the twentieth century as working crafts, and a warning that an industrial traditional-medicine sector reproduces the adulteration problem the muhtasib existed to control, at a scale he never faced.

2. Evidence grades

Thing	Grade	Basis
Regimen-first ladder (tadbir before food before drug before knife)	B	Converges with modern stepped-care and non-pharmacological first-line practice. Not trialled as a whole
Ibn Sina's drug-testing rules as method	B	Six of seven map onto modern pharmacology. Rule 7 supported by animal-human discordance data (Nasser et al. 2009)
Written case register (al-Razi's tajarib)	B	Álvarez Millán shows the casebook, not the treatise, records practice
Al-Razi's smallpox and measles distinction	B	Clinical description still recognisable. "First" is contested
Fracture and dislocation reduction then immobilisation	B	Standard practice to this day. Al-Zahrawi Part 3
Incision and drainage of superficial abscess	B	Among procedures Savage-Smith accepts as practised
Ligature of a bleeding vessel	B	Standard practice to this day
Cautery for haemostasis of last resort	C	Works and is used today as electrocautery. Hot-iron version harms (see 4)
Cautery as treatment of disease (al-kaiy, branding)	X	Case series: sepsis, cavernous sinus thrombosis, splenic abscess, deaths (Shah et al. 2009)

Thing	Grade	Basis
Perineal lithotomy	B, with a mortality attached	Cheselden's own series, 20 deaths in 213, age-stratified
Posterior lamellar tarsal rotation for trichiasis by lay operators	A	Randomised Ethiopian trial, 4-year follow-up, plus cohort at 16.6 per cent recurrence
Couching for cataract	X at household and hamlet, B evidence against overall	Nigerian national survey and clinic series, 21 to 33 per cent to no light perception
Suction extraction of cataract (Ammar)	D	One case plus contemporary scepticism
Soporific sponge as surgical anaesthetic	D	Described in texts, no outcome data found
The bimaristan as an organisational design (waqf, board of three, wards, attached pharmacy, teaching)	C	Documentary, from waqf deeds and chronicles. No outcome data exists
Chronicle bed and throughput numbers (8,000 beds, 4,000 a day)	D, treat as rhetoric	No scholarly corroboration found
Contagion inferred from the pattern of spread (Ibn al-Khatib)	B	The reasoning is correct and the method is reproducible without instruments
Nigella sativa on glycaemic indices	B	5 of 7 trials, 701 people, plus pooled analyses, modest effects
Nigella sativa on blood pressure	C	1 of 5 trials, 551 people. Reviews disagree
Senna (Senna alexandrina) for constipation	A	Grade A first-line in a 2021 systematic review of 41 trials
Syrup and oxymel (sikanjabin) as vehicle and as fluid	C	Traditional convergence plus plausible delivery and palatability role
Humoral prescribing generally	X	See TR-13

3. Means ledger

Rung	What it can do from this tradition	What changes in the outcome
Hands and knowledge alone	The regimen ladder. Reduction of a dislocated shoulder, jaw or finger. Direct pressure for bleeding. The contagion observations: who went where, who fell ill, who did not. Isolating the sick from the well	Dislocations reduced within the hour mostly do well. The contagion register is the difference between one household ill and a village ill

Rung	What it can do from this tradition	What changes in the outcome
Hearth	Add splinting with cloth and wood, honey and sugar dressings, oral rehydration, oxymel of vinegar and honey as a palatable fluid, fomentation, the bath. Senna leaf or pod as a laxative if grown	Keeps a fracture in alignment, keeps a sick person drinking. No surgical capability
Garden and still	Add distilled waters, syrups to preserve and deliver plant preparations, beeswax ointments, a scale, boiling and pressure sterilisation of cloth and instruments, ethanol for cleaning. Senna, fennel, chicory, black seed, mint, rose, willow bark	The still and the scale are what turn a plant into a dose that can be repeated. Repeatable dose is the precondition for Ibn Sina's rules 4 and 6
Village dispensary (300)	Add the register of cases, the drug trial done properly, incision and drainage, suturing, a trained operator doing one or two standardised procedures, a formulary organised by form, and an inspector of the dispensary's own stock	The register is the single biggest change. It converts a tradition into evidence within a decade
District infirmary (3,000)	Add the bimaristan design: the endowment, a board of three, wards separated by condition, an attached pharmacy with a manufacturing bench, teaching, and care of the mentally ill as a stated duty. Fracture and dislocation work, abscess drainage, control of bleeding by ligature, trichiasis surgery, and lithotomy if and only if someone will count the deaths	Separation of contagious from non-contagious cases is a measurable gain. Lithotomy at Cheselden's own figures is 9 to 11 per cent dead overall and about 28 per cent in adults over 20
Hospital before the Fall	Phacoemulsification with intraocular lens, general anaesthesia, imaging, culture and sensitivity, blood products, controlled substances, sterile theatre	Cataract becomes a day case with a good outcome instead of a gamble. Lithotomy becomes lithotripsy with near-zero mortality

What is gone after the Fall, from this tradition: nothing in it required industrial supply except the modern Unani sector's manufactured compound products and their quality control. The medieval system ran on gardens, trade goods and craft. Trade goods matter though. Opium, camphor, saffron, myrobalan, senna in cold countries, sugar in quantity, and glass for the alembic are trade items, not garden items, in most of Europe and North America. A still can be made at a forge. Sugar cannot.

4. Harm test

Cautery, al-kaiy. The characteristic harm of this tradition and still practised. A Pakistani series of four adults aged 25 to 60 branded with a red-hot iron for various complaints presented to a tertiary hospital with septic shock in two, cavernous sinus thrombosis in one and multiple splenic abscesses in one, and two of the four died (Shah et al. 2009). Indian reports describe branding of children for pneumonia, convulsions and jaundice, including a nine-year-old with a thread soaked in boiling oil wound round the leg and a six-year-old branded for hepatitis A against the parents' objection, with acute infection, allergic reaction and third-degree burn sequelae (Indian Pediatrics 2015). In one rural Indian health centre catchment, 20 of 144 children under five had been branded for pneumonia or convulsions and eight more prophylactically, all 28 by one healer. Turkish authors add that branding a newborn delays proper care. Who must never receive it: everyone, for every disease. The only defensible use of heat on tissue is to stop bleeding that pressure and ligature have failed to stop, and even then it destroys tissue and seeds infection. Signs it is going wrong: fever and spreading redness after 24 to 72 hours, foul discharge, confusion. What to do then: open and drain, irrigate, and expect to lose the patient without antibiotics.

Couching. Kills no one and blinds a fifth to a third. The failures are not immediate. Secondary glaucoma at 13 to 62 per cent across series, lens-induced uveitis, hyphaema, optic atrophy, retinal detachment, all presenting weeks to months later with a painful eye and falling vision, by which time the operator has moved on and nothing in a village can reverse it. Never on an only eye. Never on an eye that still has useful vision. Never where the patient cannot be reviewed at one week, one month and three months.

Mandrake, henbane and opium as anaesthetics. Mandragora officinarum and Hyoscyamus niger are deliriants with a narrow margin between sedation and respiratory arrest, and the dose varies with the plant, the season and the part. No preparation is given here. Papaver somniferum is covered where the library handles opioids. The harm model for all three is the same: the patient who stops breathing while unattended.

Lithotomy. Cheselden's own data, from the age-grouped table he published in 1740, is 20 deaths in 213 patients, with about 3 deaths in 105 children aged ten or under, 4 in 62 aged 11 to 20, and 13 in 46 over 20 (Tröhler 2014, James Lind Library). Other tallies give 24 of 213, and one nineteenth-century review puts other operators at one death in five and one in six. The Wikipedia figure of about 50 per cent conflicts with every primary-derived number and looks like an error. The mortality is from haemorrhage, from sepsis and from urinary fistula. Nobody under the rank of a district infirmary with a trained operator and a counted series should attempt it.

The materia medica. Misidentification is the standing risk, and it applies to every plant in the system. Senna is safe at 10 to 30 mg of sennosides and is possibly unsafe above 34.4 mg twice daily or beyond a week of continuous use (MedlinePlus). In children on long-term senna, perineal blistering occurred in 17 of 640, 2.2 per cent, in one clinic cohort, all associated with higher dose, night-time soiling or prolonged stool contact, and that review found no other major adverse effect and no evidence of tolerance (Vilanova-Sanchez et al. 2018). Compound preparations are the bigger problem: the more ingredients, the more chances for a wrong plant, and the medieval tradition prized complexity. Metals: see 1.10.

The institutional harm. A hospital concentrates sick people. Before the germ theory, and without a way to separate the infectious, that kills. The bimaristan's division of wards into contagious and non-contagious is the one structural defence it had, and the reason to copy it.

5. Red flags

These mean the patient will die or be permanently damaged without what a village cannot give, and the honest response is named beside each.

- **Open fracture with the bone through the skin, or a limb cold and pulseless below an injury.** Without an operating theatre and antibiotics this goes to gangrene and death. Irrigate with clean boiled water, reduce

and splint, elevate, and watch. If the limb dies, amputation below the knee or elbow has some chance and above has very little, which is al-Zahrawi's own rule and still correct.

- **Bladder stone with complete obstruction of urine.** Fatal in days. A catheter of any kind, passed by someone who has practised, is the only village answer and carries its own infection risk.
- **Deep abdominal pain with rigidity and fever.** Peritonitis. No village procedure helps and surgery without anaesthesia and antibiotics is nearly always fatal. Fluids, warmth, opiate if available, company.
- **Painful red eye with falling vision after any eye procedure.** Secondary glaucoma. Nothing in a village stops it. Pain relief and honesty.
- **Spreading redness with fever after any cautery, incision or scarification.** Open and drain what can be drained, irrigate, and prepare the family.
- **A household in which more than one person falls ill with the same thing in a week.** Not an individual red flag but a village one. Separate the sick from the well before you do anything else, by the Ibn al-Khatib rule: isolation spares people.

Honest comfort when the answer is no: say that you cannot cure it, say what you can do, which is warmth, water, cleanliness, pain relief and presence, and do not spend the family's last resources on a procedure the record says does not work.

6. The case against

The strongest case against taking this tradition seriously comes from four directions, and three of the four are from historians who work on it.

Savage-Smith: the manuals describe what was written, not what was done. Her 2000 paper sets the complex invasive procedures in the treatises of al-Zahrawi, al-Razi, al-Majusi and Ibn Sina against the absence of evidence that they were performed, and against contemporary statements that such techniques were unknown or should be avoided (Savage-Smith 2000). If she is right, then "al-Zahrawi's surgical manual" is a transmitted literary artefact, and a book that treats it as an operating record is making exactly the error Álvarez Millán independently documented in al-Razi's own case, where the treatise and the practice diverged (Álvarez Millán 2010). This report has tried to respect that by naming only four procedures as transferable, three of which Savage-Smith herself allows.

Ragab: the bimaristan was a charity, not a proto-hospital. He argues the institutions belong first to Islamic charity and only second to medicine, and criticises Dols and the medicalising reading for separating the charitable from the medical in a building where both happened at once (Ragab 2015). The sharper version, from his 2015 interview, is that they served the urban poor rather than being the ancestors of the modern hospital. If that is right, the design this report extracts, the board of three, the ward divisions, the endowment, is the design of an almshouse that also had doctors in it, and claiming it as a model district infirmary smuggles in an outcome claim no evidence supports. The honest answer is that no outcome data for any bimaristan exists in any form, and the design is recommended here for its governance and its division of space, not for any demonstrated effect on mortality. Ragab is himself criticised, by his reviewer for errors in the prologue and the Crusader material, and by a Turkish-language reviewer for unfounded claims.

Pormann and Savage-Smith: the foundation stories do not survive scrutiny. Their argument that institutions of the claimed scale would have left records that would have recorded them, and that the standard legend traces to Ibn al-Qifti in the thirteenth century, is the general-purpose solvent for the chronicle numbers (Arıcı's review). Conrad's conclusion that al-Walid founded no hospital at Damascus in 707 removed the oldest brick in the edifice (summarised in the Bimaristan literature).

The golden-age romance and its mirror. Both are political. The romance produces the 8,000 beds, the 4,000 patients a day, the first-ever claims around catgut, forceps, tracheotomy and the Walcher position, and the 40-day quarantine attributed to Ibn Sina, none of which could be verified here. Its mirror, the dismissal of the whole tradi-

tion as Greek material in Arabic dress, is refuted by the same sceptical historians: al-Razi tested ancient remedies and contradicted Galen, physicians described new drugs and conditions and designed instruments, Ibn al-Nafis described the pulmonary transit, and the practice of elite physicians also treating the poor in hospitals was unprecedented (Pormann and Savage-Smith 2007). A reader is entitled to both halves.

And TR-13's case stands over the whole of it: this is the system that carried the humours and venesection to Europe, and the Canon was the textbook that kept them there for six hundred years. Nothing in this report cancels that.

7. Ten-line summary of robust findings

1. The therapeutic ladder, regimen then food then drug then the knife and fire, is the single most useful inheritance, and modern historians of the tradition pick out the same thing.
2. Ibn Sina's rules for testing a drug in Book II of the Canon are good rules, were not applied to his own drug list, and lack only the concurrent control and the count.
3. Al-Razi's casebook, not his treatises, records what he actually did, and the two diverge. Keep a register.
4. Al-Zahrawi's Book 30 is the best pre-modern surgical manual and is a written document, not an operating log. Four procedures in it transfer: reduction and immobilisation of fractures and dislocations, drainage of superficial abscesses, removal of superficial growths, control of bleeding by pressure, ligature and last-resort cautery.
5. Couching for cataract is measurable because it is still done, and it is a bad bargain: in Nigeria's national survey 42.6 per cent of couched eyes were still blind with correction, and clinic series put 21 to 33 per cent at no light perception.
6. The eye procedure that does transfer is posterior lamellar tarsal rotation for in-turned lashes, taught to lay operators, with 16.6 per cent recurrence at a year.
7. Cautery as a treatment for disease, al-kaiy, kills. A series of four branded adults had two deaths, and branding of children for pneumonia and convulsions is still documented.
8. The bimaristan's design is documentary and copyable: an irrevocable endowment, a board of three, wards divided by condition including contagious and non-contagious, an attached pharmacy with a manufacturing bench, teaching in the building, and care of the mentally ill as a stated duty of the deed. Its bed and throughput numbers are rhetoric.
9. Ibn al-Khatib in 1348 to 1350 established contagion from the pattern of who fell ill, through households, garments, vessels, ports and the sparing of the isolated, against theological objection and without an instrument. The method is available to any village.
10. Living Unani is large, 50,011 registered practitioners in India in 2021, and thinly evidenced. No quality appraisal of its trial literature was found, and the heavy-metal problem demonstrated in Ayurveda is demonstrated in at least one named Unani product.

8. Open questions

- What proportion of the Canon's roughly 800 simples has any modern pharmacological evaluation? Nobody has counted. The method exists, having been applied to Dioscorides.
- Did any bimaristan leave admission or outcome records? Al-Nuri is said to be the first to keep patient records. Whether any survive, and what they contain, was not established here.
- What was al-Mansuri's actual capacity? Ragab worked from three foundation documents. No scholar found here states a defensible bed number.
- What exactly did Ibn al-Khatib write? No critical English translation was reached. Ober and Aloush 1982 and the Muhammad Hassan edition of the three Andalusian plague treatises are the leads.
- Is there a Unani-specific heavy-metal survey with a denominator? None was found.
- Did the soporific sponge ever reliably anaesthetise anyone? No outcome data of any kind was found.

- What is the seventh of Ibn Sina's rules in the Arabic, and why do the two 2009 translations number them differently?

9. Sources to read in full

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7. Greenhill 1848 translation of al-Razi on smallpox and measles. Free from the Wellcome Collection.
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At the bedside after the Fall

A household. What you take from this tradition is the ladder and the register. Before you reach for a remedy, go through the six: the air, what has been eaten and drunk, movement and rest, sleep, what is going in and what is coming out, and what has happened to the person's mind. Most of what makes a household ill is in that list, and correcting it is free. Keep a sheet of paper per person on which you write the date, what was wrong, what you gave, and what happened. Needs: paper, a pen, and the discipline. First failure to expect: you will stop writing it after three weeks. Put the register where the food is.

A village of 300. You can have a dispensary and one trained person. Organise the drug book by form and not by disease, as Sabur ibn Sahl did: how to make a syrup, an ointment, a decoction, a powder, a dressing, with the quantity and the method, so that a preparation is repeatable. Appoint someone other than the preparer to inspect the stock, the scales and the containers, which is the muhtasib's job and the reason adulteration stayed in check for centuries. Teach one procedure properly rather than six badly, and count its outcomes. Needs: a scale, a still or a pot with a lid and a cooled tube, beeswax, honey, sugar or a sweet syrup, vinegar, cloth, needle, knife, a garden with senna or another reliable laxative, and a bound ledger. First failure to expect: the trained person will be asked for something dramatic, and will do it, because a village rewards boldness. That is TR-13's seventh sign.

A district of 3,000. Build the bimaristan as a design, not as a myth. Four elements. An endowment, meaning a piece of productive property, a mill, a field, a workshop, whose income is tied by a written deed to the infirmary and cannot be redirected, with named trustees and a yearly reading of the accounts in public. A board of three, an administrator who is not a healer, a chief of the pharmacy, and a chief healer, so that no one person controls both the money and the medicine. Wards divided by condition, and the division that matters first is contagious from non-contagious, then men from women, then the convalescent from the acute, then a room for the mentally ill as a stated duty rather than an afterthought, which is what the Mansuri deed did. And a pharmacy with a manufacturing bench inside the building, so the drugs are made where they are used and by people the healers can question. Needs: a deed, a property, ten beds, a room that can be scrubbed, a bench, a boiler, and the obligation on the best healer in the district to teach and to treat those who cannot pay. First failure to expect: the endowment will be raided in the first bad winter. Write the deed so that raiding it requires more than one signature, and read the accounts aloud.

Protocols

Protocol 1. The drug trial a village can actually run (Ibn Sina's rules, completed)

1. Choose one preparation and one condition. Write the condition down in terms anyone can check: fever above a stated level, a wound of a stated size, stools more than a stated number a day.
2. Make the preparation the same way every time. Write the method by form, with quantities, before you start. Store it away from heat, damp and anything strongly scented, and discard it at a stated age.
3. Give it only to people with that one condition and nothing else serious. This is Ibn Sina's rule 2.
4. Start at the lowest dose that could work, and raise it in steps, recording each step. This is rule 4.
5. Write down, before you know the answer: the date, the person, the dose, the hour it was given, and the hour and nature of any change. Immediate change argues for direct action, delayed or reversed change argues for something else. This is rule 5.
6. Treat every second person who qualifies with the regimen alone and no drug, and record them identically. This is the step Ibn Sina did not have and it is the one that makes the rest worth anything.
7. Count after twenty people in each group, or after one year, whichever comes first. Count the deaths and the deteriorations as carefully as the recoveries.
8. Stop the preparation if the treated group is not clearly better than the untreated. Record that you stopped and why. A village that can stop something is a village that can learn.
9. Never test on a child, a pregnant woman, or someone already dehydrated or wasted, unless they are the only people who get the condition, in which case start lower and go slower.
10. Tolerance: a dose that cannot be reproduced within about 10 per cent is not a dose. Buy or make a scale before you make a compound.

Protocol 2. The contagion register (Ibn al-Khatib's method, no instruments)

1. For every person who falls ill with anything that might spread, record: name, the day symptoms started, the household, every house they slept in for the previous fourteen days, every person they shared a room, a bed, a cup or a cloth with, and any journey in or out of the village.
2. Once a week, lay the records side by side and look for the five patterns: illness moving through one household, illness arriving with a traveller, illness following a shared garment or vessel, illness following a market or gathering, and people in isolation not falling ill.
3. If two or more people in one household fall ill with the same thing within ten days, separate the well from the sick that day. Put the sick in one room with one carer, not several.
4. The carer washes hands with soap on entering and leaving, uses separate cloths and vessels, and does not prepare food for the well.
5. Boil or wash in the hottest water available every cloth, garment and bedding from the sick room before it goes back into use. Ibn al-Khatib's earring is the point: objects carry it.
6. Anyone arriving from a place known to be ill stays apart from the village for fourteen days, in their own shelter, with food left outside. If they are still well at fourteen days, they come in.
7. Record who was isolated and whether they fell ill. That record is what tells you, in five years, whether the rule is worth its cost.
8. Do not wait for a mechanism. The pattern is the evidence.

Protocol 3. A dislocated shoulder (the one piece of al-Zahrawi's Part 3 everyone should know)

1. Confirm it is a dislocation and not a fracture of the upper arm: the shoulder looks square rather than round, there is a hollow below the point of the shoulder, the arm is held slightly away from the body and will not come across the chest.

2. Check and record sensation over the outer upper arm and the pulse at the wrist before you touch it. If either is absent, record that, and still reduce, because reduction restores both more often than not.
3. Reduce as soon as possible. The longer the muscle spasms, the harder it gets. Within the first hour is far easier than after six.
4. Method: lay the person face down on a table with the arm hanging free, a weight of 2 to 5 kg tied to the wrist, and leave it for 10 to 20 minutes with the person warm and as relaxed as possible. Most reduce without anyone pulling. This needs no drugs and no strength and it is the safest method for an untrained operator.
5. If that fails after 20 minutes, apply slow steady traction along the line of the hanging arm with gentle outward rotation, over two or three minutes. Slow and steady, never a jerk. A jerk breaks the bone.
6. You will feel or hear it go back and the shoulder will look round again. Re-check sensation and pulse and record them.
7. Immobilise in a sling with the arm across the body for 1 to 3 weeks in an adult, less in a young person, then begin gentle movement. Do not immobilise beyond 3 weeks: a frozen shoulder is a worse disability than the dislocation.
8. Stop and do not persist if: there is a grating sensation, the arm shortens, the person is over 60 with severe pain suggesting a fracture, or two unhurried attempts have failed. A shoulder that stays out is bad. A shaft fracture caused by force is worse.

Protocol 4. Cautery, the only defensible use

1. Cautery is for bleeding that has not stopped after 10 minutes of firm direct pressure and cannot be controlled by tying the vessel. It is for nothing else. Never for pain, fever, swelling, jaundice, convulsions, cough or a child.
2. Before: wash the field, have the iron heating to a dull red in a clean fire, have clean water and dressings ready, and have a second person to hold.
3. Try again first. Ten more minutes of firm pressure with a clean pad, directly on the bleeding point, stops most bleeding. Then try to find and tie the vessel with boiled thread.
4. If you must cauterise: apply the dull-red iron for 1 to 2 seconds to the bleeding point only, not to surrounding tissue, then press with a clean dressing. Repeat at most twice.
5. After: dress with honey or sugar under clean cloth, change daily, and inspect every day for 7 days.
6. Signs it is going wrong, at 24 to 72 hours: fever, spreading redness beyond the burn, foul discharge, pain out of proportion, confusion. Then open and drain any collection, irrigate with clean boiled water, and tell the family the truth about what you can and cannot do.
7. Never on the neck, the face near the eye, the abdomen, or over a joint.

Numbers to carry

1. **42.6 per cent.** Proportion of couched eyes in Nigeria's national survey still blind at worse than 3/60 even with correction. A fifth to a third of couched eyes in clinic series end at no light perception.
2. **20 in 213.** Cheselden's own lithotomy mortality, about 9 per cent overall, but about 3 per cent in children ten and under and about 28 per cent in adults over 20. Age is the number, not the average.
3. **16.6 per cent.** Twelve-month recurrence of trichiasis after posterior lamellar tarsal rotation done by trained non-physician eye workers. A lay operator doing one standardised procedure can match a service.
4. **Two of four.** Deaths in the published case series of adults branded with a hot iron. Cautery as a treatment for disease is lethal.
5. **Seven rules, one missing.** Ibn Sina's conditions for testing a drug, lacking only a concurrent untreated group and a count. Supply those two and you have a trial.
6. **Six causes.** Air, food and drink, movement and rest, sleep and waking, retention and evacuation, the states of the mind. Go through them before you reach for anything.

7. **Three officers, one deed.** The bimaristan's governance: an administrator who is not a healer, a chief of the pharmacy, a chief healer, and an endowment tied by writing. Separate the money from the medicine.
8. **Five patterns.** Household, traveller, garment or vessel, gathering, and the sparing of the isolated. Ibn al-Khatib proved contagion from these alone.
9. **10 to 30 mg sennosides,** the usual effective range, and not above 34.4 mg twice daily or beyond about a week continuous.
10. **Zero.** The number of bimaristans for which any outcome data exists. Build the design, and then count what the chronicles never did.

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