TR-11 Tibetan Sowa Rigpa, Mongolian, Siberian and Arctic medicine

HEALING after the FALL, research library, TR-11

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

How to read this report

This report covers the medicine of the cold high and the cold north: the Tibetan plateau and its Himalayan rim, Mongolia and Buryatia, the Siberian taiga and tundra, Sápmi, and the Inuit, Iñupiat, Yupiit and Alutiiq lands from Alaska to Greenland. Each tradition is described first in its own words and on its own logic, and the evidence is set beside it afterwards. The knowledge belongs to named peoples, and they are named.

It builds on the library: PH-09 for the northern plants and Arctic food values, HY-08 for scurvy and rickets, HY-11 for cold injury, TR-15 for toxic remedies, TR-02 and TR-03 for the neighbouring Ayurvedic and Chinese systems, and TR-16 for ritual healing. Restricted knowledge follows SY-04 Protocol D: where the record says a prayer, song or rite is secret, this report says it exists and does not give it.

Three warnings. First, the dangerous-substance rule applies to the mercury preparations of Sowa Rigpa (tsotel and the precious pills), to aconite and to the other toxic materia medica. Their history, evidence, dose, toxicity and feasibility are given here. Their processing is not. As in TR-02, no metal, mineral or gem preparation is recommended at any rung. Second, several books the brief names were not read: the Clark translation of the Four Tantras, Fortuine's *Chills and Fever*, *Perspectives on Traditional Health*, Vitebsky's two books, Eliade in full, and Kuhnlein and Turner 1991. Third, the brief's lead "Melzer 2006, Atherosclerosis" could not be confirmed as given. The 2006 Melzer, Brignoli and Saller review I found was in *Forschende Komplementärmedizin* (Melzer 2006).

1. Sowa Rigpa on its own terms

The texts and the teachers. Sowa Rigpa, "the science of healing", is the medicine of Tibet, shared with Ladakh, Bhutan, Sikkim, Mongolia, Buryatia and Kalmykia. Its foundation is the rGyud bzhi, the Four Tantras: the Root Tantra, the Explanatory Tantra, the Instructional Tantra and the Subsequent Tantra, 156 chapters in all. Tradition holds that the Medicine Buddha taught it and that it reached Tibet in the eighth century. Historians attribute the text in its present form to Yuthok Yonten Gonpo the Younger (1126 to 1202), who drew on Indian Ayurveda, Chinese and Persian medicine and Tibetan practice (Wikipedia, Yuthok Yontan Gonpo the Younger, Wikipedia, Traditional Tibetan medicine). Under the Fifth Dalai Lama, the regent Desi Sangye Gyatso wrote the great commentary, the Blue Beryl, and commissioned the medical paintings that teach anatomy, diagnosis and the materia medica in pictures. He founded Chakpori, the medical college on Iron Hill in Lhasa, in 1696. It was destroyed in 1959, and its work merged into the Lhasa Tibetan Hospital that year (Wikipedia, Traditional Tibetan medicine).

The Thirteenth Dalai Lama founded the Men-Tsee-Khang, the Institute of Medicine and Astrology, in Lhasa in 1916. In exile it was re-founded in Dharamsala in 1961 with one physician, Yeshi Dhonden, one astrologer and ten students. Its own pages give 23 March 1961 and another source 2 June 1961 [VERIFY]. It now runs a college, a pharmacy and

58 branch clinics, with 738 staff in April 2022, although its own table adds up to 666 (Wikipedia, Men-Tsee-Khang, Men-Tsee-Khang 2022).

The body. Health is a balance of three nyes pa, usually translated "humours" but literally "faults", because their excess is what makes us ill. rLung, wind, moves breath, speech, circulation and thought. mKhris pa, bile, is heat, digestion, colour and courage. Bad kan, phlegm, is cohesion, lubrication, stability and sleep. They act on seven bodily constituents (nutritional essence, blood, flesh, fat, bone, marrow and regenerative fluid) and three wastes (urine, faeces and sweat). Behind them stand the five elements, and behind those the three mental poisons of Buddhist teaching: desire gives rise to wind disorders, aversion to bile disorders and delusion to phlegm disorders. Illness is therefore at once physical, moral and karmic. The great working division of disease is into hot disorders and cold disorders, and most remedies are classed by their tastes and potencies as cooling or heating (Wikipedia, Traditional Tibetan medicine).

Diagnosis. The physician looks, touches and asks. Looking means above all the urine, examined for colour, vapour, bubbles and sediment, and the tongue. Touching means the pulse, read with three fingers at each wrist, each finger reading different organs [VERIFY detail]. Asking covers diet, behaviour, season and the course of the illness. Diet and behaviour come first: many disorders should resolve with a change of food and conduct alone.

Treatment. Four means are used in order of strength: diet, behaviour, medicines and external therapies. Medicines are compound pills and powders of plants, minerals and animal products. External therapies include bloodletting at named veins, moxibustion, compresses, medicinal baths at hot springs and massage with oils. At the summit of the pharmacy stand the rinchen rilbu, the precious pills, compounded with tsotel and with gold, silver, gems and other metals, and given for the gravest illnesses and as protection (Gerke 2015). Section 3 deals with them.

What the evidence can and cannot test. The humoral scheme, like Ayurveda's, is a classificatory language and is not open to trial as a whole. Pulse reading is open to test, and I found no inter-rater reliability study of Tibetan pulse diagnosis. In Ayurveda, the nearest relative, fifteen physicians examining twenty healthy people agreed on pulse at a kappa of 0.07, little better than chance (THRIVING library, TR-02). I could not find any study of Tibetan urine reading against laboratory urinalysis [VERIFY]. What can be tested are individual formulas, and section 2 gives that record.

2. The formulary in trials

Padma 28. The best-tested Tibetan formula is Padma 28, made in Switzerland since 1969. The Swiss capsule today contains 21 ingredients per capsule, including *Saussurea costus* root 40 mg, Iceland moss (*Cetraria islandica*) 40 mg, neem fruit (*Azadirachta indica*) 35 mg, cardamom 30 mg, chebulic myrobalan (*Terminalia chebula*) 30 mg, allspice 25 mg, bael fruit 20 mg, calcium sulphate 20 mg, columbine 15 mg, liquorice 15 mg, ribwort plantain 15 mg, knotgrass 15 mg, golden cinquefoil 15 mg, clove 12 mg, *Kaempferia galanga* 10 mg, *Sida cordifolia* 10 mg, valerian 10 mg, lettuce 6 mg, marigold 5 mg, d-camphor 4 mg and *Aconitum napellus* tuber 1 mg. The label dose is two capsules three times a day, later reduced to one or two. It names the indication in Tibetan terms as heat excess in the vascular system, and lists stomach upset, rash and palpitations as side effects (Padma AG 2024). Most English accounts say the formula came to the West with the Badmaev family of Buryat physicians, who practised Tibetan medicine in St Petersburg from the mid-nineteenth century (Wikipedia, Peter Badmayev). The link between the Badmaevs and the Swiss formula is asserted rather than documented in what I read [VERIFY].

The claim is that it improves the circulation of the legs in intermittent claudication, the cramping pain of narrowed arteries on walking. The record is a series of small trials. The Cochrane review (Stewart 2016) found five randomised trials of at least 16 weeks with 365 participants. In two trials with 193 participants, Padma 28 increased maximum walking distance by a mean of 96 m more than placebo (95 per cent CI 79 to 113 m). Ankle-brachial pressure index did not change (mean difference minus 0.01). Adverse events were no more frequent than on placebo (odds ratio 1.09, 0.42 to 2.83). The authors graded the evidence very low quality, found signs of publication bias and concluded

that it was insufficient to support routine use. Melzer, Brignoli and Saller (2006), pooling six published and one unpublished trial, reached a warmer verdict: five of six that measured it showed a significant increase in maximum walking distance, and about one patient in five gained more than 100 m. Grade A for a modest effect on walking distance, with very low certainty.

The rest of the Western record. Reuter, Weißhuhn and Witt (2013) searched the Western literature and found 40 studies, 15 of them randomised, with 2,028 patients. Padma 28 accounted for nine of the randomised trials, five of them in arterial disease. The others were single trials: Namdul (2001) in type 2 diabetes, 100 against 100 people, with 88 dropouts, Ryan (1997) in arthritis, 15 against 15, Sangmo (2007) in hepatitis B, with no difference, and Miller (2009), in which the Tibetan formula Zhi Byed 11 was compared with misoprostol to prevent bleeding after childbirth and misoprostol was superior. The mean Jadad score was 3.4, adverse events were reported in 5 to 55 per cent of patients, and only one trial would pass the German health technology checklist. The review excluded Chinese, Russian and Tibetan-language work, and a later overview counted 227 Chinese trials with 29,179 participants that the West has scarcely read (Reuter 2013).

Single plants. *Terminalia chebula*, a-ru-ra, is the "king of medicines" in Tibetan teaching. I found no clinical trial of it as a single remedy [VERIFY]. Its laboratory pharmacology is extensive, but it is grade D for any named clinical use. *Saussurea costus* is a Himalayan root that cannot be grown in the north. The Himalayan plants that are also boreal (sea buckthorn, Rhodiola, juniper) are dealt with in sections 4 and 8.

3. Mercury: tsotel and the precious pills

On the tradition's terms. Tsotel (btso thal) is a mercury sulphide ash produced by a long transformation of liquid mercury. Barbara Gerke calls it the most refined pharmacological technique of Tibetan medicine, the base of the precious pills that physicians regard as essential for severe disease (Gerke 2015). In the tradition's logic, mercury in its raw state is a poison, and the process "tames" it into an elixir that detoxifies other poisons, strengthens the body and carries the other ingredients deep into it. A 2013 history traces the full procedure to Orgyenpa Rinchenpel (1229/30 to 1309), whose method spread through Tibetan schools, and by the seventeenth century two lines of transmission had formed: the Geluk line of Central Tibet and a Kagyü and Rimé line in the east (Czaja 2013 [VERIFY author]). Making tsotel was always rare and costly. After the 1950s the knowledge nearly broke. Two physicians, Tenzin Chödrak (1924 to 2001) and Troru Tsenam (1926 to 2004), both imprisoned, passed it on in a labour camp in 1977, and from the 1980s they led its revival in India and in the People's Republic (Gerke 2015). The procedure is specialist knowledge of the tradition and is not described here.

The precious pills. Sallon and colleagues (2017) measured mercury in pills dispensed in Dharamsala. Per pill, Samnor contained 15.3 mg, Mutik 25 11.6 mg, Gurkhyung Chakdor 10.6 mg, Rinchen Rana Samphel 6.1 mg, Rinchen Jumar 25 5.2 mg, and Rinchen Tsajor Chenmo, Dangjor and Mangjor 1.2 to 1.8 mg. A cinnabar-based pill coating, chokla, was discontinued in 2010. An earlier analysis found tsotel to be 44.7 per cent mercury, mainly as mercury sulphide, and 42.5 per cent sulphur (Sallon 2006).

The claim to test. Defenders argue that mercury sulphide is insoluble, barely absorbed and passes out unchanged, unlike the metallic, vapour and organic forms that poison.

The record. There are two clinical studies, both cross-sectional and both from Dharamsala, and one environmental study.

- Sallon (2006) studied six patients taking mercury-containing Tibetan medicine, three taking mercury-free Tibetan medicine and healthy volunteers. Mean mercury intake in the first group was 674 µg a day, about 10 µg per kg, against the US EPA chronic oral reference dose of 0.3 µg per kg per day. Blood mercury was undetectable, but urine mercury averaged 67 µg/L, above the reference level of 20. The mercury group had more loose teeth and a higher diastolic blood pressure, 85 against 73 mmHg (Sallon 2006, abstract).

- Sallon (2017) studied 50 Men-Tsee-Khang outpatients taking tsotel pills, 50 taking other Tibetan medicine and 20 referents. Estimated mercury intake was 130 μg per kg per day in the tsotel group, over 400 times the reference dose, and 30 μg per kg in the second group. The tsotel group had taken mercury medicine for a cumulative 764 days on average (SD 1,214). Mean blood mercury was 0.22 μg/dl in the tsotel group, 0.18 in the second group and 0.35 in referents. Urine mercury was mostly undetectable, 1.5 against 1.57 μg/L, and the referents' urine samples were lost in transit. The groups did not differ across 23 symptoms. Beta-2 microglobulin, a marker of kidney tubular damage, was normal. Some neurocognitive scores were better in the tsotel group, and the authors raised hormesis. Seventy-two per cent of the tsotel group were monks or nuns, whose diet and habits differ from the referents', and everyone had been on treatment at least a month, so anyone harmed early had already left the sample. Several co-authors were Men-Tsee-Khang staff, and no conflict of interest was declared (Sallon 2017).
- Liu, Wang and colleagues (2018) measured seven Tibetan medicines in China at an average of 5,600 μg of mercury per gram and up to 12,000. They estimated that users' mercury intake was 34 times that of people in a Chinese mercury-mining region and 200 to 3,000 times that of Japan, Norway and the United States. They modelled methylmercury after a single pill as taking about 180 days to clear, and estimated that Tibetan medicine released 3,600 kg of mercury into the environment in 2015, 45 per cent of Tibet's terrestrial release (Liu 2018, through a press summary). Sallon's group replied in the same journal in 2019, and I did not read the reply (Sallon 2019).

I found no published case report of mercury poisoning attributed specifically to Tibetan precious pills [VERIFY]. In the neighbouring Ayurvedic tradition, the record of harm from processed metal preparations is clear: lead and mercury in a fifth of products sold in the United States, poisonings in pregnancy and membranous nephropathy from mercury (THRIVING library, TR-02).

The inference. The 2017 study, finding no blood or urine signal and no symptoms, is the defenders' strongest case. But it is a cross-sectional study of survivors, with lost referent samples, an unmatched comparison group and an author group tied to the maker. The 2006 study, small as it was, found raised urinary mercury and loose teeth, which is what chronic inorganic mercury does. Intakes of 30 to 400 times the reference dose cannot be called safe because one small sample showed no harm, and the environmental burden is not in dispute. After the Fall, three further facts decide it. Composition cannot be checked without a laboratory. The process cannot be verified by its outcome. And the signs of chronic mercury poisoning (tremor, sore gums, salivation, a metallic taste, irritability and shyness, protein in the urine and swelling) come slowly and are mistaken for age (THRIVING library, TR-02). Grade X. No precious pill or tsotel at any rung.

4. Aconite and the Himalayan materia medica

Aconite. Monkshoods, *Aconitum* species of the family Ranunculaceae, grow across the Himalaya and the boreal north. Tibetan and Mongolian medicine use several, and the tradition itself names them as poisons that must be tamed before use. *Aconitum ferox* of the Himalaya, rich in pseudaconitine, is counted the most poisonous plant of the range (search summaries) [VERIFY]. Even Padma 28 carries 1 mg of *A. napellus* tuber per capsule (Padma AG 2024).

The pharmacology is not in dispute. Aconitine poisons at about 0.2 mg and kills at about 2 mg, by holding open the sodium channels of heart and nerve (THRIVING library, TR-03, citing Zhou 2021, and TR-15). Both library figures trace to one review, and I found no independent second figure [VERIFY]. Its course is fast. Adhikari (2024) describes a 45-year-old traditional healer in a remote Nepali village who drank an aconite tea he had made himself. Tingling round the mouth came within 30 minutes, then abdominal pain and vomiting, then weakness and difficulty breathing. His family took 3 hours to reach care. Profound slowing of the heart and low blood pressure followed at 2 to 3 hours, and he died within 12 hours despite intensive care. In Hong Kong in 1992 an aconite tea put 17 people in hospital and killed 2 (THRIVING library, TR-15, TR-03).

Where I disagree with the library. TR-03's protocols permit processed aconite at the district if boiled at least 2 hours and kept under 3 g of chuanwu or 15 g of fuzi. TR-15 grades aconite X after the Fall, because neither processing nor dose can be checked. I side with TR-15. A Himalayan or northern village has wild species whose alkaloid content no one knows, no way to test processing, and no antidote. Grade X for internal use.

Plants that pass. Sea buckthorn (*Hippophae rhamnoides*, berry) is a Tibetan and Mongolian medicine and a food, with about 400 mg of vitamin C per 100 g (THRIVING library, HY-08). Rose hips (*Rosa* species, fruit), at about 426 mg per 100 g, grow to the treeline (THRIVING library, HY-08). Rhodiola (*Rhodiola rosea*, root) is used in the Himalaya, in Siberia, in Scandinavia and by the Nunatsiavut Inuit, with an EMA traditional-use dose of 144 to 400 mg of dry extract a day for fatigue and no good evidence for depression (THRIVING library, PH-09). Juniper and birch carry PH-01's cautions and PH-09's grades.

5. Mongolian medicine

On its own terms. Mongolia had its own healing before Buddhism: bone-setting, cautery, bloodletting, massage, wrapping the sick in fresh hides and, by some accounts, trepanation (Wallace 2012, through a search summary). With Buddhism, from the sixteenth century [VERIFY], came Tibetan medicine, taught in the monastic medical colleges, the manba datsan. Kloos (2022, through a search summary) argues that there was no codified Mongolian system before it and that modern Mongolian medicine belongs to the Sowa Rigpa family, with its own adaptations. Mongolian medicine claims a history of 5,000 years in its official account (Bold 2009), which is a statement of identity rather than of record.

Its distinct practices are named and specific. The bariachi, bone-setters, were lay people with shamanist roots, the gift thought to be inborn and passed down in families. They set fractures and dislocations by holding, massaging and twisting the limb, and they were said to use horn cupping, herbal compresses and ice as an anaesthetic. Bold names Tsorj-Mergen, Nara-Abai and Heru-Ishinga among them, and records a Bone Art Hospital with 30 staff (Bold 2009). Bold calls their setting painless and perfect, which is a claim and not a finding. "Cerebral readjustment" for concussion, dom (simple comfort remedies), and balneotherapy at more than 30 mineral springs, described in a book of the 1790s by Luvsanchultem (1740 to 1810), complete the picture (Bold 2009). The court record is old: pulse diagnosis became compulsory in the imperial medical academy in 1305, and Hu Sihui's dietary manual, the Yinshan Zhengyao, appeared in 1330. Placing the patient inside the stomach cavity of a freshly killed animal for warmth is also recorded (Wikipedia, Traditional Mongolian medicine).

Suppression and revival. In 1921 the new state opened a hospital with ten traditional practitioners. On 13 March 1937 the government closed the traditional clinics and pharmacies, and Mongolian medicine was suppressed until the late 1980s, alongside the destruction of the monasteries (Bold 2009). From 1990 it revived: a six-year course at the national medical university, private colleges, and by 2001 a 100-bed hospital, ten small hospitals of 10 to 20 beds, 35 outpatient clinics, 65 private clinics and five manufacturing units (Bold 2009). A Korean review gives 1,696 traditional medicine staff and 3.7 per cent of hospital beds in 2012 (Korean review 2014, abstract).

The evidence. I found no scientific study of bariachi bone-setting outcomes, and the Wikipedia account says so too. The method is the universal method of manual reduction, and its success depends on the setter's skill and on immobilisation afterwards, which are the subjects of ME chapters elsewhere in the series. Grade D for bariachi technique as a named system, with the general practice of manual reduction carrying its own evidence elsewhere. Bloodletting, in the Mongolian as in the Tibetan and Alutiiq practice, is grade X for general illness, except as the deliberate removal of blood in the rare conditions of iron or red-cell excess, which no village can diagnose.

6. Siberian shamanism as a healing institution

On its own terms. Among the Buryat, Evenki and Even, Sakha (Yakut), Chukchi, Koryak and other peoples of Siberia, illness was often the loss or capture of a soul, or the attack of a spirit, and the shaman was the person who could

travel to the other worlds to bargain for the soul or drive the spirit out. Bogoras recorded that the Chukchi blamed sickness and misfortune on kelet, spirits that hunt human souls and bodies, and that healing was the shaman's main work, done with the drum and song in the dark inner room of the tent (Czaplicka 1914, everyculture, Chukchee). Sieroszewski saw a Sakha shaman suck the illness from the painful place with his mouth and then spit and blow it away. Among the Sakha, an illness could be transferred to cattle, which were then sacrificed, and Troshchanski recorded that for a captured kut (soul) the shaman bargained an animal substitute with the spirit (Czaplicka 1914). The séance was a public performance, with ventriloquism, staged blood and escape from bonds, which Jochelson and Bogoras recorded without all calling it fraud (Czaplicka 1914). TR-16 discusses the parallel case of Quesalid.

The fly agaric (*Amanita muscaria*) was eaten in ceremony by Koryak, Chukchi and other north-eastern Siberian peoples. It is SY-04 category 5, a ceremonial psychoactive, and its use is not taught here. What must be said is toxicological. Its toxins, ibotenic acid and muscimol, act on the brain, symptoms start 30 to 180 minutes after eating, and they include confusion, hallucinations, drowsiness, twitching and, especially in children, seizures (INCHEM, through a summary). A 44-year-old man had a cardiac arrest about 10 hours after eating four to five dried caps and died nine days later (Meisel 2022, abstract), and two elderly spouses needed intensive care after a home preparation (Stoeva-Grigorova 2025, abstract). Treat any ingestion as a poisoning, keep the airway clear, lay the person on their side and watch them for at least a day.

The romantic and the deflationary. Mircea Eliade's *Le Chamanisme et les techniques archaïques de l'extase* (1951, English 1964) made Siberia the type-site of a universal "archaic" shamanism of ecstatic flight (Wikipedia, Shamanism: Archaic Techniques of Ecstasy). Ronald Hutton's *Shamans: Siberian Spirituality and the Western Imagination* (2001 [VERIFY, also given as 1999]) argued that Eliade generalised from scattered sources, played down divination and the diversity of practice, and fed a Western imagination of Siberia (Campbell, review of Hutton). Alice Kehoe went further, arguing that "shaman" belongs to the Tungus peoples alone and that the universal category is a Western construct (Kehoe 2000 [VERIFY]). Soviet ethnography treated shamans as exploiters and their healing as fraud. Piers Vitebsky's ethnography, *The Shaman* (1995) and *Reindeer People* (2005), drawn from twenty years with the Eveny of north-eastern Siberia, sits between, describing shamanic ideas still working within a reindeer economy after Soviet rule (Vitebsky, through reviews). I did not read his books and found no account of specific healing in them.

Suppression. In 1924 a justice instruction of the Yakut republic forbade shamans to heal, tell fortunes or take payment, on pain of prosecution. The Sakha shaman Konstantin Chirkov was arrested in February 1932, and Marjorie Balzer records that Soviet officials made shamans perform under conditions designed to make them fail, and that some still succeeded in the eyes of their audience (Balzer, through a search summary). Evenki ritual specialists and reindeer herders were arrested, tortured and imprisoned in the 1930s and 1940s (search summary of Evenki ethnography). The scale is not known. Shamanism revived openly after 1991, and Balzer (2011) describes its revitalisation in Sakha and the Russian Far East.

What the record shows, and where it failed. The shaman's healing worked where TR-16 says meaning and community work: on pain, fear, grief and the illnesses of the mind, and on keeping the sick person inside the circle of care. The failure is clearest in the epidemics. Smallpox reached north-eastern Siberia around the mid-seventeenth century (Sibirskie Issledovaniya 2019, abstract). The Yukaghir suffered outbreaks of smallpox and measles in 1669 and 1691 to 1694 and were reduced towards extinction (everyculture, Yukagir). One general source says about 100,000 of 150,000 Itelmen and Koryak died after 1697 from infection, massacre and suicide, and that figure is uncited (Wikipedia, Indigenous peoples of Siberia) [VERIFY]. No séance changed the course of a smallpox epidemic. Grade for shamanic healing: D as treatment of disease, with the support it gives to the sick taken up under TR-16.

7. Arctic medicine: Sámi, Inuit, Alaska and Greenland

The Sámi. The Sámi of Norway, Sweden, Finland and Kola had the noaidi, the shaman, whose drum and joik were suppressed by church and state [VERIFY dates]. The living tradition in the coastal and inland communities of northern Norway is the healer called a reader, blower or curer. Sexton and Stabbursvik (2010), from 27 interviews

in Finnmark and Nord-Troms, describe this healing as a continuation of the older noaidi tradition under a Christian surface. Langås-Larsen and colleagues (2018) interviewed 15 healers in two coastal Sámi municipalities: "reading" is prayer, "curing" is Sámi ritual, and healers combine the doctor's diagnosis, information from the patient, a Trinitarian prayer, steel and natural elements. The healers themselves credited God, and some the placebo effect. The commonest uses were pain and inflammation, stopping bleeding and blood poisoning, and cupping and laying on of hands also appear (Langås-Larsen 2018, Liu-Helmersson 2021). The prayers are held secret and are passed on only under conditions the healers set. They exist and are not reproduced here (SY-04 Protocol D). A 2021 scoping review found 19 publications, 17 from Norway, describing Sámi traditional medicine as "claimed to be effective" and largely invisible to the health service (Liu-Helmersson 2021). The SAMINOR 1 survey of 2003 to 2004 measured how many people use a traditional healer, and I could not obtain its figure (Kristoffersen 2017). Health personnel in two northern communities, interviewed in 2017, were positive about reading, facilitated it and sometimes used its tools at the patient's request (Langås-Larsen 2017). The Sámi managed angelica stands, preserved reindeer milk with it and ate it as food (THRIVING library, PH-09).

Reading is grade D as treatment, and a good model of healing alongside the doctor, which is how its practitioners already use it.

The Alutiiq, Iñupiat and Yupiit of Alaska. Fortuine's history of Alaska records that Alaska Native healing drew on plant and animal substances, surgery, heat and cold, manipulation and water, and that bloodletting and the use of fish and sea-mammal oils were common (Fortuine 1988, catalogue abstract). The Alutiiq Museum describes Oleanna Ashouwak (1909 to 1965) of Kaguyak, a famous healer who treated headache by cutting the skin at the back of the head and drawing blood with a horn. Bloodletting at the head, wrists or thumb treated pneumonia, tuberculosis and chest pain, and new mothers were bled after childbirth. Steam baths, massage, herbs and holding were the other tools (Alutiiq Museum). Missionaries waged what an account of Fortuine's research files calls a major war on shamanism as medicine. The consequence of contact is in the numbers: in the 1920s tuberculosis killed 655 Alaska Natives per 100,000 against 56 whites, and in 1954 Native incidence was 2,452 per 100,000 against 62 in the United States (Murray 2013). Smith's "Arctic Pharmacognosia" (1973) reviews the region's remedies (abstract only).

Bleeding a woman who has just delivered is grade X: she can least afford to lose blood.

The Inuit of Canada and Greenland. *Perspectives on Traditional Health* (Ootoova and others 2001) records Baffin elders on fractures, diagnosis and care of the sick, and I could not read it. The record shows most clearly that the Inuit solved by eating two diseases that killed northern Europeans.

Scurvy. The traditional answer was raw and frozen food: raw ringed seal liver at 35 mg of vitamin C per 100 g, muktuk skin at 38 mg, mountain sorrel at 36 mg and the root of *Hedysarum alpinum* at 21 mg, against 1.4 mg in caribou flesh. Boiling loses most of it: sorrel falls from 36 to 5.3 mg (Geraci and Smith 1979, through THRIVING library, PH-09). When the diet changed, scurvy came, and Levine found subacute scurvy in 28 of 30 Barrow children in 1940 (THRIVING library, PH-09). The anti-scurvy ration is PH-09 Protocol 3 and is not repeated.

Rickets. Above about 52°N the skin makes no vitamin D from October to March (Webb 1988, through THRIVING library, HY-08), and the Arctic winter is longer still. Yet the record shows almost no rickets on the traditional diet. Frost (2016) gathers it. Of 374 skeletons from Point Hope, Alaska, spanning 100 BCE to 1700 CE, none showed rickets. At Okak in Labrador from 1903 to 1908 Inuit children had none while settler children did, at Angmagssalik in East Greenland in 1936 to 1937 none was found, and Appleton saw very little in 1921. By 1926, after flour, cereal and tinned food arrived, Thomas found among the Labrador Inuit that scurvy, rickets and both together were universal (Frost 2016). Seal oil was measured in 1936 as equal in vitamin D to the best cod-liver oil, and breastfeeding lasted four to six years. The change is ongoing: of 104 Canadian rickets cases in 2002 to 2004, 12 per cent were Inuit, and only 16 per cent of Nunavut mothers now breastfeed exclusively beyond six and a half months (Frost 2016).

The traditional diet supplied the vitamin. Kuhnlein (2006) found sea-mammal fats (beluga, narwhal, seal, walrus) to be excellent sources of vitamins A, D and E, and burbot liver to carry a mean of 318 μg of vitamin D per 100 g

(abstract). Adults eating 300 g or more of fish and game a day had a median vitamin D intake of 5.1 µg against 3.5 µg for those who did not, both well below the 15 µg recommended allowance (Kolahdooz 2013, through Frost 2016). Kuhnlein (2018) finds that lactating women on the older diet took 9 to 20 µg a day, that traditional food now supplies only about 5 per cent of energy, and that intakes fall short of the 10 µg average requirement. In the Inuit Health Survey of 2,095 adults, country food supplied only 6 to 20 per cent of energy but up to 73 per cent of vitamin D, 28 to 54 per cent of iron and 50 to 82 per cent of vitamin B12 (Kenny 2018). In Greenland, at 70°N, Andersen, Jakobsen and Laurberg (2013) found Inuit at Ilulissat and Saqqaq had higher vitamin D levels than non-Inuit (44.6 against 39.0 nmol/l, and in winter 43.5 against 32.8), that the Inuit diet raised levels, and that the skin made some vitamin D even that far north in summer. Kuhnlein (2018) found no evidence that the Inuit have a metabolic adaptation that lets them need less.

The liver rule. The same livers that save from scurvy can kill. Polar bear liver carries 18,000 to 26,700 IU of vitamin A per gram, bearded seal 15,000 and Arctic fox 12,000 (Rodahl, through THRIVING library, PH-09). The Inuit rule is never to eat them. The Government of Nunavut adds that women who may become pregnant should eat ringed seal meat rather than ringed seal liver (Nunavut Nutrition Fact Sheets 2013).

8. The cold-climate pharmacopoeia: what to keep and what to reject

Above the treeline and in the boreal forest, plants are few and the season short. The record says the diet is the medicine. Keep, in order:

1. **Raw or frozen organs and skin of sea mammals, and raw or frozen fish** (never polar bear, bearded seal or fox liver) for vitamins C, A, D and iron. Grade B for prevention of scurvy and rickets on the record above.
2. **Seal oil, fish oil and fish liver** in winter, and cod-liver oil where it can be made or traded. Grade A for rickets prevention through cod-liver oil (THRIVING library, HY-08).
3. **Berries, leaves and roots eaten raw:** cloudberry (*Rubus chamaemorus*), crowberry, mountain sorrel (*Oxyria digyna*), young willow leaves (*Salix* species), rose hips and, in the south of the range, sea buckthorn. Grade A for vitamin C as a nutrient, B for these foods as sources.
4. **Spruce resin salve** for wounds and pressure sores, on one positive trial, graded as in PH-09.
5. **Sphagnum moss** as dressing only with PH-09's caution about sporotrichosis.
6. **Rhodiola, juniper, birch, angelica** at PH-09 doses, grade C to D.

Reject: precious pills and tsotel (X), all internal aconite (X), bloodletting for illness and after childbirth (X), chaga as a daily powder (X, PH-09), Labrador tea as medicine for children or in pregnancy, and any umbellifer root unless identified beyond doubt, because of water hemlock (PH-09).

Labrador tea. *Rhododendron groenlandicum* and *R. tomentosum* (formerly *Ledum*), leaves, are a Dene, Inuit and Athabaskan beverage and cold remedy, though the Iñupiat held *R. tomentosum* poisonous (THRIVING library, PH-09). Its oil's main component is ledol (Spektrum Lexikon der Biologie), said to cause cramps, paralysis and palpitations in large amounts (UAF botany presentation). No source gives a human dose. The lookalikes bog rosemary (*Andromeda polifolia*) and bog laurel (*Kalmia*) are the greater danger. Grade D, a weak tea for adults only.

Evidence grades

Remedy or practice	Tradition says	Record shows	Inference	Grade
Padma 28, claudication	Cools vascular heat	5 RCTs, 365 people, +96 m walking	Modest, very low certainty	A (weak)
Other Tibetan formulas	Various	Single small RCTs, one lost to misoprostol	Untested	D

Remedy or practice	Tradition says	Record shows	Inference	Grade
Precious pills, tsotel	Tamed mercury, elixir	30 to 400 times reference dose, 1 small study with raised urine Hg	Cannot be called safe, uncheckable after the Fall	X
Aconite, internal	Tamed poison	Deaths with skilled users	No antidote	X
Tibetan pulse and urine diagnosis	Reads the humours	No reliability study found	Untested	D
Bariachi bone-setting	Inborn gift	No study	Manual reduction has its own evidence	D
Bloodletting for illness	Releases bad blood	No benefit, harm after birth	Harmful	X
Shamanic séance, Sámi reading	Restores soul, stops blood	Comfort, no effect on epidemics	Meaning response (TR-16)	D
Raw sea-mammal organs, fish, berries	Food is strength	No scurvy or rickets before contact	Vitamins C, D, A	B
Seal or cod-liver oil for rickets	Folk practice	Cures and prevents	Vitamin D	A
Liver rule (bear, seal, fox)	Taboo	Hypervitaminosis A	Correct	B
Labrador tea	Cold remedy, or poison	No human dose data	Low-dose beverage	D
Fly agaric	Ceremonial (restricted)	Poisonings, one death	Not taught	X as remedy

Means ledger

Practice	Hands	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Diet against scurvy and rickets	Know the foods and the liver rule	Raw, frozen, dried, never boiled long	Berry and hip stores, sprouted pulses	Register of winter diets, check gums and wrists	Ascorbic acid and vitamin D stocks, treatment doses	Blood levels, supplements
Seal or fish oil for infants	Breastfeed long	Render fat cold or gently	Fish-liver oil store	Measured spoon doses	Vitamin D drops if held	Drops, X-ray
Tibetan diet and behaviour counsel	Teach it	Warm food in cold disorders	Same	Same	Same	Lifestyle medicine

Practice	Hands	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Padma 28 type formula	Nothing	Nothing	Most ingredients cannot be grown in the north	Salvaged stock only	Salvaged stock only	Walking programme, statins, surgery
Precious pills, tsotel	Refuse	Refuse	Refuse	Refuse, collect and store safely	Refuse	Not used
Aconite	Recognise the plant	Never brew	Never grow for use	Treat poisoning (TR-15 P4)	Same, monitoring	ECG, drugs, ventilation
Bone-setting	Traction and splint	Splint, padding	Plaster from lime or resin	Trained setter	Sterile room, open wounds	X-ray, surgery
Bloodletting	Do not	Do not	Do not	Do not	Only if a cause is proven	Rare indications
Reading, séance	Presence, prayer if wanted	Same	Same	Alongside care, never instead	Same	Chaplaincy
Cold casualty	Insulate, lie flat	Warm room, 18 °C	Hot drinks if alert	Thaw frostbite 37 to 39 °C	Monitoring	Active rewarming, bypass

The household decides scurvy and rickets, because the food is the medicine. The village adds a register that notices winter deficiency. The district adds treatment doses and the authority to keep dangerous pills out of use. Only the hospital helps advanced arterial disease, severe aconite poisoning or chronic mercury poisoning.

Harm test

Precious pills. They harm by accumulating inorganic mercury in kidney, gums and nerves. The dose that harms is unknown, but the reference dose is 0.3 µg per kg per day and a single pill can contain 1 to 15 mg (Sallon 2017). Never in pregnancy, breastfeeding, infancy, kidney disease or the old. Signs: tremor, sore or bleeding gums, loose teeth, salivation, metallic taste, irritability, swelling of the legs and frothy urine (THRIVING library, TR-02). Response: stop, keep the pill, do not burn it (heating mercury releases vapour [VERIFY]), and refer to the district. Historical harm: raised urinary mercury and loose teeth in Dharamsala (Sallon 2006), and the Ayurvedic record (THRIVING library, TR-02).

Aconite. Kills within hours by heart rhythm failure. About 0.2 mg of aconitine poisons. Never to anyone. Misidentification: monkshood roots and leaves can be taken for edible roots and wild greens, and TR-15 names wild parsnip as a lookalike [VERIFY]. Signs: tingling of lips and tongue within 30 minutes, vomiting, slow or irregular pulse, collapse. Response: TR-15 Protocol 4. Historical harm: Hong Kong 1992, Nepal (Adhikari 2024).

Labrador tea and its lookalikes. Strong or long-steeped tea causes vomiting, dizziness and, in excess, cramps and convulsions. Bog rosemary is highly poisonous. Not for children, pregnancy or anyone with seizures [VERIFY, precautionary]. Response: stop, give nothing more, lie on the side if drowsy, and treat any fit as a poisoning.

Liver. Polar bear, bearded seal and Arctic fox liver cause acute vitamin A poisoning: severe headache, vomiting, drowsiness and peeling skin a day or two later [VERIFY]. Ringed seal liver is a caution in pregnancy (Nunavut 2013). Historical harm: polar explorers recorded these poisonings, and the Inuit rule against bear liver is old (THRIVING library, PH-09).

Bloodletting. Kills by blood loss and infection. After childbirth it compounds the leading cause of maternal death. Never in pregnancy, after delivery, in children, the anaemic, or anyone with fever and dehydration.

Hypothermia treated wrongly. Rubbing frostbite with snow, Larrey's old advice, tears tissue, and dry heat burns it. Alcohol contributed to about 10 per cent of United States hypothermia deaths. Standing, walking or a hot bath can stop a heart below 28 °C. Body-to-body rewarming blunts shivering and is no faster (THRIVING library, HY-11).

Fly agaric. See section 6. Children are at risk of seizures. Dried mushrooms are more potent [VERIFY].

Delay to care. The quiet harm of every tradition here is time on the wrong treatment. The Nepali healer's family needed 3 hours to reach care (Adhikari 2024). Every hour of séance or tea while a child has pneumonia or a mother bleeds is lost. Ritual alongside, never instead.

Red flags

These signs mean the patient will die or be disabled without what the village cannot give:

- Tingling lips, vomiting and a slow or irregular pulse after any root tea or Tibetan pill: aconite. Follow TR-15 Protocol 4 and send for the district at once.
- A pregnant woman or new mother who is bleeding heavily, faint or fast-pulsed. Do not bleed her. Follow the obstetric chapters.
- Swelling of the legs and face with frothy urine in someone taking precious pills: kidney damage.
- Tremor, loose teeth and personality change in a long-term pill taker: chronic mercury.
- A cold person who is drowsy, has stopped shivering, or collapses when moved: severe hypothermia (HY-11).
- Frostbite that blackens and spreads with fever and a foul smell: infection, the one reason to cut early (HY-11).
- A child with bowed legs, swollen wrists, late teeth or fits in late winter: rickets or low calcium, give treatment doses.
- A child with bleeding gums, leg pain and refusal to walk in spring: scurvy.
- Confusion, fits or deep sleep after eating a wild mushroom.

What to do anyway: lie the patient flat and warm, keep the airway open, give nothing by mouth to the drowsy, keep the pill or plant, note the time, and stay. Honest comfort is warmth, presence, clean bedding, a familiar voice and, where wanted, the reader's prayer or the community's song. A tradition that sits with the dying does what no protocol replaces.

The case against

For the precious pills. Sallon and her Men-Tsee-Khang co-authors (2017) make the strongest defence: no symptoms, normal kidney markers and no rise in blood mercury among 50 long-term users. Practitioners argue that tsotel is a different substance from raw mercury and that Western toxicology tests the wrong thing. Against them stand Liu, Wang and colleagues (2018) on intake and environmental release, Sallon's own 2006 data, and the general toxicology of inorganic mercury. Gerke's history shows how rare the knowledge always was. My verdict is X, but a careful reader should know that no study has shown clinical harm from tsotel itself.

For Padma 28. Its supporters (Melzer 2006) read the trials as clinically relevant, while the Cochrane authors (Stewart 2016) call the evidence very low quality with likely publication bias. Both readings rest on a few hundred patients, mostly in trials linked to the maker.

On shamanism. Hutton and Kehoe against Eliade: the "universal shaman" is partly a Western construction. The Soviet case against shamans as exploiters was used to justify arrest and worse, and must not be repeated as if it were neutral science. But the deflationary point stands: no record shows shamanic healing changing the course of infectious disease.

On the Arctic diet. Frost (2016) argues that the traditional Inuit diet and long breastfeeding supplied enough vitamin D and that the modern advice to supplement treats a dietary loss as a racial deficiency. Kuhnlein (2018) and the Canadian Paediatric Society reply that intakes even on traditional food measured below need and that supplements are prudent. After the Fall, a village that keeps the traditional diet may need no drops, and one that has lost it needs them badly.

On romanticism. Arctic ethnobotany is thin and was mostly recorded after contact by outsiders. Old does not mean safe: the Alutiiq bled new mothers and the Tibetan pharmacy carries mercury. Modern does not mean replaceable: the hospital cannot give back seal oil, the reader's calm or the knowledge of which liver to leave.

10-line summary

1. Sowa Rigpa is a coherent humoral medicine whose diet and behaviour advice is its safest and most portable part.
2. Padma 28 is the best-tested Tibetan formula: about 96 m more walking in claudication, very low certainty.
3. The precious pills carry 1 to 15 mg of mercury each, and users take 30 to 400 times the reference dose.
4. One small Dharamsala study found raised urine mercury and loose teeth, a larger one found no signal, and neither shows safety.
5. Aconite kills skilled users within hours and has no antidote. Grade X.
6. Mongolian bone-setting and Tibetan, Mongolian and Alutiiq bloodletting are untested or harmful.
7. Siberian and Sámi healing comforted and kept the sick in community, and failed against smallpox.
8. Inuit and other Arctic peoples prevented scurvy with raw organs, skin, fish and berries, and rickets with oils and long breastfeeding.
9. When that diet was lost, both diseases returned within a generation.
10. Never eat polar bear, bearded seal or fox liver, and never treat cold injury with snow, alcohol or a hot bath.

Open questions

- Is tsotel absorbed, and does it cause harm over years? No cohort study exists.
- What do Chinese-language Tibetan medicine trials show? 227 trials have not been read in the West.
- How reliable are Tibetan pulse and urine diagnosis between physicians?
- What were the outcomes of bariachi bone-setting?
- How large was the Soviet repression of shamans, and how much healing knowledge was lost?
- What does *Perspectives on Traditional Health* record of Inuit treatment of fractures and wounds?
- What strength of Labrador tea is safe, and what dose of ledol harms?
- How much vitamin D does a modern Arctic diet of 300 g country food supply in winter, measured as blood levels?

Sources to read in full

1. Sallon S and others 2017, Experimental Biology and Medicine, the mercury study and its tables.
2. Liu M, Wang X and others 2018, Environmental Science and Technology, with Sallon's 2019 reply.
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7. Ootoova I and others 2001, *Perspectives on Traditional Health*, Nunavut Arctic College.
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10. Langås-Larsen A and others 2018, on Sámi healers, for the model of healing alongside care.

At the bedside after the Fall

Household. Know the foods that keep away scurvy and rickets and eat them raw, frozen or dried. Keep the liver rule. Breastfeed as long as possible, two years at least. Give infants a measured daily spoon of fish or seal oil in winter, or drops if held. Keep the house above 18 °C where possible. Learn the cold-casualty rules: lie flat, insulate, no alcohol, no snow, no hot bath. Recognise monkshood and keep children away from it. Refuse any precious pill. Needs: knowledge, a spoon, a cold store, a calendar of the dark months. First failure to expect: a winter of cooked meat and flour, bleeding gums by March and a bow-legged toddler by the next spring.

Village of 300. Keep a winter register: who is eating what, gums checked monthly, infants' wrists and legs checked at each season. Hold berry, hip and fish-oil stores and any salvaged vitamin C and vitamin D. Train one lay healer in HY-11, TR-15 Protocol 4 and the protocols below. Collect and store precious pills and aconite-containing medicines in a locked, labelled box, and never burn or bury them near water. Welcome readers and singers at the bedside, and agree with them that they send for the healer first. Needs: a scale, measured spoons, a register, a thermometer, a locked box. First failure to expect: a well-loved elder or visiting practitioner offers a precious pill to a dying patient, and the family takes it.

District of 3,000. Hold the vitamin and calcium stocks for treatment doses, the records that show whether rickets or scurvy is rising, and the authority to forbid mercury and aconite remedies. Train setters in fracture reduction and immobilisation. Keep a list of the district's poisonous plants with dried specimens. Run a frostbite station with water at 37 to 39 °C. Needs: a thermometer, ten beds, a microscope for urine protein [VERIFY], stores and trained staff. First failure to expect: a trader brings Tibetan or Mongolian pills sold as cures, and the district cannot test them.

Protocols

Protocol 1. Standing prohibition on mineral and precious pills

1. Do not make, buy, accept or give any pill or powder said to contain mercury, cinnabar, tsotel, gold, silver, gems, lead or other metal or mineral, at any rung.
2. If someone is already taking them, ask what, how often and for how long. Write it down.
3. Stop them. Keep a sample in a sealed, labelled jar in a locked box.
4. Check for signs of chronic mercury: tremor, gum disease, loose teeth, salivation, metallic taste, swelling, frothy urine. Record them, and recheck monthly for three months.
5. Refer anyone with swelling or frothy urine to the district.
6. Never heat, grind or burn a pill.

Protocol 2. Winter vitamin D and rickets in the north

1. From October to March above about 52°N, assume no vitamin D from the sun (Webb 1988, through HY-08).
2. Infants: breastfeed, and give 400 IU (10 μg) a day of vitamin D (HY-08, Munns 2016). The Government of Nunavut advises 800 IU for breastfed infants and 400 IU for formula-fed infants (Nunavut 2013). The sources differ by a factor of two. Use 400 IU if supply is short and 800 IU for breastfed infants of mothers on a poor diet.
3. Children over 1: 400 IU (Nunavut) to 600 IU (HY-08) a day.

4. Pregnant and breastfeeding women: 600 IU (HY-08) to 1,000 IU a day (Nunavut 2013). The Canadian Paediatric Society advises 800 IU a day above 55° from October to April (Globe and Mail summary).
5. Without drops, use cod-liver or fish-liver oil. One teaspoon gives about 450 IU of vitamin D and 1,350 μg of vitamin A (HY-08). Give infants a quarter to half teaspoon at most, because of vitamin A (HY-08).
6. Feed oily fish, fish liver and sea-mammal fat where available, and calcium from fish bones and dairy, at least 500 mg a day (HY-08).
7. Treatment of rickets: at least 2,000 IU a day for 3 months with 500 mg calcium (Munns 2016, through HY-08). Recheck wrists and legs at 3 months.

Protocol 3. Liver rule and scurvy

1. Never eat polar bear, bearded seal or Arctic fox liver, raw or cooked, in any amount.
2. Women who may become pregnant eat ringed seal meat rather than ringed seal liver (Nunavut 2013).
3. Eat raw or frozen seal liver (other than in pregnancy), muktuk, fish, sorrel, willow leaves and berries through the winter. Do not boil vitamin C foods: boiling can lose two thirds to most of it (PH-09).
4. Target 45 mg of vitamin C a day, with 10 mg the floor (HY-08). PH-09 Protocol 3 gives the ration.
5. Treatment of scurvy: ascorbic acid 250 mg three times daily from age 12, 100 mg three times daily for children, for at least 2 weeks (MSF, through HY-08). Without tablets, the richest raw foods several times a day.

Protocol 4. Ritual and reading alongside care

1. A reader, singer or shaman may attend, pray or perform as the patient and family wish.
2. Agree beforehand: the healer comes first for bleeding, breathing problems, fever in a child, labour and any poisoning.
3. Bleeding: pressure first, prayer alongside.
4. Do not ask for or record secret prayers or songs.
5. Never let ritual replace treatment of a red flag.

Protocol 5. Cold casualty, do and do not

1. Handle gently. Lie the patient flat. Do not stand or walk them.
2. Remove wet clothes, insulate on all sides including beneath, and cover the head.
3. If alert and able to swallow, give warm sweet drinks and food (HY-11). No alcohol.
4. Shivering in insulation rewarms by about 3 to 4 °C an hour (HY-11). Let them shiver. Rest 30 minutes inside the wrapping before any walking (HY-11).
5. No warm bath, no rubbing, no snow on frostbite.
6. Thaw frostbite only when it will not refreeze, in water at 37 to 39 °C checked with a thermometer, kept warm and circulating, usually for about 30 minutes, until the part is red or purple, soft and pliable (HY-11).
7. Newborns: skin to skin with the mother under a blanket, with a hat (HY-11).

Protocol 6. Suspected aconite

1. Tingling of lips, tongue or fingers within two hours of a root tea or pill: assume aconite.
2. Follow TR-15 Protocol 4: lie flat, keep warm and still, check the pulse every 15 minutes.
3. Charcoal, 1 g per kg to a maximum of 50 g, only within one hour and only if they can drink unaided (TR-15, ME-14).
4. Nothing by mouth if vomiting or drowsy. No potassium, no calcium.
5. If breathing falls below 12 a minute, give rescue breaths at 10 a minute (TR-15).
6. Keep the remaining tea or plant. Send for the district.

Protocol 7. What a village above the treeline gathers first

1. Mountain sorrel, *Oxyria digyna*, leaves, eaten raw in summer.
2. Cloudberry, crowberry and bilberry, fruit, frozen or dried for winter.
3. Willow, *Salix* species, young leaves raw and bark for pain (PH-01, PH-09).
4. Rose hips where they grow, dried whole.
5. Spruce resin for salve (PH-09).
6. Roseroot, *Rhodiola rosea*, root, only at PH-09 doses and without overharvest.
7. Never gather: monkshood (all parts), bog rosemary and bog laurel, water hemlock and any white-flowered umbellifer not identified beyond doubt, fly agaric and any mushroom not known beyond doubt.

Numbers to carry

1. **0 IU of vitamin D** from the sun from October to March above about 52°N.
2. **400 IU a day** of vitamin D for infants, 800 IU for breastfed infants in the Arctic.
3. **10 mg a day** of vitamin C prevents scurvy, 45 mg is the target.
4. **Boiling** cuts mountain sorrel's vitamin C from 36 to 5 mg per 100 g.
5. **18,000 to 26,700 IU of vitamin A per gram** in polar bear liver. Never eat it.
6. **0.2 mg** of aconitine poisons and about 2 mg kills.
7. **1 to 15 mg** of mercury in a single precious pill, against a reference dose of 0.3 µg per kg per day.
8. **37 to 39 °C** to thaw frostbite, never snow or dry heat.
9. **18 °C** indoor minimum for the old and the young.
10. **96 m** extra walking distance with Padma 28, the best result in the Tibetan pharmacopoeia.

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