

From Hippocrates to UTCI: Twenty-Five Centuries of Human Biometeorology

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Short Report

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Abstract

Human biometeorology, which describes how the atmosphere and the wider environment affect human health, well - being, and performance, was initially organized and presented as a 20th-century discipline, formalized by Tromp and Landsberg and later by physiological thermal indices such as the Physiologically Equivalent Temperature (PET) and the Universal Thermal Climate Index (UTCI). This paper takes a longer view. It traces a continuous, if uneven, tradition of linking atmospheric conditions to human health across more than two millennia: religious and mythological ideas, the weather knowledge of indigenous societies, biblical and ancient Near Eastern sources, the medical systems of Egypt, China and India, Presocratic natural philosophy, the Hippocratic Corpus, Aristotle and the Peripatetic school, and Hellenistic and Roman scholarship. It also argues that the thermal environment is not only something scholarship later described, but a force that helped shape culture itself - visible in the thermal picture of paradise and hell across unrelated traditions and in the open - air institutions of Greek public life. On the modern side, we place the decisive physical step earlier than usual: Konrad Büttner formulated the energy balance of the human body in the 1930s, three decades before Fanger and six before PET, and Wolf H. Weihe stated in 1976 the problem that still governs the field: especially the atmosphere acts through many factors, and their ranking depends on the question asked. Modern rational indices quantify a long-standing insight rather than inventing it: human health depends on several atmospheric factors acting together, not on air temperature alone.

1. Introduction

Most accounts of human biometeorology open with a brief nod to Hippocrates and then move quickly to the 20th century to the syntheses of Tromp (1963) and Landsberg (1972) and to the physiological thermal indices that followed (Fanger 1970; Höppe 1999; Jendritzky et al. 2012). That story is not wrong, but it is short. The link between the atmosphere and human health has a far longer and more varied history, and only part of it is Greek. Sargent (1982) told much of it a generation ago; here we set it out again, in more detail than is usual in the biometeorological literature, with three aims.

First, we place the familiar Hippocratic contribution in a wider, cross-cultural setting: religious and mythological ideas, the weather knowledge of indigenous peoples, biblical and Near Eastern sources, and the medical systems of Egypt, China and India. These traditions grew up largely apart from the Greek world yet reached strikingly similar conclusions. Second, we give more room to Greek natural philosophy beyond Hippocrates - to the Presocratics, to Aristotle's *Meteorologica* and biological works, to the Peripatetic *Problemata*, and to Theophrastus. This body of work is, we think, the first systematic theory of how the atmosphere affects health in the Western tradition, distinct from purely clinical observation.

Third, we return to the modern discipline. The usual line runs from Fanger's comfort equation (Fanger 1970) to PET (Höppe 1999) and UTCI (Jendritzky et al. 2012). It should start earlier - with Konrad Büttner, who set out the energy balance of the human body in the 1930s (Büttner 1934, 1938), and it should include Wolf H. Weihe (1976), who named the problem that quantification cannot remove: the

atmosphere acts through many factors, and no ranking of their importance holds independently of the question asked. Our thesis is simple. The central idea of modern human biometeorology (thermal), and more broadly atmospheric, stress on the body comes from several factors acting together (radiation, wind, humidity, temperature), not from any one of them, as expressed in different languages and with different rigor throughout this long history. Its quantitative form is both older and more purpose-dependent than the discipline usually admits (Matzarakis 2020, 2024).

2. Pre-classical and cross-cultural roots

2.1 Religion, myth and pre-literate societies

Long before human biometeorology existed as a science, communities everywhere recognized and ritualized how much health and survival depend on the weather. In early societies, people read about heat, cold, drought, storm, and flood through religion and myth rather than physics. Atmospheric conditions decisively influenced all areas of life and activity. However, people did not understand what affected them or why they changed. This gave the atmospheric environment supernatural, or even divine, dimensions (Fig. 1). Still, the underlying observation was the same one that grounds the field today: weather and climate act directly on the body and on the resources that keep it alive. Sun gods (Ra in Egypt, Surya in Vedic India, Helios and Apollo in Greece), storm and rain gods (Baal in the Levant, Thor in Scandinavia, Tlaloc among the Aztecs) and wind spirits appear independently across unrelated cultures - a near-universal sense that atmospheric forces decide life, illness and death (Semple 1911).

Studies of indigenous and traditional societies document detailed, well-tested bodies of local weather knowledge, passed on orally over many generations. They tie together seasonal calendars, the stars, the timing of plants and animals, and ritual, and use them to anticipate rain, heat, and cold and their effects on farming and health - for example, the Andean use of Pleiades visibility and El Niño cues to judge the coming growing season (Orlove et al. 2002). These traditions did not explain the body in modern terms. Still, they captured accurate links between weather and welfare, and climate-adaptation research now treats them as a valuable, place-based source of knowledge (Orlove et al. 2002).

2.2 Thermal perception in the formation of culture

Ritual is the most visible sign of this dependence. A closer reading of myth and religion suggests something stronger: that the sense of heat and cold sits close to the core of human culture (Charalampopoulos and Matzarakis 2022). Three observations support this.

First, imagined places of reward and punishment are built, across unrelated traditions, mainly from thermal contrasts - and those contrasts track the local climate. In Greek myth, the Elysian Fields are sunny but cool. At the same time, Tartarus, as Virgil describes it in the Aeneid, is dark and unbearably hot, crossed by the fiery river Pyriphlegethon, exactly the conditions Mediterranean peoples tried to avoid. In Egypt, where life depended on the Nile flood rather than rain, paradise (Aaru) is green, lush, and

well watered, and hell (Duat) is a place of fire, boiling water, and darkness. Among the peoples of the European north, Hel is a cold realm of shadow where the dead shiver and famine returns. At the same time, Valhalla is not an open landscape but a vast roofed hall - shelter from the weather, fitting for a seafaring people whose houses were poor. On the Arabian Peninsula, in a hot, dry, windy desert, Jahannam is a fire that never goes out. In each case, the afterlife inverts the local thermal load: the reward is comfort, the punishment is thermal stress (Charalampopoulos and Matzarakis 2022).

Second, the thermal environment shaped public life. The agora - the open-air marketplace where citizens met, traded, and heard the news could be used only while people felt comfortable standing in it; how often and how long they gathered depended on the weather. When Athenian democracy required its citizens to assemble for hours to debate and vote, they met on the open rock of the Pnyx beside the Acropolis. Tolerable outdoor conditions in Athens for much of the year were a precondition, not a backdrop; the thermal environment plausibly helped democracy take its early, open-air form (Charalampopoulos and Matzarakis 2022).

Third, and more speculatively, heat and cold may have left traces in language. Breathing is one of the body's main ways of losing heat; in warm climates, an open mouth, and so a vowel-rich sound inventory, aids heat loss, while in cold, dry climates a more closed mouth reduces it. Whether this shaped the sounds of languages under extreme climates is a hypothesis, not a result, and we present it as such. It shows, though, how deeply the thermal environment may reach into culture, in a time before insulated houses and modern clothing (Charalampopoulos and Matzarakis 2022).

Taken together, these points widen the review beyond the history of ideas about climate and health. The thermal environment not only gave scholarship a subject; it also helped shape the culture in which such scholarship could arise.

2.3 Biblical and ancient Near Eastern traditions

The Hebrew Bible repeatedly links heat, wind, drought and rain to suffering, health and divine will, reflecting life in an eastern Mediterranean climate (Fig. 1). Scorching east winds and heat that wither plants and people (Genesis 41; Jonah 4:8; Psalm 121:6), drought as a threat to survival (1 Kings 17–18; Deuteronomy 28), and storm as a force to reckon with (Job 1:19; 37–38) all show an early, experience-based awareness of the dangers of thermal and hydrological extremes. In Mesopotamia, systematic sky and weather-watching was written into omen literature, where atmospheric events were recorded and read as signs bearing on the welfare of rulers and people - a divinatory rather than physiological, but still systematic, way of correlating weather and health (Rochberg 2004).

2.4 Early high cultures: Egypt, China and India

In Egypt, the Nile flood shaped not only farming but ideas of health, in a calendar built around inundation, growth and harvest. In China, classical medicine - set out in texts such as the Huangdi Neijing (compiled roughly between the third century BCE and the second century CE) - linked six external climatic factors (wind, cold, summer-heat, dampness, dryness, fire) to disease and prescribed diet, activity and rest by

season (Unschuld 1985). In the Indian Ayurvedic tradition, codified in the Charaka Samhita and Sushruta Samhita, ritucharya (seasonal regimen) adjusts diet, daily routine and treatment to a six-season year, according to how the body's doshas meet the prevailing heat, cold and humidity (Meulenbeld 2000). Both traditions set out, independently of Greece, a systematic and still-practiced framework linking seasonal weather to the body's state.

Structurally, the Chinese scheme of six external factors anticipates the ranking-free framework Weihe later described (Weihe 1976): it names several factors, privileges none in advance. It assigns causality according to the physician's assessment of each case.

3. Presocratic natural philosophy: laying groundwork

Before Hippocrates, several Presocratic thinkers (Fig. 1) had already turned atmospheric qualities into general physical principles, preparing the ground for the humoral scheme that followed. Anaximander of Miletus (6th century BCE) proposed the apeiron, the boundless, as the source from which opposites - hot and cold, wet and dry - separate to form the world; this is perhaps the first Western abstraction of the very pairs of qualities that would later organize Hippocratic theory (Kirk et al. 1983). His successor Anaximenes made air itself the primary substance, from which everything condenses or rarefies, tying the stuff of the atmosphere to the make-up of matter and of the body (Kirk et al. 1983). Empedocles of Acragas (5th century BCE) set out the four roots—fire, air, water, and earth—each with a pair of qualities (hot/cold, wet/dry); this directly foreshadows the four Hippocratic humors. Diogenes of Apollonia went further, treating air not just as matter but as the intelligent, living principle behind life and thought a forerunner of the Hippocratic idea of 'innate warmth' (emphyton thermon) discussed below (Kirk et al. 1983). Together, these thinkers supplied the vocabulary - paired qualities, elemental composition, air as a vital substance - without which the Hippocratic synthesis could not have been built.

4. The Hippocratic Corpus

4.1 Airs, Waters, Places and the Aphorisms

Within this setting, the Hippocratic Corpus (Fig. 1) produced the first surviving attempt at a systematic, natural account of climate and health: the treatise Airs, Waters, Places (about 400 BCE) (Hippocrates, Airs, Waters, Places). Its author holds that a physician must first study the seasons, the prevailing winds, the local water, the way a settlement faces the sun and wind, and the habits of its people, because these together shape the constitution of a population and the diseases it suffers (Hippocrates, Airs, Waters, Places). The text does not blame ill health on any single factor but on the combination of sun exposure, wind, humidity and water - an early version of the modern understanding that thermal stress on the body cannot be reduced to air temperature, but arises from radiant, convective and evaporative exchange together (Fanger 1970; Jendritzky et al. 2012).

At the center of the scheme is 'innate warmth' (emphyton thermon), a vital heat seated mainly in the heart and responsible for digestion, growth and vitality. Health is the right balance among four qualities, hot, cold, wet, dry, mapped onto four humors (blood: warm and moist; yellow bile: warm and dry; phlegm: cold and moist; black bile: cold and dry); disease follows when outside heat or cold upsets this balance.

4.2 The Hippocratic treatment of heat and cold

The Corpus is surprisingly specific about how heat and cold differ in their effects. In *Airs, Waters, Places*, people in cities exposed to warm, moist winds are described as slack, phlegmatic, and less robust, prone to headaches and digestive trouble (Hippocrates, *Airs, Waters, Places*). The *Aphorisms* (Book III) assign particular diseases to summer - *kausos* (καῦσος, 'burning fever', probably severe heat-related fever), dysentery, diarrhoeal disease, and ophthalmia — and link drought years to feverish, 'dry' patterns of illness (Hippocrates, *Aphorisms*). People in cold, dry places are called sturdier, more muscular and harsher in temper, but liable to other ailments: winter is tied to pleurisy, pneumonia, sore throats and sciatica, and to epileptic seizures, which *On the Sacred Disease* attributes partly to cold, moist influences on the brain (Hippocrates, *On the sacred disease*); cold is also named as a trigger of gout and joint pain.

For biometeorology, the most striking point, repeated across several treatises, is that it is not extreme temperature itself but sudden shifts between heat and cold, or between seasons, that most endanger health (Hippocrates, *Aphorisms*). This anticipates, in words, modern ideas of acclimatization and the finding that unusual or rapidly changing weather—rather than absolute temperature—is often the best predictor of excess illness and death. Just as telling, the Hippocratic authors never treat 'heat' as air temperature alone: wind, humidity and exposure always appear together — the very principle later formalized in PET and UTCI, where radiation, wind, humidity and temperature jointly set the load on the body (Höppe 1999; Jendritzky et al. 2012).

5. Aristotle and the Peripatetic school

Where the Hippocratic writers work mainly from the bedside, Aristotle and his school at the Lyceum built the first systematic physical theory of the weather itself - a clear shift from clinical to natural-philosophical treatment (Fig. 2). In the *Meteorologica* (fourth century BCE) Aristotle proposes that two 'exhalations' rise from the earth — one moist and vaporous, one dry and smoky - and together produce wind, cloud, rain and even, in his account, earthquakes; this causal theory, mistaken though it is, places weather within his framework of causes rather than in the hands of the gods (Aristotle, *Meteorologica*). *Meteorologica* also sketches an early division of the earth into habitable and uninhabitable zones by latitude and heat, foreshadowing the *klimata* of Posidonius and Ptolemy and, more distantly, the modern idea of climate zones (Aristotle 1931, 1936, 1937a).

Aristotle's biological works carry this interest over to living things: passages in the *History of Animals* and *Parts of Animals* discuss how climate and habitat shape animal bodies and behavior - an early comparative physiology relevant to thermoregulation. The *Peripatetic Problemata* - a question-and-answer text attributed to Aristotle but probably written by several hands in his school - devotes parts of

Book I ('Problems connected with medicine') and Book XIV ('Problems connected with the effect of locality on temperament') to the effects of heat, cold, wind, and place on the body (Aristotle, *Problemata*). It is the closest ancient thing to a systematic list of biometeorological questions. It shows that interest in weather and health in the school reached well beyond Aristotle himself (Aristotle 1931, 1937b, 1965, 1970, 1991).

Theophrastus, who succeeded Aristotle as head of the Lyceum, took a more applied path. His *On Winds* catalogs the origin, character, and effects of winds, and *On Weather Signs* collects short-range forecasting rules drawn from the sky and from the behavior of animals and plants - arguably the most operational meteorological text to survive from antiquity (Theophrastus, *On winds*; *On Weather Signs*). His *Historia Plantarum* records links between climate and vegetation, an early parallel to modern plant bioclimatology. Read together, Aristotle and Theophrastus mark a move from Hippocratic bedside observation toward systematic natural philosophy and practical forecasting - two strands that would not fully rejoin until the twentieth century, when human biometeorology combined physiological indices with operational forecasts and warnings.

A recent, closely annotated reassessment of the *Meteorologica* by the atmospheric scientists Tsonis and Zerefos sets each of Aristotle's claims, book by book, against present-day science, marking where his reasoning came close to modern understanding (the rough water cycle; the role of the exhalations in cloud and rain) and where it went astray (Tsonis and Zerefos 2020). Notably for this review, they stress that Aristotle worked essentially from logic, everyday observation and accumulated experience, with almost no instruments — which makes the degree of agreement with modern meteorology, imperfect as the mechanisms are, all the more striking, and supports our broader point: a multi-factor, observation-based way of reasoning about weather and health long predates the instruments that would later let it be measured.

6 The Hellenistic and Roman period

Posidonius (second–first century BCE), known mainly through later writers, organized the *klimata* - latitude bands defined by the sun's height and day length - into a coherent geography; the word *klima* is the direct root of 'climate'. The Roman architect and engineer Vitruvius (first century BCE), in Book VI of *On Architecture*, gave practical rules for placing buildings and streets in relation to sun and prevailing winds to protect health - an early, applied use of bioclimatic principles in design that looks ahead to today's climate - sensitive urban planning (Vitruvius, *De Architectura*). Ptolemy's *Tetrabiblos* (second century CE) pushed climatic reasoning into astrology, tying temperament and health to a mix of astronomical and climatic influence (Ptolemy, *Tetrabiblos*); historically important, this strand has no scientific basis and is mentioned here only for completeness. Galen (second century CE) folded the Hippocratic climate–health scheme into his broader humoral pathology, which dominated Western medicine for more than a thousand years (Strabo 1917; Vitruvius 1934; Ptolemy 1940; Kidd 1988, 1999; Galen 2018, 2020).

7. Transmission and continuity

The Hippocratic– Galenic scheme was preserved, translated, and much extended in the medieval Islamic world, above all in Avicenna's (Ibn Sīnā's) Canon of Medicine (eleventh century CE), which took up and developed the airs–waters–places tradition inside a systematic medical encyclopedia that later shaped European medicine through Latin translation (Avicenna, The Canon of Medicine). A fuller account of this transmission lies outside this review; it deserves its own study, ideally with historians of Islamic science and medicine.

8 Renaissance and Enlightenment revival, and its problematic legacy

Renaissance and Enlightenment writers revived - and often oversimplified - Hippocratic and Galenic ideas about climate and health. Montesquieu's climate determinism, and later, more baldly, Huntington's Civilization and Climate (Huntington 1915), stretched climatic reasoning into sweeping claims about the character, intelligence and 'civilizational capacity' of whole peoples. This line of thought was then used, sometimes openly, to justify racial and cultural stereotypes and colonial hierarchies (Livingstone 1991). We regard it as a matter of scientific honesty that this history be named, not passed over, whenever the Hippocratic tradition is claimed as an ancestor of modern human biometeorology. The origins of the field are not ethically neutral - even though its core empirical insight, that atmospheric conditions act together on health, remains sound and useful.

9. The emergence of scientific human biometeorology

9.1 From cooling power to the energy balance of the human being

A genuinely scientific human biometeorology -built on physiology and repeatable measurement rather than humoral reasoning - took shape in the late nineteenth and early twentieth centuries. Early instruments, most famously Leonard Hill's katathermometer, tried to capture the combined cooling effect of temperature and air movement in a single reading and, in doing so, had already given up air temperature as a sufficient measure. However, they measured the air's cooling power on an instrument, not on a person; the step from reading to a statement about a human being was still missing (Fig. 3).

Konrad Büttner took that step. In papers in the early 1930s - including his Habilitation on heat transfer by conduction and convection, evaporation and radiation in bioclimatology and meteorology (Büttner 1934) - and fully in the monograph *Physikalische Bioklimatologie* (Büttner 1938), he described the heat exchange between the human body and the atmosphere as a physical energy balance: metabolic heat, conduction, convection, evaporation and short- and long-wave radiation as terms of one equation, valid indoors and outdoors alike. This is the conceptual core on which every later rational thermal index rests (Büttner 1951).

The point deserves emphasis in the discipline's history. Büttner's formulation predates Fanger's comfort equation (Fanger 1970) by more than thirty years and Höppe's PET (Höppe 1999) by sixty; German-language bioclimatology had, in essence, correctly set out the physics of human thermal load before the Second World War. What the later indices added was not the balance itself, but the physiological model attached to it, the reference conditions used to express its solution, and – decisive for practice – the reduction of that solution to a single temperature-like number that can be communicated. Reading the modern indices as inventions rather than as completions of Büttner's equation hides both what is genuinely new in them and how long the essential insight has been available.

9.2 The many factors and the problem of ranking them

If Büttner showed how the atmosphere acts on the body, the question of which factors matter - and how much - was put most sharply by Wolf H. Weihe. Reviewing the field in 1976, he argued that the central task of human biometeorology is to establish a ranking of the atmospheric factors, and that both deductive and inductive routes lead to the same uncomfortable answer: any such ranking is relative, valid only for a stated purpose and within the limits set by how much of the system is under control. Meteorology, he concluded, can help medicine only if specialists define their purpose clearly enough that measurement and analysis can be arranged to match it (Weihe 1976).

This is a stronger claim than it first sounds, and it bears directly on our argument. The atmosphere acts on people through a large, mixed set of factors: the thermal complex (air temperature, radiation, wind, humidity), the actinic complex (ultraviolet and visible radiation), the air-hygienic complex (gases, aerosols, particles, pollen), and further components such as air pressure and atmospheric electricity - while on the human side, age, health, activity, clothing, acclimatization, and behavior modify every one of them (Matzarakis 2020). No ordering of these holds regardless of the question. For heat-health warnings, the thermal complex dominates; for skin-cancer prevention, the actinic complex does; for respiratory illness, the air-hygienic complex does. Weihe's insistence on purpose is therefore not a caveat but a structural feature of the field - and it is the modern, explicit form of the very insight that runs through the Hippocratic triad of airs, waters and places: several factors act together, and which one matters becomes answerable only once the health outcome of interest is named.

Seen this way, the habit of reducing thermal stress to air temperature - still common in public debate, in parts of the planning literature, and at times in the scientific literature itself – is not just imprecise. It quietly assumes a ranking in which one factor beats all others, for every purpose, and that is exactly the assumption Weihe showed to be unavailable (Weihe 1976; Matzarakis 2020).

9.3 Rational thermal indices as quantitative fulfillment

The discipline was consolidated through the syntheses of Tromp (1963) and Landsberg (1972). Fanger's engineering model of comfort (Fanger 1970) made the energy balance usable for indoor design; Höppe derived from it the Physiologically Equivalent Temperature (PET) (Höppe 1999), which states outdoor conditions as the air temperature of a reference indoor setting that would produce the same thermal state; and the Universal Thermal Climate Index (UTCI) followed as an internationally standardized index,

coupling a multi-node thermophysiological model to a clothing model (Jendritzky et al. 2012). These indices now underpin official heat-warning systems worldwide and predict human thermal stress far better than air temperature alone (Matzarakis 2020, 2024).

Their use, however, brings back the very problems Büttner and Weihe identified, and two recent commentaries address them directly (Matzarakis 2020, 2024). The first argues that any assessment of atmospheric effects on people must start with the full set of factors and components, not from single variables, and that which factors enter follows from the intended application, not from what is easy to measure (Matzarakis 2020). The second concerns the quantification step itself: a thermal index is meaningful only if its inputs — above all the mean radiant temperature, which carries most of the outdoor signal and is most often estimated poorly - are determined correctly; if the index is used within the range of conditions for which it was built; and if the result is reported together with its physiological meaning rather than as a bare number (Matzarakis 2024). A related note makes the same point from practice, listing the recurring misunderstandings that arise when indices are estimated and applied without regard to how they were derived (Matzarakis 2021).

Both make explicit, for today's practice, what this review traces through history: that the load on the body comes from several factors acting together, not from any one - and that quantification without a stated purpose reproduces the ranking problem Weihe named half a century ago (Weihe 1976). The indices are the quantitative form of a qualitative, multi-factor insight that religious, indigenous, biblical, Egyptian, Chinese, Indian, Presocratic, Hippocratic and Peripatetic traditions had each expressed, in their own terms, over the preceding two and a half thousand years. They do not remove the problem of purpose, and they were never meant to.

10. Conclusion

The history of human biometeorology is longer, more varied and more substantial than the discipline usually admits. From the ritual recognition of atmospheric forces in early societies and the thermal picture of paradise and hell across unrelated traditions (Charalampopoulos and Matzarakis 2022), through biblical and Near Eastern experience of thermal and hydrological extremes, the medical systems of Egypt, China and India, the groundwork of Presocratic philosophy and the clinical synthesis of the Hippocratic Corpus - with its specific, still-resonant claims about heat and cold - to the systematic natural philosophy and applied forecasting of Aristotle, the Peripatetic Problemata and Theophrastus, one idea recurs: human health depends on several atmospheric factors acting together, not on any one taken alone.

The modern discipline did not invent that idea; it quantified it. Büttner formulated the human energy balance in the 1930s (Büttner 1934, 1938), three decades before Fanger and six before PET; Weihe stated in 1976 the problem that quantification cannot remove - that the many factors admit no purpose-free ranking (Weihe 1976). Rational indices such as PET and UTCI are the rigorous completion of a two-and-a-half-thousand-year-old insight, not its origin. Their correct use still depends on stating the purpose,

determining the inputs properly, and communicating what the result means for the body (Matzarakis 2020, 2021, 2024). An honest account of where the field comes from should credit this long and mixed lineage in full - including, importantly, the periods when climate–health reasoning was misused for ideological ends - rather than shrink it to a single, out-of-context nod to Hippocrates. It should also recognize that the thermal environment was never only a subject of this science: it was among the forces that shaped the culture in which the science became thinkable (Charalampopoulos and Matzarakis 2022).

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Author Contribution

AM conceived the article and drafted the manuscript. IC performed the literature search, contributed the sections on Greek natural philosophy, and critically revised the work. Both authors read and approved the final manuscript.

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Figures

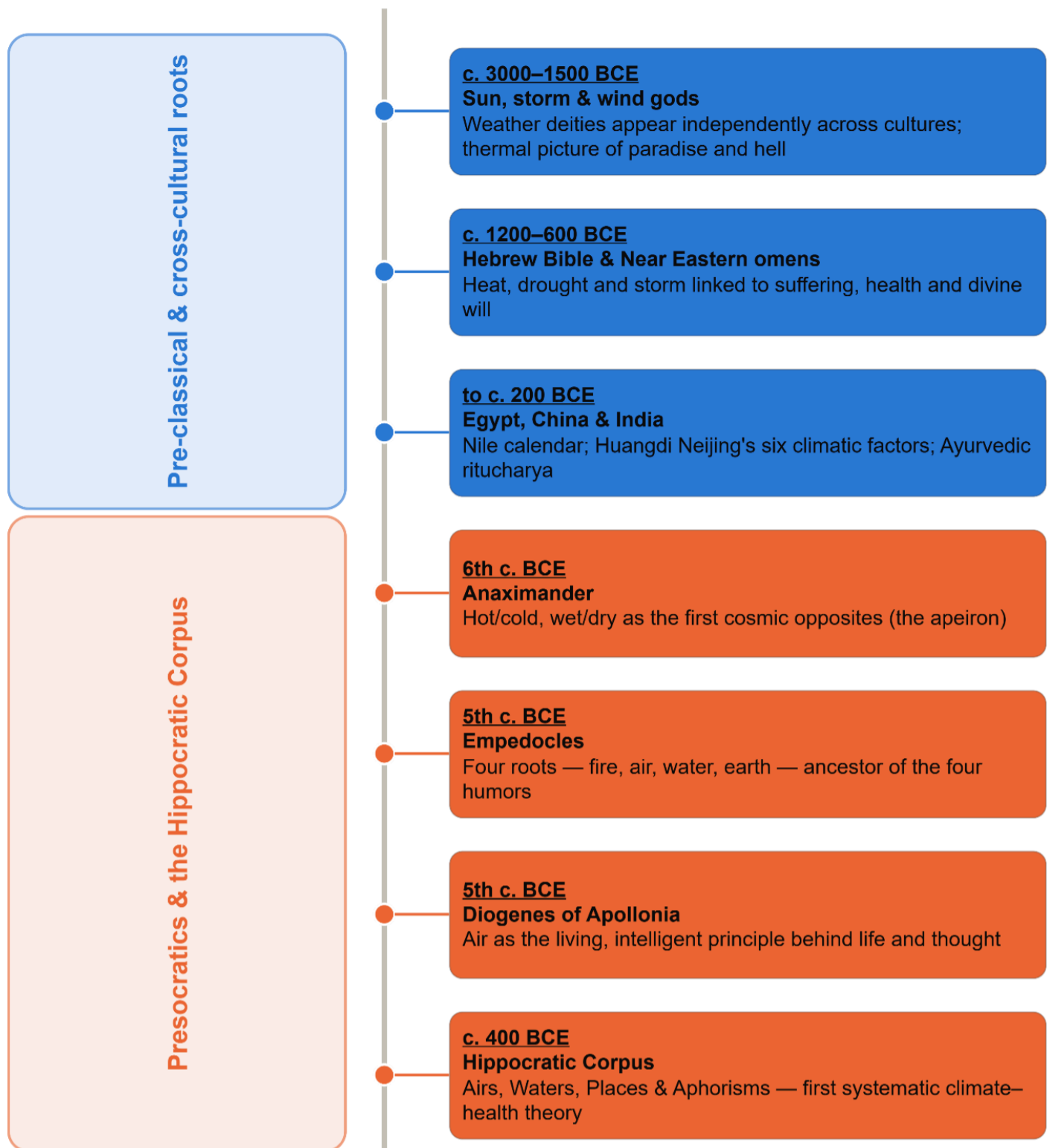


Figure 1

Pre-classical to Presocratics to Preclassical Corpus.

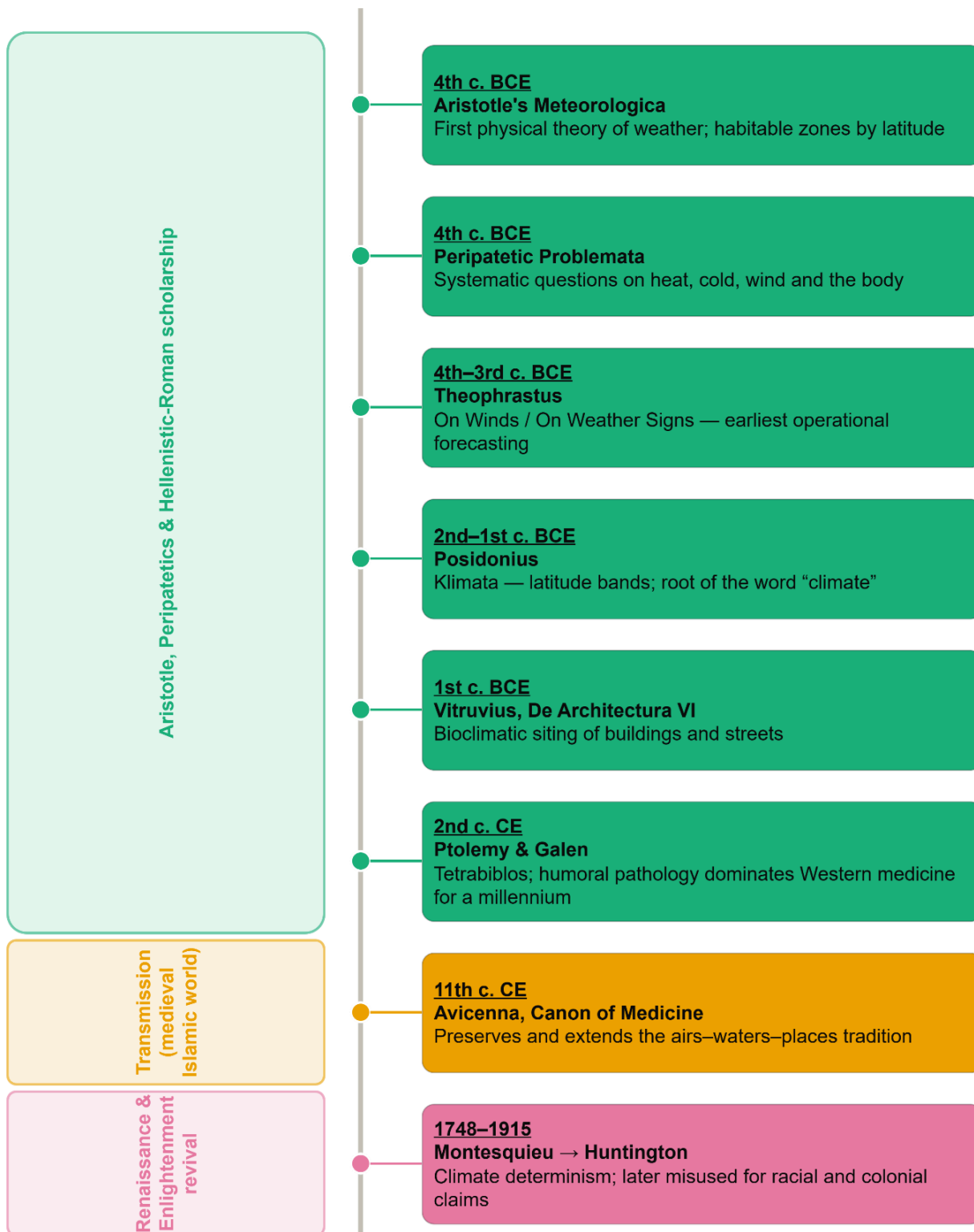


Figure 2

Historical development from Greek philosophy to the Renaissance Revival

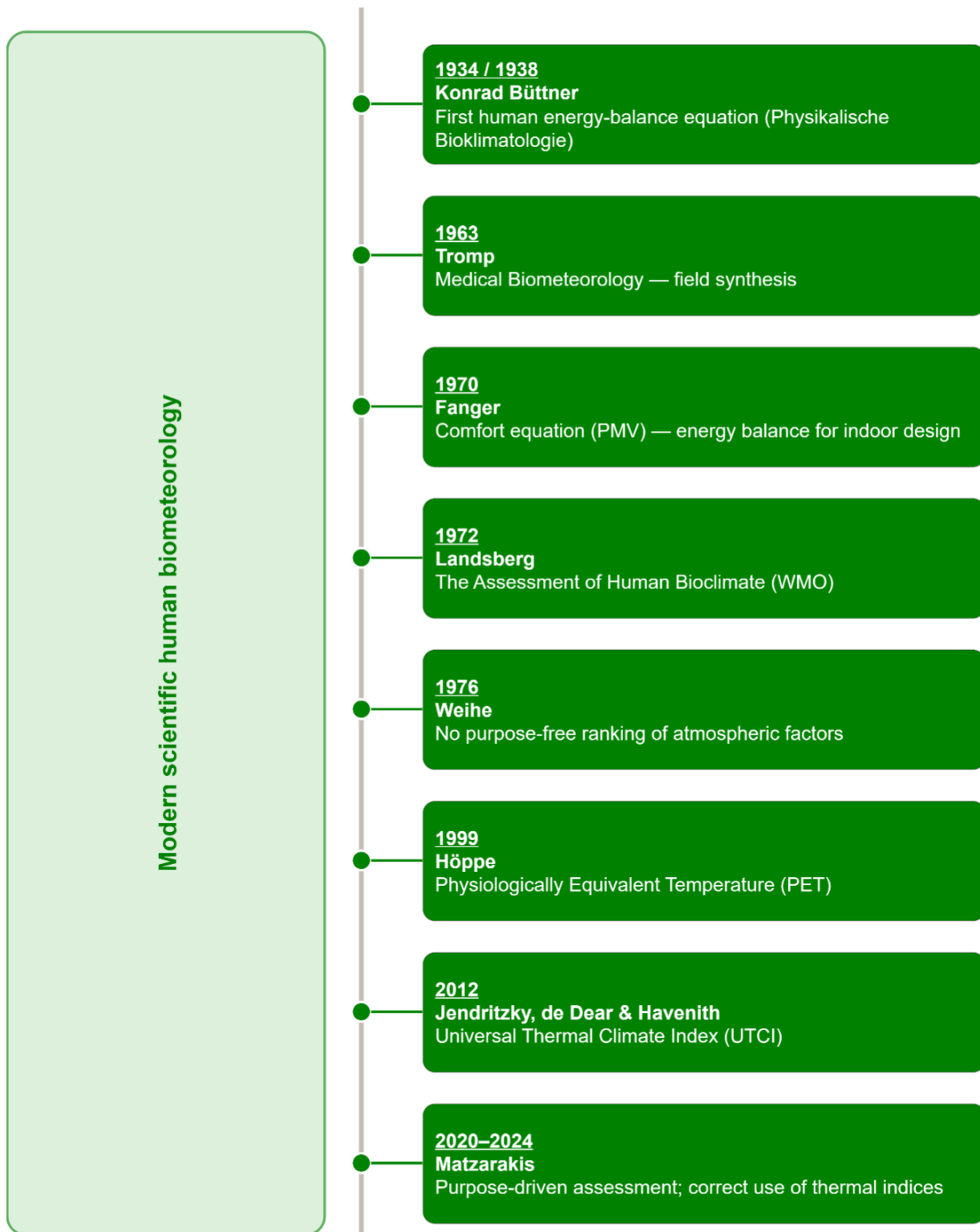


Figure 3

Time stamps of modern human biometeorology based on human energy balance.