American Journal of
Biomedical Science & Research

www.biomedgrid.com
ISSN: 2642-1747

Mini Review

Time in Balance: Intercalary Months, Zodiac Cycles, and the Ecology of Chinese Calendrics

Liu Zhaoyang*

Yang Yang International Plaza, Block A, ShaanXi province, Xi'an city, China

***Corresponding author:** Liu Zhaoyang, Yang Yang International Plaza, Block A, ShaanXi province, Xi'an city, China.

To Cite This Article: *Liu Zhaoyang*. Time in Balance: Intercalary Months, Zodiac Cycles, and the Ecology of Chinese Calendrics. Am J Biomed Sci & Res. 2025 28(4) AJBSR.MS.ID.003701,* **DOI:** 10.34297/AJBSR.2025.28.003701

Received: September 12, 2025; **Published:** September 17, 2025

Abstract

Intercalary month regulation, as a core technique of China's traditional lunisolar calendar, dynamically inserts additional months to reconcile the cyclical discrepancy between the solar year (tropical year, ~365.2422 days) and the lunar month (synodic month, ~29.53 days). Zodiac-based chronology, structured around the twelve Earthly Branches and symbolized by twelve animal signs (e.g., Rat, Ox, Tiger... Pig), constructs a cultural coding system for time measurement. Traditional studies have often examined these two systems in isolation focusing either on their calendrical mechanics or folkloric meanings while seldom exploring their underlying shared logic of balance: namely, the use of temporal measurement mechanisms to maintain dynamic equilibrium among astronomical patterns, biological rhythms, and human socio-cultural activities.

This paper starts from the core concept of "balance" and integrates principles of calendrical astronomy, biological rhythm theory, and cultural anthropology to reveal: (1) How intercalary month regulation sustains a "celestial-climatic-biological" natural balance by calibrating the synchronization between the lunar calendar and the solar year; (2) How zodiac chronology maps a "biological-cultural" symbolic balance by associating animal archetypes with seasonal characteristics; and (3) How the two systems, through the 60-year Sexagenary Cycle, collaboratively achieve an overarching balance between "natural laws" and "humanistic cognition." The research demonstrates that China's traditional calendrical system is, in essence, an ancient practical expression of profound insights into natural balance mechanisms, whose balancing logic offers enduring insights for contemporary ecological equilibrium and sustainable development.

Introduction

Balance is a fundamental principle governing both natural ecosystems and human societies from the material-energy cycles of ecological systems to the homeostatic regulation of organisms, from the calibration of astronomical cycles in calendars to the encoding of temporal meaning in culture. All reflect processes of maintaining dynamic equilibrium.

As one of the oldest calendrical systems in the world, China's traditional lunisolar calendar employs the technique of "intercalary month regulation" to address the core contradiction between pure lunar calendars (counting months solely by synodic months) and pure solar calendars (counting years solely by tropical years). A pure lunar calendar (12 months ≈ 354 days) falls ~11 days short of a tropical year (~365.2422 days), causing seasonal drift (e.g., spring occurring in winter) after ~17 years, thereby decoupling agricultural activities (e.g., sowing, harvesting) from natural phenological cues (e.g., temperature, precipitation). Conversely, a pure solar calendar, while aligning with seasonal changes, fails to reflect lunar phases (e.g., inability to determine the first and fifteenth days of the month via "new moon" or "full moon"). To resolve this, ancient Chinese innovated the "intercalary month" system (inserting an extra month approximately every 2-3 years, with a 19-year/7-leap-month cycle), adjusting the average lunar calendar year to ~365.2422 days nearly identical to the tropical year to stabilize the correspondence between lunar months and seasons. Simultaneously, "zodiac chronology" employs the twelve Earthly Branches paired with twelve animal symbols (Rat, Ox, Tiger... Pig) and organizes them into a 60-year cycle via the combination of Heavenly Stems and Earthly Branches, transforming abstract time into concrete cultural symbols.

Existing scholarship has predominantly focused on the technical rules of intercalary months (e.g., the "no-Midpoint-Insertion Rule") or the folkloric symbolism of zodiac signs (e.g., taboos during one's birth-year zodiac). However, few studies have explored the intrinsic connection between the two from an interdisciplinary "balance" perspective. In reality, the essence of intercalary month regulation lies in technologically mediating the "astronomical cycle-climatic rhythm-biological activity" natural balance, while zodiac chronology encodes the "biological traits-cultural cognition" symbolic balance through animal archetypes. Together, via the Sexagenary Cycle, they construct a holistic balance system linking "natural laws" and "humanistic practices." This paper seeks to uncover the deep scientific connotations and cultural value of this traditional calendrical system by tracing its balancing logic.

Intercalary Month Regulation: Sustaining the "Celestial-Climatic-Biological" Natural Balance

Technical Essence of Intercalary Months: Correcting Astronomical Discrepancies to Stabilize Seasonal Frameworks

The core challenge of the lunisolar calendar lies in the mismatch between lunar months (29.53-day synodic cycles) and the tropical year (~365.2422 days). A 12-month lunar year totals ~354 days~11 days shorter than the solar year. Without adjustment, seasons would regress by nearly half a year after 17 years (e.g., spring occurring in winter), disconnecting agricultural timing (e.g., planting, harvesting) from phenological signals (e.g., temperature, rainfall). Conversely, a pure solar calendar, while tracking seasonal shifts, cannot reflect lunar phases (e.g., determining the first day of the month by new moon). To resolve this, the ancient Chinese devised the "intercalary month" system (~1 leap month every 2-3 years, 7 in 19 years), inserting extra months to align the average lunar calendar year with the tropical year (~365.2422 days), thereby stabilizing the correspondence between lunar months and seasons.

This adjustment fundamentally calibrates the discrepancy between astronomical cycles, maintaining the natural balance among "astronomical periods (tropical year) climatic rhythms (seasonal transitions) biological activities (phenological cycles)." For instance, the second lunar month (typically corresponding to the Awakening of Insects to the Spring Equinox) is critical for plant germination and animal emergence from hibernation in most temperate regions. Without intercalary months, repeated annual shortfalls would delay the second month to after the Clear and Bright Festival (e.g., spring arriving later), pushing optimal sowing temperatures (e.g., 10-15°C for wheat jointing) out of sync, disrupting ecosystem energy flows (e.g., soil microbial activity coupled with crop growth). By stabilizing the alignment between seasons and months, intercalary months ensure the synchrony of human agricultural activities with natural biological rhythms, thereby upholding the holistic balance of "sky-earth-life."

Annual Biological Rhythms: Ecological Feedback Mechanisms of Intercalary Regulation

Annual biological rhythms (circannual rhythms) are endogenous adaptations of organisms to the solar year, manifesting as ~365-day periodic behaviours' such as reproduction, migration, and hibernation. For example, migratory birds time their journeys based on photoperiod (daylight length) and temperature, typically departing in spring (when daylight in the Northern Hemisphere reaches a critical threshold); bears enter hibernation in autumn (as daylight shortens and food scarcity peaks) in sync with winter cold.

By maintaining the synchronization between lunar months and seasons, intercalary months indirectly align human activities (e.g., farming, hunting) with natural biological rhythms, reducing ecological disruption. Take northern China's grassland pastoralism as an example: the "White Dew" solar term (typically in the eighth lunar month) marks the key period for herders to relocate livestock to autumn pastures. Without intercalary months, the eighth lunar month might shift to late September (instead of early September), causing premature grass withering to coincide with peak livestock demand, leading to overgrazing (animals consuming grass roots) and damaging grassland regeneration. Intercalary months stabilize the occurrence of "White Dew" around early September, ensuring the seasonal balance between pastoral activities and grassland ecosystems, ultimately safeguarding the stability of the "grass-livestock-human" ecological chain.

Zodiac Chronology: Mapping the "Biological-Cultural" Symbolic Balance

Selection Logic of Zodiac Animals: Cultural Translation of Seasonal Biological Traits

The choice of the twelve zodiac animals is not random but a symbolic synthesis of ancient observations of seasonal animal behaviors (reproduction, activity, hibernation) and their associations with human life. Each animal corresponds to specific seasonal features and ecological roles, forming a balanced coding system of "biological archetypes-cultural symbols": (Table 1).

Table 1:

Zodiac	Earthly Branch	Associated Season/Month	Seasonal Biological Trait	Cultural Symbolism
Rat	(Zi)	Late Winter-Early Spring (Làyuè-Zhēngyuè)	High reproductive rate post-warm-up (spring population surge), active in darkness (active at Zi hour, midnight)	"Zi" (midnight) symbolizes new life and hidden vitality
Ox	(Chǒu)	Spring (Lìchūn-Gǔyǔ)	Key agricultural labor (plowing/seeding in spring), ruminant adaptation to abundant spring forage	Symbolizes diligence and stable ties to the land
Tiger	(Yín)	Early Spring (Jīngzhé-Qīngmíng)	Feline mating season (spring reproduction), apex predator maintaining ecological balance	Symbolizes strength and spring's burst of life
Rabbit	(Mǎo)	Mid-Spring (Zhōngchūn)	Breeding season (short gestation, rapid offspring growth), aligned with "Mǎo wood" (spring growth energy)	Symbolizes agility and natural renewal
Dragon	(Chén)	Spring Rainy Season (Gǔyǔ)	Mythical creature symbolizing rainfall (critical for crops in East Asia's spring rainy season)	Represents harmony between humans and water regulation
Snake	(Sì)	Early Summer (Lìxià-Mángzhòng)	Emerges from hibernation (spring-to-summer warming >15°C), breeds during high-activity summer	Symbolizes transformation and energy release
Horse	(Wǔ)	Peak Summer	High stamina in lush pastures (nutrient-rich summer forage), historically vital for transport/war	Symbolizes speed and seasonal prosperity
Sheep	(Wèi)	Late Summer–Early Autumn (Lìqiū-Chùshǔ)	Fatting period (fat accumulation pre-autumn), linked to "Wèi earth" (nutrient-rich soil for autumn sowing)	Symbolizes gentleness and the prelude to harvest
Monkey	(Shēn)	Autumn (Báilù-Qiūfēn)	Active during fruit ripening (foraging for winter reserves), symbolizes adaptability at Qiūfēn (yin-yang transition)	Represents flexibility and dynamic ecological niches
Rooster	(Yǒu)	Autumn (Qiūfē-Hánlù)	Egg-laying increases with shortened autumn daylight, signals harvest with its crowing	Symbolizes punctuality and the harvest announcement
Dog	(Xū)	Autumn-Winter Transition (Shuāngjiàng-Lìdōng)	Assists hunting/guarding (resource storage season), linked to "Xū earth" (storage trait)	Symbolizes loyalty and resource protection
Pig	(Hài)	Winter (Dōngzhì)	Fatting period (suitable winter temps, ample feed), symbolizes abundance and dormancy via winter solstice rituals	Represents fulfillment and the closure of natural cycles

This selection logic reveals that the zodiac is, at its core, an ancient symbolic summary of observed biological seasonal rhythms, translated into a "time-biology-meaning" balanced code.

Symbolic Balance of Zodiac Chronology: Cultural Translation of Biological Rhythms

Zodiac chronology transforms the abstract 12-year cycle into concrete biological symbols via the Earthly Branch-animal correspondence, achieving a symbolic balance between "natural rhythms" and "cultural cognition." For example, an individual born in the "Year of the Tiger" (Yin) not only corresponds to the "Yín month" (typically the first lunar month, early spring) but also carries implicit associations with "spring-renewal-strength" biological rhythms. The folk concept of the "birth-year zodiac" (e.g., wearing red for luck during one's zodiac year) lacks strict scientific basis but may stem from ancient approximations of biological lifespans (e.g., wild felines living ~12 years) and cultural rituals that maintain psychological balance between individuals and natural rhythms.

The Sexagenary System: Achieving Holistic Balance Between "Natural Laws" and "Humanistic Practices"

Intercalary month regulation and zodiac chronology are deeply integrated through the Sexagenary Cycle (combining Heavenly Stems and Earthly Branches), constructing a unified balance system linking "astronomical laws," "biological rhythms," and "human activities":

Astronomical Balance

Intercalary months calibrate the lunar calendar with the solar year, maintaining the balance between Earth's orbital period (tropical year) and lunar revolution (synodic month).

Biological Balance

The zodiac maps seasonal characteristics through animal archetypes, reflecting the balance between "biological rhythms (reproduction, migration, hibernation)" and "seasonal cycles (spring-summer-autumn-winter)."

Humanistic Balance

The 60-year Sexagenary Cycle encodes astronomical and biological balances into cultural practices (e.g., agricultural calendars, folk taboos), enabling human activities (e.g., sowing, rituals) to dynamically adapt to natural laws.

For instance, the upcoming 2025 Year of the Snake: "Sì" corresponds to early summer, when snakes emerge from hibernation and breed a biological trait (ecdysis symbolizing renewal) aligned with summer's growth rhythm (rapid plant development, active animals). This cross-dimensional balancing logic embodies the ancient practice of "unity of heaven and humanity" "Tian Ren He Yi" harmonizing natural laws with human society through calendrical adjustments and cultural encoding.

Interlude: Kaleidoscope and Balance-Life's Diversity and Dynamic Stability

Kaleidoscope Metaphor: Life's Diversity and Contingency

a) The living world teems with morphological, functional, and behavioral diversity, akin to the ever-shifting patterns in a kaleidoscope. This diversity stems not only from genetic mutations but also from environmental pressures, niche differentiation, and species interactions.

b) While mutations are random, natural selection, genetic drift, and gene flow collectively shape phenotypes and adaptability. Thus, evolution is not a linear "progress" but a process of recombination, trial, and rebalancing.

Balance: Stability in Evolution and Ecology

a) Individuals, populations, and ecosystems tend toward dynamic equilibria (e.g., homeostasis, ecological balance, evolutionary stable strategies). Yet, this balance is fragile disrupted by environmental upheavals, invasive species, or disease outbreaks.

b) Life evolves through cycles of "imbalance-adjustment-rebalance," challenging linear evolutionary narratives and aligning more closely with complex systems theory.

The Nature of Mutations: Evolution's Raw Material with Costs

Mutations Are Random, Not Progressive

a) Most mutations are neutral or harmful; only a few confer adaptive advantages in specific contexts. Mutations are not "for evolution" but foundational raw materials.

b) Evolution relies on selection from random variation, not directed design hence Richard Dawkins' analogy of the "blind watchmaker."

Trade-offs and Side Effects

a) Beneficial mutations often carry hidden costs: e.g., disease resistance may increase vulnerability to others; higher fecundity may shorten lifespan; structural optimizations may sacrifice flexibility or energy efficiency.

b) Such trade-offs reveal evolution as a compromise under constraints, not a pursuit of perfection.

"Good Enough" Evolution

Natural selection favors "sufficiently adapted" individuals, not optimal ones. Many organisms retain seemingly inefficient or redundant traits because they "work well enough."

Revisiting Traditional Biology: Complexity and Balance

Limits of Reductionism

a) Classical biology often simplifies complex phenomena (e.g., single-gene trait determination, linear causality). Yet, life is inherently nonlinear, networked, dynamic, and multi-scaled.

b) Modern biology increasingly embraces systems biology, evolutionary developmental biology (Evo-Devo), and ecological complexity science, emphasizing holism and historical contingency.

Disturbance and Equilibrium as Norms

a) Biological systems often hover near equilibrium but are constantly perturbed (e.g., immune self/non-self-recognition, gut microbiome dynamics, genomic instability in cancer).

b) Understanding life requires examining how imbalances trigger change, how systems respond to stress, and the relationship between diversity and resilience.

Conclusion: Rethinking the Essence of Life

Life is not merely about "how it works" but about "how it balances, adapts, and navigates constraints." Its essence lies in the dynamic interplay of a kaleidoscope of diversity and the continuous adjustment of equilibrium.

Final Conclusion

Intercalary month regulation and zodiac chronology exemplify the "balancing logic" of China's traditional calendrical system: intercalary months sustain the "astronomical-climatic-biological" natural balance through technical intervention; zodiac chronology achieves the "biological-cultural" symbolic balance via symbolic encoding; and the Sexagenary System unifies them into a holistic bal-

ance between "natural laws" and "humanistic practices." This logic reflects ancient insights into natural regulation and offers enduring guidance for contemporary ecological sustainability (e.g., agricultural resilience, biodiversity conservation) and cultural heritage (e.g., temporally informed ecological wisdom). True balance emerges from respecting natural laws while adapting to human needs.

Conflict of Interest

None.

Acknowledgments

During the preparation of this manuscript, I utilized Tencent Hunyuan's large language model "Yuanbao" to optimize the text, including grammar correction, sentence structure adjustment, and terminology standardization. The following is some advice from artificial intelligence. The Imperative of a Civilizational Paradigm Shift Contemporary modern civilization may be characterized as inherently myopic, for it has proven unable to resolve the very crises it engenders, and in certain respects threatens the conditions of its own survival. This concern is not without justification, given the accelerating risks of ecological collapse, nuclear proliferation, and intensifying social fragmentation.

Rather than advocating for a wholesale negation of modern civilization, it is more constructive to posit the necessity of a paradigmatic transition: from the limitations of "modernity" toward a form of civilization that is more prudent, balanced, and integrative of both human and ecological concerns. Such a civilizational reorientation would entail, at minimum, several foundational shifts: From anthropocentrism toward an ethos of the community of life; From the pursuit of unlimited economic expansion toward ecological equilibrium; From predatory competition toward cooperative and mutually beneficial relations; From materialist reductionism toward the cultivation of inner-outer harmony; From divisive antagonisms toward the recognition of a shared destiny for humankind. This is not an appeal to regress into primitivism, but rather a call for a comprehensive renewal-of values, institutional arrangements, technological pathways, and modes of life-that both preserves the achievements of modern civilization and transcends its structural deficits [1-7].

References

1. Chen Jiujin (1989) Foundations of Chinese Astronomical Calendars [M]. Beijing: Sci Press.
2. Aschoff J (1981) Circadian and circannual rhythms in animals [J]. Endeavour 5(1): 43-50.
3. Zhang Peiyu (2008) Ancient Chinese Calendars [M]. Beijing: China Sci Technol Press.
4. Pittendrigh CS (1960) Circadian rhythms and the circadian organization of living systems. Cold Spring Harb Symp Quant Biol 25: 159-184.
5. Liu Yaohan, Lu Yang (1984) History of Yi Astronomy [M]. Kunming: Yunnan Peoples Publishing House.
6. Wang Dayou (2005) Zodiac and Folk Culture [M]. Beijing: China Soc Sci Press.
7. Zhao Ji, Chen Chuan kang (1995) Physical Geography of China (Biogeography Section) [M]. Beijing: Higher Education Press.