

The Remainder in the Leaf

The Evolution of Plants and Trees Set Beside the Evolution of the Net

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1. The question and the rule

The question is one: how does the evolution of plants and trees correlate with the evolution of the net of the Vacuum.Net theory?

The rule is one: nothing is added to the theory. What the theory says about its own growth is taken from its texts. What is known about plants is taken from measurement. A correlation is a pair of the two with the same form. Where no pair exists, this essay says so.

Every statement below carries a mark. *Text*: stated in a Vacuum.Net text. *Measured*: read in a cited source. *Computed*: arithmetic shown. *Read*: a pairing made here. A read is a hypothesis.

2. How the net evolves, in its own words

The net is one strand. At each crossing it holds one of three states: +1, 0, -1. Three neighbours form a window. The window closes when the three states add to a multiple of three. Of 27 windows, nine close: three with one value, six with all three (text).

A ring closes completely only when every state equals the state three places back. Rings with all three values exist only at depths divisible by three. At depth 3 there are two such rings, running opposite ways. At depths 4 and 5 there are none. At depth 6 there are two again, and a ring of 6 cuts into 3 + 3 (text). The texts read depth 3 as self-maintenance without division and depth 6 as the form of a single cell (text).

The net grows by $b(n) = 3 \cdot b(n-1) + b(n-2)$: 1, 3, 10, 33, 109, 360. The limit ratio is $\sigma_3 = (3 + \sqrt{13})/2$ (text), 3.3028 (computed). The second term is the net's memory: a route of period two returns two levels up (text).

Then the two-layer law (text). " σ_3 is the law of the address." " ϕ is the law of tension." The derivation of ϕ is three sentences long. "Counterwinding on its own winding is unwinding: $\Psi^2 = 0$, the closure vanishes." "In time an existing closure therefore has two effective states — loading and not-loading — and it cannot load twice in succession without first discharging." "That is exactly the constraint that generates Fibonacci: $x^2 = x + 1$, order one." The summary: "Address is topology $\rightarrow \sigma_3$, growth in depth, ternary. Life is tension $\rightarrow \phi$, growth in time, binary. Two fields, two layers, one strand. They are never to be mixed in one formula."

$\Psi^2 = 0$ is the nilpotent condition. "The algebra of closure is the nilpotent condition $\Psi^2 = 0$ " (text). A separate text sets out where it comes from: Rowlands' system, in which the operator squares to zero and "the totality of everything is nothing" (text).

Evolution, in the texts: "A species is a subtree; an organism is a closure at a depth; life is tension that stays within the zone." "Evolution is not selection on frequency — frequency does not place — but the filling of depths until the next is forced." The range of depth n is $(3^n - 1)/2$: 1, 4, 13, 40, 121, 364. "A larger number forces the next depth" (text).

Last, where three meets two (text). The address ladder triples; the dimensional ladder doubles. They come close where $3^q \approx 2^p$. Those places are the convergents of $\log_2 3$: $2/1, 3/2, 8/5, 19/12, 65/41, 84/53, 485/306$. The denominators 1, 2, 5, 12, 41, 53, 306 are the closure depths. The quotient $3^q/2^p$ is the residue. At depth 12 it is 1.01364, the Pythagorean comma. The residues in cents: $-498, +204, -90, +23.5, -19.8, +3.6, -1.8$ (computed). The residue never reaches one. In another text: "no closure is ever exact: each depth leaves a remainder"; "a ladder driven by a rest cannot end" (text).

The texts say nothing about plants. No leaf, no chlorophyll, no tree except as a data structure and as a name beside layers 18 and 19 of the size ladder (text, absence checked).

3. How plants evolved, measured

The dates, oldest accepted evidence, with the position on the time ladder (computed from the age in seconds and $T_0 = 1.520655 \times 10^{16}$ s):

Step	Date	Position
Great Oxidation Event	2,501–2,434 Ma; 2.33 Ga in another section	68.57–68.50
Oldest thylakoids in a fossil cell	1.78–1.73 Ga	68.24
Oldest secure multicellular alga	1.047 Ga	67.78
Oldest multicellular green alga	~1.0 Ga	67.73
Oldest land-plant spores	473–471 Ma	67.05
Oldest Cooksonia	433–427 Ma	66.97
Rhynie chert: stomata, rooting axes	407.1 ± 2.2 Ma	66.92
Oldest wood	407–397 Ma	66.90
Oldest forest	393–388 Ma	66.88
Trees of 8 m	~385 Ma	66.86
Oldest seeds	Late Devonian, 383–359 Ma	66.85–66.80
Genome doubling, seed plants	~319 Ma	66.69
Genome doubling, angiosperms	~192 Ma	66.23
Oldest whole-plant angiosperms	≥ 124.6 Ma	65.84
Oldest accepted grasses	67–65 Ma	65.26
First C4 photosynthesis	32–25 Ma	64.5

The sizes: cellulose microfibril 4 nm at -2.21 ; thylakoid bilayer 4.0 nm; granum repeat 16.3 nm at -0.94 ; *Prochlorococcus* $0.5\text{--}0.7\ \mu\text{m}$ at $2.2\text{--}2.5$; tracheid $10\text{--}42\ \mu\text{m}$ at $4.9\text{--}6.2$; vessel length up to 27 cm at 14.19; *Wattieza* 8 m at 17.28; tallest measured tree 112.7 m at 19.69 (measured; positions

computed). Twenty-two positions. The human body, from the Bohr radius to the tallest man, also spans twenty-two, about four lower at both ends (computed).

The counts (measured). In the light reaction: four charges before oxygen is released; Mn_4CaO_5 ; 35 chlorophylls per photosystem II core, 96 per photosystem I; 14 subunits in the ATP-synthase ring; 8 to 12 quanta per O_2 . In the wall: six lobes of three synthases, 18 chains per microfibril; three monolignols in lignin; four classes of hemicellulose. In the body plan: the first vascular plants branch into two equal daughters; the life cycle has two phases; two fertilisations; two ancient genome doublings; four independent origins of flat leaves; 62 independent origins of C4; secondary growth in at least seven lineages; multicellularity twice in each of the three photosynthetic clades. In the leaf: parastichy counts are consecutive Fibonacci numbers in 73.6 per cent of 657 sunflowers; 8 and 13 in 6,000 pine cones; and the same Fibonacci order arises in a physical experiment in which each new element is placed where the earlier ones leave most room.

4. Where the two meet

4.1 Two counts

The theory keeps two layers apart: the address, ternary, growth in depth; and tension, binary and ϕ , growth in time (text).

The plant's growth in time is counted in twos and in ϕ (measured). The stem forks into two. The generations alternate between two. The genome grew by doubling, twice. The leaves follow Fibonacci.

The plant's standing form is counted, in two places, in threes (measured). The microfibril is spun by six triplets. Lignin is made of three alcohols.

The rest of the count list is neither. Four, five, fourteen, 35, 96, 62. A list of plant counts is mixed, and picking the twos and threes from it is selection after the fact. So the pairing rests on the four time-side facts, not on the list. Read: moderate on the time side, weak on the form side.

4.2 The remainder

This is the pairing that holds.

The net's closure depths are the convergents of $\log_2 3$. Each is the best rational approach to an irrational at its size; each leaves a residue; the residue never reaches one (text, computed). At depth 12 it is the comma.

The leaf is the same arithmetic (computed, read). The convergents of $1/\phi^2$ are $1/2, 1/3, 2/5, 3/8, 5/13, 8/21$: the classical leaf fractions. The convergents of $1/\phi$ are $1/1, 1/2, 2/3, 3/5, 5/8, 8/13$: the measured parastichy pairs, with $8/13$ the sixth. The angle that follows, $360/\phi^2 = 137.508^\circ$, is irrational in turns, so no leaf ever stands exactly above an earlier one. Douady and Couder reproduced this outside biology and named the reason: the system avoids rational, periodic arrangements and is driven toward the golden mean (measured).

The theory derives ϕ from $\Psi^2 = 0$: a closure cannot load twice in succession (text). The plant lays down each new leaf where the earlier ones leave room, never on top of the last (measured). These are two descriptions of one constraint: the next step cannot repeat the one before it. In the net this gives the Fibonacci rule for growth in time. In the plant it gives the Fibonacci leaf. The

identification is a read. It adds no rule, because both halves are in print, one in the theory and one in the measurement.

And the remainder is the same remainder. The net's ladder "cannot end" because each depth leaves a rest (text). The leaf's spiral cannot close because $1/\phi^2$ has no last convergent (computed). The comma at depth 12, 23.5 cents, and the gap between $8/13$ and $1/\phi$, 0.0026 (computed), are the same kind of number: what is left when three is measured against two, or one leaf against the next.

4.3 Filling until forced

The texts say evolution is "the filling of depths until the next is forced" and a species is a subtree (text). The record says the same forms arose many times, independently: C4 62 times, flat leaves four times, wood at least seven times, multicellularity twice per clade (measured).

Read: if a depth is reached when the one below is full, the same form appears in many subtrees at about the same time and has no single inventor. That is what the counts show.

But the standing account reads the same counts as convergent evolution under one pressure, and for C4 the dates follow the fall of CO_2 in the Oligocene (measured). The counts do not separate the two readings. The pairing stands; it does not yet discriminate.

4.4 Depth in the second sense: the positions are the plant

"Depth" has two senses in the texts. The ring depth is the length of a closed ring: 3, 6, 9. The Climate paper's depth is the layer: "Each depth n is one layer. Layer n has the length $3^n \cdot S_0$ " (text). In the second sense every plant size has a depth, and that is its position.

Step	Size	Position
Cellulose microfibril	4 nm	−2.21
Cyanobacterium (2.0 Ga)	0.5–0.7 μm	2.18–2.49
Oldest multicellular green alga, <i>Proterocladus</i> (1.0 Ga)	millimetre-sized	about 9.1
Tracheid (407 Ma)	10–42 μm	4.91–6.21
First trees, <i>Wattieza</i> (385 Ma)	≥ 8 m	17.28
Scale trees, <i>Lepidodendron</i> (Carboniferous)	c. 45 m	18.85
Tallest measured tree, <i>Sequoia</i> (now)	112.7 m	19.69
Height limit from water tension	122–130 m	19.76–19.82
Longest clone, <i>Posidonia</i> (now)	15 km	24.14

(measured; positions computed; sources in *Plants on the Ladder*, Part 2.)

Read in this sense, the evolution of plants is a sequence of depths: the highest occupied position rises in 2.4 billion years from 2.5 to 19.7 and stops there, under the water limit at 19.8; the clone goes on to 24.1. Each new maximum comes hundreds of millions of years after the one before. That is the form of the texts' "filling of depths until the next is forced", in the position sense. It is a reading, and it is descriptive: a sequence in which size is limited by water transport and support has the same form.

The tree. $3^{18} \cdot S_0 = 17.7$ m, $3^{19} \cdot S_0 = 53$ m, $3^{20} \cdot S_0 = 159$ m (computed). Trees fill from 17.3 (the first) to 19.8 (the limit); none has reached 20 in 385 million years. In time: the growth ring at 48.87; first seed of *Sequoia* at 5–15 years, 50.3–51.3; needles of *Pinus longaeva* 45 years, 52.3; *Sequoia* 2,200 rings, 55.9; *Pinus longaeva* 4,900 rings, 56.6; the oak clone of Jurupa over 13,000 years, 57.5; *Lomatia* at least 43,600, 58.6; *Posidonia* bounded at 80,000–200,000, 59.2–60.0 (measured; positions computed). The single tree reaches 56.6; the clone 60. A trunk is nearly all closed form that has stayed, dead wood, each ring the walls of one season's cells, with the living part a thin layer around it; the tree is then the organism in which N3, "the net keeps the orientation of what was first laid down", is visible as form: 4,900 rings, none overwritten. That is a reading of wood anatomy, marked as such.

5. Where the two do not meet

The depths 3 and 6. The texts read depth 3 as metabolism and depth 6 as the single cell. The first organism in the plant line, the cyanobacterium of two billion years ago, is already a dividing cell with heredity (measured). Placing it at depth 6 is a read; but then the whole plant line sits at or above depth 6, and the texts give no ring depth for the alga, the land plant or the tree. The sequence $3 \rightarrow 6 \rightarrow 3 + 3$ describes the step to the cell. It does not describe the steps from the cell to the tree. None in the ring-depth sense. In the other sense of depth, the layer of the Climate paper, every plant size has one: that is the position, and the plant line fills positions 2 to 20 (section 3).

The closure depths. Depth 12 is 24 mm and 81 ps; depth 41 is 92 minutes; depth 53 is 93 years. No verified plant quantity sits at any of them. Charge separation is 3 ps, the step to the quinone 200–250 ps, the stoma 45–60 minutes, the needle 45 years, the oak's first acorns 50 to 200 (measured). None.

The ladder. The plant line spans 22 positions in size and 49 in process time, from 1 ps to 4,900 years. The dates span four positions. These are coordinates. The book From Atom to Body tested the body's sizes for clustering at whole positions and found none; the plant list here is too short to test. No claim.

6. The tests, fixed first and then run

Three tests were fixed before any data was looked at, and then run by Claude Code on 12 October 2026 on the data named in advance. The attestation is the author's. The outcomes stand as they fell.

Test 1, the count list. Source chosen in advance: OpenStax Biology 2e, chapters 8, 30 and 32. Required by 4.1: counts divisible by three over-represented among standing form, twos and Fibonacci numbers among growth in time, each at one in a hundred. Found: 134 counts; 116 form, 11 time. Multiples of three: 28 per cent of form counts, 55 per cent of time counts. Twos and Fibonacci: 45 per cent of time counts, 61 per cent of form counts. Both p-values above 0.9. **Fail, in the opposite direction.** In that text the two is the commonest count of standing form (two guard cells, two cotyledons, two sperm cells, two photosystems) and the three the commonest count of process (three stages, three turns of the Calvin cycle). Correlation 1 does not survive its own test.

Test 2, the convergents. Required by 4.2: in the parastichy data of Swinton and of Fierz, the frequency of each Fibonacci pair falls with its order, and non-convergent pairs stay under the authors' noise rate or under 10 per cent. Found: Swinton's per-value counts sit in a data file that could not be retrieved, so the order test could not be run there; the non-convergent share over all 768 counts is 17.8 per cent, above the bar, though 5 per cent among heads the authors call unambiguous. Fierz: 0.40 per cent non-convergent in 6,000 pine cones and 3.85 per cent in 1,506

larch cones, under the bar; but each sample holds one Fibonacci pair, 8/13 or 5/8, so an order test over several pairs is impossible there. **Fail by the rule as written.** The rule was badly made: it asked single-species cone samples for a sequence they cannot hold. What the data do show is narrow: 97.3 per cent of the pine cones sit on one convergent of $1/\phi$, 8/13, and 99.6 per cent on a convergent-type pair. That is not a test of the pairing with the net; it is the measured half of it, confirmed.

Test 3, filling against pressure. Required: for the dated C4 origins, a Poisson fit of origins per 5 Myr against the accumulated C3 lineages beats a fit against CO₂ by two AIC units, or the reverse. Found: 53 origins with dates from Christin 2008 and 2011; 92 per cent within the last 20 Myr, median 8.9 Ma, oldest 28.5 Ma. The CO₂ fit beats the null by 50 AIC units, slope -0.72 per 100 ppm. The dated grass tree needed for the lineage curve could not be retrieved, so the filling predictor was not built. **Not run.** The CO₂ side is as strong as the standing account says; whether the filling side would match it is not known.

7. Status

- **From the texts.** The closure rule, the rings per depth, $b(n)$ and σ_3 , the two-layer law, $\Psi^2 = 0 \rightarrow \phi$, filling until forced, the closure depths and the comma, the remainder rule.
- **Measured.** The dates, sizes and counts of section 3, each with a primary source in the dossier behind this essay.
- **Computed.** σ_3 ; the residues in cents; the convergents of ϕ , $1/\phi$ and $1/\phi^2$; the golden angle; every ladder position; the three test statistics.
- **Read, and tested.** Correlation 1, two counts: failed its test, reverse direction. Correlation 2, the remainder: the arithmetic stands, the measured half stands at 97.3 per cent on one convergent, the test of the pairing itself was ill-posed and is to be remade. Correlation 3, filling: untested; the pressure side fits strongly.
- **None.** The depths above the cell; the closure depths; the ladder as more than coordinate.
- **Not claimed.** That the net causes any plant form. That the texts mention plants. That the remainder pairing has passed a test.

What remains after the tests is one thing. The theory derives ϕ for growth in time from $\Psi^2 = 0$. The leaf grows in time on ϕ , to 97.3 per cent on one pair in the measured cones. The two statements are of the same form. Whether they are the same statement is open, and the test that would close it has to be built again, on data with more than one Fibonacci pair per sample.

Annotated references

Konstapel, J. (2026). *Plants on the Ladder: A Reference Work on the Evolution of Plants and Trees, Set Beside the Evolution of the Net.* Constable Research, Leiden, first edition, 12 October 2026. *Why read?* The reference work behind this essay: fifteen groups, 222 sources, every size and time with its position, and the three tests in full. *Reading advice:* Part 3, Table G, and Part 4.

Konstapel, J. (2026). *The Balanced Three, the Balanced Tree and the Vacuum.Net Theory.* Constable Research, Leiden, 29 August 2026; PDF *Balanced Ternary and the Balanced Tree: One Balance and What Follows From It.* *Why read?* The source of everything this essay says about how the net grows: $b(n)$, σ_3 , the two-layer law, $\Psi^2 = 0 \rightarrow \phi$, and "the filling of depths until the next is forced." *Reading advice:* §2, §4, §5 and §11.

Konstapel, J. (2026). *The Climate on the Ladder of Three*. Constable Research, Leiden, 3 October 2026. Why read? The closure rule in full, the period-3 theorem, the range $(3^n - 1)/2$, and §3.2, where the ladder of three meets the ladder of two: the convergents of $\log_2 3$ and the comma.

Konstapel, J. (2026). *Life and Consciousness from One Rule*. Constable Research, Leiden, 29 September 2026. Why read? The rings per depth, 3, 6, 11, 24, 51, 130; the two living rings at depth 3; the gap at 4 and 5; the division at 6. The reason section 5 finds nothing above the cell.

Konstapel, J. (2026). *The Universe of Peter Rowlands: A Comprehensive Review of the Nilpotent Quantum Paradigm*. Constable Research, Leiden, 29 June 2026. And Rowlands, P. (2007). *Zero to Infinity: The Foundations of Physics*. World Scientific, Series on Knots and Everything 41. Why read? Where $\Psi^2 = 0$ comes from: an operator whose square is zero, and a totality that is nothing.

Konstapel, J. (2026). *From Atom to Body*. Constable Research, Leiden, first edition. Why read? The ladder, the natural units, the four marks, and the test that showed the ladder orders but does not select.

Douady, S., and Couder, Y. (1992). "Phyllotaxis as a physical self-organized growth process." *Physical Review Letters* 68, 2098–2101. Why read? Fibonacci order made in a dish of ferrofluid: each new drop placed where the earlier ones leave room, and the golden mean as the escape from every rational arrangement. The measured half of section 4.2.

Swinton, J., Ochu, E., and the MSI Turing's Sunflower Consortium (2016). "Novel Fibonacci and non-Fibonacci structure in the sunflower." *Royal Society Open Science* 3, 160091. Why read? 657 sunflowers; 565 of 768 parastichy counts Fibonacci. The number behind "73.6 per cent", and the non-Fibonacci minority that Test 2 needs.

Fierz, V. (2015). "Aberrant phyllotactic patterns in cones of some conifers: a quantitative study." *Acta Societatis Botanicorum Poloniae* 84, 261–265. Why read? 6,000 cones from one pine, 8/13 dominant, and the aberrant patterns ranked by their distance from 0.618.

Nixon, B. T., et al. (2016). "Comparative structural and computational analysis supports eighteen cellulose synthases in the plant cellulose synthesis complex." *Scientific Reports* 6, 28696. And Hill, J. L., Hammudi, M. B., and Tien, M. (2014). *Plant Cell* 26, 4834–4842. Why read? Six lobes of three: the one count of three in the plant's form that is measured to the molecule.

Vanholme, R., Demedts, B., Morreel, K., Ralph, J., and Boerjan, W. (2010). "Lignin biosynthesis and structure." *Plant Physiology* 153, 895–905. Why read? The three monolignols, named.

Edwards, D., Davies, K. L., and Axe, L. (1992). "A vascular conducting strand in the early land plant *Cooksonia*." *Nature* 357, 683–685. Why read? The first vascular plant: isotomously branching axes, two equal daughters, and the first tracheids.

Jiao, Y., et al. (2011). "Ancestral polyploidy in seed plants and angiosperms." *Nature* 473, 97–100. Why read? The two doublings of the plant genome, at about 319 and 192 million years.

Niklas, K. J., and Kutschera, U. (2010). "The evolution of the land plant life cycle." *New Phytologist* 185, 27–41. Why read? The two generations, and the ancestor that had only one.

Sage, R. F., Christin, P.-A., and Edwards, E. J. (2011). "The C4 plant lineages of planet Earth." *Journal of Experimental Botany* 62, 3155–3169. And Christin, P.-A., et al. (2008).

"Oligocene CO₂ decline promoted C₄ photosynthesis in grasses." *Current Biology* 18, 37–43. *Why read?* Sixty-two independent origins, and the dating that ties the first to the fall of CO₂. The data for Test 3.

Boyce, C. K., and Knoll, A. H. (2002). "Evolution of developmental potential and the multiple independent origins of leaves in Paleozoic vascular plants." *Paleobiology* 28, 70–100. *Why read?* Four origins of the flat leaf, from 641 fossil species.

Demoulin, C. F., Lara, Y. J., Lambion, A., and Javaux, E. J. (2024). "Oldest thylakoids in fossil cells directly evidence oxygenic photosynthesis." *Nature* 625, 529–534. *Why read?* The oldest photosynthetic machinery seen directly, 1.75 billion years old, and the oldest accepted cyanobacterial body fossil at 2.0.

Rubinstein, C. V., Gerrienne, P., de la Puente, G. S., Astini, R. A., and Steemans, P. (2010). "Early Middle Ordovician evidence for land plants in Argentina." *New Phytologist* 188, 365–369. *Why read?* The oldest land-plant spores, 473–471 million years.

Stein, W. E., Mannolini, F., VanAller Hernick, L., Landing, E., and Berry, C. M. (2007). "Giant cladoxylopsid trees resolve the enigma of the Earth's earliest forest stumps at Gilboa." *Nature* 446, 904–907. *Why read?* The first trees of eight metres, 385 million years ago: 88 million years after the first spores.

Morris, J. L., et al. (2018). "The timescale of early land plant evolution." *PNAS* 115, E2274–E2283. *Why read?* The molecular-clock brackets for green plants, land plants and vascular plants, printed beside the fossil dates so that the two can be compared.