

Medusozoa: inputs, internal responses and repair

Integrated research synthesis · 18 September 2026

Scope: The supplied water–cell evidence map, the preceding foundation packet, six follow-up questions, and the combined question below. **Depth:** Standard, bounded literature synthesis. **Sources cited:** 30 primary-research and associated-data records.

Can a brief, naturally realistic mechanical or electrical input produce a measurable internal change after the input stops—and does that change affect wound closure, tissue reorganization, or genuine regrowth?

Main finding

Brief injury can initiate an internal repair program and genuine regrowth. For a separate natural cue, the complete post-input sequence remains unestablished. Mechanics can influence organizer signaling; electrical stimulation can redirect tissue organization; and wound-associated genes contribute to rebuilding organs. These are substantive results in particular organisms—not one demonstration connecting a separate natural cue to a lasting internal state and altered repair. [\[1\]](#) [\[2\]](#) [\[3\]](#)

The most useful new addition is a 2026 *Aurelia coerulea* study of sensory-organ regeneration. It measures an early wound-associated cell population, identifies genes needed for normal blastema formation, and follows structural and swimming recovery. This is a direct post-injury connection, distinct from testing a separate cue. [\[3\]](#)

Question	Best available answer
1. Another mechanical input, with persistence?	Partial. Stretch–Wnt3 coupling is established; an alternative brief input with post-input regenerative effects is unresolved.
2. Electrical conditions and withdrawal?	Direct during exposure; partial after removal. Prolonged AC can reversibly redirect Hydra morphogenesis; removal permits regrowth.
3. Why does water current permit arm regrowth?	Mechanism unresolved. The permissive effect is reported, but its physical and physiological causes were not separated.
4. Sealing versus replacing a structure?	Direct distinctions. Closure, remodeling and functional organ replacement have experimentally different requirements.
5. Persistent internal state affecting repair?	Direct post-injury connection; otherwise partial. Molecular requirements for regrowth are identified; learned state controlling repair is unestablished.
6. Natural sound, heartbeat or bioelectric exposure?	Partial. Some mechanical effects are measured; realistic heartbeat-to-jellyfish dose, distance and response are unresolved.

The sections below give the evidence and limits behind each determination. **Unresolved does not mean refuted:** it identifies the particular comparison that the located studies do not make.

What the supplied map adds

The supplied seven-page map improves the investigation in three important ways: it restores the cellular interior to the discussion, distinguishes repair endpoints, and supplies preliminary Staurozoa evidence where our earlier search had a gap. Its original file and the foundation packet remain unchanged; this document is a consolidated follow-up.

The cellular interior is experimentally relevant. In mammalian cultured cells, osmotic volume changes alter cytoplasmic mechanics, and short-time mechanical relaxation is consistent with water redistributing through a crowded porous interior. This is direct component evidence for intracellular water and mechanics, although it is not a jellyfish regeneration experiment. [4]

The map also adds calcium- and ATP-dependent plasma-membrane resealing in mammalian cells. Here ATP depletion impairs repair; this is not the same experiment as extracellular ATP signaling in a jellyfish. [5] In *Clytia hemisphaerica*, extracellular ATP affects epithelial closure and actin organization; that study does not directly image an intracellular calcium response or measure intracellular hydration. [6]

There is now a specific Staurozoa comparison. The April 2026 *Haliclystus sanjuanensis* preprint reports sealing in both tested tentacle types but tip regrowth only in the secondary-tentacle condition within the observation window. This narrows the earlier gap without establishing a class-wide rule or a water-related mechanism. [7]

Keep the measured compartments separate

Measurement	What it addresses	What it does not measure
Medium osmolarity and Hydra cavity inflation	External conditions, lumen dynamics and tissue stretch [1]	Intracellular water organization or single-cell volume
Cytoplasmic poroelastic relaxation	Short-time intracellular mechanics in mammalian cells [4]	A lasting regenerative state
Calcium-sensitive fluorescence	Activity of an intracellular calcium probe [2]	Hydration, mesogleal calcium or an uncalibrated absolute calcium concentration
Mesogleal rheology	Extracellular matrix mechanics [8]	Cytoplasmic transport or a repair outcome
Cell markers and organ anatomy	Cell programs, tissue organization and replacement [3]	A hydration cause unless water is also measured

The resulting working model is more specific: external conditions, intracellular activity and tissue structure can interact. The remaining task is to identify which internal variable changes, how long it remains changed, and whether that change matters for the chosen repair endpoint.

1 · Can a different mechanical input work—and persist?

Answer: the stretch-linked response is real; substitution by a brief alternative input, followed by persistent regenerative effects, remains unresolved.

In freshwater *Hydra vulgaris* polyp-derived tissue spheroids, Ferenc and colleagues suppressed osmotic inflation using isotonic medium. Spheroids remained viable but failed to establish normal Wnt3 organizer activity and head/tentacle regeneration. Constitutive Wnt3 expression, or tissue already containing an organizer, permitted regeneration without the usual oscillations. This is evidence that organizer state can bypass a requirement for the normal mechanical input. [\[1\]](#)

Crucially, transfer back to normal Hydra medium restarts continuing water influx and stretch. The Wnt3 measurements at three and six hours after transfer therefore occur during renewed stimulation, before the first collapse—not after a finite stretch pulse has ended. The results support sustained or integrated stretching rather than simply counting rupture events; they do not demonstrate post-input memory. [\[1\]](#)

What later mechanical studies contribute

Microaspiration provides a genuinely different way to deform regenerating Hydra tissue. Perros and colleagues measured reversible deformation at lower stresses, with viscoelastic flow or rupture at higher stresses. However, the experiment measured tissue mechanics, not subsequent Wnt3 activation, organizer formation or head regrowth. It establishes a useful manipulation, not the requested regenerative substitution. [\[9\]](#)

A 2025 study observed recurring local strain events at future Hydra head sites: typical events lasted about seven minutes and occurred roughly once per hour. These are repeated endogenous events during regeneration. Their relationship to tissue organization is informative, but event-by-event strain-induced morphogen production was partly a model hypothesis, not a measured response to a single applied pulse. [\[10\]](#)

In marine *Aurelia coerulea* medusae, a separate 2025 study altered contraction rates and observed different stable shapes. It strengthens the evidence that active muscle forces and tissue mechanics influence form, but does not establish a completed external cue followed by a persistent intracellular change and altered repair. [\[11\]](#)

Where intracellular water fits

The mammalian poroelasticity study measured rapid force relaxation—most of the measured relaxation occurred within about half a second under its indentation conditions—and showed that osmotic volume changes altered the response. That gives a plausible physical component to investigate, not a transferable duration for jellyfish “memory.” [\[4\]](#)

The missing comparison is specific: a finite alternative mechanical input, confirmed cessation, a post-input internal measurement, and a later repair endpoint in the same organism. Neither an expanding lumen nor a cell-area change alone supplies the intracellular-water measurement.

2 · Which electrical conditions matter, and what happens afterward?

Answer: electrical conditions can directly change activity and morphogenesis. The strongest withdrawal result is renewed Hydra regrowth after prolonged electrical reversal—not a demonstrated benefit from a brief naturalistic pulse.

Braun and Ori studied freshwater *Hydra vulgaris* epithelial spheroids after the cut tissue had folded closed. In their apparatus, approximately 20–30 V peak-to-peak at 1 kHz could stop regeneration or gradually reverse a regenerated polyp toward a spheroid. The threshold varied between samples. Epithelial calcium-probe activity increased while Wnt3 organizer-reporter activity declined during reversal. [\[2\]](#)

At the same 26.5 V peak-to-peak, switching from 1 to 3 kHz reduced calcium activity and allowed morphogenesis. Lower voltage could increase calcium fluorescence without preventing tentacle emergence. Thus response depends on stimulus conditions and tissue state, rather than “electricity” having one uniform effect. [\[2\]](#)

Increasing extracellular potassium from 0.1 to 1 mM also increased calcium-probe activity and folded the tissues, but these tissues appeared to lose regenerative capacity, unlike the reversibly field-treated ones. Elevated calcium activity alone is therefore not an adequate marker of a beneficial or recoverable state. [\[2\]](#)

When voltage was set to zero, calcium activity decreased, Wnt3 signal reappeared during renewed patterning, and tentacled animals regenerated. This is a genuine post-removal outcome. But the altered morphology had developed over prolonged exposure, and the study does not isolate a lasting intracellular signal induced by a short pulse as the cause of subsequent repair. It also does not test initial wound sealing, which preceded field exposure. [\[2\]](#)

What medusa pacing demonstrates

Study and context	Reported stimulation	Actual endpoint
<i>Aurelia aurita</i> marine medusae, 2020	Implanted electrodes; 3.7-V, 10-ms pulses repeated at 0.25–1 Hz	Contraction, swimming and metabolic/transport measurements during stimulation [12]
<i>Aurelia coerulea</i> marine medusae, 2025	3.3-V, 50-Hz carrier in 0.1-s bursts, repeated over 30 s	Body deformation, velocity and computational prediction—not post-off repair [13]

These are **reported experimental settings, not proposed protocols**. Electrode voltage is not a measured ambient electric-field strength at a naturally exposed animal. Electrode geometry, conductive medium and contact with tissue matter; freshwater Hydra and seawater medusae cannot share an exposure scale merely because both settings are expressed in volts.

The Hydra study's frequency dependence, medium flow and depolarization comparison support an excitability interpretation, but do not completely separate temperature, electrode chemistry and nonspecific stress. The remaining question is whether a brief exposure produces a verified post-off internal change that predicts or causes altered repair, with those alternatives controlled.

3 · Why did water current permit Aurelia arm regrowth?

Answer: the permissive effect was measured; the reason it worked was not isolated. “Current” here means moving water, not electric current.

Abrams and colleagues removed three arms from marine *Aurelia coerulea* ephyrae and screened conditions for appendage regeneration. A bubbler-cone arrangement maintained water motion during the one-to-two-week recovery period. The source-data workbook documents current and aquarium-configuration screening; this was continuing environmental exposure, not a brief input followed by withdrawal. [\[14\]](#) [\[15\]](#)

The resulting outgrowth was more than wound sealing. Regenerated arms contained radial canal, muscle and neurons, sometimes a rhopalium, and could pulse synchronously with retained arms. Regeneration frequency and completeness varied, including variation between clutches. A positive arm-regeneration score should not be read as complete restoration in every animal. [\[14\]](#)

What the competing explanations can currently claim

Contraction and mechanical loading remain candidates. Animals in moving water swam more, whereas animals in stagnant conditions tended to rest on the bottom and pulse in place. Water movement, locomotion, loading and posture were therefore not separated. Earlier contraction-blockade experiments establish a mechanical role in symmetrization, but that different endpoint does not identify the cause of later arm replacement. [\[14\]](#) [\[16\]](#)

A simple “more oxygen enables regeneration” account is insufficient. Reduced oxygen also increased regeneration in the permissive setup. That weighs against oxygen supply alone explaining the current effect. However, the study did not use a current-by-oxygen comparison that could resolve oxygen's interaction with water movement. [\[14\]](#)

Nutrition and transport remain plausible contributors. Food, insulin and leucine promoted regeneration under the reported conditions. Those interventions do not isolate water current from prey encounter, feeding access, nutrient delivery or canal transport. Calling the successful condition a particular physiological state is an interpretation unless that state is independently measured. [\[14\]](#)

The best research conclusion is therefore not a choice among these mechanisms. It is that moving water supplied a permissive condition in this setup while the relevant combination of mechanics, metabolism and transport remains unresolved. Existing screen data can describe tested associations and variability; they cannot retrospectively supply controls or cellular measurements that were never collected.

4 · What distinguishes sealing from replacing a missing structure?

Answer: retaining viable tissue and closing a wound are not sufficient for organ replacement. In the clearest experiments, different endpoints depend differently on proliferation, tissue organization and available cell populations.

Hydrozoa: direct endpoint separation

In marine *Clytia hemisphaerica* medusae, wounds closed by about 12 hours and surviving tissues reorganized into a smaller umbrella. Remodeling did not necessarily reconstruct the original canals or fourfold topology. Hydroxyurea treatment impaired manubrium outgrowth without preventing initial closure, umbrella remodeling or repositioning. This is a pharmacological separation of repair processes, not evidence that every drug effect is exclusively proliferation-specific. [\[17\]](#)

Untreated animals regenerated a smaller feeding-functional manubrium by day four in 43 of 44 cases. The contrast is particularly useful: restoration of a tissue boundary, recovery of body geometry and replacement of a feeding organ are separately observable outcomes within one species. [\[17\]](#)

In marine *Cladonema pacificum* medusae, bulb-retaining tentacle wounds sealed by 24 hours, then rebuilt epithelial, muscular, neural and nematocyte-containing structures. Prey capture recovered in 55% at 48 hours and 100% at 72 hours in the reported assay, with 36 animals per time point. Repair-specific proliferative cells and resident bulb populations made different contributions; the exact origin of the repair-specific cells remains unresolved. Isolated tentacles could seal yet fail to replace proximal organs and subsequently degenerate. [\[18\]](#)

Staurozoa: a preliminary, bounded contrast

The unreviewed *Haliclystus sanjuanensis* preprint compares stage-II primary tentacles with mature secondary tentacles. Both sealed by 48 hours. Secondary tips reformed by 168 hours, including mature cnidocytes, but remained shorter than uncut controls. Primary tips did not reform during that window. The primary assay used three animals; the secondary assays used five or four animals for different labeling times, with within-animal controls. [\[7\]](#)

Proliferation accompanies secondary-tip regrowth, but no selective blockade/rescue establishes it as the sole cause of the difference. Tentacle identity and developmental context also differ. This supports a specific closure-versus-regrowth distinction, not permanent or class-wide incapacity. [\[7\]](#)

Cubozoa: structural and neural function

The accessible primary abstract for *Tripedalia cystophora* reports rhopalial regrowth, most or all neural elements within two weeks, renewed pacemaker signals and normal lens-eye light responses. These are stronger endpoints than closure alone, while leaving the initiating mechanism and any role of prior learning unanswered. [\[19\]](#)

5 · Can a lasting internal change influence repair?

Answer: there is direct evidence for a post-injury cellular program with tested gene requirements. Whether a retained learned state or a separate brief cue changes later jellyfish repair remains unresolved.

New evidence: *Aurelia* neural-organ regeneration

A May 2026 study followed rhopalium repair in marine *Aurelia coerulea* medusae using single-cell analysis, spatial expression, gene perturbations, anatomy and swimming measurements. It identified wound-induced cells, or WICs, associated with early regeneration. Two timings must be distinguished: **WIC marker expression peaked during wound healing at 0–1 days; WIC population abundance peaked during blastema formation and declined afterward.** A blastema is the cell-rich outgrowth that precedes replacement of the missing structure. [3]

Knockdown of *Soxf2* or *Otx5b* eliminated blastema formation in the reported groups: 0 of 16 individuals for each, compared with 15 of 16 controls. *Wntless* knockdown reduced the outcome to 4 of 16. These experiments support necessary gene functions and a Wnt-related contribution; they do **not** prove that the entire WIC population is necessary, because those cells were not selectively ablated. The proposed cell trajectories also include computational inference rather than direct lineage tracing alone. [3]

Regenerating organs regained statocysts and ocelli, continued growing through day 14, and supported recovery of swimming. This supports structural replacement and motor recovery—not a direct recovery assay for every sensory function. The important advance is a measurable post-injury cell program with experimentally perturbed molecular requirements. The initiating input remains amputation, which both creates the wound and starts its response. [3]

What learning contributes—and what remains separate

The 2023 *Tripedalia cystophora* study demonstrated associative changes in obstacle avoidance and isolated-rhopalium activity. Intact animals improved within a 7.5-minute trial while reinforcement continued. Isolated rhopalia received five one-minute training sequences followed by a post-test, with paired and unpaired controls. The altered post-training response is real, but the paper does not define a stimulus-free retention delay showing persistence for hours or days. [20]

The separate *Tripedalia* regeneration study does not connect that learning result to repair in its accessible abstract. Combining the two papers would establish that the species can learn and can regenerate a sensory organ—not that retained learning guides its regeneration. [19]

Likewise, extracellular ATP affects early *Clytia* wound closure, but it was not administered as a verified pulse-and-washout test. The result concerns signaling during repair, not demonstrated persistence after the signal has gone. [6]

The next distinction is therefore between **a program that develops after injury, a signal that remains physically present**, and **a state retained after a separate input ends**. These need different measurements.

Recent evidence · additional comparisons

Hydra: changing cellular organization

A June 2026 study in the freshwater polyp *Hydra magnipapillata* adds a more detailed account of regeneration at the cell-state level. Single-cell and spatial measurements show the sequential reappearance of positional cell identities; the authors describe the Wnt organizer as changing over time rather than immediately becoming a fixed terminal structure. This strengthens the case for tracking cellular states over time, alongside the visible recovery of shape. It does not measure intracellular water or test a completed external mechanical/electrical cue. [\[21\]](#)

Another 2026 Hydra study examines calcium excitation, polarity and changing tissue shape through microscopy and a one-dimensional model. Its abstract and figure captions provide complementary mechanochemical context; they do not establish the proposed input-cessation sequence. The full article was not reviewed for this synthesis. [\[22\]](#)

A finite electrical-treatment comparison outside Medusozoa

A May 2026 PNAS study in the colonial tunicate *Botryllus schlosseri* is relevant, but it needs the correct endpoint label. **This is a chordate, not a jellyfish.** Its routine electrical regimen consisted of three five-minute sessions at 15–20-minute intervals; some preliminary cohorts received six sessions separated by 48 hours. The authors report later changes in normal asexual budding, zooid production, size, fertility and survival. [\[23\]](#)

This is real colony renewal, not an assay of repairing an induced wound or replacing an amputated structure. The 35-day budding comparison used seven colonies per group. Bulk RNA samples labeled two and 24 hours post-treatment showed expression differences, but the main text does not unambiguously connect those samples to a particular session schedule or define timing relative to its first or final session. The RNA results therefore support reported post-treatment molecular differences without specifying one precisely tracked retained cell state. [\[23\]](#)

The paper does not establish that those expression changes mediate the later budding or survival effects: it lacks a corresponding pathway-perturbation or mediation test. Handled controls were described, but treated and control groups occupied separate tanks, and no electrode-connected zero-current sham was reported. Naturalistic field strength was not established. [\[23\]](#)

Why retain this comparison? It supplies a closer published example of finite electrical treatment followed by later molecular and organismal differences. Its limitations identify what a stronger post-input study would need to resolve. It must not be relabeled as a jellyfish result, a wound-repair result, or evidence for heartbeat-strength exposure.

6 · Can natural sound, heartbeats or electric signals reach jellyfish?

Answer: source-to-receiver exposure remains the limiting comparison. No defensible heartbeat-detection distance can be supplied from the located studies.

Mechanical and acoustic evidence

A controlled 2016 study exposed marine adult *Cotylorhiza tuberculata* and *Rhizostoma pulmo* medusae to a 50–400 Hz sweep for two hours. Reported received pressure was 157 ± 5 dB re 1 μ Pa, with peaks up to 175 dB. Statocyst sensory-cell lesions were present 48 and 96 hours afterward and became more severe. This is a measurable post-exposure tissue effect. [\[24\]](#)

But it is **persistent injury after prolonged high-level playback**, not a brief naturally realistic cue or improved repair. Particle velocity and acceleration were not measured at the animal, so the experiment does not resolve vibration/particle-motion versus sound-pressure coupling or provide a noninjurious sensory threshold. [\[24\]](#)

Electrophysiology in the marine hydrozoan *Aglantha digitale* establishes internal circuitry associated with swimming and escape. The accessible primary record does not establish a calibrated remote vibration threshold or detection distance. Its proposed extracellular field effect concerns local neural coupling, not reception of another animal's distant electric field. [\[25\]](#)

Heartbeat-associated and bioelectric signals

Marine-organism source measurements show that bioelectric potentials can be recorded near mouths, gills and other tissues. In Bedore and Kajiura's study, the probe was initially less than 1 mm from the source; distance measurements out to 15 cm were possible for teleost-mouth signals. The prominent temporal signals were associated mainly with ventilation or movement, not an isolated heartbeat. No jellyfish receiver was tested. [\[26\]](#)

An underwater human ECG study used skin-attached isolated recording electrodes and a common electrode in seawater. That demonstrates an electrical measurement circuit under immersion, not the amplitude of a freely propagating cardiac field at a jellyfish. [\[27\]](#)

For a realistic comparison, the missing quantities are the actual pressure and particle motion, or electric gradient, **at the receiver**, together with source geometry, distance, exposure duration and a species-specific response. Heartbeat-associated mechanical motion and cardiac electric activity must be tested separately rather than treated as interchangeable signals.

Accordingly, natural mechanical sensitivity remains a legitimate research direction; the present literature does not yet calibrate the proposed heartbeat pathway or connect it to post-input repair. This is a missing measurement, not a measured absence.

The combined question: what is established?

Best available answer: distinguish the injury itself from a separate environmental cue. If the input is tissue injury, Aurelia provides direct evidence of later cellular responses and regrowth with tested molecular requirements. For an additional natural cue—such as sound, heartbeat-associated motion or a weak electric field—the complete cue-to-retained-state-to-repair sequence is not established in the located studies. [3]

Three independent research contexts support the broad proposition that tissue behavior depends on physical conditions and cellular programs: stretch-linked Hydra organizer formation, electrically altered Hydra morphogenesis, and proliferation-dependent Clytia organ outgrowth. They do not constitute three replications of a natural-cue memory mechanism. [1] [2] [17]

Required connection	Closest evidence	What remains missing
A brief, naturally realistic input reaches the animal	Controlled pacing or acoustic exposure [12] [24]	Naturalistic receiver dose and a completed brief exposure
An internal change remains after cessation	Immediate post-training rhopalial response [20]	Defined duration and an identified retained internal variable
That change causally affects repair	Gene perturbations during wound-associated Aurelia regeneration [3]	A separate cue-induced post-input state linked causally to repair
The endpoint is specified	Closure, remodeling and feeding-organ replacement separated in Clytia [17]	All links measured in the same causal comparison

“Persistence” needs an identified variable

Passive mechanical relaxation, ongoing muscle activity, altered neural responsiveness, gene expression, a growing repair-cell population and a lasting lesion are different forms of change. Their different durations do not by themselves establish the same mechanism.

The external input must end; the organism does not need to become inactive. An actively maintained biochemical or neural process could be a valid aftereffect if it remains different from controls after the external cue stops.

Published neuromechanical-resonance work combines measured activation-wave behavior with fluid–structure modeling; some lasting turning effects are computational results. [28] Likewise, an Aurelia neural model makes predictions about coordinated activation, and the 2025 embodied-computing study analyzes stimulated body dynamics. These are useful mechanical and computational contributions, not measured post-input cellular memory controlling repair. [29] [13]

What this contributes to the working research model

The supported connection is not merely that jellyfish contain much water. It is that **water-related mechanics, cellular signaling, tissue organization and regenerative competence can be studied as interacting variables.** The intracellular contribution remains in scope rather than being replaced by mesogleal mechanics alone.

Outcome definitions, scope and limitations

Outcomes used in this synthesis

Membrane repair restores a damaged individual cell's barrier; the mammalian resealing study uses permeability and calcium-related readouts. [\[5\]](#) **Tissue closure** covers an opening. **Remodeling or symmetrization** rearranges surviving tissue and can restore geometry without replacing missing parts. [\[17\]](#) [\[16\]](#)

Organ regeneration replaces a missing structure; anatomy plus function is stronger evidence than size alone, as illustrated by *Cladonema* prey capture and *Tripedalia* pacemaking/light responses. [\[18\]](#) [\[19\]](#) **Life-cycle reversal** is different again: the historical *Turritopsis nutricula* paper reports medusa-to-hyroid reversal involving particular differentiated tissues. Its species name is retained as published; the accessible abstract does not establish a water mechanism or indefinite survival of each animal. [\[30\]](#)

What existing data could still clarify

The Aurelia current-screen workbook can support an audit of tested conditions, reported frequencies and variability; it cannot identify an unmeasured intracellular mechanism. [\[15\]](#) The 2026 neural-regeneration paper identifies public sequencing data under BioProject PRJNA1224934 and a processed-data/code deposit. These could support closer analysis of wound-marker timing and cell-population dynamics, but not a pulse-withdrawal or hydration comparison absent from the experiment. No such reanalysis was performed for this document. [\[3\]](#)

Research method and access limits

The supplied map was read across all seven pages, including its tables and linked sources, and integrated with five focused literature searches covering the six questions. Primary text or associated data was saved for the cited claims. Search results and computational predictions were not treated as experimental confirmation. This is a selective synthesis, not a systematic review or meta-analysis.

The core results remain study-specific. Older mechanistic papers are retained as historical primary evidence, not presented as recent replications. A final 2026 freshness check added the Hydra cell-state studies and the explicitly non-Medusozoan electrical-treatment comparison. Source tiers indicate academic provenance, not independent replication or certainty.

The Haliclystus source is bioRxiv version 1, posted 1 April 2026; its checked record is unreviewed, and the search did not establish a later journal version. Stamatis 2018, Piraino 1996 and the Aglantha circuit record are abstract-only in this pass; the Agam 2026 record adds accessible figure captions. Unseen full-text details are not inferred.

The combined-input hypothesis has not received a direct test in the located studies. Missing literature is therefore neither a refutation nor an instrument-limited experimental result. "Supported" here refers to a specifically scoped published finding; no new replication or biological experiment was performed.

This document preserves the original foundation packet, uploaded map and recovered LTOE corpus. The map's earlier authored water, transport, recall and physical-stimulation passages remain research framing; the external studies do not retroactively become earlier predictions. No app changes, treatment recommendations, laboratory activity or new numbered paper are part of this work.

Sources

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8. [Micro- and Macrorheology of Jellyfish Extracellular Matrix](#) — 2012-01-04; Tier 1 academic source; peer-reviewed; open full text.
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12. [Low-power microelectronics embedded in live jellyfish enhance propulsion](#) — 2020-01-29; Tier 1 academic source; peer-reviewed; later locomotion follow-ups exist, repair consequence not tested; open full text.
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14. [A conserved strategy for inducing appendage regeneration in moon jellyfish, Drosophila, and mice](#) — 2021-12-07; Tier 1 academic source; peer reviewed; open full text.
15. [Figure 2 source data: Aurelia factor screen](#) — 2021-12-07; Tier 1 academic source; published with peer-reviewed article; open spreadsheet.
16. [Self-repairing symmetry in jellyfish through mechanically driven reorganization](#) — 2015-06-15; Tier 1 academic source; peer-reviewed; open full text.
17. [Pattern regulation in a regenerating jellyfish](#) — 2020-09-07; Tier 1 academic source; peer reviewed; open

full text and source data.

18. [Distinct stem-like cell populations facilitate functional regeneration of the Cladonema medusa tentacle](#) — 2023-12-21; Tier 1 academic source; peer reviewed; open full text and data.
19. [Regeneration of the Rhopalium and the Rhopalial Nervous System in the Box Jellyfish Tripedalia cystophora](#) — 2018-02-01; Tier 1 academic source; peer-reviewed; abstract via EPA HERO bibliographic record; publisher full text inaccessible.
20. [Associative learning in the box jellyfish Tripedalia cystophora](#) — 2023-09-22; Tier 1 academic source; peer-reviewed; full text.
21. [Dynamic cell fate transitions during morphallactic regeneration](#) — 2026-06-02; Tier 1 academic source; peer-reviewed; open full text.
22. [The dual nature of body-axis formation in Hydra regeneration: Polarity-morphology concurrency](#) — 2026; Tier 1 academic source; published journal research; experiment/model distinction retained; primary abstract and figure captions; full article not reviewed.
23. [Electrical stimulation promotes longevity and regeneration in a colonial chordate](#) — 2026-05-26; Tier 1 academic source; peer-reviewed; single-study comparison; open full text.
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