In Context

Number 38 Fall 2017

The Newsletter of **The Nature Institute**

#38

Dear Friends,

If you read through the News section of this issue (as in other recent issues), you may be impressed by the wide-ranging extent to which we have managed to get The Nature Institute's work "out there." Sometimes we find ourselves impressed, too! The past several months have seen Craig and Henrike traveling the length of the Australian continent in order to lead workshops, give keynote talks, and teach courses. They then revisited Brazil to conclude a two-year intensive program in phenomenological science for a diverse collection of professionals, ranging from a medical doctor to a lawyer to an agronomist. (For all our staff engagements, you can browse through the calendar listings on our website.) Bruno has likewise continued his agricultural consultations, workshops, and conference presentations, which have taken him as far as Chile, where he consulted with biodynamic vineyards and a conventional livestock farm. If he has reduced his travel schedule a little of late, it is due to the happy occasion of his son's birth.

Not that we have to travel to distant regions in order to get our word out. You can read on page 6 about our first experiment with a fellowship program, which brought students from three continents outside North America for extended training and practice at the Institute. And, on the back cover, you will find the first, brief announcement of a new, two-year course in the foundations of phenomenological science that will include two summer intensives at our site.

Our publications are a reaching out of a rather different sort. In the feature article of this issue Steve addresses both the advocates of intelligent design theory and their more conventionally minded opponents. He suggests that the seemingly irreconcilable conflict between the two camps stems from their common assumptions. Overcoming what is faulty in these assumptions could not only heal a rather ugly cultural wound, but also lead all of biology in a healthy direction. The fundamental points of view offered by The Nature Institute—and particularly our focus on what we can learn from living activity as we observe it in the present, as opposed to hypothetical processes at work in the past—turn out to be exactly what is needed in order to move beyond the unfortunate "evolution wars" of recent years.

Moreover, we have taken a new and substantive step to promote such a phenomena-based approach. On page 10 you can read about our release of a special teaching kit put together by Craig for use in courses on human evolution. We think this kit can play a significant role in bringing the teaching of evolution into closer correspondence with the available evidences, which are never as neat as the textbook theories might suggest. And, simultaneously with the release of this kit, we are publishing Craig's new Nature Institute Perspectives booklet, *Do Frogs Come from Tadpoles? Rethinking Origins in Development and Evolution*.

You will also find on page 10 mention of various articles our staff members have published in other journals.

There are, as you can see, many possible avenues for bringing our work to bear where it can do the most good, all of which have required your generous support (for which we are grateful!). Yet we hardly think we have exhausted the possibilities. That brings us to a request: if you, in your community, can imagine ways we might connect better with the needs you see around you, please do let us know. Our resources, of course, are limited—but not our hopes!

Craig Holdrege

Steve Talbott

The Nature Institute

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Nature's Revealing Surprises

Craig Holdrege

Everything in science depends on what we call an aperçu, a beholding of what lies at the basis of the appearances. Such beholding is infinitely fruitful. — Goethe

During July and August you can sometimes come across wild bergamot (*Monarda fistulosa*) growing along roadsides and in old fields in our upstate New York region. The color of the flower heads (inflorescences), which consist of numerous individual flowers, varies from plant to plant. It can be paler or darker violet, and the violet can be more reddish or more bluish. Wild bergamot belongs in the mint family, and when you rub its leaves you can smell an oregano-like scent.

On a warm sunny day you find countless insects flying from flower to flower. They extend their "tongue" (proboscis) into the long flower tubes to drink nectar. One of the most impressive visitors is the hummingbird clearwing (*Hemaris thysbe*), a moth that beats its wings so quickly that you hardly see it while it zips from place to place and then hovers, often with its front legs lightly touching the petals of the flower as it drinks.

It is a joy just to stand and watch these moths, the numerous bumble bees, and the different butterflies moving in and through a patch of wild bergamots. You see that while the plants and insects are in significant ways their own creatures, they are also tightly connected with each other.

One day I was observing a patch and came across a surprise. I noticed a wild bergamot flower head that looked unusual (photo 4). At the place where one flower would usually grow within a head of flowers, a stem had emerged that resulted in a whole new flower head. Where a single flower "should be," a whole head of flowers had grown. The head had fewer flowers than typical flower heads, but the grouping of small leaves at the base of the head (bracts) were of normal size.

It is common to consider such anomalies as "malformations," "quirks," or "abnormalities." In such a view, they are deviations from the norm, expressing some mistake in the developmental process. But that is not what this anomaly said to

me. For me it was a revelation of the remarkable potential of the plant. But to see such revelations, you have to be open to them.

Such openness develops when through much observing you begin to get a sense of the plant as an organism that lives in transformation. We can see this in the ongoing development of new parts as old ones die away, the changes in leaf form along the stem, and the radical metamorphosis into a flower whose leaves (petals, stamens, and carpals) are very different from the foliage leaves. Moreover, you observe again and again how the plant as a whole and in its parts varies when it grows in different environmental conditions. All this leads you to see the plant as a dynamic, flexible organism. As a result, you become open to further expressions of its transformative capacity.

And then such an anomaly appears as the one pictured here. Whereas normally the formation of a specific organ (the flower in this case) is connected with a specific place and time in the developmental process, the plant has the flexibility—the hidden potential—to do something quite different and instead develop a whole shoot with many flowers. A deeper wellspring of potency has broken through. It's as if the plant were saying through the anomaly: "Do you see all that I'm capable of?"

In witnessing such an anomaly I wake up from taking the plant for granted in a dreamy, everyday way. It is so easy to fall into the habit of not really perceiving and thinking. The unexpected flower head lets me see—in a momentary "aha"—the agency of the plant that my habitually looking eye normally overlooks. I get a glimpse of and am touched by the plant's creative potency. Thank you, anomaly.

When Our Way of Knowing Matters

Rarely do you come across a book about science where the central focus is the process of knowing itself. Such is Peter Heusser's *Anthroposophy and Science* (Frankfurt: Peter Lang, 2016, 368 pages). Heusser is a professor of medicine at Witten/Herdecke University in Germany and head of its Institute for Integrative Medicine.

The book offers a careful, critical, and step-by-step look at how we come to know about the world through science. Heusser urges scientists and medical professionals to take seriously, as a fundamental part of science, the insights gained through such reflection. Often the fundamental questions of knowing are looked upon by scientists as part of "philosophy," and these questions are ignored in the day-to-day doing of science. But this is an illusion. Every scientific endeavor presupposes or embodies a way of knowing as well as ideas about the nature of reality and what it means to understand or explain something. You can't get away from the need for philosophical self-reflection, even if it is often ignored.

Heusser has immersed himself deeply in the understanding of scientific knowledge as it was practiced and described by Goethe in his scientific writings and then further elucidated by Rudolf Steiner. Steiner in turn developed a practice of scientific knowing that became the foundation for what he later called "spiritual science" or "anthroposophy." This is an empirical, experience-based approach that gives careful attention to forming scientific ideas in close connection with the phenomena being observed. Heusser speaks of "objective empirical idealism."

On the one hand, Heusser wants to show the rigor, clarity, and fruitfulness of the Goethean-Steinerian approach. On the other hand, he considers at great length this approach within the context of contemporary science.

The book provides a rich picture of the variety of scientific views of the past hundred years and of the striving to understand the world in ever more adequate ways. For example, mainstream biology is still today dominated by the drive to reduce all life processes to molecular, cause-and-effect occurrences (see Steve Talbott's article in this issue of *In Context*). Heusser shows again and again the shortcomings of this perspective. These shortcomings reveal themselves both in the prevailing theoretical framework and in the plethora of actual phenomena that are being discovered every day in labs around the world. Inasmuch as researchers become more interested in the actual phenomena than in their theoretical biases, they begin to break through to ideas of life that are more faithful to the processes and organisms themselves. Then concepts such as "self-organization" or "autopoiesis° arise, which point to the agency-character of all life.

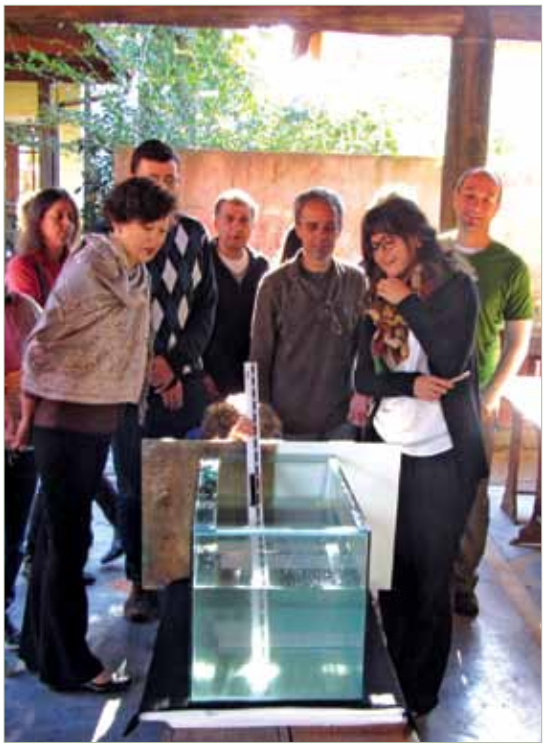
This book is challenging and not an easy read. You have to commit yourself to reading slowly and thinking along with the author. But the effort is worth it. *CH*

Seeing Nature Whole

Completion of the Course in Brazil

At the beginning of July, Henrike and I arrived in Florianopolis, Brazil, to give the second two-week module of a course that had its first session in 2016. We were once again impressed by the participants' open-hearted and enthusiastic interest and willingness to engage in all the explorations that we guided. For us the course was a confirmation that careful phenomenological study, which works from experience to form flexible, growing, and context-sensitive ideas, is of importance for people from many walks of life and professions. This year's practice areas were optics and visual perception on the one hand and, on the other, animals, the human being, and evolution. You might wonder how these topics could be of interest to a lawyer, an agronomist, a philosopher, an organizational consultant, a medical doctor, or an engineer—to mention a few of the professions among the participants. But they were. That is the case, at least in part, because the way we worked let participants explore and have experiences that were significant for their personal and professional lives.

At the end of the first week we did a review and one participant's remark struck everyone: "*My way of seeing has changed in this one week. I didn't really see before. I thought and then looked. Now I look and then think!*" It is this kind of shift that we hope to facilitate in our courses. Nowadays we are so caught up in our ideas and what we think we know that we rarely penetrate the veil of our preconceptions. When we do, the appearing world becomes alive for us in its vitality, beauty, and subtlety. Such experiences give us grounding and orientation—a sense of truthfulness that can live in our interactions with the broader world. *CH*



Out and About

- Early in April, Bruno consulted at Good Water Farm, an organic microgreens farm on Long Island, New York.
- Later in April, Bruno gave a workshop and consulted at the Farm School in Athol, Massachusetts.
- Bruno also traveled to Chile at the end of April to consult at three biodynamic vineyards and at a conventional livestock farm.
- At the end of August, Henrike worked, by invitation, with the faculty at the Green Meadow Waldorf School on the significance of experiential learning in science education.
- Bruno traveled up to Avena Botanicals in Rockport, Maine, at the end of September to teach at a three-day biodynamic training program.
- In October, Craig visited the Goetheanum in Dornach, Switzerland, where he was a keynote speaker at their *Evolving Morphology* conference.

Still Ahead

- In early November, Bruno will teach in Chestnut Ridge, New York, as part of the Pfeiffer Center's year-long biodynamic training program.
- That same weekend, Craig will go to Toronto, Canada, where he has been invited to speak at a conference put on by faith leaders concerned with the direction that our food system is going. The conference is entitled *Redesigning the Tree of Life: Synthetic Biology and the Future of Food*.
- Later in November, Bruno will speak at the Bionutrient Food Association's annual *Soil and Nutrition Conference*.
- Then in March, Craig will also teach as part of the Pfeiffer Center's biodynamic training program down in Chestnut Ridge, New York.

2017 Fellowship Program

Last May, the Nature Institute offered its first ever fellowship program. We welcomed six individuals from Argentina, France, India, and Scotland, who wanted to deepen their understanding and practice of Goethean science. During the first three weeks, Institute staff led seminars in phenomenology—both its practice and underlying epistemology. We worked mostly in close proximity to the Institute, while also traveling farther afield to explore the diverse landscapes of our region on weekly field trips. After these first three weeks, the fellows continued to meet with mentors and with each other to study, go on outings, and share their ongoing research.

In the end, it was a rich and rewarding experience for everyone. Individually, fellows were given the space to conduct their own research, while at the same time everyone's learning was quickened and intensified through their shared explorations.

To give you a sense for the specificity of the fellows' work, here are the titles of their research projects:

"Growth Forms of Trees and the Wooded Landscape"
"Becoming a Dandelion" and "Plant Growth and Soil"
"Landscape and People: Finding Common Ground"
"The Form and Movement of Fishes in Relation to their Environments"
"Unfolding Ways of Seeing—Plant Study and Art"
"Schooling Thinking and the Senses in Relation to Education"

We thank the Evolving Science Association—our partnership with the Myrin Institute—for supporting the fellowship program. In the future we hope to offer such a program again.

> *The fellowship was one of the most enriching experiences that I have had. It has really laid the 'foundation,' to say the least, for true observation and research in me. And I do believe that more young people should be able to access such opportunities.*
>
> – Ritika Arya, India

> *I have been waiting for this opportunity for a long time. Deepening my knowledge of the Goethean approach and observing plants were the best things that could ever happen to me. … I had time to develop embeddedness and embodiment. My work in relation to children and teachers in educational contexts is related to these aspects. I have read a lot about it, but here I had the opportunity to 'live' these and other concepts.*
>
> – Cecilia Eyssartier, Argentina

Land Art at the Institute

This August, The Nature Institute was visited by international artist Axel Ewald. He came to our area as part of a larger "art convergence," and worked for three days with a group of staff and friends, transforming a piece of land behind the Institute.

We chose a space that was once a clearing in the woods but was now being reclaimed by the forest. At first we simply approached and observed the place. We talked about it: What qualities could we experience? What kind of place was it? We walked around the clearing along its edge, then through the tangle of bushes and into the middle. We came at it from many sides—always building up pictures together, trying to characterize what lived there, what came to meet us from the place itself.

We then tried to separate the essential from the inessential. It's a clearing in the woods—there's a reflective, quiet quality to it, but it's also a meeting place where two paths come together. Could we bring these qualities to the fore? Could we draw out the social aspect and still maintain the quiet inwardness? We took up our tools—scythes to cut grasses and shears to clear bushes and branches—and then, little by little, cleared away the inessential, always trying to sense the changing composition of the place, always working to protect and enhance the integrity of what lives there.

Next, we asked what elements we could bring in. We sketched the place from above and from many sides, seeing where something might be added and what it could be. Through more conversation we envisioned a bench on higher ground along one edge, and a stone fire pit in the center.

Then we finally started in. We took stones from the woods (where they lie scattered in abundance) and began a bench. We dug the beginning of a fire pit, took the clay back to the bench and added sand, straw, and water to make a simple mortar to help hold the stones together. We worked throughout this last day—with other people joining us to help mix the mud, cut boards, or lay some stones—and by the end found ourselves immensely richer. There is now a beautiful clearing in the woods where friends can come for a solitary moment and where classes can gather for observation, conversation and an occasional evening fire! Please come visit us and take a look for yourself next time you're around.

Many thanks to Axel Ewald and everyone involved in this project. *SJ*

A Month in Australia

In April, Henrike and I spent a month in Australia giving conference keynote talks, workshops, and courses in conferences for educators. As you can imagine, this was a month of rich interactions with a variety of people and places. The work began in Sydney, where we spent a week. Then we traveled a few hours north of Sydney to the Hunter Valley to contribute to a conference on "Life and Living." From there we went to subtropical Mullumbimby, which is close to the east coast in the north of New South Wales, for a week-long conference for educators. Finally we flew across the large continent to Perth on Australia's west coast for another conference for teachers. Both of these teacher conferences had as their main theme "Conversing with Nature: Phenomenological Engagement with the Living World."

In between the different stations of our trip, and at the end before returning home, we had some days to explore the countryside. Here are just a few impressions.

We were deeply moved by our visit to the Blue Mountains, west of Sydney (see photo at top). A high, north-south wooded plateau has been carved by water into individual mountains that drop off in steep escarpments that separate the lush valleys from the flat mountain tops. Although the growth forms—trees, bushes, wildflowers—were "familiar," the countless indigenous species of plants presented us with surprise after surprise. Hiking along the top of the escarpments, encountering new plants and birds around every bend, and then intermittently gazing out into the vast blue distances, we felt carried by the life of the natural world. So many different species of eucalyptus trees! And I was particularly struck by shrubs and small trees in the genus *Banksia*, which we saw in different areas during our trip.

We were eager to encounter kangaroos, and we had to wait until the end of our trip to spend time watching these fascinating animals. We were invited by our host, Konrad Korobacz, to spend a few days south of Perth near the town of Yallingup, where western grey kangaroos seemed to be everywhere. At dawn and dusk they gathered in open spaces and grazed on the short and meager vegetation of fields and empty lots. You don't speak of "herds" of kangaroos in Australia, but of "mobs"!

We spent hours watching their movements and interactions. The seemingly effortless bounding of fleeing kangaroos took our breath away—the large rear legs release like springs, the massive tail extends and swings up and down as the animal floats through the air until it touches ground for a moment before the next bound. When it "walks," a kangaroo uses its tail as a fifth limb; it leans forward onto its short front legs and, with the support of front legs and tail, it lifts its hind legs forward. The encounters with kangaroos certainly planted a seed in me for a new whole-organism study! *CH*

Above: A flowering branch of *Banksia integrifolia* in the Yuraygir National Park on the Pacific coast of Australia. The photo shows the flower heads in bud stage (lower right) and in different stages of unfolding. The uppermost flower head is in full bloom. The woody “cone” contains the dried fruit capsules that have already released their seeds.

New Publications

Two New Resources on Evolution and Development

Craig has created a kit on human evolution for educators teaching at the high school and undergraduate levels. It is entitled ***Diversity in Human Fossil History: A Teaching Unit on Hominid Evolution***. Human evolution can be one of the most fascinating topics in school, but, unfortunately, the complex reality is often overly simplified into a linear view of the process.

This set of teaching materials illustrates in a vivid, yet still concise way the complexity and patterns of human-becoming as revealed in fossil skulls. It provides methods and materials (including 30 powerful copies of original drawings of representative hominid skulls) for weaving experiential, inquiry-based activities into a course on evolution in ways that spark fresh insights and help students themselves practice the work of exploratory science. You can view and purchase the kit through our website.

We have also recently published Craig's newest monograph, ***Do Frogs Come From Tadpoles?*** as part of The Nature Institute Perspectives series. This beautifully illustrated study is based on three articles on the frog from *In Context* #33, 34, and 35. Through closely attending to the phenomena of amphibian development, Craig shows that evolution is in reality a creative process, and not simply the inevitable product of lifeless mechanisms. The result is a concrete example of how one can begin to understand, as well as teach, natural science in a truly holistic and living way. The booklet can be purchased from our online bookstore or by contacting the Institute.

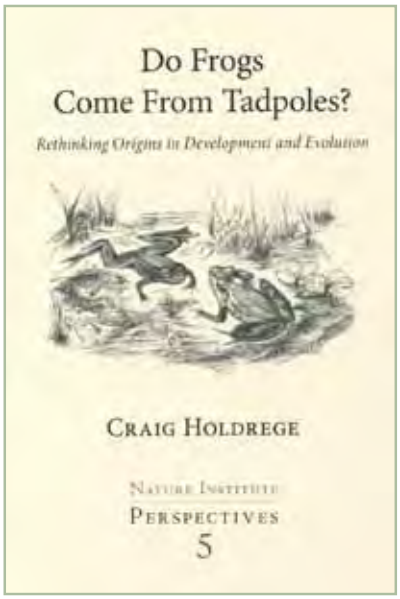
In other publication news: Our ability to explain and promote rigorously holistic approaches is increasingly being recognized and sought after by other publishers. Craig Holdrege, Steve Talbott, and Bruno Follador have each had major articles either commissioned or reprinted by respected publications.

In their newest issue (Fall 2017) the popular progressive magazine, *Utne Reader*, republished Craig's article "Meeting Nature as a Presence: Aldo Leopold and the Deeper Nature of Nature" from last fall's *In Context*. The *Reader* has a broad appeal with a total monthly audience, for its print and online versions, of about 275,000. You can pick up that issue on newsstands or download the article online at http://natureinstitute.org/pub/ic/ic36/leopold.pdf.

Another of last fall's *In Context* articles, Bruno's piece "Soil, Culture, and Responsibility," was also republished, this time in the summer issue of *Lilipoh*. In his article, Bruno looks back on what has been called "the most severe environmental catastrophe in the entire history of the white man on this continent"—the Dust Bowl of the 1930s. You can find it on our website at http://natureinstitute.org/pub/ic/ic36/dustbowl.pdf.

The Worldwatch Institute, one of the world's leading environmental think tanks, also included in its 2017 book, *Earth Ed: Rethinking Education on a Changing Planet*, a short essay from the Institute about the new Ecospheric Studies initiative in which Craig is participating. (See "Fall Events at The Nature Institute" on the following page.)

Steve's article, "Evolution and the Purposes of Life" appeared in the winter 2017 issue of *The New Atlantis*. It is available at http://thenewatlantis.com/publications/evolution-and-the-purposes-of-life.



Fall Events at The Nature Institute

Do Frogs Come From Tadpoles? (September 22)

Talk by Craig Holdrege, book signing, and refreshments

Animal and Human Morphology and the Idea of Freedom (September 30)

Workshop with Craig Holdrege and Henrike Holdrege

> *"The agreement within the whole makes every creature what it is. The human being is a human being through the whole gestalt as well as through the last segment of the little toe. And so it is that every creature is one tone, one shade of a great harmony that one must study as a whole if the particulars are not to become dead letters." – Goethe*

By comparing skulls and skeletons of various animals with that of the human being, we will work to discover how each part is revelatory of the nature of the whole being.

Where Do We Come From? The Question of Origins and Ancestors in Evolution (October 27)

Talk by Craig Holdrege

Teaching Human Evolution: Diversity and Origins (October 28)

Workshop with Craig Holdrege for biology teachers and others interested in human evolution

This all-day workshop builds on the previous evening's talk. We will work with a "teaching kit" that Craig has designed for classroom use in high school and college. It provides methods and materials for weaving experiential, inquiry-based student activities into a course on evolution in ways that spark fresh insights. The question "Where do we come from?" will appear in a fundamentally new light.

Fun Fall Work on The Nature Institute Grounds (November 4)

Please join us to prepare the grounds of The Nature Institute for the winter. Refreshments and good cheer will be provided! Please let us know in advance if you plan to volunteer.

Working on Ecosphere Studies at The Nature Institute (November 6 & 7)

In 2015, Wes Jackson of the Land Institute in Kansas initiated an ambitious project to transform higher education by working to develop higher education curricula that would help to re-orient education around a worldview that prioritizes the understanding and protection of the ecosphere. Craig was asked to be one of the founding faculty members, whose task it is to explore how such a radical re-focusing of educational priorities could occur. A variety of meetings have taken place, and in November two core members of the ecosphere initiative, Aubrey Streit Krug and Bill Vitek, will come to The Nature Institute for two days. The main question to be discussed is how to develop intensive, experiential workshops to help students develop and apply an ecospheric perspective.

Celebrating Henry David Thoreau at Two Hundred: the Path Ahead (November 13)

Talk by Christina Root

On the 200th anniversary of his birth, Henry David Thoreau continues to inspire and guide us politically, spiritually, and ecologically. This talk will explore Thoreau's great gifts as a writer, his ability to embody the life of nature in his language, and to help us to get a sense of the whole without resorting to abstraction.

For more information about fall and winter events, please visit our Calendar of Events:
http://natureinstitute.org/calendar.

2018 WINTER COURSE AND A NEW PROGRAM— See announcement on back cover

Thank You!

We would like to give special thanks to a Nature Institute supporter who offered a $5,000 challenge grant in the spring, and to all who responded — your gifts totaled $14,000! And thank you to everyone else who contributed goods or services between April 1, 2017 and September 30, 2017.

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Why Can't Evolutionary Biologists Quit Believing in Intelligent Design?

Stephen L. Talbott

NOT LONG AGO an intelligent design advocate responded to one of my occasional swipes at ID theory. Thinking I had misinterpreted the theory, he said it was wrong to imagine the Designer working only in the remote past. "ID is open as to when the Designer implements Design."

My response was along these lines:

> For me, the issue isn't whether a designer acted millions of years ago or a millionth of a second ago. Rather, it's that the picture being offered is one of a designer working from outside upon a mechanical artifact. But organisms are not machine-like. Their activity is not an outcome of parts assembled by a designing engineer. They are not contrivances periodically requiring service by an outside agent for the sake of evolutionary progress. No, their very *life* consists of the activity through which they grow and transform their own physical means of acting.

Given today's charged environment, you might wonder why I did not accuse my correspondent of being a "science-denier." There is good reason. The label is a dastardly one, poisoning the spirit of evidence-based conversation, which is so crucial to science. It strongly suggests an inquisitorial demand for creedal belief rather than understanding. It almost inspires sympathy for intelligent design theory — and *does* inspire it for a number of the theory's proponents, who can be fully as qualified as their authoritarian persecutors, and sometimes far more critically alert.

Some of those who labor to guarantee the purity of evolutionary orthodoxy habitually refer to intelligent design theorists as "IDiots" — and their argumentation naturally tends toward the same exalted level of discourse. To the shame of science, relatively few biologists have yet been willing to call out such behavior. It has mostly been outsiders who have urged greater scientific integrity. For example, the widely respected New York University philosopher, Thomas Nagel, has labeled the biological community's treatment of intelligent design proponents "manifestly unfair"[1] — this at the risk of his own reputation.

History teaches us that the kind of knee-jerk nastiness and vitriol leveled at ID theorists is not uncommon among competing sects trying to differentiate themselves from each other on fine points of sectarian doctrine — nuances that can assume gigantic importance in the minds of the disputants. You have to fight hardest with those who try to occupy your own ground.

That mainstream biologists are quarreling with ID theorists over common ground may seem a strange idea. But look again at the quoted paragraph above. As we will see more clearly in what follows, it applies without reservation to conventional evolutionary theory as well as ID. Few biologists are reticent about their conviction that organisms are machine-like and have been "tinkered" with throughout evolutionary history by a designer capable of producing intelligent results — all without any *intelligent* aid from organisms themselves.

The designer they have in mind, of course, is natural selection, which has famously been likened to a blind watchmaker and is almost universally referred to as an agent capable of intelligent activity. Selection *shapes* the bodies and behaviors of organisms, *builds* specific features, *targets* or *acts* on particular genomic regions, *favors* or *disfavors* (or *punishes*) various traits or behavioral strategies, *operates* in this way or that, *maintains* DNA sequences, *promotes* adaptation of populations to local environments, *polices* mutations, and, in general, *causes* an endless variety of effects.

Not many biologists, whether ID proponents or otherwise, seem particularly interested in confronting the reality of intelligent agency where we observe it directly — in living beings — as opposed to taking the organism merely as evidence for the *real* guiding intelligence of their preferred Designer. This indifference toward organisms follows rather naturally when you have conceived them as machines, which always require an external designer. But we will take the alternative path, turning toward the organism's inherent *life*. And because the molecular level is where mechanistic explanation was supposed to triumph finally and completely over life, we will start there.

Intelligence, caught in the act

RNA splicing is one of countless activities in our cells that put the problem of intelligence on display. The standard story is that DNA gives rise to RNA, and RNA is in turn "translated" into protein. This story is now almost *nothing but* complication, and one of the complications is known as "RNA splicing." That is, our cells routinely cut RNAs into pieces, with some of the pieces discarded — possibly to be put to other uses — and the remaining ones stitched back together, often in different ways at different times.

In other words, the organism effectively modifies and repurposes its genetic content "on the fly." The cutting and stitching must not only be attuned to the context, but also be executed with a precision that would put any brain surgeon to shame.

Through careful variations in this process, different protein molecules can be synthesized from a single RNA derived from a single locus of DNA. This is one reason why it is thought that the 21,000 or so genes in human DNA may give rise to as many as a million different proteins. To say that the function of a protein-coding DNA locus is context-dependent is to say, among other things, that the organism as a whole oversees splicing with great subtlety, so that the derived protein can vary slightly or otherwise from one cell or context to another. And the differences can be more than a little consequential. "Even relatively modest changes in alternative splicing can have dramatic consequences, including altered cellular responses, cell death, and uncontrolled [cell] proliferation that can lead to disease."[2]

In organisms possessing nucleated cells ("eukaryotes"), the central player in this drama is known as the "spliceosome," which is less a fixed thing or structure than a complex performance. The performers include, among other contributors, over three hundred proteins. Working together — in coordinated groupings that must reconfigure themselves along the way — the elements of the spliceosome "select" two of the various possible endpoints of the RNA segment to be removed. They then ligate, or join, the portions of the RNA on either side of this segment, following which the segment itself is released. It is rather as if you were to take a string and bring one point together with a second point a few inches away. By joining those two points together, you would be able to release and discard the intervening portion, which now forms a loop.

This entire, extremely elaborate biochemical process may be performed several times along the full length of the RNA. Misjudging either terminus of a removed segment — shifting the point of severance by a single "letter," or nucleotide base (RNAs may contain thousands of them)— could well render the spliced product useless for producing protein, if not downright harmful or fatal.

To complicate matters further, "rather than being the one-way pathway typically drawn in textbooks, almost every step in the spliceosome cycle is readily reversible." In fact, the spliceosome "can even convert spliced products ... back into unspliced [RNA]!"[3]

The intricacies of splicing, and the multiple, interwoven levels of "decision-making" (which extend far beyond "Should we now move this process forward or backward?"), are far too many to enumerate here. For example, some of the spliceosomal proteins are subject to "post-translational modification" — the addition or removal of (mostly small) chemical groups that can critically shape how the proteins function within the larger context. These modifications, too, are dynamic and reversible, which is to say that they must be properly applied or removed in light of current needs.

And, again, some proteins of the spliceosome are themselves spliced — a fact that illustrates the causal ambiguity (X is one of the causes of Y, and Y is one of the causes of X) deeply engrained in all organic activity.

Finally, whereas proteins were once viewed as rigidly formed "molecular machines" (for which there was never any justification), biologists now speak of "disordered" regions in many proteins — meaning, a little confusingly, only that their structure is not strictly fixed. This allows for a lively and wisely employed flexibility:

> To achieve the right balance between precision and malleability, the spliceosome contains scores of individual parts, many of which are structurally disordered. Working in a highly orchestrated manner, these parts perform incredible feats of molecular gymnastics with each round of splicing.[4]

Ignoring the organism's wisdom is not an option

I would ask any biologist: Think back on the preceding description and concretely picture the activity of the several hundred participant molecules. "Watch" them as they are synthesized and somehow modified in the needed manner. Watch as they converge upon one of perhaps hundreds of currently available splicing targets, each requiring its own unique "surgery." And then watch as they cooperate in a tortuous, drawn-out, contextually regulated operation requiring remarkable teamwork from beginning to end. Remember also that the "surgery" required for the different RNAs — or for the same RNAs under different circumstances —

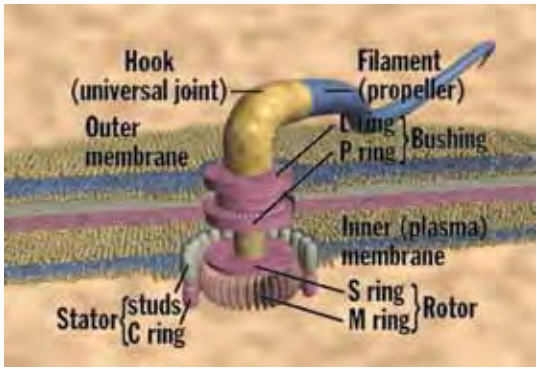
can be very different. So the dynamically varying collection of spliceosomal molecules must continually honor distinctions both subtle and profound.

And after taking all this in, tell me whether, based on what you know of the physical and chemical laws and regularities of the universe, you can even begin to imagine those laws and regularities being adequate, solely in their own terms and in ever-varying contexts, to direct these molecules every considered step of the way. In imagining this, it is also worth bearing in mind that these molecules, as they diffuse through the thickly populated plasm of the nucleus to carry out their tasks of the moment, encounter numerous opportunities for other legitimate (and illegitimate) business.

Certainly all the activity is "lawfully correct." But can you picture just how that sort of correctness could ever underwrite the proper unfolding of the many-themed, extended, and end-directed molecular *story*, with all its requirements for *getting from here to there* — for, that is, complex, end-directed coordination and right "choices" in light of the organism's current needs?

I find myself perplexed again and again by the fact that, with all the contemporary progress in molecular biology, the difficulty of this question has yet to erupt with volcanic force in all the molecular-based disciplines of the life sciences. Surely the picture we have gained brings current ways of speaking and styles of explanation into question.

It is not that physical and chemical investigations reveal any anomalies in their own terms, or that they fail to serve crucial supportive functions for biological science. It's just that physics and chemistry do not tell us about the distinctively *biological* activity. They can only characterize activity with regard to those lawful aspects that continue, uninterrupted and just as lawful, when the organism dies. In terms of *this* characterization, death is not even a recognizable event.



In particular, physical laws and regularities cannot satisfy our need for understanding the organism's *perception of significances* in its environment; its power of appropriate response to stimuli; the molecular "surveillance" processes through which cellular health is maintained and problems corrected; or, in general, the end-directed nature of all activity — from DNA replication, to mating and reproduction, to preying and predator-avoidance.

If the problem presented by the profound intelligence immanent at the molecular level hasn't disrupted our life sciences, then, so far as I can surmise, it is because scientists at their workbenches and theorists in their studies do not concretely picture the *biological* reality they are talking about, as opposed to its physically and chemically lawful aspects. What most intelligent design advocates and conventional evolutionists do imagine is well-designed machines. They simply assume that the machine's successful operation will have been underwritten by the omnipotent Designer, or Blind Watchmaker, at some time in the past. This is despite the fact that the organism's activity is a *present* and unprogrammed creative improvisation and "decision-making" of the sort we see from moment to moment in RNA splicing, as in all other life activity.

The argument for intelligent design

Intelligent design theorists like to point to features of organisms that are "too complex" for accepted evolutionary processes to explain. One of their chief exhibits is the flagellum, a whip-like appendage of various bacteria and other single-celled organisms. It is used for propulsion when swimming, and also performs sensory functions. It is indeed an impressively complex structure, which can vary between different types of organism. The illustration at left, below, shows a group of green algae (*Chlamydomonas*) cells with flagella, at 10,000X magnification. At right is a schematic (and highly "mechanized") representation of a bacterial flagellum — the kind of illustration much beloved by both ID proponents and mainstream, machine-minded biologists.

In their rather nicely written textbook, *The Design of Life*,[5] mathematician and philosopher William Dembski, and molecular biologist Jonathan Wells — both writing as Senior Fellows at the flagship intelligent design organization, the Discovery Institute in Seattle — discuss the bacterial flagellum at some length. It is worth looking at an extended passage in which they enumerate the "hurdles evolution must overcome" in order to bring about structures of such "irreducible complexity":

1. *Availability*. Are the parts needed to evolve an irreducibly complex biochemical system such as the bacterial flagellum even available?
2. *Synchronization*. Are these parts available at the right time so that they can be incorporated when needed into the evolving structure?
3. *Localization*. Even with parts that are available at the right time for inclusion in an evolving system, can the parts break free of the systems in which they are currently integrated (without harming those systems) and be made available at the "construction site" of the evolving system?
4. *Interfering Cross-Reactions*. Given that the right parts can be brought together at the right time in the right place, how can the wrong parts that would otherwise gum up the works be excluded from the "construction site" of the evolving system?
5. *Interface Compatibility*. Are the parts that are being recruited for inclusion in an evolving system mutually compatible in the sense of meshing or interfacing tightly so that, once suitably positioned, the parts work together to form a functioning system?
6. *Order of Assembly*. Even with all and only the right parts reaching the right place at the right time, and even with full interface compatibility, will they be assembled in the right order to form a functioning system?
7. *Configuration*. Even with all the right parts slated to be assembled in the right order, will they be arranged in the right way to form a functioning system?

Keep in mind that the authors' concern is the evolutionary *origin* of the flagellum. They want to know: "Is the Darwinian mechanism adequate for coordinating all the biochemical events needed to clear these seven hurdles and thereby evolve the bacterial flagellum?" And they believe a positive answer would "attribute creative powers to the Darwinian mechanism that are implausible in the extreme" (pp. 184-6).

I fully agree. Dembski and Wells have pinpointed a critical problem for any evolutionary theory grounded in a machine-like understanding of organisms. Unfortunately, that includes intelligent design theory as it has been widely presented to the public.

What if the organism's intelligence is the real thing?

The problem lies in an indisputable fact: all the intelligence we could ask for is clearly already there in the living bacterium, which proves quite handy at growing its own flagellum. In doing so it must overcome a developmental version of all the hurdles listed above. It has to bring all the right resources together, in compatible form and at the right place and right time, assimilating them to the growing structure in the correct order, all while avoiding both unwanted cross-reactions and harm to other processes dependent on the same resources.

We are looking here at a sustained, almost unimaginably complex choreography in the face of all sorts of unpredictable variation and contingency. At the lowest level the narrative is a trillion-stepped performance that, in the history of all bacteria, could never have been carried out twice with exactly the same sequence of molecular interactions.

We are looking, in other words, at a present, effectively striving intelligence — a *forming activity*. If we don't really understand it — well, there are many things we do not currently understand, especially if we have preferred not even to acknowledge them. But we still observe what we observe.

Unlike most biologists, ID theorists do not resist the very idea of intelligence. I assume they will have no great difficulty acknowledging the creative, adaptive, improvising, presently active intelligence evident in the individual organism — an intelligence capable of surmounting in a living way the developmental version of the hurdles listed by Dembski and Wells. But, then, what are the grounds for claiming that this intelligence is inadequate for the kind of adaptive change we call "evolution"? What, exactly, is the missing ingredient?

I am not suggesting that we now understand how evolution occurs. I believe we are still almost wholly ignorant. But I do not see what intelligent capacities we can reasonably imagine are required beyond those that now so thoroughly challenge our understanding in the lives of all our fellow creatures.

Here's a way to think about it. Organisms are not collections of things, or parts. Every organism is an *activity* — the particular sort of activity through which its own, ever-changing parts continually come into existence and pass away. The organism is not a mere product, but is a living way of being. It gives rise to its own material basis. It is this living activity alone of which we can meaningfully say, "It has the capacity for evolution." *Living things are by their very nature powers of origination.*

This is what my colleague, Craig Holdrege, had in mind in titling a recent monograph, "Do Frogs Come from Tadpoles?"[6] The answer, in a critical sense, is "no." A tadpole is a prerequisite for the adult frog, but no one can look at a tadpole — or the egg preceding it — and see any physical/chemical necessity for the subsequent, dramatic, and detailed story of metamorphosis and transformation that yields the adult. At every stage a creative activity is bringing something into play that is not already wholly prepared for or determined in a purely physical and chemical sense — which is the same truth I was pointing to with my abbreviated depiction of RNA splicing.

This is also the truth that philosopher Ronald Brady was getting at when he wrote, "We cannot detect, in [organic] phenomena, the distinction between 'that which is to be vitalized' and 'that which vitalizes.'"[7] The material organism is itself a direct, unmediated manifestation of the power we refer to as "life." It makes no sense to detach this living impulse from its coming-to-material-appearance in the organism, then project that impulse upon an outside designer performing occasional tune-ups on supposedly independently existing physical "mechanisms." We never see such a separation, just as we never see mechanisms. The physical structures of the organism "precipitate" out of its intelligent *doings*, and they never become wholly fixed — they never achieve independence from those doings — until the moment of death.

According to a statement on the Discovery Institute website, "The theory of intelligent design holds that certain features of the universe and of living things are best explained by an intelligent cause, not an undirected process such as natural selection."[8] But *there are no undirected life processes*, and the conventional attempt to conceive organisms and their evolution in such terms, being confused, should simply be rejected. Whenever we look at organisms, we find ourselves staring at active intelligence.[9] Surely this ought to affect how one argues about evolution.

When ID theorists do truly reject the conventional view with its scientifically extraneous materialist metaphysics — when they recognize that every organism is through and through a play of its own wisely directed activity — then the main foil for the ID argument will be gone. It will no longer make much sense to elaborate arguments aimed at proving that such-and-such a conventionally conceived process cannot, in the end, achieve this or that evolutionary result except through an appeal to a designer's intelligence. For the fact is that the conventional conceptions fail at the very outset. They fail by refusing to acknowledge the intrinsic intelligence without which not even the most basic biological activity is conceivable.

The task I would recommend for the intelligent design theorist, in other words, is not to confront science with an outside Power that must periodically intervene in order to make up for the world's "deadness." Rather, it is to transform this science from within, by overcoming the bias that refuses to acknowledge intelligent activity where we actually see it.

An irrepressible recognition of agency, misplaced

Intelligent design theorists at least recognize the fact of intelligence in general. But because most of them have accepted the image of the engineered machine-organism, they have shifted the living locus of this intelligence to an external Designer. As for conventional biologists, they would like to deny the very idea of intelligence, at least as a living power rather than as a lifeless design imprinted upon machine-like organisms. And so they shift the source of this intelligence as far as possible to less obvious, less sentient, and less threatening places, where it doesn't belong.

One of those sources, noticed by a few observers over the past century, consists of sovereign molecules such as the gene that, according to geneticist Sean Carroll, "sculpts the form of [a fly's] hindwing."[10] Commenting on the way the germplasm of his day was being pictured (it was then on its way to becoming the genetic material of our day), marine biologist E. S. Russell wrote in 1930 that "Aristotle would have recognized in this almost mystical conception something strangely like his 'soul'!"[11]

Three decades later the eminent cell biologist, Paul Weiss, referred to "current hopes — or illusions — that it might be possible to pinpoint in the cell a master compound 'responsible' for 'life' — an obvious reversion in modern guise to animistic biology, which let animated particles under whatever name impart the property of organization to inanimate matter."[12]

In our own time, philosopher of biology David Scott Robert observes how, with the demise of vitalism, the "*animistic* (and otherwise problematic) idea of a genetic programme" took its place.[13] Likewise, in an article entitled "Biologists Behaving Badly," developmental systems theorist Susan Oyama seems perplexed by the creative and almost mystic role assigned to immaterial information and programs by some of the most influential biologists and philosophers of biology. Many of them, she notes, "wish to convince their readers of the absolute sufficiency of materialism, the absurdity of anything else." But then, "If you find the formulations of past vitalists (and present theists) so devoid of reason, why would you adopt so much of their conceptual and lexical infrastructure?"[14]

All this testifies to the fact that the organism's native intelligence — even, or especially, when observed at the molecular level — is so obvious that no one manages to describe living activities as if it were absent. The problem is that biologists have attributed this intelligence to specific molecules via terms such as "control," "regulate," "information," and "program."

This sleight of hand has been rather easy to pull off because the supposedly controlling molecules are indeed *caught up in* an undeniably intelligent performance. The deception lies in the fact that molecules as such are not intelligent agents in the required sense. They cannot direct the *storyline* of activities such as RNA splicing. The relevant agent — the organizing center of the life performance — is the

organism as a sentient, cognizing, living whole. This whole cannot be described as the causal result of its parts, since the parts come and go — and even gain existence in the first place — only through the coordinating powers of a whole that cannot be identified with any particular collection of material substances.

A "higher" designing power

But controlling molecules are not the only vessels for the biologist's misplaced agency. The idea of information, along with that of the genetic program, coheres wonderfully well with the notion of natural selection as a kind of higher, orchestrating power hovering above the collective life of organisms and directing their evolutionary advance. This power is often projected upon a programmatic logic, abstracted away from organisms themselves. In philosopher Daniel Dennett's succinct formulation, "evolution will occur whenever and wherever three conditions are met: replication, variation (mutation), and differential fitness (competition)."[15]

Dennett refers to this as a mindless recipe, or *algorithm* — one that could be derived even without reference to organisms, while nevertheless offering "guaranteed results" in biology.[16] The algorithm, according to Dennett, is "Darwin's dangerous idea" and, its wholly abstract, materially indifferent character notwithstanding, it is the key to making sense of everything from the simplest irritable cell to human meaning, cognition, culture, and morality.

But the fact is that logical abstractions such as program instructions and algorithms do not *do* anything. The only doers in the picture are the organisms that Dennett considers scarcely relevant to the evolutionary algorithm. So if we think the logical structure of natural selection tells us much of interest about what actually happens in the history of life, it can only be because we think we already know everything living beings are up to. We know how they will, with no surprises, collectively "execute" the algorithm.

Of couse, the prevailing assumption is that they are not up to much of anything at all. They are straws in the wind, driven this way or that by the environment and subject to random, "cosmic-ray-induced" mutations, which they mindlessly pass on to their offspring.

Yet the story of evolutionary studies has been one of continual surprises. Many of these reflect the fact that *nothing* in the organism is any more random or undirected, any less a kind of purposeful striving, than those activities of RNA splicing we looked at earlier. For example, organisms possess unthinkably complex and directive capacities for managing exactly what form mutations take and how those mutations get assimilated into genomes. As evolutionary biologist Arlin Stoltzfus has remarked, "Heritable variations generally aren't chemical accidents, but programmed responses catalyzed by enzymes acting in complex pathways, sometimes induced by genomic damage or cellular stress ... The more one learns about mutation, the less one thinks of it as a series of accidents."[17]

To say that "natural selection did it" is just as much a refusal to investigate the actual life of organisms as to say "God did it." At the same time, biologists do carry out all sorts of empirical studies that illuminate what organisms actually do. These are where understanding arises, and it is a real question whether the obligatory casting of the findings in terms of natural selection has ever added much at all to that understanding.

Beyond "science-denial" and the machine-organism

I am convinced that, for the population at large, much of what evolutionists call "science denial" is not fundamentally a refusal to "believe in evolution." It's just that many people recognize what is overwhelmingly obvious — namely, that the activity of living beings is meaningful and purposeful. When they are told that life results from a series of lifeless and meaningless evolutionary events, they simply can't believe it.

Intelligent design offers these people an alternative. And one thing that makes the alternative attractive is the fact that the leading exponents of the theory have not abdicated their critical faculties. Mainstream biologists, on the other hand, especially those who question the dominant forms of theory, must proceed in fear of crossing an ill-defined (and potentially career-ending) line and sounding "ID-friendly" — a constraint perhaps more severe than that imposed by the church upon Galileo.

Yet criticism, along with some fresh, creative thinking, is certainly needed. How little we know about the most basic evolutionary questions is not often acknowledged. The blank spots include the fundamental problem of macroevolution (how does it occur?) and, specifically, the origin of body plans. There is also the difficulty of knowing when, today, we are ever actually looking at *evolution*, as opposed to the many forms of plasticity, including genetic plasticity, that seem to be features of a healthy species regardless of any evolutionary trajectory it may be on. Actually, there may be no clear distinction between these two things, since evolution can hardly be anything *but* the continuing, plastic, adaptive activity of communities of organisms within their changing and challenging environments.

So, then, what is my advice to the adversaries in the "evolution wars"? Just this — first to ID theorists, based on my

(admittedly limited) understanding of the religious convictions common to most of them:

"Consider what you mean by the 'breath of life', or by the 'creative Word' through whom material stuff is said to come into being as living speech. Do these images from your own traditions not provide a far more reasonable foundation for your thinking about the evolution of living things than the woefully inapt model of the human engineer merely manipulating already existent stuff?

"In other words, are not the meaning and purpose you seek to understand manifested *in the world* rather than somehow impinging upon the world from a place apart? You could perform a tremendous service, helping to reshape contemporary biology, by drawing forceful attention to this meaning. You imagine that a Designing Power, in ways more or less unknowable by us, has acted *upon* the bacterium, making its flagellum possible. Why not shift your attention to the power of life we can observe, here and now, acting *in* the bacterium, making its flagellum possible?

"This in no way conflicts with any convictions you may hold regarding a transcendent creative power sustaining the universe. It is merely to say that what we observe on earth is a power of life immanent in the organisms around us. Presumably you believe not only in the transcendence, but also in the immanence of the creative power. Surely whatever we know about this power can only derive from that which is immanent and therefore accessible to us."

And my advice to conventional evolutionists: "When you confront those who cannot accept your metaphysical appeal to the 'meaninglessness' of reality, do not stoop to insults that demean your profession. Better to leave your critics alone. Better still would be to learn from their criticisms how to make your own case more convincingly.

"And if, quite apart from intelligent design theories, you are inclined to dismiss references to intelligence, consciousness, and purposeful activity as 'unscientific' or 'vitalistic' or 'mystical', perhaps it would be worth checking in with your respected colleagues in the various disciplines of cognitive science. Many of them today are arguing vigorously, vibrantly, and without much constraint over matters of consciousness, meaning, and purpose — all topics that might seem to reside at the heart of biology. Why can't evolutionary biologists be given the freedom to consider these aspects of life, not as things to be explained away, but rather as key elements of their understanding? Would there not be a hint of what you call 'science denial' in any effort to declare the exercise of such freedom out-of-bounds for respectable investigators?"

NOTES

1. Nagel, Thomas (2012). *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature Is Almost Certainly False*. Oxford: Oxford University Press, p. 10.
2. Luco, Reini F. and Tom Misteli (2011). "More Than a Splicing Code: Integrating the Role of RNA, Chromatin and Non-coding RNA in Alternative Splicing Regulation," *Current Opinion in Genetics and Development* vol. 21, pp. 366-72. http://sciencedirect.com/science/article/pii/S0959437X11000645.
3. Chen, Weijun and Melissa J. Moore (2014). "The Spliceosome: Disorder and Dynamics Defined," *Current Opinion in Structural Biology* vol. 24, pp. 141-9. doi:10.1016/j.sbi.2014.01.009.
4. Ibid.
5. Dembski, William A. and Jonathan Wells (2008). *The Design of Life*. Dallas: Foundation for Thought and Ethics.
6. Holdrege, Craig (2017). *Do Frogs Come From Tadpoles? Rethinking Origins in Development and Evolution*. Ghent NY: Evolving Science Association.
7. Brady, Ronald H. (1987). "Form and Cause in Goethe's Morphology," in *Goethe and the Sciences: A Reappraisal*, edited by F. Amrine, F. J. Zucker, and H. Wheeler, pp. 257-300. Dordrecht, Holland: D. Reidel. Available at http://natureinstitute.org/txt/rb/pdf/1987a_form_and_cause.pdf. See also my discussion of the relevant aspects of Brady's article in Talbott, Stephen L. (2014). "How Does an Organism Get Its Shape? The Causal Role of Biological Form." http://natureinstitute.org/txt/st/org/comm/ar/2014/brady_24.htm.
8. http://www.discovery.org/id/faqs/.
9. See Talbott, Stephen L. (2017). "Evolution and the Purposes of Life," *The New Atlantis* (Winter), pp. 63-91. Available at http://thenewatlantis.com/publications/evolution-and-the-purposes-of-life.
10. Carroll, Sean B. (2005). *Endless Forms Most Beautiful: The New Science of Evo Devo*. New York: W. W. Norton, p. 127.
11. Russell, E. S. (1930). *The Interpretation of Development and Heredity*. Reprinted in 1972. Freeport NY: Books for Libraries Press, pp. 267-8.
12. Weiss, Paul (1962). "From Cell to Molecule," in *The Molecular Control of Cellular Activity*, edited by John M. Allen, pp. 1-72. The University of Michigan Institute of Science and Technology Series. New York: McGraw-Hill.
13. Robert, Jason Scott (2004). *Embryology, Epigenesis, and Evolution: Taking Development Seriously*. Cambridge UK: Cambridge University Press, p. 37; emphasis in original.
14. Oyama, Susan (2010). "Biologists Behaving Badly: Vitalism and the Language of Language," *History and Philosophy of the Life Sciences* vol. 32, pp. 401-24. http://www.jstor.org/stable/23335080.
15. Quoted in Lenski, Richard E., Charles Ofria, Robert T. Pennock and Christoph Adami (2003). "The Evolutionary Origin of Complex Features," *Nature* vol. 423 (May 8), pp. 139-44. doi:10.1038/nature01568.
16. Dennett, Daniel C. (1995). *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. New York: Simon and Schuster, p. 51.
17. Stoltzfus, Arlin (2014). "Evolution: A View from the 21st Century (book review)." http://molevol.org/evolution-a-view-from-the-21st-century-book-review/.

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