Becoming a Disciplined Science:

Prospects, Pitfalls, and Reality Check for ID

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Recently I asked a well-known ID sympathizer what shape he thought the ID movement was in. I raised the question because, after some initial enthusiasm on his part three years ago, his interest seemed to have flagged. Here is what he wrote:

> An enormous amount of energy has been expended on "proving" that ID is bogus, "stealth creationism," "not science," and so on. Much of this, ironically, violates the spirit of science. The proof of the pudding is in the eating. But on the other side, too much stuff from the ID camp is repetitive, imprecise and immodest in its claims, and otherwise very unsatisfactory. The "debate" is mostly going around in circles. The real work needs to go forward. There is a tremendous ferment right now in the "evo/devo" field, for instance. Some bright postdocs sympathetic to ID (and yes, I know how hard a time they would have institutionally at many places) should plunge right into the thick of that. Maybe they are at this very moment: I hope so!

Every now and again we need to take a good, hard look in the mirror. The aim of this talk is to help us do just that. Intelligent design has made tremendous inroads into the culture at large. Front page stories featuring our work have appeared in the *New York Times*, *L.A. Times*, *Wall Street Journal*, *San Francisco Chronicle*, and so on. Television, radio, and weeklies like *Time Magazine* are focusing the spotlight on us as well. This publicity is at once useful and seductive. It useful because it helps get the word out and attract talent to the movement. It is seductive because it can deceive us into thinking that we have accomplished more than we actually have.

Two animating principles drive intelligent design. The more popular by far takes intelligent design as a tool for liberation from ideologies that suffocate the human spirit, such as reductionism and materialism. The other animating principle, less popular but intellectually more compelling, takes intelligent design as the key to opening up fresh insights into nature. The first of these animating principles is purely instrumental -- it treats intelligent design as a tool for attaining some other end (like defeating materialism). Presumably if other tools could more effectively accomplish that end, intelligent design would be abandoned. The second of these animating principles, by contrast, is intrinsic -- it treats intelligent design as an essential good, an end in itself worthy to be pursued because of the insights it provides into nature.

These animating principles can work side by side, and there is no inherent conflict between them. Nonetheless, there is a clear order of priority. Unless intelligent design is an intrinsic good -- unless it can be developed as a scientific research program and provide sound insights into the natural world -- then its use as an instrumental good for defeating ideologies that suffocate the human spirit becomes insupportable. Intelligent design must not become a "noble lie" for vanquishing views we find unacceptable (history is full of noble lies that ended in disgrace). Rather, intelligent design needs to convince us of its truth on its scientific merits. Then, because it is true and known to be true, it can become an instrument for liberation from suffocating ideologies -- ideologies that suffocate not because they tell us the grim truth about ourselves but because they are at once grim and false (Freud's psychic determinism is a case in point).

Intelligent design's dual role as a constructive scientific project and as a means for cultural renaissance should raise some concerns over characterizing our movement as a "wedge." Intelligent design's instrumental good of renewing culture hinges on its intrinsic good of furthering science. Unfortunately, the metaphor of the wedge clouds this order of precedence. The wedge metaphor, as Phillip Johnson initially used it, focused on the discrepancy between science as an empirical enterprise that goes where the evidence leads (which is a legitimate conception of science) and science as applied materialist philosophy that maintains its materialism regardless of evidence (this is a bogus, though widely held, misconception of science). According to Johnson, the discrepancy between these two conceptions of science provides a point of weakness into which the thin end of a wedge can be inserted. Pounding the wedge at that point of weakness is supposed to invigorate science, renew culture, and liberate society from the miasma of materialism and naturalism. That's the promise.

Worthy goals though these are, their accomplishment is, in my view, not appropriately ascribed to a wedge. Wedges break things rather than build them up. Wedges are provisional and instrumental, conducing toward some end but not ends in themselves. The subtitle of Phillip Johnson's book *The Wedge of Truth* is *Splitting the Foundations of Naturalism*. I submit that the foundations of naturalism are already split (thanks largely to Johnson's efforts). Even now the right questions are on the table and being vigorously discussed. What's more, the intelligent design movement is setting the terms (and even the vocabulary) for the debate over biological origins. Karl Giberson and Donald Yerxa (neither design advocates) make this point in their new book titled *Species of Origins*, which details the debate in the United States over evolution, creation, and intelligent design. In it they remark:

> Since its inception in the early 1990s, the intelligent design movement has attracted so much attention that it has succeeded in dominating the origins debate. By this we do not mean that it is triumphant. Far from it. While design has made some modest inroads in the academy, it is frequently seen ... as a more attractively packaged variety of creationism. But design has succeeded in setting the agenda for much of the debate. (p. 210)

The wedge metaphor has outlived its usefulness. Indeed, with ID critics like Barbara Forrest and Paul Gross writing books like *Evolution and the Wedge of Intelligent Design: The Trojan Horse Strategy*, the wedge metaphor has even become a liability. To be sure, our critics will attempt to keep throwing the wedge metaphor (and especially the notorious wedge document) in our face. But the wedge needs to be seen as a propaedeutic -- as an anticipation of and preparation for a positive, design-theoretic research program that invigorates science and renews culture. The wedge, to mix metaphors, has already swept the field, cleaned house, shone the spotlight, and exposed scientific materialism's dirty laundry. Now that that has been accomplished, where do we go from here?

After the Polanyi Center debacle at Baylor University in the fall of 2000, my colleague (and still good friend) Bruce Gordon assessed what happened as follows:

> Design theory has had considerable difficulty gaining a hearing in academic contexts, as evidenced most recently by the Polanyi Center affair at Baylor University. One of the principle reasons for this resistance and controversy is not far to seek: design-theoretic research has been hijacked as part of a larger cultural and political movement. In particular, the theory has been prematurely drawn into discussions of public science education where it has no business making an appearance without broad recognition from the scientific community that it is making a worthwhile contribution to our understanding of the natural world. (*Research News*, January 2001, p. 9)

Gordon's assessment contains an important kernel of truth but in other respects is off the mark. The kernel of truth is that ID needs to succeed as a scientific enterprise to succeed as a cultural and political enterprise (in other words, the instrumental good of intelligent design cannot be achieved at the expense of its intrinsic good). But this is quite different from requiring that intelligent design attain a certain level of maturity and acceptance in the scientific world before it may be regarded as a bonafide intellectual project and legitimately influence public opinion.

Intelligent design's legitimacy as an intellectual project hinges on two facts that are independent of its state of development. First, evolutionary biology has been so hugely unsuccessful as a scientific theory in accounting for the origin of life and the emergence of biological complexity that it does not deserve a monopoly regardless what state of formation ID has reached. Second, ID is logically speaking the only alternative to a mechanistic evolutionary biology. Evolutionary biology, as currently formulated, embraces material mechanisms and eschews teleology. Yet these are the only two available options: Either material mechanisms can do all the work in biological origins or some telic process is additionally required. The issue, therefore, before the public square is not in the first instance how far intelligent design has developed as a scientific project but freedom and equity. In particular, are all sectors of the public free to examine and discuss the full range of scientific options concerning biological origins? Design theorists say yes. Darwinism's defenders prefer that certain sectors of the public (like public education) be cordoned off and censored.

Any rule-setting about what intelligent design must accomplish in the scientific sphere before it may legitimately influence the political sphere is arbitrary and betrays a naiveté about the actual workings of science. In fact, any such rule-setting is sure to undermine intelligent design's progress as a scientific and intellectual movement. For a scientific research program to prosper, it must employ talented workers and ensure that their efforts to further the program get rewarded. This requires societal and political structures to be in place that can attract talented workers and offer them incentives for a fruitful career. Science, culture, society, and politics all work together in this regard. If you don't believe it, try lobbying to get the NSF's or NIH's funding cut.

Although ID as a scientific program stands logically prior to ID as cultural movement, this logical priority does not imply temporal priority. To think that the scientific program must first succeed (and according to whose criteria of success?) before the cultural movement can legitimately be undertaken is not only naive but to give up on both. Baylor's Polanyi Center, which I founded, was closed not because there was any problem with the design-theoretic research it was conducting (the external review committee found no fault here) but because of political efforts by Darwinists both inside and outside Baylor to shut the center down. The scientific research and cultural renewal aspects of ID need to work together, protecting and reinforcing each other. Science grows within a cultural matrix but at the same time shapes that matrix. Their relation is not linear but dialectical.

That said, we need to be very clear when we are doing the nuts-and-bolts scientific and conceptual work on ID and when we are engaged in cultural and political activity. What's more, these aspects of ID need to keep pace. We have done amazingly well in creating a cultural movement, but we must not exaggerate ID's successes on the scientific front. It is fine to receive respectful notice from *The New York Times*. But, as David Berlinski has pointed out to me, René Thom's catastrophe theory also received front page coverage in the *Times* and thereafter, despite its real content as both a scientific theory and a philosophical attitude, died quietly some time in the 1980s. An intellectual movement cannot sustain itself on media attention. The scientific and conceptual work on ID occurs out of the limelight, requires intense concentration over extended periods, and is fully appreciated only by relatively few specialists. The cultural renewal work on ID, by contrast, occurs in the limelight, offers quick closure and gratification, and makes its appeal to the population at large.

Because of ID's outstanding success at gaining a cultural hearing, the scientific research part of ID is now lagging behind. I want therefore next to lay out a series of recommendations for rectifying this imbalance.

1. Catalog of Fundamental Facts (CFF)
One of the marks of a disciplined science is that it possesses an easily accessible catalog of fundamental facts. Think of the magnificent star cluster catalogs in astrophysics. ID needs something like this. It would be enormously helpful if we had and could make publicly available a catalog of irreducibly complex biological objects or processes. The catalog should contain as complete a list as possible, organized more or less as a table,

with very complete descriptions. Under the bacterial flagellum, for instance, the catalog would list: found in the following; involving these biochemical parts; requiring this level of energy; these substrates, etc. etc. The catalog should move from simple to profound examples of irreducible complexity (such as the mammalian visual system).

The criteria governing entries should be very strict and should be stated explicitly: such and such is IC if and only if *fill-in-the-blank*. The catalog should be widely distributed to the biological community. No mention of intelligent design, nothing about naturalism. Just a catalog of the fundamental facts as they are now known. Such a catalog would do more than any number of forums or debates to persuade biologists that Darwinism is in trouble and that ID is a live possibility. Right now most of them don't even see that there is a problem. Irreducible complexity is for them not a problem urgently in need of resolution but a detail to be shelved indefinitely. Such a catalog would put an end to the current complacency.

2. Catalog Correcting Misinformation (CCM)

There is a tremendous amount of misinformation in the biological literature whenever it impinges on design. Jonathan Wells's *Icons of Evolution* is an attempt to redress that problem by examining a few faulty evidences used to prop evolutionary theory at the expense of design. But the problem is pervasive. Sometimes it's merely giving an evolutionary spin to a biological experiment or fact when the actual evidence warrants nothing of the sort. Sometimes it's the double standard by which natural selection gets applied -- if a biological system looks well-designed, that's because natural selection is an efficient designer-substitute that prunes away deadwood; on the other hand, if it looks cobbled together, that's because natural selection is a sloppy opportunist.

The suboptimality objection has traditionally been Darwinism's ace for keeping intelligent design at bay. But as with so many protective measures, it ends up undermining the very thing it was designed to protect -- the field of biology itself in this case! To refute design, critics resort to belittling systems they claim are not designed (the logic from incompetent design to no design presumably being *de rigueur*). In repudiating design, biologists therefore consistently underestimate biological systems. Take, for instance, the inverted retina of vertebrates. It continually comes in for abuse from Darwinists. What sort of designer would have created such a system, with its backward wiring, occlusion of incoming light, and blind spot? What more needs to be said? End of story. No design here.

In fact, there appear to be good functional reasons for this construction. A visual system needs three things: speed, sensitivity, and resolution. Speed is unaffected by the inverted wiring. Resolution seems unaffected as well (save for a blind spot, which the brain seems to work around without difficulty). Indeed, there is no evidence that the cephalopod retina of squids and octopuses, which is said to be "correctly wired" by having receptors facing forwards and nerves tucked behind, is any better at resolving objects in its visual field. As for sensitivity, however, it seems that there are good functional reasons for an inverted retina. In the human body, for instance, retinal cells require the most oxygen of any cells. But when do they require the most oxygen? Their oxygen requirement is maximal when incident light is minimal. Having a blood supply in front of the photoreceptors guarantees that the retinal cells will have the oxygen they need to be as sensitive as possible when incident light is minimal.

The catalog for correcting biological misinformation that I am recommending would not suggest that the vertebrate eye can't be improved or is in some ultimate sense optimal. It would simply show why it is mistaken to regard the inverted retina as incompetently designed. Indeed, there are no concrete proposals on the table for how the vertebrate eye could be improved which guarantee no loss in speed, sensitivity, and resolution. There's also an irony worth noting: the very visual system that is supposed to be so poorly designed and that no self-respecting designer would have constructed is nonetheless good enough to tell us that the eye is inferior. We study the eye by means of the eye. And yet the information that the eye gives us is supposed to show that the eye is inferior.

This biting of the hand that feeds you is typical of evolutionary biology. The catalog I am proposing would document as much. Like the previous catalog, this catalog is not optional. Biology is firmly in the grip of an anti-design bigotry that needs to be unmasked and defeated. As David Berlinski has put it to me, "A shift in prevailing scientific orthodoxies will come only when the objections to Darwinism ... accumulate so forcefully that they can no longer be ignored."

3. Network of Researchers and Resources (NRR)

Intelligent design as a scientific and intellectual project has many sympathizers but few workers. The scholarly side of our movement at this time consists of a handful of academics and independent researchers. These numbers need to swell, and we need to be properly networked. We need to know who's out there working on what. To this end the Internet will prove invaluable. Intelligent design is at this time still an academic pariah. Consequently, it is difficult to concentrate our forces in any one institution. And yet, when I speak about intelligent design on university campuses, I almost invariably encounter at least one scientist on faculty eager to do research pertinent to intelligent design. The Internet, particularly as live chats and videoconferences become more readily available, will bring together scholars who now work in isolation. This will help overcome the institutional barriers they now face. Full and effective use of the Internet is simply a must.

The natural place to house such a network is within a professional society. Fortunately, such a society is now in place -- the International Society for Complexity, Information, and Design (ISCID -- www.iscid.org). Housing the network there is an option, though there are other options. The important thing for now is that we get networked, not who does the networking. Associated with this network should be research coordinators expert in a given field of science to help researchers in that field coordinate their efforts. The network needs to be endowed with resources. The International Society for Complexity, Information, and Design is currently working on an annotated bibliography of design-relevant literature. Access to various online subscription services (journals, specialized search engines, electronic books, etc.) should also be part of the resource package. This will cost money but be well worth the investment. Concentration of forces is a key principle of military tactics. Without it, troops, though willing and eager, wallow in indecision and cannot act effectively. The network of researchers and resources that I am recommending is the first step in concentrating our forces. The next step is setting the intellectual agenda for academic departments and even whole academic institutions. But that is still downstream and will depend on the next recommendation.

4. Building a Design Curriculum (BDC)

Ivan Pavlov and John Watson were both active in the early part of the twentieth century developing a behaviorist psychology. Behaviorism itself, however, didn't take off as an intellectual movement until a generation later when psychologists built a curriculum around it. For scientific ideas to prosper (regardless whether they are correct or ultimately mistaken, as behaviorism proved to be), they must be part of a curriculum that gets taught within the educational mainstream. This is the only way to win the next generation of scholars to intelligent design. Without a presence in the science curriculum, intelligent design will limp along, merely winning stragglers here and there.

A problem we now face with intelligent design is that even if the educational mainstream opened its arms to us (don't hold your breath), we have no sustained course of study to give them. A curriculum provides that, and much more. It takes the crazy-quilt of science and systematizes it into an intellectually coherent position. Students are thus introduced to a research tradition and not merely to a disconnected set of claims and arguments, or worse yet to some effective but easily ignored criticisms. Darwinists, by contrast, have a curriculum -- indeed, one that is steadily gobbling up discipline after discipline (evolutionary psychology being one of the more visible recent additions). Daniel Dennett was right when he called Darwinism a universal acid. Darwinism's hold on the academy is pervasive and monopolistic. By building a design curriculum, we attempt to restore a free market.

Are we at this time in the position to build a design curriculum? Certainly intelligent design as a scientific program needs to develop and mature. Nevertheless, I believe we are in a position to start building such a curriculum. At the very top of the list we need a introductory basal biology textbook -- in other words, a standard 800- to 1000-page introductory biology text framed around intelligent design rather than Darwinian evolution. Note that such a text would provide a fair and detailed treatment of Darwinian evolution. In fact, it would tell students more about Darwinian evolution than Darwinists typically want them to hear, notably about the theory's problems and weaknesses (and we don't even need to cite ourselves here; critics within evolutionary biology's own ranks, like the late Stephen Jay Gould and now Lynn Margulis with her theory of symbiogenesis, have saved us the trouble).

Actually, we'll need two basal biology texts, one geared toward college students and then a simplified version geared toward high school students. The closest thing we have right now is a supplemental biology text (*Of Pandas and People*). This is a terrific book. Nevertheless, as a supplemental text, its market and readership is necessarily limited. Once we have a basal biology text, we need to go through each discipline where Darwinian and naturalistic thinking has been used to illegitimately exclude intelligent design. Darwinism's universal acid has eaten into many disciplines, ranging from the sciences to the humanities. To counteract that acid, design theorists need to target each such discipline and systematically rethink it. Make no mistake, this work of reconceptualization and restoration will be very labor intensive and require the efforts of many scholars. The disciplines at the top of the list after biology that need to be reconceptualized are these: evolutionary psychology, bioethics, cognitive neuroscience, artificial intelligence, philosophy of mind (especially the problem of consciousness), the history and philosophy of science, foundations of physics, and cosmology.

Building a design curriculum is educational in the broadest sense. It includes not just textbooks, but everything from research monographs for professors and graduate students to coloring books for preschoolers. It needs to take full advantage of the technologies and media at our disposal -- CD ROMs, Videos, DVDs, computer animation, e-learning, and more. The videos *Unlocking the Mystery of Life's Origin* and *Icons of Evolution* are exemplary in this regard. So too is the cartoon book *What's Darwin Got to Do with It?*, which provides a perfect lead-in for students about to study high school biology.

Martin Luther once remarked that we can do without lots of things, but we can't do without schools, for they must rule the world. Not only must they rule the world, but they do indeed rule the world. Without a significant presence in the educational mainstream, intelligent design will continue to be marginalized and never attain its full potential. A design-theoretic curriculum is therefore indispensable to the success of intelligent design as a scientific and intellectual movement.

5. Objective Measures of Progress (OMP)
How do we gauge how well we are doing in developing ID as a scientific research program? We need some objective measures of progress. Rather than lay out such measures in pedantic detail, let me indicate what they are under four rubrics, each followed by a series of questions:

- **Intellectual Vitality**. Have we become boring? Have we run out of things to say? Is the fount of fresh ideas drying up? Are we constantly repeating ourselves? Are people who once were excited about what we're doing no longer excited? Or do we have the intellectual initiative? Are we setting the agenda for the problems being discussed? Are we ourselves energized by our research? Is there nothing we'd rather be doing than work on intelligent design? Are our ideas strong enough to engage the best and the brightest on the other side?

- **Intellectual Standards**. Are we holding ourselves to high intellectual standards? Are we in the least self-critical about our work? Are we sober or immodest about our work? Do we demand precision and rigor from our each other? Do we examine each other's work with intense critical scrutiny and speak our minds freely in assessing it? Or do we try to keep all our interactions civil, gentlemanly, and diplomatic (perhaps so as not to give the appearance of dissension in our ranks)? Does the mood of our movement alternate between the smug and the indignant -- smug when we hold the upper hand, indignant when we are criticized? Do we react to adverse criticism like first-time novelists who are dismayed to discover that their masterpiece has been trashed by the critics? Or do we take adverse criticism as an occasion for tightening and improving our work?

- **Exiting the Ghetto**. Do we refuse to be marginalized within an intellectual ghetto or second-class subculture? Are scholars and scientists on the other side actually getting to know us? Once they get to know us, do they still demonize us or do they think that we have an interesting, albeit perverse, point of view? Is intelligent design's appeal international? Does it cross religious boundaries? Or is it increasingly confined to American evangelicalism? Who owns ID? Are we trying to get our ideas into the scientific mainstream? Are we continuing to plug away at getting our work published in the mainstream peer-reviewed literature (despite the deck being stacked against us)? Or are we seeking safe havens where we can publish our work easily, yet mainly for the benefit of each other? At the International Society for Complexity, Information, and Design, for instance, we encourage contributors to the society's journal also to submit their articles to the mainstream literature. John Bracht, for instance, recently had his lengthy design-theoretic appraisal of Stuart Kauffman's latest book, *Investigations*, accepted in the Santa Fe Institute's journal *Complexity*. This is precisely what needs to happen.

- **Attracting Talent**. Are we continually attracting new talent to intelligent design's scientific research program? Does that talent include intellects of the highest caliber? Is that talent distributed across the disciplines or confined only to certain disciplines? Are under-represented disciplines getting filled? What about talent that's been with the movement in the past? Is it staying with the movement or becoming disillusioned and aligning itself elsewhere? Do the same names associated with intelligent design keep coming up in print or are we constantly adding new names? Are we fun to be around? Do we have a colorful assortment of characters? Other things being equal, would you rather party with a design theorist or a Darwinist?

These, then, are my recommendations for turning intelligent design into a disciplined science. Their implementation is absolutely necessary for the success of intelligent design as a scientific program, intellectual project, and cultural movement. Even so, their implementation is not sufficient for the success of intelligent design. One more thing is required, and that's a set of research problems that thoroughly captivate our scientific imaginations. These need to be so compelling that scientists eagerly devote their careers to resolving them.

Plenty of scientists are intrigued with intelligent design but for now don't see how they can usefully contribute to it. I recently had an exchange with one such scientist (a geneticist). I asked him, "What sort of real work needs to go forward before you felt comfortable with ID?" His response was revealing:

> If I knew how to scientifically approach the question you pose, I would quit all that I am doing right now, and devote the rest of my career in pursuit of its answer. The fact that I have no idea how to begin gathering scientific data that would engage the scientific community is the very reason that I don't share your optimism that this approach will work.

Or consider Francis Collins, head of the human genome project. As a Christian believer, he is committed to design in some broad sense. Yet, at the most recent meeting of the American Scientific Affiliation (Pepperdine University, 2-5 August 2002) he expressed doubts about intelligent design as a scientific project. The problem, according to him, is intelligent design's "lack of a plan for experimental verification."

I remain supremely optimistic that intelligent design has the research potential to satisfy such scientists. That potential, however, needs to be actualized. How, then, to actualize it? The most important thing right now is a steady stream of good ideas together with the resources to implement them. In particular, we need to reflect deeply about biological systems. That reflection needs to generate profound insight. And that insight needs to get us asking interesting new questions that can be framed as research problems. With these research problems in hand, we then need to go to nature and see how they resolve.

I'm mainly a theoretician, so I'm not in a position to lay out a detailed set of research problems for intelligent design. Nonetheless, as an interdisciplinary scholar who rubs shoulders with scientists from many disciplines, I am in a position to lay out some *research themes* that may prove helpful to scientists who are trying to find a way to contribute usefully to intelligent design research. What follows, then, is a list of research themes (let me stress that I make no pretense at completeness).

1. Design Detection
Techniques, methods, and criteria of design detection are widely employed in various special sciences (like archeology, cryptography, and the Search for Extraterrestrial Intelligence or SETI). There's currently much discussion from all sides about the validity of detecting actual design in biology using Michael Behe's criterion of irreducible complexity or my criterion of specified complexity. Design theorists need to be at the center of this discussion.

2. Biological Information
Information, according to its Latin etymology, means to give shape or form to something. It's no exaggeration to say that the origin of life and its subsequent complexification constitutes an "information revolution" in the history of matter. Indeed, matter needs to be formed in very special ways to constitute life. What is the nature of biological information? How do function and fitness relate to it? What are the obstacles that face material mechanisms in attempting to generate biological information? Most importantly, what are the theoretical and empirical grounds for thinking that intelligence is indispensable to the origin of biological information? I've begun to address these problems in my book *No Free Lunch*, but much more work is needed here.

3. Minimal Complexity

Living things are complex systems that consist of complex subsystems that in turn consist of complex subsubsystems and so on until a level of organization is reached that is chemically simple (for instance, individual amino acids or nucleotide bases). How does pruning away the complexity of such systems affect their ability to perform some function or set of functions (most notably, keeping the organism alive and able to reproduce)? How much can the complexity be pruned down and still preserve function? Once a complexity barrier is reached below which function can no longer be preserved, could coevolution overcome that barrier by switching function? Are there systems that are not only minimally complex with respect to some function, but for which any reduction of complexity eliminates all possibility of biological function? Would such systems provide decisive confirmation of intelligent design?

4. Evolvability

Evolutionary biologists are in the business of drawing evolutionary connections between biological systems. This requires identifying biological systems, relating them according to some similarity metric, and then telling evolutionary stories that, as it were, connect the dots. Yet for large-scale evolutionary changes, these stories tend to be imaginative reconstructions with no firm evidential basis. This is certainly true of attempts to bridge major divisions in the fossil record. It is also true of molecular phylogenies. Evolutionary biology's preferred research strategy consists in taking distinct biological systems and trying to merge them. Intelligent design, by contrast, focuses on a different strategy, namely, taking individual biological systems and perturbing them to see how much the systems can evolve (with and without intelligence). Limitations on evolvability by material mechanisms constitute evidence for design.

5. The Principle of Methodological Engineering

The reason evolutionary biology has lost all sense of proportion about how much evolution is possible as a result of blind material mechanisms (like random variation and natural selection) is because it floats free of the science of engineering. At every crucial juncture where some major evolutionary transition needs to be accounted for, evolutionary biology invokes a designer-substitute (like natural selection, lateral gene transfer, or symbiogenesis) to do the necessary design work. Yet unlike the science of engineering, evolutionary biology does not actually perform the necessary design work or specify a detailed procedure by which it might be accomplished. Intelligent design, by contrast, takes what I call "methodological engineering" as a fundamental regulative principle for understanding biological systems. According to this principle, biological systems are to be understood as engineering systems. In consequence, their origin, construction, operation, break down, wearing out, repair, and above all history of modifications (both designed and accidental) are all to be understood in engineering terms. In the next ten years I foresee academic programs in biotic engineering supplanting academic programs in evolutionary biology.

6. Technological Evolution (TRIZ)

The only well-documented example we have of the evolution of complex multipart integrated functional systems (like we see in biology) is the technological evolution of human inventions. In the second half of the twentieth century, Russian scientists and engineers studied hundreds of thousands of patents to determine how technologies evolve. They codified their findings in a theory to which they gave the acronym TRIZ, which in English translates to Theory of Inventive Problem Solving. The picture of technological evolution that emerges out of TRIZ maps amazingly well onto the history of life as we see it in the fossil record and includes the following:

(1) New technologies (cf. major groups like phyla and classes) emerge suddenly as the solution of an inventive problem, which requires a major conceptual leap (cf. design).

(2) Existing technologies (cf. species and genera) can, by contrast, be modified by trial and error tinkering (cf. Darwinian evolution), which amounts to solving a routine rather than an inventive problem. (The distinction between routine and inventive problems is central to TRIZ. In biology, irreducible complexity suggests one way of making the analytic cut between these types of problems. Are there other ways?)

(3) Technologies approach ideality and thereafter tend not change (cf. stasis);

(4) New technologies, by supplanting old technologies, can upset the ideality and stasis of the old technologies, thus forcing them to evolve in new directions (requiring the solution of new inventive problems, as in an arms race) or by driving them to extinction.

Mapping TRIZ onto biological evolution provides a potentially fruitful avenue of design-theoretic research that is entirely consonant with the principle of methodological engineering.

I need here to add a footnote about TRIZ. Most design critics, by conflating ID with creationism, see ID as committed to a designer who always designs from scratch and has to get everything right the first time. TRIZ, by contrast, bespeaks an evolutionary process that as much as possible takes advantage of existing designs but then at key moments requires a conceptual breakthrough to move the process of technological evolution along. On this view, the process of technological evolution is itself designed. What's more, within that process, designing intelligences interact with natural forces. Does this mean that designer(s) is/are making things up as they go along? Not necessarily. The conceptual breakthroughs needed to drive technological evolution can be programmed from the start. And what about suboptimal and dysteleological design? These can be explained in part as the result of natural forces subverting an original design plan. Teasing apart the effects of intelligence from natural forces thus becomes a key research question for a TRIZ approach to intelligent design.

7. Autonomy vs. Guidance

Many scientists worry that intelligent design attempts to usurp nature's autonomy. But that's not the case. Intelligent design is merely trying to restore a proper balance between nature's autonomy and teleologic guidance. Prior to the rise of modern science all the emphasis was on teleologic guidance (in the form of divine design). Now the pendulum has swung to the opposite extreme, and all the emphasis is on nature's autonomy (an absolute autonomy that excludes design). Might there not be a mid-point that properly respects both and in which design becomes empirically evident? The search for that mid-point needs always to be in the back of our minds as we engage in design-theoretic research. It's not all design or all nature but a synergy of the two. Unpacking that synergy is the ID research program in a nutshell.

8. Evolutionary Computation

Increasingly it is becoming evident that organisms employ evolutionary computation to solve many of the tasks of living. But does this show that organisms originate through some form of evolutionary computation (as through a Darwinian evolutionary process)? It seems that the immune system, for instance, is a general purpose genetic algorithm that targets an interloper, sets up a gradient that tracks the interloper, and then runs a genetic algorithm specifically adapted to that gradient whose output is a molecular assemblage that vanquishes the interloper. All of this sounds very high-tech and programmed. Are GPGAs (General Purpose Genetic Algorithms) like this actually designed or themselves the result of evolutionary computation. Evolutionary computation occurs in the behavioral repertoire of organisms but is also used to account for the origination of certain features of organisms. It would be helpful to explore the relationship between these two types of evolutionary computation as well as any design intrinsic to them. My work in chapter 4 of *No Free Lunch* lays out some of the theoretical groundwork here. Besides theoretical work in this area, we need a large contingent of ID computer programmers who can write and run computational simulations that investigate the scope and limits of evolutionary computation. One such simulation is the MESA program (Monotonic Evolutionary Simulation Algorithm) due to Micah Sparacio, John Bracht, and me. It is available on the ISCID website (http://www.iscid.org/ubbcgi/ultimatebb.cgi?ubb=get_topic;f=6;t=000054).

9. Understanding Discontinuity

Evolution is committed to continuity in a broad sense. Its main business is to connect dots. But for dots to be plausibly connected, they need to be reasonably close together. That's why the absence of transitional forms, gaps, and missing links or intermediates constitute a problem for evolution. To be sure, evolutionists do not regard the absence of intermediates as a problem in the bad sense. They regard such discontinuities not as challenges to their theory but as discontinuities that are only apparent and that will disappear once the missing intermediates are found. Consequently, whenever an intermediate is found, it is regarded as a triumph for evolutionary theory (witness the recent excitement over the Toumaï fossil find in Chad).

Evolutionary biology attempts to explain the absence of intermediates from an evolutionary path on the assumption that the intermediates did once exist. But now let's turn the question around. Suppose that discontinuity is a fact not just about the history of life as we know it but about the history of life itself—in other words, the intermediates never existed. In that case, how did biological forms in all their vast complexity and diversity come about? In asking this question, let's hold off asking for the underlying cause or causes of biological complexity and diversity. Rather, let's merely ask what a video camera would see if it were scouring the past and recording key events in life’s history. There are exactly four possibilities:

(1) **Nonbiogenic emergence**. Organisms emerge without the direct causal agency of other organisms. In place of life begetting life, here we have nonlife begetting life.

(2) **Generative transmutation**. Organisms, in reproducing, produce offspring that are vastly different from themselves.

(3) **Biogenic reinvention**. Organisms reinvent themselves in midstream. At one moment they have certain morphological and genetic features, at the next they have a vastly different set of such features.

(4) **Symbiogenic reorganization**. Organisms emerge when different organisms from different species get together and reorganize themselves into a new organism.

None of these possibilities is out to lunch. Nonbiogenic emergence had to happen at least once, namely, at the origin of life. Symbiogenic reorganization has been Lynn Margulis's main focus of research, and there is increasing evidence for it. Biogenic reinvention (organisms changing in midstream) is also not that crazy when one considers the life cycles of certain organisms which from one stage to the next are completely unrecognizable (for example, the metamorphosis of the butterfly or, even more extremely, the various forms of the liver fluke). Finally generative transmutation suggests a programmed view of evolution, where, like a computer program that kicks in at a certain time (recall the Michelangelo virus that kicked in March 6th, 1993), organisms change in one generation. French paleontologist Anne Dambricourt has seriously argued for this view in respect to the emergence of *Homo sapiens*.

With regard to these four possibilities, the crucial question now is this: How does one make sense of these possibilities in light of intelligent design? Clearly, none of these possibilities makes sense without some directed coordination.

10. Steganography

Finally, we come to the research theme that I find most intriguing. Steganography, if you look in the dictionary, is an archaism that was subsequently replaced by the term "cryptography." Steganography literally means "covered writing." With the rise of digital computing, however, the term has taken on a new life. Steganography belongs to the field of digital data embedding technologies (DDET), which also include information hiding, steganalysis, watermarking, embedded data extraction, and digital data forensics. Steganography seeks efficient (that is, high data rate) and robust (that is, insensitive to common distortions) algorithms that can embed a high volume of hidden message bits within a cover message (typically imagery, video, or audio) without their presence being detected. Conversely, steganalysis seeks statistical tests that will detect the presence of steganography in a cover message.

Consider now the following possibility: What if organisms instantiate designs that have no functional significance but that nonetheless give biological investigators insight into functional aspects of organisms. Such second-order designs would serve essentially as an "operating manual," of no use to the organism as such but of use to scientists investigating the organism. Granted, this is a speculative possibility, but there are some preliminary results from the bioinformatics literature that bear it out in relation to the protein-folding problem (such second-order designs appear to be embedded not in a single genome but in a database of homologous genomes from related organisms).

While it makes perfect sense for a designer to throw in an "operating manual" (much as automobile manufacturers include operating manuals with the cars they make), this possibility makes no sense for blind material mechanisms, which cannot anticipate scientific investigators. Research in this area would consist in constructing statistical tests to detect such second-order designs (in other words, steganalysis). Should such second order designs be discovered, the next step would be to seek algorithms for embedding these second-order designs in the organisms. My suspicion is that biological systems do steganography much better than we, and that steganographers will learn a thing or two from biology -- though not because natural selection is so clever, but because the designer of these systems is so adept at steganography.

Such second-order steganography would, in my view, provide decisive confirmation for ID. Yet even if it doesn't pan out, first-order steganography (i.e., the embedding of functional information useful to the organism rather than to a scientific investigator) could also provide strong evidence for ID. For years now evolutionary biologists have told us that the bulk of genomes is junk and that this is due to the sloppiness of the evolutionary process. That is now changing. For instance, Amy Pasquenelli at UCSD, in commenting on long stretches of seemingly barren DNA sequences, asks us to "reconsider the contents of such junk DNA sequences in the light of recent reports that a new class of non-coding RNA genes are scattered, perhaps densely, throughout these animal genomes." ("MicroRNAs: Deviants no Longer." *Trends in Genetics* 18(4) (4 April 2002): 171-3.) ID theorists should be at the forefront in unpacking the information contained within biological systems. If these systems are designed, we can expect the information to be densely packed and multi-layered (save where natural forces have attenuated the information). Dense, multi-layered embedding of information is a prediction of ID.

It's time to bring this talk to an end. I close with two images (both from biology) and a final quote. The images describe two perspectives on how the scientific debate over intelligent design is likely to play out in the coming years. From the vantage of the scientific establishment, intelligent design is in the position of a mouse trying to move an elephant by nibbling at its toes. From time to time the elephant may shift its feet, but nothing like real movement or a fundamental change is about to happen. Let me emphasize that this is the perspective of the scientific establishment. Yet even adopting this perspective, the scientific establishment seems strangely uncomfortable. The mouse has yet to be squashed, and the elephant (as in the cartoons) has become frightened and seems ready to stampede in a panic.

The image that I think more accurately captures how the debate will play out is, ironically, an evolutionary competition where two organisms vie to dominate an ecological niche (think of mammals displacing the dinosaurs). At some point, one of the organisms gains a crucial advantage. This enables it to outcompete the other. The one thrives, the other dwindles. However wrong Darwin might have been about selection and competition being the driving force behind biological evolution, these factors certainly play a crucial role in scientific progress. It's up to ID proponents to demonstrate a few incontrovertible instances where design is uniquely fruitful for biology. Scientists without an inordinate attachment to Darwinian evolution (and there are many, though this fact is not widely advertised) will be only too happy to shift their allegiance if they think that intelligent design is where the interesting problems in biology lie.

I close with a quotation by Emanuel Lasker, philosopher, mathematician, friend of Albert Einstein, and world chess champion for 27 years. Strictly speaking his comments are about chess. But for Lasker, chess was life and life was chess. Victory in chess was for him a triumph of truth. I present Lasker's quote because he puts his finger on the honesty, precision, and critical sense that must guide our thinking if we are to meet the challenges of evolutionary biology and turn intelligent design into a disciplined science. Here is the quote:

> Life is generated only by life. He who wants to educate himself in Chess must evade what is dead in Chess -- artificial theories, supported by few instances and unheld by an excess of human wit; the habit of playing with inferior opponents; the custom of avoiding difficult tasks; the weakness of uncritically taking over variations or rules discovered by others; the vanity which is self-sufficient; the incapacity for admitting mistakes; in brief, everything that leads to a standstill or to anarchy. (*Lasker's Manual of Chess*, p. 338)

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