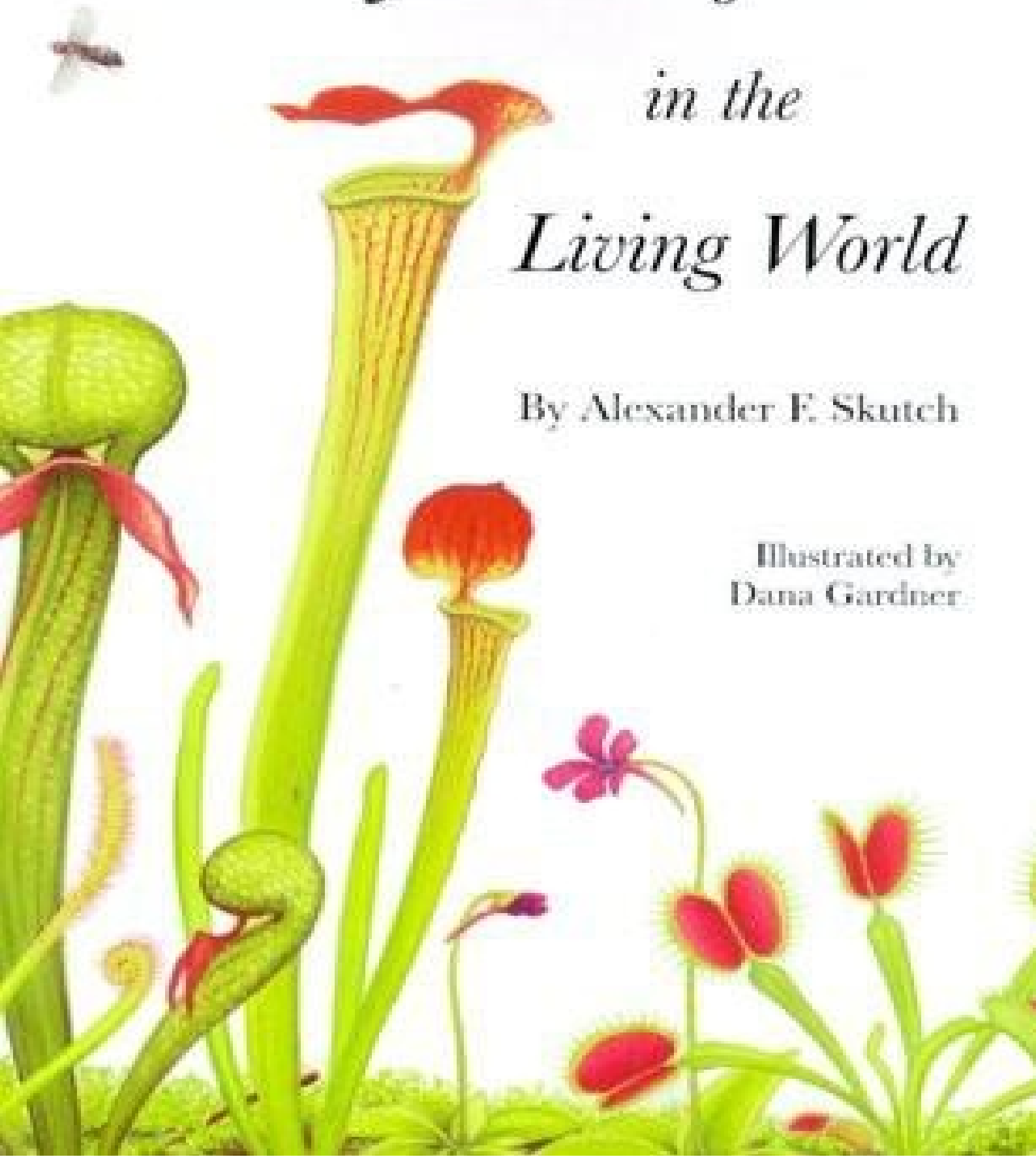
Harmony and Conflict in the Living World

By Alexander F. Skutch

Illustrated by
Dana Gardner



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Preface

If I were asked to characterize the living world in one word, the word would be *paradoxical*. A paradox is a conclusion that, although possibly true, appears not to follow logically from its premises or a situation incompatible with its antecedents. Paradoxes are inconsistencies, contrarieties in the development of a doctrine or a system. The living world, incongruously replete with beauty and ugliness, delight and terror, love and hatred, cooperation and exploitation, life and death, is a fabric o paradoxes.

The most glaring of nature's incongruities is the internecine strife between organisms that, from the least to the greatest, have so much in common. The more intensively they are studied, the more similarities are disclosed, in genetic control and physiological processes, between creatures that vary immensely in form, habitat, and activities. The life and health of each are preserved by a high degree of internal harmony among diverse organs and functions, yet their external relations are frequently fa from harmonious.

To understand this paradoxical situation, we must look deeply into the nature of the universe, which, as I explained in *Life Ascending* (1985), is pervaded by an unremitting tendency to arrange its materials in patterns of increasing amplitude, complexity, and coherencethe process of harmonizatio that brings order out of chaos. On a vast scale it has condensed great quantities of matter, originally present as intergalactic clouds of gases and dust, into stars, planets, and their satellites. It has set the planets in orbits around the stars, the satellites in courses around the planets, in dynamic systems so balanced and stable that, as in our solar system, they endure for long ages.

On a small scale, the same process is evident in the union of atoms in molecules of innumerable kind and the alignment of atoms or molecules in enduring crystals that are often of scintillating splendor. In the living world, the tendency of matter to form patterns of increasing amplitude, complexity, and coherence is most

It is not difficult to understand how strife and suffering arise in a world pervaded by a process that is primarily creative and beneficent. Unguided creativity is unrestrained by moderation. It initiates so many organisms that they compete stubbornly for the space and materials that they need to complete and preserve themselves, with all the lamentable consequences that we have noticed. Not more creativity but more restraint is the world's great need, and this is nowhere more evident than in the human sphere.

In addition to this major paradox, the living world presents many minor ones, a few of which are examined in this book. Among them is the dual nature of animals, products of harmonious development, depending for their survival upon close adjustment to their environments, often dwelling in amity with other creatures, yet capable of such fierce rivalry and lethal violencecontrasts nowhere more glaring than in humankind. Is it not paradoxical that plants, sharply distinguished from animals by their ability to synthesize their own food from inorganic matter as no animal can do, should occasionally turn the tables and devour animals as, on an infinitely larger scale, animals devour plants as well as other animals?

Not the least of the incongruities that the living world presents are revealed by a survey of the growth of intelligence. We might expect reasonthe ability to think, to compare, to foresee to advance steadily from humblest rudiments to full maturity, as a seedling grows into a tree, as daylight brightens from dawn's first glimmer to noontide brilliance, thereby becoming a luminous guide to peaceful living. On the contrary, as chapter 9 tells, our fumbling cold in a frigid zone, causes great destruction of living things. We are then apt to remark upon the harshness or cruelty of nature. But can one who perversely sits too close to the fire claim to be unfairly treated if scorched now and then?

efforts to use our inchoate rationality have yielded mountains of error and been a major source of absurd practices and widespread suffering.

It is not surprising that serious attempts to understand a confusing living world have led to fantastic interpretations widely accepted by biological orthodoxy. Prominent among those that claim our attention is the doctrine of the "selfish gene," with its corollary that individual animals and plants never act "for the good of the species." Presumably, survival is good, species continue to survive, and what keeps them extant if not the activities of the individuals that compose them? When we reflect that anatomical similarities among diverse animals, such as primates, ungulates, bats, and birds, provide strong evidence for evolution, fervently supported by orthodox biologists, it is puzzling to find them so vehemently rejecting suggestions of psychic resemblances between humans and other creatures, which they condemn as anthropomorphism.

Another scientific heresy is teleology, the ascription of ends or purpose to any part of nature except our very purposeful selves; as though, after a prolonged purposeless preparation for humanity and its manifold material and spiritual needs, purpose suddenly sprang up in the world without antecedents. Equally difficult to understand is the widespread insistence that natural selection acts exclusively upon individuals, never upon populations or groups, apart from which no sexually reproducing organism can propagate its kind.

Chapter 5 compares the consequences of unilateral exploitation with those of cooperation among organisms, noticing the many benefits that we owe to the latter, whereas exploitation has been a major source of life's ills. Finally, we arrive at the paradox that humans, each separated from the surrounding world by a skin that protects his or her finely adjusted vital processes from disastrous intrusions and lethal losses, reach out beyond this insulating integument with love, sympathy, and thirst for understanding that know no bounds.

We look at conservation, which is the effort to halt, or at least to retard, the rapid deterioration of the paradoxical living world, rife clearly revealed in the growth of organisms, even the simpler of which are of greater complexity, and more closely integrated, than anything of comparable size we can find in inorganic nature. The same process is apparent in the moral endeavor to create harmoniously integrated societies, in the efforts of thinkers to form coherent systems of thought, and of artists to create beauty. We owe to harmonization all the values that enhance existence and make life worth living. It appears to be a universal striving to enrich the cosmos by actualizing potentialities, thereby transforming bare Being to full Being, replete with high values.

with antagonisms and conflicts. This growing enterprise is supported, vocally and often materially, b people with contrasting temperaments and opposing interests. This lack of unanimity is not surprisin in a movement that enlists such a diversity of people committed to the preservation of such a perplexing world; conservation is not devoid of its own internal conflicts. Hunters support conservation to ensure a continuing supply of targets for their guns, while friends of animals deplore their needless destruction. Many try to protect, and even increase, the raptors that prey heavily upon the birds, especially Neotropical migrants, whose decline others deplore. Some assign priority to the preservation of habitats, whereas others are more concerned about the fate of species on the verge of extinction. To avoid contrary efforts and waste of inadequate funds, conservationists need to clarify their objectives and agree upon priorities. In chapter 8, I suggest a criterion for conservation that is objective in the sense of being independent of individuals' preference of this or that category of organisms. Wide-spread adoption of this criterion should greatly promote the ends of conservation.

I wrote this book because I was convinced that examination of some of nature's paradoxes could deepen our understanding of life. Each chapter is an independent essay, understandable without reference to the others; together, they develop a view of the living world that is not despondent but cautiously optimistic. For ready reference, the scientific names of organisms capitalized in the text a given in the index.

1
A Realm of Paradoxes

What is the most fundamental difference between a living organismyourself, for exampleand a lifele object, such as a stone? You are self-moved, and the rock is not. You feel and think, as stones evidently cannot do. You are structurally much more complex than any mineral, and your parts are more closely integrated. You are capable of doing a hundred things that stones cannot do. We might continue for pages to enumerate all the ways in which people, and other living things, differ from lifeless things, without hitting upon the most basic difference because it is perhaps the least obvious. hope that you will not be offended if I suggest that the most fundamental difference between you and stone is that you are covered by skin and the rock is not. All that the living world has achieved, all its glories and likewise its tragedies, may be traced to the unexciting and sometimes overlooked fact tha organisms of all kinds are separated from their ambience by a semipermeable integument, a thin pellicle or a thick skin, such as inorganic objects commonly lack.

Insulation and its Consequences

The basic unit of life is the cell, with the protoplast that it encloses. This consists of the watery, somewhat viscous cytoplasm and the organelles within it, including a nucleus, mitochondria, and various

other plastids. Even one-celled organisms, scarcely visible or invisible to our unaided eyesthe amoeb and the paramoeciumare vastly complex. To carry on their diverse functions, they must control their contents, retaining within themselves what they need, resisting the intrusion of superfluous or harmfu substances from the surrounding water. They cannot completely insulate themselves from their milieu, for they depend upon it for indispensable materials, and they must return to it waste products of metabolism that would be injurious if permitted to accumulate. To control its exchanges with its surroundings, each minute organism encloses itself in a selectively permeable pellicle or membrane, which freely permits the inward or outward diffusion of certain substances but refuses passage to others. The creature's life depends upon the maintenance of this exceedingly thin and fragile barrier. To impair it is to kill the organism.

Plants and animals increase in complexity by adding cell to cell. Although they cooperate closely, th cells of a multicellular organism preserve a certain independence by retaining the semipermeable ectoplasm that regulates their exchanges with adjoining cells. This is most readily demonstrated in vegetable tissues with cells enclosed in more or less rigid walls of cellulose. Tender growing stems and leaves maintain their shapes while their cells are turgid with water; if they lose too much liquid they wilt and droop, like a balloon from which the air escapes. If one places a thin section of plant tissue in a concentrated solution, as of cane sugar, and watches through a microscope, each protoplas can be seen shrinking away from its enclosing wall of cellulose. The cell's semipermeable ectoplasm permits water to flow outward but retards or prohibits the inward diffusion of the solute. The cytopla continues to lose water and contract until its osmotic pressure equals that of the solution in which it i immersed.

In addition to the defenses of their individual cells, multicellular organisms develop more obvious ar resistant means of regulating their exchanges with their media. Trunks, branches, and roots of woody plants cover themselves with bark, which at least on younger branches is penetrated by lenticels mor permeable to air. Leaves

and herbaceous stems are covered with waxy cuticles, which are thicker and less permeable to water the more arid the environment. Penetrating the cuticle and epidermis of leaves and green stems are multitudes of minute pores, the stomata, which by opening and closing regulate the inward and outward passage of gases needed for respiration and photosynthesis, and the outward diffusion of water vapor in transpiration.

The integuments of animals are wonderfully diverse. Many aquatic and not a few terrestrial creatures enclose themselves in hard shells or carapaces, which may have evolved primarily for protection fro predators but at the same time help to insulate animals from the ambience. Insects are covered by their chitinous exoskeletons, penetrated by the tracheal openings through which they breathe. Among vertebrates, the primary integument is a flexible skin, resistant to most substances that are likely to moisten it in an animal's natural environment, constantly renewed as it wears away, and in many animals equipped with sweat glands that help to regulate body temperature, or with chromatophores that by changing its color assimilate to the background and make the wearer less conspicuous to enemies. The scales of fish and reptiles, the hair of mammals, and the feathers of birds give addition protection.

Although every organism from algae and protozoa to trees and the largest vertebrates can regulate th entrance and exit of materials to and from its living cells, only fur and feathers, or subcutaneous fat i certain animals of cold climates, provide effective thermal insulation. Only animals covered with hai or feathers that enclose many minute air spaces can afford the luxury of constant body temperature; for others, the attempt to achieve homeothermy would cost too much energy. By growing a thicker coat of feathers or fur as the climate becomes colder, or depositing more fat beneath their skins, bird and mammals can remain warm and active in air so frigid that all other creatures become dormant or die. They have attained the maximum independence from climatic extremes that animals can achieve without shelters that can be heated or cooled.

Insulation is not only physical but also psychic. We do not doubt that other people feel, and sometimes think, much as we ourselves

do; and the more intimately we study the lives of other animals, the more certain we become that the too, are stirred by emotions and are not devoid of thought. But, with certain possible and debatable exceptions, we never have direct, unassailable evidence that other creatures of any kind feel or think; we infer their feelings and thoughts from the way they act, the sounds they emit, their facial expressions. Our psychic insulation is tighter than our physical insulation; the membranes that separate us from our physical environment are but semipermeable, permitting many substances to pass in and out; whatever it may be that shields our minds from direct awareness of the psychic state of other creatures is nearly, if not wholly, impermeable. This insulation makes it possible for one animal to harm another without feeling the consequences.

Although we seldom attribute sociality to lifeless things, they are in fact much more social than livin organisms. They seldom enclose themselves in integuments that, like walls, effectively separate then from surrounding materials but freely intermingle when they meet. Rocks and crystals expose their unmodified substance, their naked bodies, to the disintegrative action of air, water, and soil. Gasses c different kinds intermingle, or are absorbed by liquids, with usually no barrier to control the process. Drops of a liquid coalesce when they flow together, one losing its identity in the other. Even solids such as metals slowly diffuse through each other when tightly pressed together. Everywhere in inorganic nature we find readiness to meet and to mingle; no substance appears to be consistently averse to losing its distinctness by union with some other substance. Rarely do we find such aloofnes such stubborn clinging to a separate and insulated existence, as in living things. It is significant that when we wish to waterproof a fabric, or to cover metal or wood with a thin, impermeable pellicle tha will shield it from rust or decay, we commonly choose for the protective coating some substance elaborated by living organisms. Waxes, resins, rubber, in their many varieties, are not fortuitous secretions of plants; they are elaborated for the protection of vegetable bodies.

With the exceptions of parasites and their hosts, only exceptionally do separate organisms unite as intimately as lifeless sub-

stances so frequently do, and these are nearly always members of the same species. Relatively simple animalcules, like corals and sponges, join in large numbers to form compound organisms. Roots of different trees of the same species, especially conifers, may fuse together when they meet in the soil, and the horticulturist's art may graft one variety of a tree or shrub upon the stock of another. The higher animals so stubbornly resist the intrusion into their own flesh of alien flesh, even of their own species, that only by the surgeon's utmost art can they be induced to accept a foreign organ to replace a diseased one of their own.

Even in their manner of destruction, living beings demonstrate their essential difference from the nonliving. Barring violent impacts and such crushing forces as might reduce rocks and crystals to rubble or powder and living flesh to formless pulp, organic and inorganic bodies are destroyed in radically different ways. Rocks weather on their exposed surfaces and slowly dwindle; crystals dissolve from the surface inward; drops of a liquid evaporate from the outside. But living things are so well enclosed in protective membranes or integuments that their destruction, when not caused by violence or high temperatures, usually results from changes in the interior rather than at the surface. The deadly poison or fatal parasite must insinuate its way into the body, either through one of the natural openings normally under the control of the organism or through a break in its integument, before it can begin its work of destruction. Or, if it escape death in other forms, the organism runs down and becomes quiescent from senescence, a process wholly internal.

The other distinctive qualities of living organisms are ancillary to their ceaseless effort to preserve separate identity. Most significant of these are their capacity to assimilate and incorporate intimately into themselves materials different from their own substance, and to grow from within rather than at the surfaceby intussusception rather than by apposition, as botanists say. Whereas crystals and other inorganic bodies that do not enclose themselves in insulating membranes may continue to grow by means of superficial deposits, this method of enlargement is not available to an insulated organic body.

Living things tend to avoid contact with substances and processes that would harm them: a protozoan swims away from the diffusing chemical that would kill it; a man snatches his hand away from a hot stove. Inorganic bodies show no comparable tendency to avoid other bodies that would injure them. But the living organism does not always passively await actual contact with the deleterious substance it displays a sensitivity to influences playing upon it, from sources near or remote, such as is rarely found in inorganic matter, and frequently it succeeds in escaping from dangerous situations. And wh contact with the injurious foreign object is inevitable, it exhibits an ability to adapt itself, to escape destruction by changing shape and endless stratagems, for which one looks in vain in lifeless bodies.

But in spite of all its defenses and its wiliness in confronting unfavorable situations, the more highly differentiated organism must sooner or later succumb, if not by external agency, then by internal decay. Yet even mortality cannot defeat it. If it cannot maintain its separateness in its own body, it will transmit this capacity for preserving separateness to others like itselfnot only to one, but to several or many, to ensure the perpetuation of its kind against all contingencies. As though foreseein its own eventual disintegration, it does this while still at the flood tide of vitality, while senescence and death seem remote. The capacity to reproduce itself in all its complexity, from a minute and seemingly simple particle of itself, is one of the most marvelous of all the properties of the living organism, and one that strongly distinguishes organic from inorganic bodies. Although the latter sometimes display superficial resemblances to the life processes, analysis shows that these seeming likenesses in inorganic substances are not close.

Toughness and Aggressiveness of Life

A great paradox of living substance is its combination of tenacity with extreme frailty. It is so easy t destroy by heat, by intense illumination, by chemicals of a thousand kinds, by mechanical violence;

A fundamental property of life is its stubbornness, its opposition to the forces that would carry it away, reduce it, or annihilate it. The swiftly flowing river bears downward, for yards or miles, a stick a stone, or any other lifeless thing that may fall into it; but all its free-swimming living inhabitants, from great fish to frail beetles and striders and other organisms so small that they escape the careless eye, set their heads resolutely against the current and resist its force. The fish in the mountain torrent is symbolic of all life, in the water, on the ground, or in the air: it resists the forces that would carry i along. Life seems to be pitted against the external world; struggle is its essence. And although agains cataclysmic forces it is pathetically helpless, tossed like a feather by the tempest, burnt to cinders by puff of volcanic vapor, for all its frailty it is the toughest thing under the Sun.

To add to the paradox, this thing at once so delicate and so resistant, so ephemeral and so enduring, tends ever to clothe itself in forms that present a greater challenge to all that is inimical in its environment, as though exulting in opposition to elemental forces and delighting to devise new ways of thwarting them. To the seaweed floating in still water, the maintenance of life is relatively simple. Constantly bathed in a liquid containing all that it needs for respiration and growth, it is hardly affected by the pull of gravitation; neither scorching sunshine nor drying wind is a yet with incredibl Protean cunning living things outwit destroyers and blossom forth again with renewed vigor and fertility. A rock in your field is troublesome; you carry it away and see it no more. But pull up a wee remove it, burn it, grind it into fragments, utterly obliterate itand the chances are that within a few months, seeds or fragments of it that escaped your notice will have produced a hundred weeds where you found one. To emphasize the evanescence of human life, moralists sometimes ask where are the hands that erected the Pyramids or built the Parthenon. Where are they, indeed? Those hands are multiplied a thousandfold; they are in Europe and America and Africa and Australia and on the farthest islands of the oceans; while the stones that they set in place daily dwindle under the action o wind, rain, and frost.

threat to it; it has no occasion to send forth roots to gather essential elements thinly diffused through the soil, then transport them to distant organs.

Why did not vegetation remain forever content with the security of the aquatic environment in which it arose? What stubborn perversity of the living substance goaded it into invading the land, into assuming forms the continued existence of which is a miracle of audacity? In every respect in which life is simple and safe for the seaweed, it is complex and perilous for the tree. Whereas the alga vegetates in a caressing bath of nutrient fluid, the tree rears its lofty head as though to defy the gales and the lightning, the drying winds and the desiccating sunlight, the unremitting gravitational pull of Earth. It is endlessly extracting water and solutes from the soil and, by a process that has been difficult to understand, raising them fifty or a hundred yards into the air. It ceaselessly resists the elemental forces that would dry up its sap, starve its living foliage, and flatten it on the ground. And yet, as though to testify to the toughness and enterprise of life, trees, not algae, are (or until recently were) the dominant vegetation on this planet.

In the animal kingdom, the course of evolution has paralleled that of plants. Life is simple for the amoeba and other blobs of protoplasm that live always immersed in the water that forms the greater part of their substance; but as we all know, life is complicated for humans in our multiform, constantly changing environment. The more we contemplate the transformation, the more incredible appears that organisms forsook the ease and security (except from other organisms) of their primitive aquatic ambience to live unquietly amid all the stresses and perils of the less stable aerial environment. Had they been forced by some external power to assume forms whose preservation demands ever-increasing effort, their metamorphosis would have been surprising enough. We marvel the more when we remember that the impulse that drove them from change to change has always come from within them.

It is not that the universe, or that immediately effective part of it that we call the environment, is actively hostile to life, as Bertrand Russell (1917) believed. Save for an occasional hurricane, volcanic eruption, or flood, the environment is passive enough. In many

regions, it is so favorable for vital processes that it almost seems to invite the presence of living things. Its fitness to support them has many aspects. Water is, of all known liquids, that which best serves as a medium for intricate processes that can go forward only within a narrow range of temperatures; and it is the only liquid abundantly present on the surface of our planet. Among the properties that make it a fit medium for life are its high specific heat, which retards changes in temperature; its abrupt change from contraction to expansion as, in cooling, it approaches the freezin point, which causes it to congeal from the surface downward rather than from the bottom upward and increases the thermal stability at low temperatures of deep lakes and seas, making their complete congelation improbable. Add to this its chemical stability combined with its versatility as a solvent, and its capacity to form, with carbon, compounds rich in latent energy. Likewise oxygen, hydrogen, nitrogen, the sunlight, and the soil all have properties that make them peculiarly favorable for vital processes. The environment is friendly enough to life.

Life, on the other hand, often seems to challenge or defy the environment, like an aggressor invading hostile land. Had it been content to remain in the warm seas where it began, in the humid tropical lands where today it flourishes most lushly, it might have existed in vast profusion yet remained in friendly inorganic surroundings. But not satisfied with these immense yet almost uniformly congenia domains, restless life, impelled by its own great capacity for multiplication, invaded the arid deserts, advanced far toward Earth's frigid poles, climbed ever higher up rocky mountain slopes, battling against thin air and intense insolation and cruelly sudden changes in temperature. On every front, life armed itself to battle with the environment, which is not intentionally cold or arid or changeableseize it by the throat, so to speak, and by sheer force compelled it to yield what imperious life needed and demanded. When conflict arises between life and its milieu, life is usually the aggressor; the passive environment is what it must be.

In these uncongenial regions where intrusive life exists precariously, a slight intensification of the prevailing conditions, such as more prolonged drought in an arid land or exceptionally intense

It was once the habit to look upon all those features of Earth that make it a favorable home for living things as special provisions for this end. This interpretation provided a strong argument for natural theology, and writers of this school became eloquent as they contemplated the manifold arrangement that make this planet a congenial abode for humankind. Since the publication of *The Origin of Specie* in 1859, an exactly contrary view has become current. It is now held that we must not regard any features of the physical world as adaptations to support life; but that life, the latecomer, has simply had to conform to the conditions it found here, which it accomplished by a long course of trial and error.

This interpretation is as wide of the mark as the earlier one. It would be true only if life owed its origin to a process wholly different from that which formed the lifeless world, or if it had somehow intruded into this world from beyond. But since it is a product of the same processharmonizationthat earlier prepared the stage for it, this modern view is obviously too extreme. Actually, the living worl is related to the physical world as one phase of a continuous process to an earlier phase. Life is adapted to its inorganic setting because it emerged from that setting; the setting is adapted to life because it was formed by a preceding phase of the movement that gave rise to life. The adaptation is neither all on the side of the environment nor all on the side of life, but the conformity is that of the parts to the whole.

Life's stubborn intrusion into environments poorly fitted to support it reveals the intensity of harmonization's striving to build up patterns of higher integration, even in the face of the utmost obstacles. By far the greater part of the stuff of the universe is prevented by physical conditions from attaining the level of organization found in living things. Only an infinitesimal proportion of the tota quantity of matter can at one time participate in such complex formations. Yet the moment it encounters favorable circumstances,

the stuff of the universe rushes with unrestrained exuberance to arrange itself in elaborate patterns, exhibiting closer integration and greater beauty than we often detect in the lifeless world. A major portion of life's ills springs from just this almost explosive rush by the cosmic stuff to participate in a higher synthesis; if this urge did not result in such excessive numbers of organisms, life would certainly be more pleasant for those endowed with it.

Conflicts between Organisms

Just as they are often militant against the environment, living things are belligerent toward one another. One organism invades another, forcing it to yield the requisites of its own existence, to become a living environment for it. Nothing is sacred; no organ, tissue, or fluid, no matter how exquisitely delicate and admirably adapted to an intricate function, no matter how indispensable to the life of the host, is spared the pitiless invasion. Eyes and ears, heart and lungs, the very lifeblood itselfall are at times forced to become the medium of aggressive foreign organisms. Myriads of creatures live parasitically at the expense of others, from viruses too minute to be detected by common microscopes to ticks and leeches that batten shamelessly in view of all the world.

A growing organism tends to perfect a form intimately related to its mode of life and the constants of its natural environment. Except where strong winds prevail, trees commonly form upright trunks surrounded by boughs arranged with radial symmetry. Encrusting lichens spread in expanding circles over the faces of rocks. The giant kelp assumes an elongate, flattened form that permits it to yield gracefully to the ceaseless surge and tug of the surf where it thrives. Not only the organism as a whole but each organ strives to express its innate form or pattern; each leaf, according to its position on the herb or tree, would if left to itself become an undistorted example of its hereditary type. Likewise, each animal tends to become a shapely representative of its kind, perfect of limb and organ, its garment of scales or fur or feathers comely and complete

in every detail. Nevertheless, countless creatures fail to attain the full perfection of which they are capable.

When we investigate the causes of the failure of organisms to be whole and perfect examples of their kind, we usually find that other living things, rather than the inorganic setting, are to blame. As a rule the environment cooperates with the organism, helping it to perfect the form that was evolved in relation to this same environment. But it is quite the contrary with living things; they rarely modify their innate tendencies to grow to full perfection so that neighboring organisms may do likewise. The crowd and push against each other until shapeliness is impossible; they twine around and constrict each other; they strive to live in such egregious numbers that none of the multitude can procure all that it needs for full development; they invade each other's vital tissues; they consume each other piecemeal or devour each other whole. So intense is the struggle that, in tropical forests, a botanist may often search through the whole crown of some great fallen tree without finding a single twig with perfect foliage for his collectioninsects have gnawed into all of them even before they stopped growing. It is only exceptionally that the environment prevents organisms from attaining their ideal form; it is far more often the strife between the living things themselves.

Yet, except among morally underdeveloped people, we rarely find a suggestion that one living thing injures another just for the sake of hurting or destroying it. Each is striving to maintain and complete itself, to realize that particular perfection inherent in its own organization, but its circumstances are often such that it cannot procure all the materials or the space it needs for this purpose without opposing or injuring other living things. Life is always primarily constructive; destruction is all too often incidental to its activity but hardly its primary goal. Thus, each living thing owes its being to an organizing movement and its continued existence to the maintenance of a harmoniously integrated pattern, yet it must ever be prepared to contend with or to resist other more or less similar entities. These opposing tendencies account for those contradictions in the character of animals that claim our attention in chapter 3.

Real Strife Confined to the Living World

By the efforts of living things to occupy environments unfavorable to vital processes, and even more by the clash of organism with organism in a crowded world, harmonization, itself a definite, straightforward movement, becomes entangled in organic evolution, a labyrinth of complexities and contradictions that confuse the student of nature. We shall not succeed in understanding evolution unless we distinguish clearly between its driving force and true constructive principle, harmonizatior and the dreadful embroilment into which the living world is plunged by the manifold interactions of evolution's products. Without this distinction, the living world appears to be a fantastic welter of competing forms, a maze of frenzied stirrings leading nowhere; only in this light can we hope to discover a path through the labyrinth (Skutch 1985).

Life has needed to be aggressive because it has had to make its own way, creating itself under the constant impulsion of harmonization working within it. Evolution is self-creation. The origin of species by gradual evolution implies their formation by their own efforts. External agents have dictated the forms that organisms must assume in order to survive, but they have not made these organisms. Beyond the primitive home of life in tepid seas and humid adjoining lands, external agent would have annihilated living things but for their stubborn drive to exist. The environment has everywhere stipulated the conditions that organisms must accept if they would continue to live, but it has not itself altered them into conformity with these conditions. On the contrary, living things have molded themselves to their medium like some soft, plastic creature or tissue, an octopus or a growing root, forcing itself into a crevice in the rock, pressing itself home until it fits snugly into every cranny and around every projection. It is not the rock, but the octopus or the root, that has supplied the energ for this close adaptation.

The genesis of species by gradual changes promoted by interactions between themselves, surrounding organisms, and the physical environment provides a key to the understanding of evil. As long as people believed that each kind of living thing had been created

in its finished form by an Agent at once omnipotent and beneficent, strife and evil remained inexplicable, or could be explained only by means of unconvincing myths. For a Creator of unlimited power and perfect benevolence might have established each species in all its perfection, adjusting the relations of each one to every other, and of every one to its environment, so harmoniously that strife and discord would never arise. Actually, however, they have been self-created, formed by this very attrition and interplay that special creation might have obviated.

Apart from life, the disharmony we behold in the universe is more seeming then real. Matter flows ceaselessly from form to form; body collides with body; the smaller mass fuses with the greater and loses separate identity. Solar systems no less than molecules are constantly changing, dying, being born anew. No composite thing is eternal, nothing immutable, nothing fixed for all time. Strife has been called cosmic; but are the collisions and the often violent transformations that we witness in lifeless matter actually strife? Strife is essentially a conflict of wills, an attempt to alter or destroy that which stubbornly strives to preserve its present form. But in inorganic matter we detect no strong will to exist as a separate entity. Lifeless bodies rarely sheathe themselves in an insulating integument as in a coat of armor; it appears immaterial to the crystal, the rock, the mountain, the planet, or the solar system whether it continue in its present form or be transmuted to something else. These compound bodies evidently lack the will to perpetuate themselves. Far from resisting the closest union with others, the micropsychic atoms of which they are composed readily seek such union to satisfy their social nature.

"Cosmic strife" would be more aptly characterized as a cosmic dance. The dancers are marshaled in companies of the most diverse sizesof atoms, molecules, crystals, drops, oceans, continents, planets, solar systems, and galaxies. Each company is ceaselessly shifting its place, meeting others and uniting with them; or else great armies separate into smaller bands. And within each company the platoons, squads, and individuals are in constant happy agitation, following the immutable rules of the dance. In all