An Earnest Proposal

By Lewis Thomas

From *The Lives of a Cell*

There was a quarter-page advertisement in the London Observer for a computer service that will enmesh your name in an electronic network of fifty thousand other names, sort out your tastes, preferences, habits, and deepest desires and match them up with opposite numbers, and retrieve for you, within a matter of seconds, and for a very small fee, friends. "Already," it says, "it [the computer] has given very real happiness and lasting relationships to thousands of people, and it can do the same for you!"

Without paying a fee, or filling out a questionnaire, all of us are being linked in similar circuits, for other reasons, by credit bureaus, the census, the tax people, the local police station, or the Army. Sooner or later, if it keeps on, the various networks will begin to touch, fuse, and then, in their coalescence, they will start sorting and retrieving each other, and we will all becomes bits of information on an enormous grid.

I do not worry much about the computers that are wired to help me find a friend among fifty thousand. If errors are made, I can always beg off with a headache. But what of the vaster machines that will be giving instructions to cities, to nations? If they are programmed to regulate human behavior according to today's view of nature, we are surely in for apocalypse.

The men who run the affairs of nations today are, by and large, our practical men. They have been taught that the world is an arrangement of adversary systems, that force is what counts, aggression is what drives us at the core, only the fittest can survive, and only might can make more might. Thus, it is in observance of nature's law that we have planted, like perennial tubers, the numberless nameless missiles in the soil of Russia and China and our Midwestern farmlands, with more to come, poised to fly out at a nanosecond's notice, and meticulously engineered to ignite, in the centers of all our cities, artificial suns. If we let fly enough of them at once, we can even burn out the one-celled green creatures in the sea, and thus turn off the oxygen.

Before such things are done, one hopes that the computers will contain every least bit of relevant information about the way of the world. I should think we might assume this, in fairness to all. Even the nuclear realists, busy as their minds must be with calculations of acceptable levels of megadeath, would not want to overlook anything. They should be willing to wait, for a while anyway.

I have an earnest proposal to make. I suggest that we defer further action until we have acquired a really complete set of information concerning at least one living thing. Then, at least, we shall be able to claim that we know what we are doing. The delay might take a decade; let us say a decade. We and the other nations might set it as an objective of international, collaborative science to achieve a complete understanding of a single form of life. When this is done, and the information programmed into all our computers, I for one would be willing to take my chances.

As to the subject, I propose a simple one, easily solved within ten years. It is the protozoan Myxotricha paradoxa, which inhabits the inner reaches of the digestive tract of Australian termites.

It is not as though we would be starting from scratch. We have a fair amount of information about this creature already--not enough to under- stand him, of course, but enough to inform us that he means something, perhaps a great deal. At first glance, he appears to be an ordinary, motile protozoan, remarkable chiefly for the speed and directness with which he swims from place to place, engulfing fragments of wood finely chewed by his termite host. In the termite ecosystem, an arrangement of Byzantine complexity, he stands at the epicenter. Without him, the wood, however finely chewed, would never get digested; he supplies the enzymes that break down cellulose to edible carbohydrate, leaving only the non-degradable lignin, which the termite then excretes in geometrically tidy pellets and uses as building blocks for the erection of arches and vaults in the termite nest. Without him there would be no termites, no farms of the fungi that are cultivated by termites and will grow nowhere else, and no conversion of dead trees to loam.

The flagellae that beat in synchrony to propel myxotricha with such directness turn out, on closer scrutiny with the electron microscope, not to be flagellae at all. They are outsiders, in to help with the business: fully formed, perfect spirochetes that have attached themselves at regularly spaced intervals all over the surface of the protozoan.

Then, there are oval organelles, embedded in the surface close to the point of attachment of the spirochetes, and other similar bodies drifting through the cytoplasm with the particles of still undigested wood. These, under high magnification, turn out to be bacteria, living in symbiosis with the spirochetes and the protozoan, probably contributing enzymes that break down the cellulose.

The whole animal, or ecosystem, stuck for the time being halfway along in evolution, appears to be a model for the development of cells like our own. Margulis has summarized the now considerable body of data indicating that the modern nucleated cell was made up, part by part, by the coming together of just such prokaryotic animals. The blue- green algae, the original

inventors of photosynthesis, entered partnership with primitive bacterial cells, and became the chloroplasts of plants; their descendants remain as discrete separate animals inside plant cells, with their own DNA and RNA, replicating on their own. Other bacteria with oxidative enzymes in their membranes, makers of ATP, joined up with fermenting bacteria and became the mitochondria of the future; they have since deleted some of their genes but retain personal genomes and can only be regarded as symbionts. Spirochetes, like the ones attached to M. paradoxa, joined up and became the cilia of eukaryotic cells. The centrioles, which hoist the microtubules on which chromosomes are strung for mitosis, are similar separate creatures; when not busy with mitosis, they become the basal bodies to which cilia are attached. And there are others, not yet clearly delineated, whose existence in the cell is indicated by the presence of cytoplasmic genes.

There is an underlying force that drives together the several creatures comprising myxotricha, and then drives the assemblage into union with the termite. If we could understand this tendency, we would catch a glimpse of the process that brought single separate cells together for the construction of metazoans, culminating in the invention of roses, dolphins, and, of course, ourselves. It might turn out that the same tendency underlies the joining of organisms into communities, communities into ecosystems, and ecosystems into the biosphere. If this is, in fact, the drift of things, the way of the world, we may come to view immune reactions, genes for the chemical marking of self, and perhaps all reflexive responses of aggression and defense as secondary developments in evolution, necessary for the regulation and modulation of symbiosis, not designed to break into the process, only to keep it from getting out of hand.

If it is in the nature of living things to pool resources, to fuse when possible, we would have a new way of accounting for the progressive enrichment and complexity of form in living things.

I take it on faith that computers, although lacking souls, are possessed of a kind of intelligence. At the end of the decade, therefore, I am willing to predict that the feeding in of all the information then available will result, after a few seconds of whirring, in something like the following message, neatly and speedily printed out: "Request more data. How are spirochetes attached? Do not fire."