

## INTERVIEW WITH A FUNGUS

By Diane Brooks Pleninger

D.P. Good evening, viewers. Our guest this evening is *Pilobolus crystallinus*, author of the award winning best seller, “Do We Need Mankind? A Fungal Perspective”. Mr. Pilobolus is a member of the kingdom *Fungi*, class *Zygomycetes*. He is a scholar, lecturer, dung-dweller and author of numerous scientific articles and papers as well as several books for popular audiences. Welcome, Mr. Pilobolus.

P.c. Thank you, Diane. Good to be here.

D.P. Mr. Pilobolus, your most recent work raises tantalizing questions about the future of the biosphere and the role that you and other inhabitants of this planet will play in it. Tell us how you came to write this book.

P.c. The book resulted from a series of symposia I attended over the past two centuries under the sponsorship of the World Federation of Fungi, on the topic, “What Does Nature Need?” The Academy of the WFF is constituted of one delegate from each family of fungi. I was fortunate to represent the *Pilobolaceae*. Conferences were held decadally in many different parts of the world. Matters particular to the host locale were given close consideration, but the global perspective of the Academy was never eclipsed.

D.P. The 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup> centuries have been a revolutionary period in the biosphere. How have fungi been affected by the events of modern history?

P.c. The modern history of the fungi, which I date from about 400m years ago, has been a remarkable success story. The fungi occupy two vital niches in nature whose importance has never been challenged. In one niche, we are drivers of the carbon cycle, elite teams of detritivores whose mission is to digest organic matter and return the component parts to the ecological system. Without our work, life on earth would long since have ground to a halt for lack of raw materials. In another niche, we act in partnership with the roots of plants to extend their reach into the soil environment and enhance their uptake of water and nutrients. These partnerships are called mycorrhizas – *myco* for the fungus, *rhiza* for the root. Animals in turn feed on plants and benefit from this arrangement. So the fungi play two very distinct roles worldwide, and both roles are critical to maintaining the biosphere in good working order.

D.P. Where does mankind come into your history?

P.c. Mankind comes into our history about 20,000 years ago, at the time they discovered the uses of alcoholic fermentation. We credit the genus *Saccharomyces* with this development. Ancestral spores of that yeast settled in a pot of gruel prepared by a group of hominids whose existence up to that point was best described as nasty, brutish and short. This began what we call the honeymoon period in the relationship of man and fungus. Unfortunately, the honeymoon didn't last very long.

D.P. What happened to end it?

P.c. Two things happened. Agriculture was one. Mono-cropping and animal husbandry led to concentrations of plant and animal populations that were vulnerable to certain of our members, particularly the smuts, rusts, mildews and blights. Some crops and herds proved to be sensitive to basic fungal metabolites. For instance, my colleague *Claviceps purpurea* produces the biochemical ergot. Ergot causes gangrene, madness and death in certain animals, among them humans. However, there is no credible scientific evidence that ergot evolved in *C. purpurea* with harm to megafauna in mind. The same may be said of *Aspergillus flavus*, which occurs on nuts and grains in the field and in storage. The aflatoxins produced by *A. flavus* are among the most powerful poisons and carcinogens on earth. Introduced into human environments, they are nothing less than weapons of mass destruction. To *A. flavus*, they are merely metabolic by-products, with perhaps a touch of self-defence function as well.

The other change for the worse resulted from transportation. The rapid movement of species around the globe allowed no time for immunities to develop in local populations. Many fungal species have been vilified for causing mass extinctions of elms, chestnuts, potatoes and other plants. This mirrors the unhappy experience of animal and viral microorganisms implicated in plagues and epidemics. The real culprits, of course, are the humans who transport exotics from continent to continent without considering the consequences.

D.P. As you see it, what has been the human purpose during recent centuries?

P.c. With the advantage of hindsight, I think we can summarize it as a failed experiment in individualism. The idea of the individual – and there is no fungal equivalent – arose during a period of rapid change in human society. In the abstract, individualism looked defensible, even appealing. The ideal individual was to be educated and enlightened, someone we'd all like to know. However, as a practical matter, the culture of enlightened individualism reformed itself after a brief period into a cult of personal freedom.

Over the next several centuries, unbridled personal freedom and chance distributions of natural resources led to the creation of certain wealthy and isolated colonies of humans. Their prosperity excited envy and the rest of the world did what they could to emulate them. Large populations of humans moved from a very simple experience of the natural world to the expectation of a lifestyle similar to what the exploiters were enjoying. This clamour for plenitude – for meat in daily diets, for manufactured goods, for personal comfort, for leisure activities – put enormous stress on the biosphere.

D.P. As we know, humans failed to reverse this trend. Can you explain their failure to act?

P.c. It certainly wasn't for want of trying. If you visit the media archives of mankind – and we fungi are able to do so freely in spite of their efforts to exclude us – you will see

that environmental issues were at the forefront of concern in all the wealthier nations for the past century and a half. Treaties, regulations, protocols and public opinion were all used to stem the tide of harmful practices. But events outstripped them. Chief among these events was population growth. Population growth outpaced the effectiveness of trade boycotts. The offenders were able to simply form trade blocks of their own. Population growth outran the ability of the media to cultivate public awareness of environmental issues. And of course, population growth added to the pressure on the biosphere as more and more people demanded higher standards of living.

A couple of analogies can help us visualize what was happening. One is the problem of the universal solvent. If there were such a substance, what would you keep it in? The phenomenon of affluence turned out to be a sort of universal solvent. Nothing could contain it. Affluence was a marker of evolutionary success. Eventually, the cultural and political meanings intersected and in many parts of the world, it became seditious to propose programmes regulating or moderating affluence.

More insight is provided by the old canard about bread and circuses, which refers to the stultifying effects of amusement. Poor quality information tends to ferment into low-grade entertainment. Under the sulphurous glare of continuous, worldwide news broadcasts, human institutions – government, military, religious, the culture itself – became subjects of human amusement. This unrelenting, self-referential entertainment left a large part of mankind chronically inebriated and fundamentally uneducable. The ideal of public education was a notable casualty. I discuss this phenomenon fully in my chapter, “The Second Fermentation.”

D.P. Many times in your book, you mention what in earlier centuries would have been called “values” – altruism, moderation, that sort of thing. How do the fungi define ethical values? Or perhaps you call them spiritual values?

P.c. (Laughs) Much of what others consider spiritual, we call secular. This does not mean we are without a theology. In fact, I have devoted an entire chapter to formal fungal theology.

D.P. Can you tell us briefly about fungal theology?

P.c. There are two major systems of mycotheism in the fungal world. The more recent religion is only about 50m years old, but it has a strong representation among the younger orders. The older religion is more widespread, although it is also more rationalized from the original texts. Overall, 99.4% of fungi are adherents of one or the other faith. But the important thing to note is that there are no tensions, no doctrinal disputes between the two theisms. The core principle of both religions is identical.

D.P. And that principle is...?

P.c. Whereas the root principle of virtually all the religions of mankind is behaviour modification, our core religious value is species recognition. The fungi comprise nearly a million and a half species and uncounted millions of mating types. The pressures that result from diversity of this magnitude cannot be overstated. We have long recognized

that the best way to maintain order in the system is to encourage institutionalized mycotheism. As a result, we are widely considered to be the polity most capable of reaching consensus amongst ourselves and acting in concert upon that consensus.

D.P. How do you describe the present relationship between nature and mankind? Conflict? D tente? Symbiosis?

P.c. I can only speak for the fungi, who characterize mankind as expendable. My chapter, "Many Keystones, One Arch," explores the uses that mankind has made of the fungi, which range from antibiotics and immunosuppressants to papermaking to bread, beer, cheeses and wines and the familiar delights of mycophagy. Our members observed and recorded millions of human-fungus interactions over a period of two centuries. Again, humans cannot escape our observation. We are everywhere: on their skins, in their homes, underground, in the stratosphere. After intensive analysis of these data, the Academy was not able to identify even one indispensable human-fungus transaction. No obligate parasitism, no essential relationships, no *sine qua non*. I ask readers to remember this important fact as they learn the startling outcome of our deliberations.

D.P. Without revealing the ending to your book, can you speak briefly about the last chapter?

P.c. Recently, the Academy convened a plenary forum to review our findings concerning the place of mankind in the world ecosystem. We evaluated the state of the biosphere, giving due weight to mankind's most recent energy policies, bioengineering innovations, developments in agriculture, industry and transportation, the efforts made toward environmental remediation and detoxification of hazardous and radioactive wastes. We considered the question of just how much perturbation of the natural order we should tolerate from human activities. We agreed that the biosphere presently stands at 9.6 on a scale of disturbance ranging from zero to ten. Based upon these findings, the Academy adopted a position statement which we presented to the WFF. I have taken the title of that statement for my last chapter, "The Knot of a Thousand Tyings."

D.P. Can you summarize this position statement for us?

P.c. I'd like to read from it, if I may.

D.P. Please do.

P.c. "Our members do not recoil from the future. We believe that life on earth is embarked on a unique trajectory, one that will not be repeated. We believe that the outward journey has entailed a long and intricate interweaving of the interests of all living things. We believe that the homeward path will entail the systematic unweaving of those threads. We believe we are eminently suited for a role in this process."

D.P. And here, we must encourage our listeners to read your book. “Do We Need Mankind? A Fungal Perspective”. *Pilobolus crystallinus*, thank you so much for joining us today.

*P.c.* Thank you for having me, Diane.