LONG ISLAND MYCOLOGICAL CLUB

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FINDINGS AFIELD

A New Helvella for L.I.

By Dom Laudato

Helvella queletii

Serendipity took center stage in the encounter with the mushroom that was espied growing at the edge of black mulch used to landscape the medical park located in Setauket, L. I.

The specimen is *Helvella queletii,* that makes its home on the west coast of the U. S. A. Black mulch has been one of the vehicles that appears to transport " alien " species to our neck of the woods. David Arora in Mushrooms Demystified, P. 809, depicts the mushroom that coincides with the digital photo above. Measurement of spore size averaged 18 X 14 µm (with some of diminished size probably due to immaturity) compatible with those given by Arora. A large single central spheroid oil droplet (a vacuole per-

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HOW LONG DO FUNGAL SPORES LIVE?

By Nhu Nguyen

(*originally published in the March 2012 edition of Mycena News, Mycological Soc. of San Francisco)*

"How long do fungal spores live?" seems like a pretty obvious question, but in reality, we don't really know. The good news is that mycologists are starting to take an interest in this question and running long-term experiments to answer one of the most basic questions in mycology.

For many years, the few examples that exist that clue us in to how long fungi can live come from observations of pathogenic fungi. The resting sporangia (structures that contain spores) of the potato wart disease fungus *Synchytrium endobioticum* (Thaxter 1890), the resting sporangia of the soil fungus *Allomyces macrogynus* (J. W. Taylor per. communication), and spores of the onion smut fungus *Urocystis cepulae* (Putnam & Sindermann 1994) are thought to last >25 years in the soil. However, the evidence in all three cases is anecdotal without specific experiments to back them up.

As to saprobic and mycorrhizal basidiomycetes, there have only been a few studies that tell us about the spore longevity of these fungi. Unfortunately, all of these studies end within one year. So based on this, we know that at least a few mushroom forming species have spores that could last up to one year. But what about long term survival? Can we continue observing these spores for their viability year after year? Of course we can!

In 2004, Tom Bruns at UC Berkeley took on the challenge of trying to figure out how long spores of ectomycorrhizal fungi could live in the soil (Bruns et al. 2009). He picked four Rhizopogon species *(R. occidentalis, R. salebrosus, R. vulgaris, and R. olivaceotinctus*), extracted the spores, and sprayed them onto soil that has no Rhizopogon spores. The soil/spore mixtures were packed in terracotta pots, covered with terracotta saucers, tied, and buried in a tree-less area at Point Reyes National Seashore. The reason for this was so that he could emulate the natural conditions that the spores would face in nature. These pots of soil would remain buried for 99 years. Each year for the first 4 years, we unearthed a pot of soil from each species, the soil/spore mix-

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PRESIDENT'S MESSAGE

So far, this is the worst season for mushrooms that I have experienced in the last 20 or so years that I have been foraging. The only worthwhile edibles so far have been oyster mushrooms that appeared in Bethpage early this year and some beautiful specimens I found on July 13th. (They appeared at the base of a very old, dying maple on the north shore.) A small sized chicken mushroom was also found about a month ago, and one of our members reported good-sized Chanterelles in her backyard. The former grow on wood which can retain enough moisture to get them fruiting. Of course there are lawn mushrooms which are nice to see, but not usually edible, although there were several appearances of the edible Meadow mushrooms. Cooler temperatures and some constant moisture would be welcome..

In the last issue, I wrote that we need a new board member. That is still the case, and I am again requesting that someone step forward to put their name in the ring. This is a volunteer organization, and will not endure if members remain passive. Elections will take place this Autumn, and an election without candidates is impossible. This is a case of "Ask not what the LIMC can do for your, but what you can do for LIMC." If you think that the continued existence of our club is a good thing, then please pitch in. We all need to support our club by helping out.

Until the weather is kind to us, please keep searching for goodies but avoid the heat. You never know what you may find.

Hope to see you along the trails...soon.

EDITOR'S NOTE

"Negative data are also interesting" a biologist friend of mine declared. Perhaps so, but not when the data is completely negative, which has been the case throughout this collecting season. Or almost so, with some exceptions now and then.

Can scarcity then have its positive side? Yes, for it permits us to concentrate on the few species which are hardy enough to show up. And as Woody Allen has instructed us, showing up is 90% of life. Neophytes can therefore concentrate on the characteristics of those few fungi that do grace us with their presence without being overwhelmed by an abundance of forms.

For example, watered lawns will produce the trio of *Panaeolus foenisecii, Conocybe tenera*, and *Agrocybe pediades* and less frequently *Conocybe lactea* and *C. subovalis*. Although similar, these can easily be differentiated in the field without resorting to reagents or microscopes. Forests may display a few *Amanitas (brunnescens, rubescens & flaviconia)* and Russulas *(crustosa, flavissicans, & ochroleucoides)* all distinctive enough to be identified with the use of a good field guide (or several) and close observation. This exercise will serve us well when the inevitable abundance of Autumn erupts.

MATERIAL FOR THE AUTUMN, 2013 EDITION SHOULD REACH THE EDITOR BY SEPT. 1

(Submissions may be forwarded by email in any format or typed.)

(All unsigned articles authored by editor.)

FORAY RESULTS SUMMARY

Sadly, this report is greatly curtailed since, as everyone is painfully aware, the season was almost non-existent due to the very dry Spring and early Summer lack of rainfall. While we all hoped for a kick-start to the Morel season after a poor one last year, it simply did not happen, thereby shattering another rule-of-thumb which maintains that two bad seasons (or two good ones) do not occur back to back. From what information came my way, it seems that morel collectors elsewhere in the Northeast fared little better. Anyway, below is the little data we gathered from our forays. Note that except for those listed below, all our other scheduled forays were cancelled.

May 11, Bethpage SP: The poplars did not fail us, and over a dozen collectors found enough Spring Oysters (*Pleurotus populinus)* for several good meals. Not many other species, although we did encounter *Peziza repanda* and *Piptoporus betulinus.* Peggy found a species new to the list, the unobtrusive twig decomposer *Peniophora rufa,* which is a Basidiomyte, despite its resemblance to Asco's.

Peniophora rufa

July 6, Planting Fields SP: Led by Jacques, this early summer foray was enjoyed by all and tallied a representative list of seasonal standbys, including Amanitas, Russulas, Polypores, Boletus (Xanthoconium) affinis, for a nice total of 22 species; comparatively, a veritable cornucopia !

FINDINGS AFIELD *(Cont'd from page 1)*

haps) comprised most of the internal cytoplasm of the cell.

The stalk ribs do not continue to the top of the cap rim; they terminate at the cup bottom, likened to the attachment of the stem of a wine glass to its bowl. The similar *Helvella acetabulum* can be distinguished in the field by the continuation of the stalk ribs to encircle the bowl, extending almost to the rim. (See illustration below.)

Helvella acetabulum

Originally described by Bresadola from Europe *H. queletii* is fairly widely distributed there and in North America, and can also be found in Asia and India. Believed by some to be synonymous with *H. solitaria,* but not as yet so recognized by Index Fungorum.

HIDDEN FUNGI

Not visible in my photo of the Pink Lady Slipper Orchid *(Cyprepedium acaule)* taken somewhere in Suffolk County's Pine Barrens are its fungal partners, varied mycorrhizal fungi which help to establish the seedling, which is bereft of nutritional sources of its own. (Most plant seeds have a built-in food supply known as an endosperm, but not Orchids.)

Therefore, in order to establish themselves and survive, the Lady's Slipper must establish a relationship with a food source, and this particular species has been found to be rather indiscriminate in its choices, as many as 30 species having been shown colonizing its roots in one study, mostly from the genera Tulasnella and Russula, including the familiar *Russula crustosa.* It is unclear whether these associations persist into the maturity of this plant, whose longevity may endure several decades.

Other species of Cyprepedium are achlorophyllus and therefore can be classified as mycoheterotrophs, whose reliance upon their mycorrhizal partner is lifelong.

AN OVERLOOKED EDIBLE ?

For as long as I can remember, the "false truffle" *Rhizopogon rubescens* (now *R. roseolus*) has been collected by LIMC, but never for its edibility, false truffles being thought of as inedible at best. When "Field Guide to North American Truffles" by Matt and James Trappe and Frank Evans was published in 2007, I was surprised to learn that it is an edible species, but considered to have "pleasant but undistinguished culinary qualities" which relegated it to the "palatable" category. This was far from high praise, and considering its small size, never tempted me to try it.

Consider my amazement when I recently read that it is a favorite in Japan, indeed a delicacy, where in the past its popularity ranked it among the top most consumed species. It is known as "shoro", literally "dew of the mountain". According to "Edible and Poisonous Mushrooms of the World", by Ian R. Hall, Steven L Stephenson et al, it is edible when young and the interior pale and spongy, much as our edible Puffballs. As it ages, the interior becomes darker and unpalatable, eventually turning into a gelatinous mass. (This interesting and informative book can be found in its entirety online by googling the title.)

The authors go on to say that shoro has little flavor of its own, the spongy texture of the interior allows it to absorb the flavors of the food with which it is cooked. The Japanese refer to its crisp texture as having a "good tooth touch". During the nineteenth century, it was consumed in large quantities, but is now described as being rare in Japan, despite having a global distribution, partly due to the importation of Pines to the Southern Hemisphere for plantation forestry.

However, for market purposes fruitbodies of *R. roseolus* from New Zealand are considered less desirable than the Japanese shoro, and have been demonstrated to be morphologically and genetically distinct. Methods to increase their production, such as mycelial slurries, continue to be investigated. With such global efforts underscoring the desirability of this fungus, perhaps our local version is worth investigating. Who among us will be the adventurous pioneer to sample and review this edible "truffle" from a culinary standpoint?

PARASITIC BOLETES

We are all aware of one parasitic bolete, *Pseudoboletus parasiticus,* which grows on *Scleroderma citrinum,* but it turns out that there are others. Pictured here is *Buchwaldoboletus lignicola,* which grows on pine, and which we have collected only once. According to a recent paper, it also appears to be a mycoparasite. That is, its host is not the pine on which it appears, but rather on *Phaeolus schweinitzii,* a pine pathogen. Microphotos depict the hyphae of *B. lignicola* wrapping around the hyphae of *P. schweinitzii*..

Buchwaldoboletus lignicola

Buchwaldoboletus is the sister taxon of *Chalciporus piperatus,* another mycoparasite whose putative host is *Amanita muscaria.* No mention is made of other species of *Chalciporous*. Other findings include the conclusion that most members of the *Boletineae* are not closely related to the type species, *Boletus edulis.*

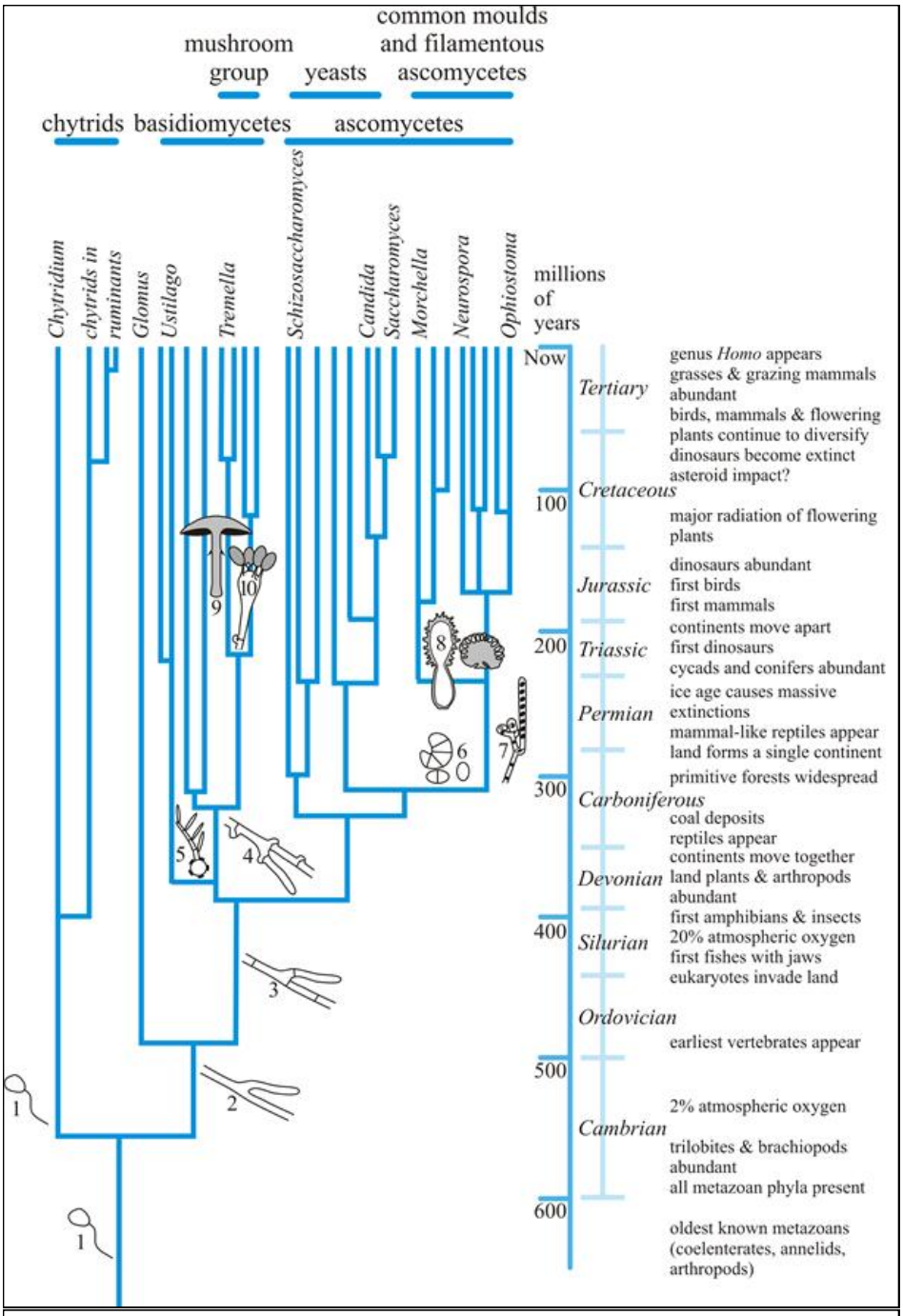
As a side note, we were pleased to see that among the hundreds of Bolete samples were two that we had collected on Long Island, (*Chalciporous pseudorubinellus* and *Boletus pallidoroseus)* and submitted to Ernst Both's herbarium.

References:

(*Phylogenetic Overview of the Boletineae, ME Nuhn, M. Binder, FS Taylor, RE Halling, DSHibbet, Fungal Biology, in press, online 9 May 2013)*

THE PLACE OF FUNGI IN EVOLUTION

There are some fundamentals that every mushroomer should be aware of, but that are often overlooked in the day-to-day business of collecting and identifying species. For example, it was only in mid-twentieth century that mushrooms were separated from plants and provided with their own kingdom, the true fungi. Prior to that, they had been studied as part of the plant kingdom, as Cryptogamic Botany, along with lichens, mosses, bladderworts, etc. And it was only in 2011 that the International Rules of Botanical Nomenclature were rewritten as the International Code of Nomenclature for algae, fungi, and plants. Among other things, this permits mycologists to refer to them as "organisms" rather than "plants."Also, Latin is no longer required when describing a new species, and electronic publication is acceptable.



This evolutionary tree show the fungi at various stages as numbered drawings, as follows: 1-Water moulds 2-Branching filaments without septa 3– Septate filaments 4– Clamp connections of early basidiomytes 5 – Smut-like basidia 6– Asexual spores 7-Asci 8-Fruiting bodies 9– Mushroom fungi and their 9– Characteristic holobasidium

Another basic discovery, that fungi and animals are sister groups, diverging from a common ancestor almost a billion years ago, should be part of every mushroomers knowledge. That they are more closely related to animals than to plants helps to make sense of many characteristics, such as their ability to synthesize vitamin D from sunlight, as we are also capable of.

This diagram, from the website http://www.davidmoore.org.uk/ shows the evolution of the fungi in relation to evolution generally. From this we can see that the fungi are very ancient and that they coexisted with the dinosaurs, although popular depictions of Jurassic life fails to depict that. In fact, the largest living organism 400 million years ago was *Protaxites,* a towering 30 feet tall.

For further fascinating reading, we strongly suggest accessing the above website.

How Long do Fungal Spores Live?

(Cont'd from page 1)

ture within was mixed with sterile soil, and pine seedlings were planted in them. We grew the seedlings for six months and then examined the roots for colonization of Rhizopogon. We initially hypothesized that the spores would die off over time but the experimental evidence was contrary. We found that the spores actually became more alive over time! But what does becoming more alive mean?

What it means is that most of these spores start out being dormant, and they wake up over time. Analogous to a seed, a dormant spore cannot germinate and can only grow and partner with a seedling root after it had awaken from dormancy. Thus, a consequence of this dormancy means that the spores lay in the soil for years, waiting for the moment when by chance a pine seed would drop onto the soil and germinate. It is only then that the spore will germinate and form mycorrhizae with the seedling. This idea is along the same lines of thought as a "seedbank", where a seed lays dormant in the soil and waits for the proper conditions before it germinates. We call the waiting of spores in the soil for proper a condition to germinate a "sporebank".

What about other species of ectomycorrhizal fungi? Do they behave the same way as Rhizopogon and produce a sporebank? To answer this question, Tom collected forest soil (which we thought contained spores of many species), put them into terracotta pots, and buried them. After 6 years, we dug up these pots, planted seedlings in the soil and identified the species that have colonized the roots. As expected, spores of Rhizopogon species, particularly *R. vulgaris* and *R. salebrosus* could survive up to 6 years. The surprise came from the fact that *Suillus brevipes* could also survive up to 6 years in the soil. Even though Suillus is closely related to Rhizopogon, their fruiting structure (mushroom in Suillus vs. truffle in Rhizopogon) and the way they disperse their spores (wind in Suillus vs. rodents in Rhizopogon) are different. We only expected the rodent dispersed species to be resistant through time, but the results of this experiment proved otherwise.

So, all of these results together tells us that spores of suilloid ectomycorrhizal species can form a sporebank and remain alive in that sporebank for at least 6 years. Of course this is only the first 6 years of the experiment. We still have 93 years to go! Tom considered sticking around until the experiment is done.

(Nhu Nguyen is a PhD candidate at UC Berkeley studying under Tom Bruns. His research interest is in symbiotic interactions between fungi and other organisms.)

USDA NUTRIENT DATA FOR WHITE MUSHROOMS

Nutrient	Unit	Value per 100.0g	cup, pieces or slices 70g	cup, whole 96g
Proximates				
Water	g	92.45	64.72	88.75
Energy	kcal	22	15	21
Protein	g	3.09	2.16	2.97
Total lipid (fat)	g	0.34	0.24	0.33
Carbohydrate, by difference	g	3.26	2.28	3.13
Fiber, total dietary	g	1.0	0.7	1.0
Sugars, total	g	1.98	1.39	1.90
Minerals				
Calcium, Ca	mg	3	2	3
Iron, Fe	mg	0.50	0.35	0.48
Magnesium, Mg	mg	9	6	9
Phosphorus, P	mg	86	60	83
Potassium, K	mg	318	223	305
Sodium, Na	mg	5	4	5
Zinc, Zn	mg	0.52	0.36	0.50
Vitamins				
Vitamin C, total ascorbic acid	mg	2.1	1.5	2.0
Thiamin	mg	0.081	0.057	0.078
Riboflavin	mg	0.402	0.281	0.386
Niacin	mg	3.607	2.525	3.463
Vitamin B-6	mg	0.104	0.073	0.100
Folate, DFE b	µg	17	12	16
Vitamin B-12	µg	0.04	0.03	0.04
Vitamin A, RAE	µg	0	0	0
Vitamin A, IU	IU	0	0	0
Vitamin E (alpha-tocopherol)	mg	0.01	0.01	0.01
Vitamin D (D2 + D3)	µg	0.2	0.1	0.2
Vitamin D	IU	7	5	7
Vitamin K (phylloquinone)	µg	0.0	0.0	0.0
Lipids				
Fatty acids, total saturated	g	0.050	0.035	0.048
Fatty acids, total monounsaturated	g	0.000	0.000	0.000
Fatty acids, total polyunsaturated	g	0.160	0.112	0.154
Cholesterol	mg	0	0	0

Gleanings

■ **MANUFACTURED MYCELIUM :** Three years ago we reported on several new start-ups that proposed using mycelia to construct packing products and building materials. One of these companies, Ecovative, in Green Island, NY is featured in an article in the May 20 issue of the New Yorker entitled "Form and Fungus". The firm, after winning several grants and competitions, now employs 60 workers, and manufactures packaging materials, which replace Styrofoam and other plastics with biodegradable mycelium. The founders' goal is to "displace plastics all over the world."

■ **REVERSE ARCHEOLOGY:** A Swedish study of carbon sequestration in boreal forests determined that not only is 50-70 percent of the total carbon stored in these forests found in underground mycorrhizal fungi, rather than in forest floor litter, the youngest carbon deposits were found deeper down, contrary to prevailing wisdom that deeper layers would be older, reflecting the settling of carbon-rich litter. DNA analysis of these layers proved them to be composed of fungi. These findings will aid global carbon modelers to more precisely tune their simulations. *(K.E. Clemmensen et al. Roots and associated fungi drive long-term carbon sequestration in boreal forest. Science. Vol. 339, March 29, 2013, p. 1618.)*

■ **BIGGER IS (SOMETIMES) BETTER:** Relying once again on an extensive Norwegian database of over 66,000 mapped autumnal collecting records, representing 271 species, the authors analyzed the relationship between spore size, shape and color, fruit body size & shape, time of fruiting and geographical distribution. Results demonstrated that spore size is significantly related to time of fruiting in autumn fruiting species: early fruiting species produce larger spores than late fruiting species, tending to corroborate the hypothesis that spores shed earlier in the season are more prone to desiccation due to higher temperatures and lower precipitation. I.e., more voluminous spores can harbor more water. (*H. Kauserud et al, Mushrooms spore size and time of fruiting are strongly related: is moisture important? Biol Lett. 2011 April 23; 7(2): 273–276.)*

■ **THE SOUND OF FUNGI:** In an effort to duplicate the sound quality of wood used to manufacture violins, Prof. Francis Schwarze of the Swiss Federal Laboratory has patented a technique for infecting the upper and lower plates of violins with two fungi, *Physisporinus vitreus* and *Xylaria longipes.* (Amusingly, the common name of the latter is Dead Moll's Fingers.) This has the effect of thinning the wood and thereby improving its acoustic properties. In blind testing against a Stradivarius, their sound was preferred by experts and lay audience members alike. *(Published in several sources, including Engineering & Technology magazine, Sept 12, 2012. Item suggested by Cathy & Bob Cresko.)*

■ **A SIGNAL CONNECTION:** It is known that plants emit chemicals into the air that serve as signals to others of their species that they are under attack by insects or other predators. Now, a new study documents that they can also warn each other of such attacks by communicating via mycorrhizal mycelia. Intact, aphid free bean plants, *Vicia haba,* when connected only by their common mycelial network to aphid infested plants responded as though they themselves had been attacked. "This underground messaging system allows neighboring plants to invoke herbivore defenses before attack", the authors state. Yet another service that fungi provide for their symbiotic partners. (*Underground signals carried through common mycelial networks warn neighboring plants of aphid attack, Z. Babikova et al, Ecology letters, Vol. 16, issue 7, July 2013, pp.835-43.)*

■ **A NEW TICK-BORNE DISEASE:** In the Autumn 2011 edition we reported that *Borrelia miyamotoi* had been detected by researchers in Deer Ticks in the Northeast, and the active infection has now been demonstrated in a small number of people, with greater numbers showing antibodies, indicative of previous infections. Originally described in Japan in 1995, the disease is present in Russia, where a diagnostic test has been developed. Although there appears to be some difficulty differentiating it from other related illnesses, it responds well to Doxycycline, as does Lyme Disease. There is also the possibility of co-infections. All the more reason to take every possible precaution when venturing into the woods. See our website (under Resources tab) for recommended methods.

(Compiled by editor from cited sources.)

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"Have no respect for the authority of others, for there are always contrary authorities to be found."

Bertrand Russell, Autobiography, 3rd Volume, 1944-1969

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