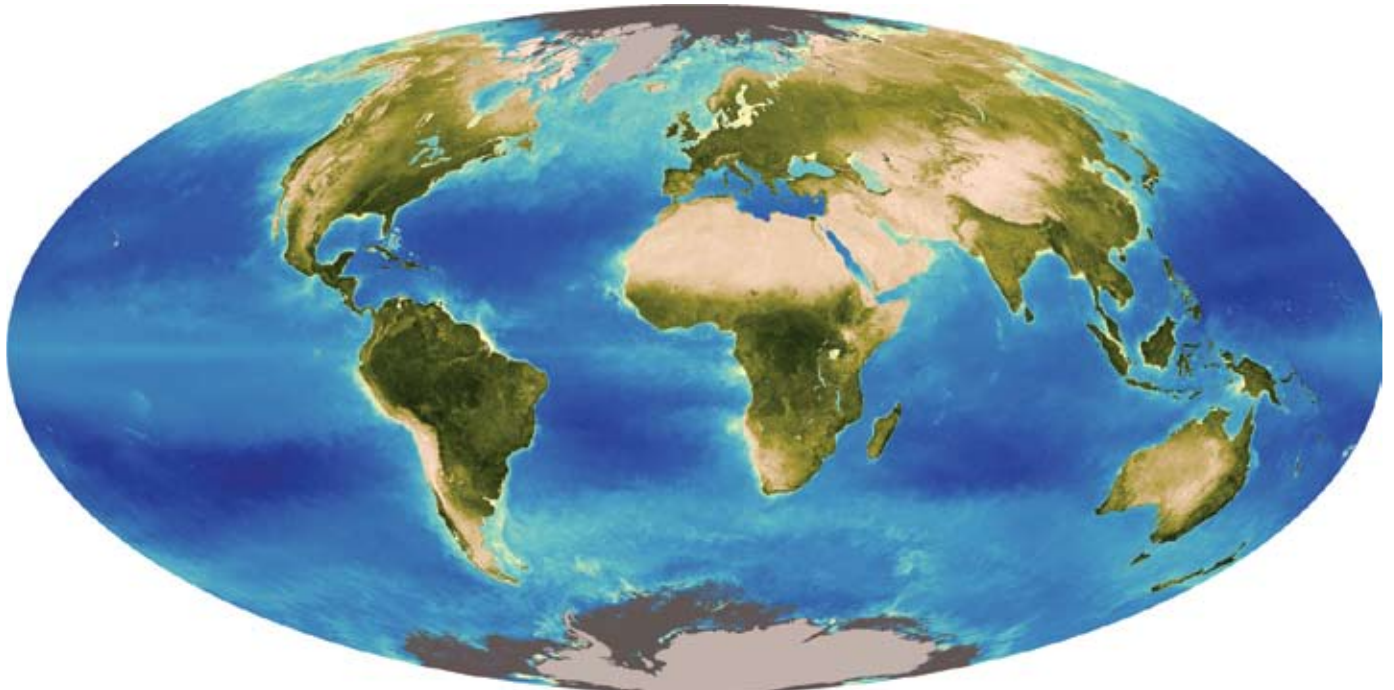


# The Universe Is Creative

by Sky Shields



James Rea/EIRNS

*Sky Shields: "Everything you know as the physical universe is derived from that exact same process that you know in yourself as Mind..."*

*Sky Shields, a member of the LaRouche "Basement Team," made this presentation, titled "The Preeminence of Science over Ideology," at the Schiller Institute European Conference, "Rescuing Civilization from the Brink," which took place July 2-3, in Rüsselsheim, Germany.<sup>1</sup>*

1. A video Shields's speech can be found here <http://www.larouchepac.com/node/18723>. The complete conference is available in video format. <http://www.schillerinstitute.org/> The July 15 and July 22 issues of *EIR* also carried transcripts of speeches from the conference.

I would like to take up the theme—it's a theme that is taken up in the recent series of videos which have gone under the title "[Is the Past Fixed?](#)"<sup>2</sup> but which are tackling a question that might be best described as the ontology of mind. People have a lot of different concepts, I think, attached to the word "Mind." But the problematic thread that I think runs through all the different concepts people have of "Mind," is that somehow, Mind is something which we possess: There's something that we recognize exists in us—but is completely distinct, and it's maybe observing something out there, called the objective universe.

That is to say, you've got something in *you*, you want to call "Mind," you want to name yourself. It has certain laws, certain rules to it. Certain words seem to come to mind when you think about it: ideas, concepts, like morality, beauty. There are certain principles that you consider to be definite principles of Mind. But then, these are not necessarily principles that you would assume exist in the so-called "objective universe." You assume that there must be some other thing out there that perhaps is more logical, perhaps has other characteristics to it, and we are using our minds to observe it.

The theme of this video series is what I'd like to cover today,

2. [www.larouchepac.com/node/18639](http://www.larouchepac.com/node/18639)

using some of the work of Vladimir Vernadsky. I'd like to disabuse you of that idea, and develop a notion instead, that this thing we call "Mind" has a fundamental ontological significance. That is to say, that everything you know as the physical universe is derived from that exact same process that you know in yourself as Mind, to the extent that you recognize it in yourself and others. That this is a principle that has a very serious ontological significance that is the basis for everything that we see in Creation.

And, in the course of this, we will see that the actual scientific facts of the matter, agree very closely with the notion that you find in the Abrahamic religions, of man being made in the image of the Creator. We'll demonstrate that this is actually a very rigorous scientific concept, and it's the basis for all human knowledge, and it's the basis of all human economic activity in the universe: The ability for the human species to act on the universe is based on this principle, this ontology of Mind.

To do it, I'd like to give people an introduction to a thinker whom you have probably seen in various works of the movement. Mr. LaRouche has referenced his works in a number of different papers, a number of different locations: This is the Russian biogeochemist Vladimir Ivanovich Vernadsky. He is most well known as being the founder of the notion—he's not the person who coined the word, but he's the person who most rigorously develops the concept—of the Biosphere. And that, in its short description, is the envelope of the planet on which we recognize the existence of living processes.

But in its more in-depth investigation, it actually becomes something much larger. To make the point that people have seen, I think, in some of the recent discussion we've had, that has come under the rubric of "cosmic radiation": The entire first half of his book *The Biosphere* is describing processes that you would name, that would also fall under that rubric of "cosmic radiation."

### Vernadsky: The Ontology of Mind

That is to say, his definition of that thin layer of the planet that we call the Biosphere, is that this is the only part of the planet which interacts with the rest of the cosmos. Or this is the part of the planet which most actively interacts with the rest of the cosmos, largely through the process we know as photosynthesis, where the steady flow of radiation from the Sun, electromagnetic radiation from the Sun, is being used to catalyze an amaz-

ing negentropic process of the development of the beginning of all of the food and all of the energy cycles that you see on the planet: The construction of the carbohydrate structures that form the bodies of these plants, and that are eventually incorporated, later on, into the bodies of animals, to be recycled, to pass through the Biosphere, in what Vernadsky called a biogenic migration of atoms, ultimately to become the structure of that Biosphere itself, via the death and the decay of various living organisms; to become other generated waste products, to become the mountains, to become the soils, to become the oceans.



[www.tstu.ru/tambov/](http://www.tstu.ru/tambov/)

*Academician V.I. Vernadsky with his daughter, Nina, around 1910.*

You've got a steady flow that, if you were to view it as this biogenic migration of atoms, would be something that continues from the far reaches of our cosmos into that thin layer we know as the Biosphere, and becomes the very structure of the Earth, the rest of it as we know it.

That's the scope of what he's actually describing. But in the course of describing that, he ends up drawing some conclusions which have major implications for ontology in general, but which we'll see—once we follow this path—lead us directly to this question of the ontology of Mind.

I'll give you some background. Vernadsky's life is a funny one. We've discussed this in the past. It spans a time period which is a very unusual, but very interesting and rich time period. It roughly spans a period between the

American Civil War and World War II, so it positions him in an interesting place. He lives half of his life in Tsarist Russia, and half of his life in post-Tsarist Russia. And he's a major political player in organizing for the overthrow of feudalism in Russia, in particular. But because of his scientific views, he realized the necessity of this being the complete elimination of feudalism in order to facilitate the evolution of the human species.

Just to give you some idea of where he stands. A lot of his work leading into the Russian Revolution, and out of it, was on the topic of human economic studies, for that reason. You'll find studies of his on examining, comparing different kinds of farming practices, between the United States and Russia at the time. He does a study of U.S. agriculture, European agriculture, as he's trying to find out what's going to replace the feudal structure that exists in Russia at that time. He's looking, and says, "Well, after revolution—if you're going to end the idea of serfdom, you're going to end the idea of a feudal structure under the Tsar—what should replace that?" And in his mind, this was a real question of the scientific evolution—this is a question of



the evolution of the human species. And you'll find writings of his on that subject already in the late 1890s, early 1900s; that this is a theme that's on his mind.

But he's investigating that at the same time as he's doing some early geological studies with his teacher Dokuchaev, examining, looking at the nature of soils, looking at the nature of the mineral composition of the Earth's crust. And in the course of this study, he quickly realizes that when he's looking at these minerals, that you're not observing a fixed system; that what you're looking at is a process that exists. He said, you're looking at a process that changes and evolves.

And very early on, he makes the statement that you see a process that exists *in time*. And this strikes him as early as, again, the 1890s, early 1900s; this strikes him as something that's unique to, first, geological processes. But then he realizes that every place you see change in these geological processes, it's connected to the action of living processes. And he realizes—his background is initially only in geology—that he needs to hurry up and give himself a crash course in the biological sciences, in order to be able to make any functional, useful statements about geology.

And so he does this. He does a whole investigation himself of figuring out, of just getting at what we later recognize as his impressive map of all life on the planet, really, everything you can possibly imagine. Because he realizes that all of this, this entire Biosphere, is involved in acting on, and developing, and changing the underlying abiotic structure of the Earth's crust.

### 'The Eternity of Life'

But then it begins to spark in his mind, from that observation of the way these biological processes operate on geological processes, it makes him begin to realize that, if this is true, then that earlier recognition that he had about the fact that geology is a science that exists in time, means that the thing he's calling time is closely connected to the action of living processes. And in fact, he coins a term that becomes very controversial, which he calls "the eternity of life."

Now, this has two interpretations at present. One is a very practical interpretation, which is not un-useful, but it's a very important thing to know this and kind of wrap your mind around: that, to the extent that he can observe



Dokuchaev Museum, St. Petersburg

*Vasily Vasilievich Dokuchaev (1846-1903), Vernadsky's teacher is considered to be the father of soil science.*

these changes in geological structures over geological time, every metric of change that you have to look at is something that's connected to life. Everything, from carbon-dating, all dating methods in geological strata, depend on living processes. But then, he says, that these changes in the geological strata were exactly the thing that separates geology from the other sciences, because it gives us this feeling, this sensation that you want to refer to as "time." And what he concludes from that is that there's never been a period on the planet when life did not exist.

Now, this is very interesting for a couple of reasons. The first thing that should come to mind, as we had a discussion earlier: "Well, isn't it true, wasn't there some period of time when conditions on the Earth were so hot, so impossible, around the formation of the Earth, that you couldn't possibly have life? How could you have this guy Vernadsky claiming that life, as a principle, is something that's eternal, if there was some point where you couldn't have living things? Doesn't there have to be some moment of what's called abiogenesis, where life has to spring out of nothing and come into being?"

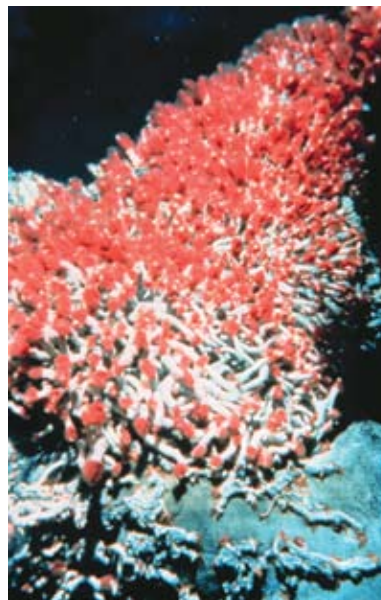
And Vernadsky is very insistent that, no, this is not true. And as early as 1908, we have him making the statement—which he'll refine—I'll give it in the

form he gives it in 1908, but we'll see, as time progresses, that his development of this notion becomes much more complex. But he says, in 1908, he's beginning to recognize, *that life is a*

*principle as fundamental as matter or energy.* This is as early as 1908, so you can get an idea of where his mind is going.

That's obviously very different from the standard reductionist view. The view that is prominent today is that, somehow, life is just some epiphenomenon, composed out of non-living processes. And then cognition, we're just some epiphenomenon that grew out of living things. But he stresses, no; he's saying that this principle of life is something that exists, that, he says, is eternal, that predates all other phenomena that might be observable.

By 1920, he comes under very heavy attack specifically for that notion, the idea of the eternity of life. This is a period, after he plays a major role in the overthrow of Tsarism in Russia, but there's



National Undersea Research Program/NOAA

*"There's never been a period on the planet when life did not exist"—what Vernadsky called "the eternity of life." Here, tube worms feeding at the base of a hydrothermal vent, an environment where it was once thought that no life could exist.*

a coup that's launched by—he recognizes it as some sort of meddling. He's not totally clear that this is the meddling of the British Empire to ensure that the revolution that occurs is the Bolshevik Revolution, and not the kind of revolution that Vernadsky is looking for, but this happens.

In that context, you have the takeover in Russia of the ideology of dialectical materialism: The materialist aspect of that requires the reductionist notion of the progression upwards, from the abiotic, into the biotic, into the cognitive. Whereas Vernadsky is making this insistence, that processes are organized in the opposite direction. At this point, he's only being very explicit that it's life, as primary, that governs the processes that are below it. But then we'll see that he develops that further.

This becomes a huge deal. The paper he writes on the subject in 1920, which is called "The Origin and Eternity of Life," is completely censored. It's not allowed to be published, and the book in which he was planning to publish it, is heavily redacted. The piece that's most heavily redacted is his piece on human autotrophy, which is on the willful evolutionary development of the human species. So this gives you an idea of the context.

This notion of the eternity of life is exactly what Alexander Oparin is deployed to attack in Vernadsky's work, to attack and try to attempt to rework and rewrite and to explain away. But we'll see that Vernadsky is not only insistent upon that principle, but his later work develops that to an even higher level.

### Work with the Curies

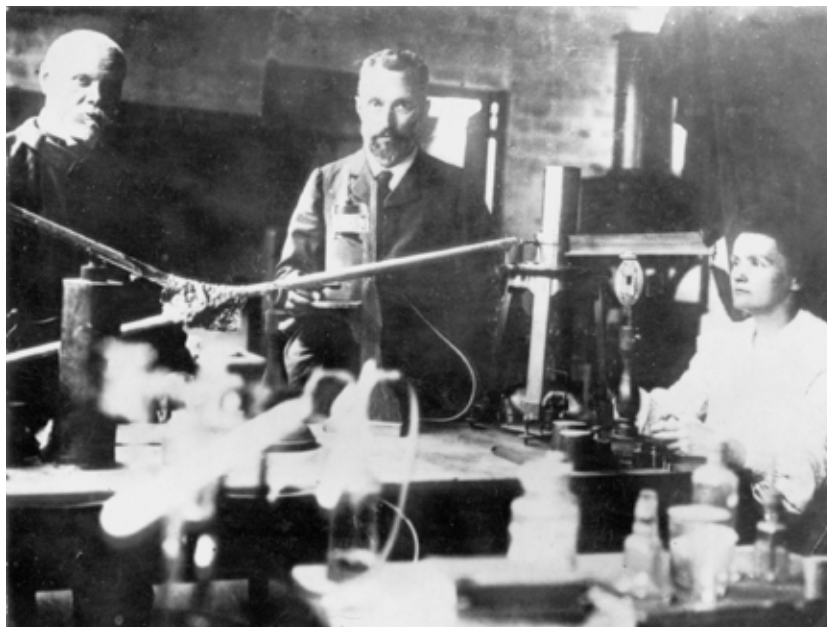
A major change in his development of this concept occurs in the period around 1924, when he moves to France to work in the laboratory of Marie Curie. Now, he's working there on various topics, many of which are dealing with the notion of radioactivity, obviously, and radioactive dating methods, which he saw as a major way to see this expression of time and development in the Biosphere.



*Party-line enforcer Alexander Oparin (1894-1980) was deployed to attack Vernadsky and his idea of "the eternity of life," in the early 1920s. Here, Oparin in 1938 with Andrei Kursanov (left) in their enzymology laboratory.*

But while he's there, he has a series of personal discussions with Marie Curie, and she relates to him the work of her husband, Pierre Curie. In that series of vignettes, it's interesting to see, he describes her description of dinner-table discussions with the family, which would be Pierre Curie, Marie Curie, and their daughters, on scientific topics. He mentions that they had a very peculiar working style, which is that they would spend a long time in discussions, that they would spend months in just discussion amongst them, developing these ideas in their head, and then Pierre Curie would write a very short paper as a result. And Vernadsky does a little summary; he points out that the Curies' life's work, which he says is about—he gives a figure of something like 25 years—some number of decades of life's work, fits in one volume. He says this is not because he's not a prolific writer, but because he writes these incredibly dense summaries of his thought process.

But, as a result, when Pierre Curie is killed, he doesn't get a chance to write out the final project that he was working on, which was the generalization of work that had been done earlier by Louis Pasteur. Now this was some work that Vernadsky was obviously very familiar with, on the question of handedness, or chirality. This was Pasteur's observation that there was a distinction between the same chemical compounds when they are produced: The exact same chemical compound, which is chemically identical, meaning it undergoes the exact same reactions, is produced in the exact same way in each case, but there's something fundamentally different for certain compounds, when they're produced by living processes, or in a laboratory, outside a living



Roger Viollet

*Pierre Curie (1859-1906) and Maria Curie (1867-1934) in their laboratory in an unheated shed in the courtyard of the School of Physics and Chemistry in Paris. On the table is the Curies' quartz piezoelectrometer. At left is chemist Gustave Bémont.*



process. And that difference is expressed in the ability of these compounds to rotate a plane of incident light.

If you have light that is polarized to oscillate in a specific plane, certain compounds produced by living processes would exhibit an ability to rotate that plane of light, whereas that exact same chemical compound, produced outside living processes, could not. And again, I'd like to stress that, in other respects, these compounds are completely identical. They are completely chemically identical, but somehow, their relationship to light changes, on the basis of their being generated, or not being generated, by living processes.

Now, Curie saw this as an expression of a much more broad principle of symmetry. And he had discussed this in work with his family, with Marie Curie. Vernadsky found this very exciting, and in particular, he said that he was excited about the universality of this principle of Curie, and in particular, that it had two expressions. One is a quote that became very fruitful in all areas of investigation later on, where Curie notes that a dissymmetry is an event.

Now what did he mean by that—that dissymmetry is an event? I can give you a mental image, which would help. If you were to picture in your head, right now, a rotating sphere; now imagine that we're talking about a perfectly geometric sphere, with no external markings. If it were perfectly geometric, no external markings on it, would you be able to register that that sphere was rotating? And in fact, could you even give a meaning to rotation? If it were perfectly geometric, no external markings to it, you'd find, as you look at the thing, it looks exactly the same.

If you do something to that sphere, and you change its spherical symmetry—say you put a dot on it, all of a sudden—so imagine you've got this spinning sphere, and somebody comes with a paint brush and they dab a dot on the side of that sphere: Suddenly you have motion, you have something that you recognize as rotation. That, as soon as you add a dissymmetry, you have something that becomes recognizable as an event. And Curie generalizes that, to say that in general, whenever you see something you recognize as a phenomenon, as an actual event, it's because you're seeing a dissymmetry that's generated out of a symmetry.

Now, this is important, because that principle alone, allows you to eliminate the idea of empty space. Because you realize that what seems in this case to be an object in empty space—in that case, you would say the dot moving on the surface of the sphere—is not. It is a process that initially seemed to be, with respect to some parameter, perfectly symmetrical. Suddenly, some portion becomes asymmetrical—you introduce a singularity in that process, and the asymmetry relative to the symmetry registers to you as an event, as a thing. And the simple sense-perception response to that, is to say, "Well, this is an object, whereas what you had before was empty."

But in general, Curie says no, that's not true. Everything you see as an event or an object, is, in fact, a dissymmetry being measured against a pre-existing symmetry, and that looks to you like an object against empty space.

And so Vernadsky recognizes in that approach Curie is taking, a very powerful heuristic tool. And if we get a chance, we'll be able to see that you will find that, in musical composition, that becomes a principle that you can play with, and you will



*Francesco Redi (1626-1697) formulated the principle that all life comes from life.*

see how it moves the mind: What you recognize as background versus foreground; what you recognize even as silence versus sound in a musical composition, is really playing on this question of the symmetries and asymmetries, in your mind: There's no such thing as empty space.

So Vernadsky is excited about this, because he has started to realize that this gives you the ability now, to eliminate all the notions of the physicists, these sort of pre-existing unquestionable notions of absolute space, absolute time, and matter. He says, well, these are fictions, these are mathematical fictions, and in the real world, they don't exist. And you have to figure out a healthier way to get around them, to be able to approach actual phenomena, to describe actual phenomena as they are.

So that becomes an exciting notion.

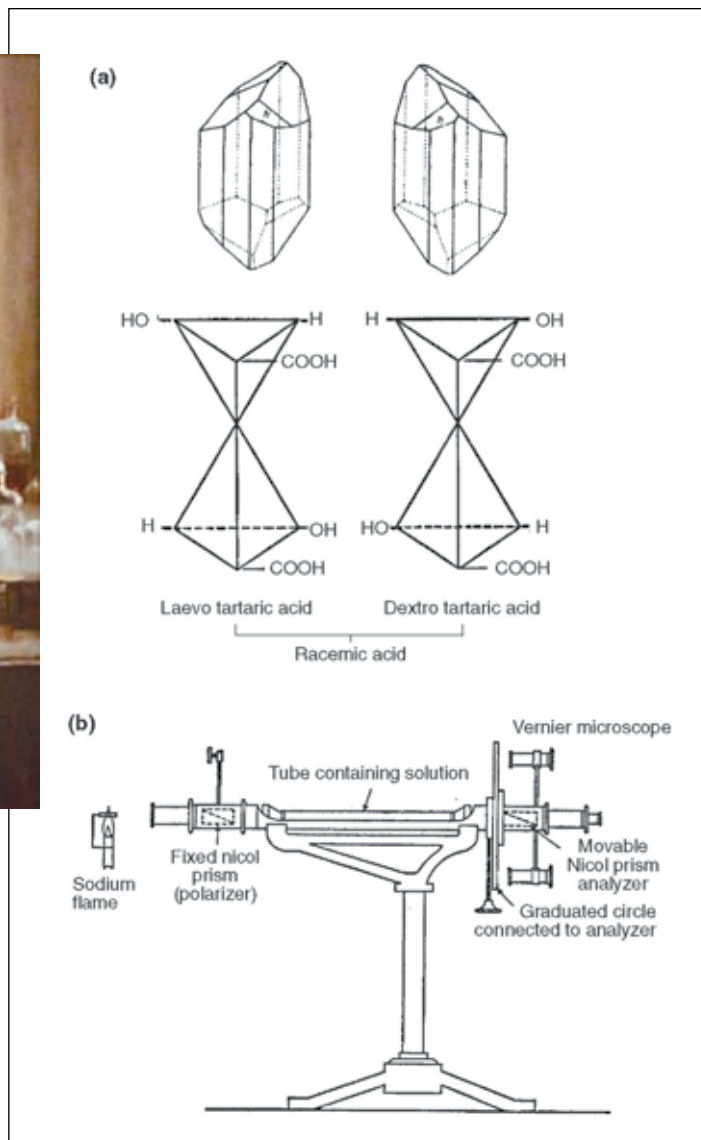
### **The 'Principle of Redi'**

But then he's also taken by the second element, that's often called Curie's Principle, which is that the symmetry of an effect must be contained in the symmetry of the cause. And so, he asks, what does that exactly mean? Curie has famous examples of it. The most famous example is, Pierre Curie and his brother—their discovery of the phenomenon of piezoelectricity.

Now, people may or may not be aware, that their discovery of piezoelectricity, that is, the ability for certain crystals, when compressed, to generate an electric current, is based entirely on considerations of symmetry. Of recognizing what pre-existing symmetry exists in a crystalline structure, and upon its compression, what sort of changes in symmetry are you observing? What occurs as a result? And do the induced symmetries—do they or do they not agree with the symmetry of an electric field,



Louis Pasteur (1822-1895) is shown here in his laboratory in an 1885 painting by A. Edelfeldt. Pasteur successfully separated the left- and right-handed forms of tartaric acid crystals (a) at right. Dissolving them in water and examining the two solutions in a polariscope (b), he found that one solution turned the plane of polarized light to the left, and the other one to the right. He then showed that only the left-handed form is produced in biological processes, while equal quantities of left- and right-handed forms arise in laboratory synthesis of the compound.



of a generated electric current? And on that basis, he's able to determine, first predict, that the phenomenon of piezoelectricity will occur; but then also be able to determine in what material could that phenomenon be generated. And it's premised on the idea that you can get the symmetries to agree between the electrical current and its associated magnetic field, and the crystal itself.

Vernadsky hears this in his discussion with Marie Curie, and then, in his own reading of Pierre Curie's work. And then he connects that with an idea that was already dear to his heart, which is this question of there not being any observed abiogenesis. The idea of what he calls the "principle of Redi":<sup>3</sup> that life always comes from life. That is to say, you never see the

3. What Vernadsky calls Redi's principle, "*omne vivum ex vivo*," is the principle, proven by Pasteur, that "all life comes from life." This principle was formulated by the 17th Century Italian scientist Francesco Redi (in the form "*omne vivum ex ovo*"—all life comes from the egg) and has not been disproven to this day: There has never been discovered any evidence of the ability to generate the living from the non-living.

spontaneous generation of a living process. And what he observes in the history of the Biosphere, you see the steady emergence of life, from life, typically expressed as organism to organism.

But we will see that the symmetry principle is going to allow him to expand this notion of life much more broadly than even that simple description allows.

What he does see also, is that this peculiar symmetry that you see with the handedness—he goes back, now, and looks at the work that Pasteur had done on the ability for certain compounds, when produced by living processes, to be able to rotate the plane of light as it passes through them—and he starts to realize that there seems to be here an intrinsic handedness in the process itself.

Pasteur himself had already concluded that this was a form of handedness that had to exist in the very, very small; that this was not some property of the compound in the large. I'll give you an example: It was already known that certain crystals could rotate a plane of light when light was shone on them. For



N.N. Lusin (1883-1950)



Pavel Florensky (1882-1937)

*Lusin and Florensky were part of a 20th Century Russian school of mathematics that opposed the concept that continuity is primary in philosophy (and mathematics). Vernadsky introduced the Curies' work to Lusin in 1929.*

example, quartz crystal. Crystallized quartz, if you shine light through it, is capable of taking a plane of polarized light and then rotating that, as the light passes through it. But, if you liquefy the quartz, or you convert it into glass, the form that we often see it, in its liquid form or in solution, it loses that ability to rotate the plane of light. So you're able to conclude from that, that the rotation of light in the case of quartz has something to do with the crystal structure itself.

But then, in the case of these living products—like the famous example we discussed in a [[video]] on this subject on the website,<sup>4</sup> the case of tartaric acid: In the case of living processes, the plane of light is rotated in the solution by the liquid itself; which means in Pasteur's mind, that no matter how you change the liquid, it will continue rotating the plane of light as the plane of light passes through it. So in Pasteur's mind, this is a product of the solution in the very, very small.

### A Fruitful Discussion

This is something about the handedness of the geometry that goes to the very, very small. He calls it molecular dissymmetry. Vernadsky takes a look at that, and says that that thing that Pasteur is calling molecular dissymmetry, is actually an expression of something much more fundamental. And remember, he's coming from the standpoint that he recognizes life as being an actual independent, active principle in the universe, a fundamental one.

So, he begins a discussion. He begins tossing these ideas around. They develop really to their peak in the period around 1929, 1930, 1931. In 1929, he begins a correspondence with a mathematician, but a very interesting mathematician, named N.N. Lusin, Nikolai Lusin. It's interesting, because Lusin is part of a very specific mathematical school in Russia at the time.

This school includes Lusin, another figure named Pavel Florensky; there's a number of these folks. I won't give this as an endorsement necessarily, but to give you an interesting idea of what their mindset is: people who were opposed to dialectical materialism, because they were opposed to the concept of continuity as being primary in philosophy. And they stress that there had become an over-obsession in mathematics, in particular, with continuity in continuous processes.

And, so the discussion amongst themselves in this group, is that real processes are, at their heart, at root, discontinuous. And in their discussions, you find that they discuss, in particular, that political processes and social processes, do not occur by some kind of gradual social evolution, That they occur of necessity by discontinuous leaps, that they occur in revolutions.

And so they stress that any kind of mathematical study that is not taking discontinuity into account, is something that's problematic. Florensky, for his part, goes so far as to say that he thinks that it has the net effect of separating man from God, because of man's preoccupation with the necessity that things must continuously follow from what came prior.

So that's simply to give you some context. And among them, they form a group which was heavily opposed to the reigning ideology, the materialist ideology in dialectical materialism. Florensky himself is later executed. Lusin, in a major event in the early 1930s, becomes a target for execution, which is eventually stopped by Vernadsky, groupings around Stalin, and other people. I'll get into some of that and what's to come, but this is just to give you a flavor of what the discussion is.

So this is whom Vernadsky writes to, asking him about this question of handedness. He sends Lusin a copy of Marie Curie's book; it's a biography of Pierre Curie written by Marie Curie. Vernadsky sends this to his friend Lusin, and says: "Look, I'd like you to take a look at this"—this is in 1929—and simply: "look at this and tell me your thoughts on this. I'd like to know from your standpoint, is there any mathematical or geometrical significance to this question of handedness in living processes?" That discussion may end up being taken up in person between Vernadsky and Lusin, between 1929 and 1937, but the next letters we have between them are in 1937.

### The Handedness of Space-Time

Before I get to that, I'd like to discuss some of the developments in-between, but that letter in 1929 just shows that this was something that was on Vernadsky's mind as a fundamental question, and already connected to his idea of, at this point, the primacy of life as a process. But in 1931, something interesting happens. In 1931, Vernadsky—already in his 70s—is again coming under heavy political attack from different circles. Some groupings within the Soviet Union are defending him; others are attacking him. Some of those that are defending him are attempting to defend his scientific work, but prevent it from being propagated into the general population, because people recognize that his concepts are obviously correct, because they're effective, but that they would be dangerous, were they taken up by the general population.

4. See "Louis Pasteur: The [Space](#) of Life."





University of Texas at Austin

*The Russian Academy of Sciences enforced the Soviet doctrine of dialectical materialism among scientists and censored parts of Vernadsky's work.*

So, one of the major moves of the censors at this time was, instead of stopping the publishing of his work, they would prevent it from circulating any wider than the Academy of Sciences. They would only allow the work to circulate among a very small circle of scientists and then limit the amount of publication.

But in 1931, he applies to do research abroad and is denied, and instead is told that what he can do is go and study in a special vacation house that's been set aside for members of the Academy of Sciences. So he's understandably upset. But this year, 1931, where he's in this vacation house, becomes a very fruitful year for him, because a number of ideas that have been floating around in his mind begin to converge. One, his concept of the eternity of life, this idea of life being an actual fundamental principle. But then, that combined with the notion of symmetry, as he had discussed it with Marie Curie from the works of Pierre Curie, and this combined, then, with certain other clear properties that he recognized.

One is, he recognizes the creative nature of living processes, that they express a very clear anti-entropy, where the only place that what you would call an "arrow of time" seems to be seen in the abiotic, at least in the small, as in what Sadi Carnot was able to describe for heat engines, which is their tendency over time for concentrations of heat to dissipate, etc., which was described as entropy, and named entropy. And he makes the point that it was erroneously attempted to be applied to the whole universe by Clausius. Vernadsky makes the point that that was an invalid attempt to generalize it, that nothing experimental demonstrates that. In fact, Vernadsky will show, when you're talking about the whole universe, it's going to have a characteristic which looks much more like a living process than anything else.

But he recognizes this anti-entropy, and he makes a very unique and interesting correlation, which is between that directedness of living processes, that anti-entropy of living processes, and the handedness as Pasteur had observed it. And he says, what we're seeing

here in the case of the living processes is a handedness of time. And then in his writings, he says, well, of course, this makes sense, because it was actually an arbitrary division that was done by Descartes and Newton, to separate space and time into distinct things.

In fact, you only have one phenomenon here, which you would call space-time but really physical space-time. It's a process. The thing that you're calling space and time are reflections of some actual physical process there that is occurring. Since that's true, things that you see reflected in the characteristic space of a process should also be in the characteristic time. So, whatever this handedness of space that we're seeing in Pasteur's work, should also be connected to a handedness of time.

And he starts a deep investigation of this, really getting into the thick of it around 1931, when he does a full historical study of this discussion of everybody who tried to tackle time, and he concludes that—it's really at this moment, that he's doing his work now—the first moment that the greatest fallacy up until this point, has been the idea really imposed by Newton, that time and space are some sort of absolutes that are not subject to be studied by the human mind. That these are something that you're supposed to take as *a priori*, and not be able to question.

And he says, well, that's clearly wrong. He says that's something that the mathematician might think, that's something that even the physicists may think, but it's not something the real scientist, the naturalist, has the liberty to think.

So he begins elaborating this notion. He begins a series of discussions. He writes a series of papers in 1931 on this theme, on the theme of the, as he calls it, "living time," and sometimes, "biological time." But it's interesting that already in this period, over the Summer of 1931, he's beginning to realize that certain principles that you've already seen reflected earlier in his work about the nature of human activity and economic processes—he starts realizing that these are absolutely fundamental, in dis-



Sadi Carnot  
(1736-1892)



Rudolf Clausius  
(1822-1888)

*Vernadsky understood that the dissipation of heat in heat engines, known as entropy, did not apply to the entire universe, as Clausius falsely claimed. The universe according to Vernadsky was anti-entropic.*



curring this question of even living time.

And you see there, in his work, as far as I can tell, the first reference to the works of Wolfgang Köhler and the Gestalt psychologists. And his explicit statement on that matter, He references the work of Köhler and the Gestalt psychologists, and he says that what's most interesting about them is that they recognize in perception the things that you would normally start to describe as perception, which is:

They point out the necessity of recognizing certain geometrical forms or structures for visual space, for tonal melody, and for other such phenomena, which are connected with the structure of the spatially and temporally identifiable cognitive apparatus.

And he points out that the "Berlin Professor Wolfgang Köhler extends these notions about the psychical forms, about these cognitive processes, to phenomena of zoopsychology and to physics." And this becomes a new philosophical current of Gestalt philosophy.

Now, it's important—I just want to draw your attention right there to that reference. He says specifically that what he's talking about when he's describing this character of biological creative space-time, is the best example of being able to start to examine these sorts of geometries—is what you see specifically in the work of the Gestalt psychologists, but specifically in their work on vision and hearing, and specifically music. Note the reference to tonal melody, because that will come up. His discussion of the significance of music for these geometries, and for the notion of time, will become interesting, especially when we come back to a discussion of what Köhler was working on at that time, elements of which would have undoubtedly been known to Vernadsky.

But I'll come back to that.

### The 'States of Space'

I want to do a little more on the arc of what Vernadsky was doing. But keep in mind that reference, in his work on biological time, to specifically cognitive processes, specifically the work of the Gestalt psychologists, and then specifically the character of the role of music, and tonal melody in this process.

But that's 1931; you see that reference. And I know of one other reference at that time to Köhler's work, which is in his notes being prepared around the same period. So that develops.

And a number of other things begin to happen. He publishes those papers. He comes under heavy, heavy



Wolfgang Köhler (1887-1967). Vernadsky began investigating the work of Köhler and the Gestalt psychologists in 1931, in particular their work on vision and hearing, specifically music, and tonal melody, as he was developing his notion of biological space-time.

attack in 1931 as a result of that. I should add that in January of that year, he'd already come under fire. In the magazine *Bolshevik*, there was an article published which was called "Subversives in Science." And it was one of these things—clearly, to get how the process worked—you'd have these moments of just riling up the population. You'd build a rage in the population into a fever pitch, with the intent of targetting certain specific individuals, and usually they would meet with very bad ends.

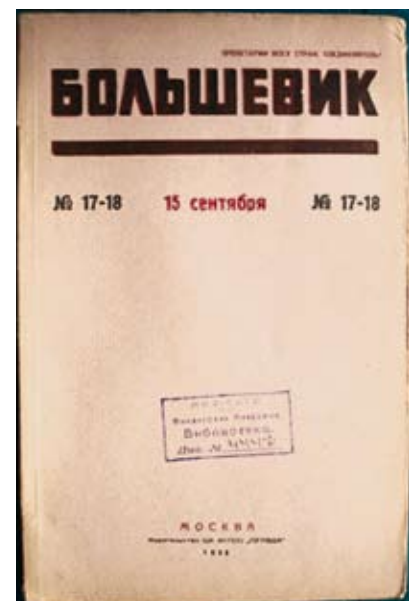
And at this point, Vernadsky had been attacked. He had never made a secret of his own attacks on dialectical materialism, and he'd been attacked publicly for this before. But this one had a particularly sharp edge to it. And he was put on a list with a number of other scientists, a very short list, among whom was Alexander Gurwitsch, for the record, scientists who, this article in *Bolshevik* magazine claimed, were using their scientific work and using their positions to draw political and philosophical conclusions.

And I will make the point: He most certainly was using his scientific work to draw political and philosophical conclusions, and I think this was a moment of clarity on the part of the enemy at this point.

But he was singled out for attack. In that context, he still wrote what he was writing on this further development of his anti-reductionist work on life, and extending it more explicitly into cognition, in 1931, and published it. He presented it at that Fall's session of the Academy of Sciences, and he gave a speech on what he called "the problem of time in contemporary science," where he included his work on life, he included the reference to the Gestalt psychologists, and he included the reference to music, in particular. This came under fire from A.M. Deborin, who at the time, was sort of *the* watchdog



A.M. Deborin (1881-1963) was a leading party enforcer of what he called "subversives in science." His attack on Vernadsky was published in the magazine *Bolshevik* (right) in 1931.



for dialectical materialism. He was *the* Soviet philosophical defender of dialectical materialism; he was *the* person who would be assigned to try and attack you for being a subversive.

And attack Vernadsky he did: He launched a massive, scathing attack. It was very vicious, but everybody also recognized, it was sort of universally recognized, that it lacked content.

Vernadsky, again, in his 70s, responded—again, I'm going into this, to give you a sense of what the context was. This was a very sensitive situation. I mean, to draw in other people who would come under this kind of attack who had been exiled and/or killed—that was clearly what some people, whoever Deborin was connected with, were lining up Vernadsky for.

So it was important that he handle this well; and he writes a large public response, and launches a very sharp counterattack on Deborin. And in it, he emphasizes his, Vernadsky's, own importance for Soviet science and the maintenance of the Soviet Union, and really lacerates Deborin for attempting to stop scientific progress with this attack, for his uneducated ideological reasons. And when you see Deborin's response after that, he actually puts Deborin on the defensive, which is very nice, and Deborin begins nagging somewhat after that, but then backs down in that series of attacks.

But now this frees Vernadsky up to do some other work, and he starts building networks to broaden this notion that he's been working on, this concept of—a term he borrows, that Pierre Curie used, that Marie Curie told him about—this “states of space.” So he continues his work on what he calls the states of space. But he then stresses everywhere he writes it, what he means when he says that is, he's referring to this physical space-time.

In what follows, almost every time I use the word “space,” unless otherwise specified, I'm referring to a physical space-time, and he's clear on that himself. This is, again, most explicitly after this 1931 period, where you've got his explicit work on time being carried out.

### Georgii Frantsevich Gause

So then, in 1933, Vernadsky, then in his 70s, in his diary, he describes meeting with a 23-year-old researcher named Georgii Frantsevich Gause, and they discuss. Vernadsky had been familiar with Gause's mentor, who was a friend of his, and Vernadsky had three years prior approved for publication Gause's first published work. But in this meeting, Vernadsky's ill, and he's staying in a sanatorium to get better, a special sanatorium for members of the Academy of Sciences, and he has a number of people come to visit him.

In 1933, Gause comes to visit him, and what he tells



Biologist Alexander Gurwitsch (1874-1954) was another anti-reductionist scientist singled out for attack by Deborin.

Vernadsky is that he's doing experimental work on this question of optical activity in the protoplasm, that he's taking up the questions that Pasteur had posed on the optical activity of protoplasm, experimentally. And Vernadsky becomes very excited. He's thrilled this is taking place. He even goes so far as to offer Gause a position in his laboratory, because Vernadsky sees in this the potential to extend, experimentally, his idea, as he begins to work it around this time, that the principle that governs living processes is something that lies on a much more fundamental level than space, time, or matter; that this is something that space, time, and matter are a process, that they're a reflection of. These are simply projections of something much more fundamental.

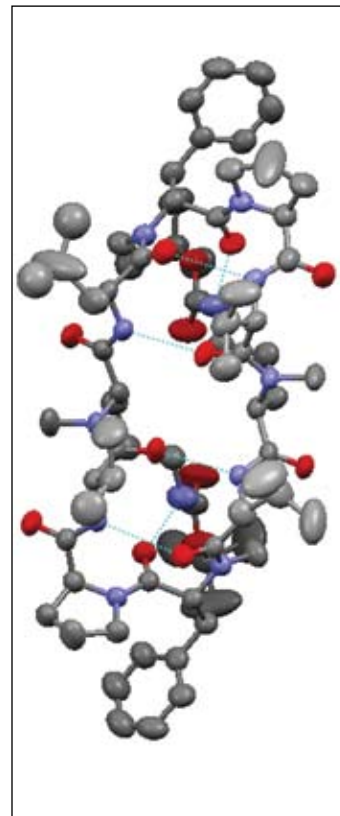
So he offers Gause a position. Gause does not take it, but he agrees to research and publish things in the laboratory. The only reason Gause doesn't take it is because—if you take a look at the areas he's working on at the time, they're so broad, he feels he'll be limited if he leaves the university and goes to work for a spe-

cific laboratory.

But to give you an idea of the number of things that come out of this: Gause is able to confirm that the Pasteur principle of the handedness of time runs far deeper than had even been suspected prior, with just optical activity. In fact, if you are to take a look at the actual structural composition of an organism, there



Biologist Georgii Frantsevich Gause (1910-1986) worked with Vernadsky, experimenting with Pasteur's idea of the optical activity of protoplasm. To protect himself from the Soviet science police, he becomes involved in essential work with the military during World War II, developing antibiotics. The crystal structure of Gause's naturally produced gramicidin-S is shown above.





*Vernadsky put his attacker on the defensive, accusing Deborin of trying to stop scientific progress.*

are certain principles of handedness that aren't violated.

For instance, the handedness of proteins, the optical activity of proteins in living processes, the amino acids that compose proteins, is always the same. You always have proteins that have what's called left-rotary power. They always rotate the plane of light to the left. The sugars that are involved in the construction of living processes will always have right-rotary power. They also rotate the plane of light to the right.

He does a lot of interesting work. He, unfortunately, comes under heavy fire from the Lysenko apparatus, and then the same groupings among the Soviet apparatus that are enforcing materialism as an ideology launch an attack on him; his main collaborator actually ends up being killed, is executed, and Gause becomes understandably afraid.

His work takes a very practical turn. He continues working with Vernadsky, and Vernadsky never leaves the direction that he's on. Gause makes a point, though, to avoid the actual work, the conclusions that Vernadsky is drawing about the states of space, but discovers a number of very interesting things. One thing is, he tries to, in the course of trying to take a practical job, he assigns himself to work with the Soviet military in World War II, making himself indispensable and un-executable, in the way he positions himself. He's the only person able to develop antibiotics for Soviet Russia, and he develops the first—possibly the only antibiotics during the war. I'm not certain, but definitely the first native antibiotics that Soviet Russia had during World War II were developed by Gause.

But an interesting spin on the story, is that it's a naturally produced antibiotic, that has the capability of rendering bacterial cell walls permeable and causing them to eventually just simply disintegrate. And Gause looks at their structure and he breaks down the amino acid structure of the antibiotic, and he finds out that it contains exactly one amino acid, which is mirrored in the opposite direction, as that which should be required for living processes. Every other occurrence of that amino acid, when it's in the organism, is left-handed, and this one case in the antibiotic is right-handed. He experimentally switch-

es the hand, and turns it back left-handed, and it ceases to be an antibiotic.

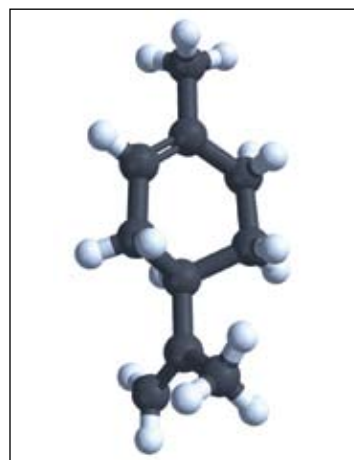
So he's able to demonstrate that the antibiotic character of this thing is closely connected to the nature of handedness in the antibiotic. A whole class of these antibiotics is developed, called "Gramicidin S" for Gramicidin Soviet.

But then there's a whole class of Gramicidins: Each and every one of them contains at least one flipped amino acid, where if you flip the amino acid back, it loses its ability to be an antibiotic. So then, despite the fact that he ceases to draw some of these more profound conclusions, he is able to conclude that this is a deep-running principle.

Now, we know that that shows up in a number of different places. I'll just give a list, so people know that it's true that living processes are uniquely sensitive to the handedness of the chemical compound. I'll just give you an example. People know maybe aspartame, which is the artificial sweetener. If you take the exact same chemical and you reverse the handedness of it, it ceases to be sweet and becomes bitter—chemically identical. Every experiment you could do, outside of experiments with light, would demonstrate those two compounds to be identical. But the organism recognizes them as a universe apart in terms of actual activity.

The smell of caraway and spearmint is the exact same chemical: The difference is the handedness. So, chemically identical, but you, your organism, recognizes them as being distinct. The limonene, which makes citrus fruit smell like citrus—orange, lemon, etc.—if you reverse its handedness, it begins to smell like pine or turpentine.

Some of these artificial drugs are nice: One called Darvon, in one form, is a painkiller. If you flip it to its mirror-image, it will have no effect on your pain, but it will cure your cough. And there are all sorts of insect pheromones and things, that have completely different actions: Exact same chemical, just flipping the hand, that changes fundamentally its biological effect.



*Another example of handedness in chemical compounds is that of limonene (the citrus smell) and turpentine, which are chemically identical—except for their handedness.*





## Riemannian Geometry

So you realize there's a symmetry principle there in living processes that's very specific, and does not exist outside of it. In 1937, Vernadsky continues his discussions with Lusin on this topic, and he asks Lusin: "I want to ask you something that's more profound. Is there anything in Euclidean geometry that can account for this distinction here?"

Supposedly, the standard description of what the handed molecule is, is a handed molecule floating in Euclidean space. And I've had discussions, we've gone to a number of these astrobiology events, talking to the people who are supposed to be the main workers in this area, and you'll find they all subscribe to this idea, that you cannot touch the nature of the space that things operate in. It is a Euclidean space with a handed molecule.

But Vernadsky goes deeper. He says, "Look, is there anything in a Euclidean space that can distinguish, fundamentally, between these hands?" And he assigns Lusin this investigation to figure it out. And they have a really wonderful dialogue back and forth. I won't go into all the details, but it involves them really hacking and slashing at everything that's known about Euclidean geometry and beyond, and concluding that there's not a way to make this distinction in Euclidean space—and again, I'm summarizing a lot of a very interesting discussion. We can have some more on it.

But then Lusin asks a friend of his, Finikov; he asks a number of mathematicians. They're all passing around Curie's book. And a friend of his relays back to Vernadsky, that well, no, in order to get to the phenomena that you're talking about, you're going to have to start looking at the works of Bernhard Riemann. And so you then begin to have a discussion, here, with Vernadsky, with a number of other thinkers, on the nature of Riemann's work.

They have a first-pass series of discussions, and you see this develop over time. It culminates in 1938, where Vernadsky holds a number of seminars at his house with these thinkers. At first, he initially asks Gause to come and just talk with him, and he gets the reply back that Gause will not meet in private with any professor, because there had been some bad blowback from the Soviets, due to people setting themselves up like that; he refused to set himself up in that way. But later on, Vernadsky was able to call together a larger meeting, including Gause, another histologist—essentially, it becomes two mathematicians (it sounds like we're setting up a joke!); two mathematicians, two physicists, and two biologists, and Vernadsky.

The biologists are experts in the handedness in living organisms: Gause and another thinker; two physicists, one an expert in relativity, and the other one an expert in spectrometry. And then the two mathematicians, Finikov, who is the expert in Riemannian geometry, and Lusin, who was the expert, who had this streak of requiring discontinuity, who said that continuity was



*Bernhard Riemann (1826-1866). Vernadsky and his circle of biologists, physicists, and others intensively studied Riemann's geometry and its application to physical space-time.*

the biggest problem you had in mathematics.

They have a number of discussions. Again, I'll just summarize: They conclude with Vernadsky's conclusion in 1938—what becomes the second in a series called "The Problems of Biogeochemistry," that living processes express a distinct physical space-time, and that that distinct physical space-time has to be of a Riemannian character. And again, there's a lot in this. There's a lot more to that, but then, in the course of discussing working on it, he's got a number of references where he's very, very explicit (and again, I'll make these available in an upcoming paper); but he's very explicit that the mind is capable of understanding this.

But in order to understand the actual character of the geometry that's characteristic of these living processes, it's necessary to embark on a more fundamental discussion of creativity

per se. And you see a lot in his diary entries, of him discussing the fact that, likely, the model that we're going to need to look at, in order to examine, to look at the sort of space-time phenomena I want to look at here, is going to be the one you find in the compositions of Bach, Mozart, and Beethoven. There's quote after quote of him discussing that. This is in his private writings, not in the published ones, but you can see the direction his mind is going.

It's significant that he's doing this at the exact same time—this is almost exactly coincident with the time period, where you see Einstein coming to some of the same conclusions. He makes an explicit statement in a dialogue Einstein has with [Max] Planck, that some of the phenomena that are being run into in physics, the quantum phenomena, can only be addressed from the standpoint, he says, specifically, of a Bach fugue. So you start realizing this theme is coming up.



*Trofim Lysenko (1898-1976), another Soviet science enforcer, who targeted the work of Gause. Here, Lysenko speaking at the Kremlin in 1935. At the back (from left) are Stanislav Kosior, Anastas Mikoyan, Andrei Andreev, and the Soviet leader, Joseph Stalin.*

Remember that Vernadsky had started looking at Köhler's work on sight and sound, and realized that Köhler had been in a dialogue at that time and prior with Max Planck, whom Einstein was in his dialogue with, on exactly that theme, on the nature of the character of creativity, as it expressed itself in music and psychology, for physics.

### Picking Up the Threads

I'm actually going to leave it at that point, because frankly, that's sort of the most honest thing that we could do here: Because things actually are left at that point right now. To give you an idea of where things stand, Vernadsky never finished founding the science that he wanted to found on that topic. There is an amazing body of work, and we want to assemble it so people can see what it is, but it was left unfinished. The threads that are required to be pursued there are very clear, though, on the investigation of creativity per se, and its expression in the anti-entropic nature of living processes. That that's going to have a very specific geometric characteristic that will be reflected in the space-time of the process.

All that is clear, but what's left to be done is going to require the work of people with the expertise in the right areas, with the right sense of the physical-scientific questions that are involved, but also, the sense that the resolution lies in the higher domain of Mind. It would have to be a group of people that somehow had an expertise in Classical artistic composition, maybe performed it often, maybe opened events with impressive performances. It would have to be that same group of people that would do these musical performances, that would also engage in their free time in profound scientific discussion. It would have to be a group of people which was interested in the exact same sorts of economic questions that Vernadsky was interested in, because you would have to be able to pursue a



Max Planck (1858-1947) and Albert Einstein (1879-1955), in Berlin, 1929, where Planck presented Albert Einstein with the Max Planck medal of the German Physical Society. Both scientists understood the intimate connection between music and science. *Quantum phenomena, Einstein wrote Planck, can only be addressed from the standpoint of a Bach fugue.*

study of human activity in the large.

So it would require a very specific kind of grouping that you don't often find in history. That exact same grouping would be well situated to finally finish off, pick up the thread where it was left by Einstein and Planck, where they didn't get much further than the recognition that the whole approach quantum mechanics has taken to these questions is wrong, and the proper approach would have to be something that looked like something in the character of a Bach fugue.

Now, again, that was left undone. It's going to require a very specific grouping of people to be able to pursue that. I think people might get the idea. I'd like to propose that this is a task that we take up, and that we are well situated to take up amongst ourselves. And that, frankly, there's nobody else on the planet except for our association that's in the position to answer these questions.

Everything that came after has proven itself to be a dead end. The reductionist approach in biology has proven itself to be a dead end. The statistical approach in physics has proven itself to be a dead end. Not by coincidence, they're closely connected to the statistical approach, the fraud that's launched in economics, because it's the exact same problem expressed across the board, the same underlying ideological problem. And the resolution to all of these I think will be found at once. But that's a discussion that, hopefully, we'll be having over

the course of the weekend, and in perpetuity, after this moment.

So, that's what I've got so far. We can pursue some more in discussion afterwards.



James Rea/EIRNS

*The Schiller Institute chorus performing at the Rüsselsheim conference in July, where Shields presented this speech. Shields challenged the audience to "pick up the thread where it was left by Einstein and Planck," away from the dead end of reductionism in biology, physics, and economics.*