New Directions in the Dialogue between Buddhism and Science

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What can be said about the nature of the human mind, and about how mind is related to the physical properties of the brain and body? What can be said about the nature of physical reality, and about the structure of the observed Universe? How might consciousness and cosmology be related? Twenty-five years ago, His Holiness the Dalai Lama initiated a dialogue with Western scientists directed toward developing a deeper understanding of the most profound questions about existence. His Holiness drew attention to how the nature of mind and the nature of reality are central questions both in contemporary science and in Buddhist philosophy. And since the investigative approaches in Western science and in Buddhism are complementary, perhaps interesting new ideas might come from engaging in conversation. Indeed, fruitful new research directions in neuroscience and in psychology have come from this dialogue. Still, within the Western scientific tradition, an understanding of how mind is related to everything else in the physical Universe presents a deep puzzle. It may be that a paradigm shift in the metaphysical framework of Western science will be necessary to take us to the next phase of more deeply understanding the nature of mind and consciousness and how they relate to the rest of physical science. How might such a paradigm shift even be envisioned? We will consider the following

features: (1) that such a shift may include an experiential dimension present as a fundamental feature of reality, similar to the present status of space, time, and energy; (2) certain phenomena, considered anomalous within the current framework of Western science, may point the way toward a new framework; and (3) quantum mechanics, the very successful fundamental physical theory describing the behavior of matter and energy in Western science, may contain hints as to the nature of the new framework. This broad arena of discourse may be one in which the evolving Buddhism–science dialogue may forge powerful new collaborations.

David Presti: This is a tremendous honor. This is a really special moment in the evolution of this dialogue that His Holiness had the wisdom to suggest back in the 1980s that brings contemplatives and scientists together to discuss questions that are at the most basic level of appreciating who we are, what our mind is, and how we relate to the rest of the Universe. For 25 years there has been a very active dialogue, which has been institutionalized in the Mind and Life conferences that have involved His Holiness and various scientists over the years, but relatively few other monastics. It is an amazing thing that we are now, through educational programs such as Science for Monks and the Emory–Library collaboration, able to expand this dialogue to so many people in the Buddhist tradition. It is a tremendous thing, so many venerable monks and nuns being here, so this is a very special moment.

Many really powerful ideas have been put forward over the day and a half that we've been talking, and more will come. What I will say, though, will be my way of saying it. Sometimes different ways of hearing the same thing are valuable in appreciating the complexity of these problems.

The Andromeda Galaxy is the famous galaxy that is our nearest neighbor in the heavens. Some time back in the 1970s, there was a 10-minute documentary made called Powers of Ten. It tried to

illustrate, and it actually did a very good job of illustrating, in movie form, the scale about which Paul Doherty was just talking, from the very largest things like the size of the Universe all the way down to sub-atomic particles, 10^{42} orders of magnitudes or so. It illustrates a very interesting thing about the theme of our conference, "Cosmology and Consciousness."

You asked a few minutes ago about the connection between cosmology and consciousness, and what we can say about it. We can certainly say what Paul said: that everything that we know about anything at all is coming through our consciousness, it's coming through our awareness, and any theories we have about the physics of the Universe have been created by our brains and minds. There is that connection between cosmology and consciousness. In fact, it was something like that connection that first got me interested in this whole subject. When I was an undergraduate student, I was studying physics and general relativity and I began to wonder how it was that Einstein could sit in his room and invent a theory that describes the whole of the Universe. How was it possible for humans to do that? That's definitely a connection between cosmology and consciousness. I think another connection, which we don't know about yet, is whether there is some profound connection between the inner reality of our mind and the outer reality of what we call physical reality, including the large-scale nature of the Universe. How these are connected is still very much beyond the limit of our knowledge. I believe that perhaps the next big revolution in science will somehow shed some light on that. That would be very exciting. There is no reason why that might not be the case, and what we are doing here speaks to that possibility.

The word "science" actually comes from the same word as "knowing," and so science is a way of asking questions about our world of experience and designing ways to test, to gather data, to do experiments, and then to form theories to try to explain the organization of things. It's a way of gathering information, organizing it, and expanding our framework of understanding. It's a very, very general term. It applies to understanding our outer world, and there

is every reason to believe that it can also apply to understanding our inner world; asking questions, gathering data, developing theories, and so forth. Western science, which developed out of the traditions of Europe and America, has now spread to the entire world, it's the way in which science is conceptualized across the entire world.

It is grounded in astronomy. It began with trying to understand the movement of the planets, the movement of the Moon and the Sun and the Earth. These guys here on the screen are sort of the acknowledged founders of Western science: Copernicus, Galileo, Descartes, Newton. Descartes was actually one of the first people to suggest that Western science works well in trying to understand our outer world, but that our inner world may be more complicated. Newton took this to the next step. He explicitly said, "I can't deal with experience. I don't know how to account for the redness of red. What I can talk about is the mathematical properties of light." And he invented an entire mathematics, and physics, to do that. Newton also was very good at making connections between the movements of the planets, the Sun, and the Moon, and what was happening here on Earth, like an apple falling. He also showed that there were universal regularities and laws that could describe these things.

This has become an extremely successful framework, which has been expanded by people like Maxwell and Einstein into the 20th century. It provided, by the beginning of the 20th century, an awesomely successful framework for describing our physical world. In the 19th century, this began to be applied to biological things too. Darwin was really the main mover of a revolutionary way of looking at living organisms, and as our technologies of observations got better and better in the 20th century we could examine cells and later molecules and so forth. We were able to describe the cellular and molecular chemical make-up of living organisms in a very detailed way that was completely continuous with the way physics and astronomy described the larger-scale structure of the Universe. If we bring this to the present day, we now have an awesomely beautiful and stunningly powerful framework of understanding, which we call physical

science or bio-physical science, that describes everything from the furthest reaches of the observable Universe all the way down to the microscopic layers and the makeup of cells, the makeup of organisms, the structure of DNA, the structure and functioning of the brain.

This is all beautifully articulated in this framework that we can call Western physical science, and again we call this Western physical science but everybody does it. It has led to all of the wonderful things that we like to play with, like computers and mobile phones. If you have a mobile phone, you are a beneficiary of this way of looking at the Universe. It really works. Then to introduce a few more terms, these ideas of physicalism, or physical materialism, are other ways to describe the framework. I keep using this term framework. Science, as I said, is just looking for knowledge, gathering data, and doing experiments. Right now it is within a particular framework that can be called physicalism, or physical materialism, which is basically the idea that everything is made of matter. More technically stated, it is the idea that everything is describable in terms of mathematical quantities attached to coordinates in space-time. That is a technical definition involving masses, energy, field strengths, location, space-time coordinates, and so forth. That's the way everything is described, including what's going on in the brain. We don't usually talk about it in exactly that language, but if you really traced it you could.

This has given rise to a hierarchy or connection between different fields of science, with physics often considered the most fundamental because it describes things at the very microscopic levels of interaction. The behavior of atoms can be described by physics, but when you get a larger number of atoms coming together to form molecules, a new kind of area of scientific description emerges that we call chemistry. And then, if some of these atoms come together, if molecules come into particular stable configurations and form entities that can maintain their stability over time by consuming energy and replicating themselves, we call that life, and that's studied by biology. If we look at a particular piece of biology that is related to how the body and brain are working to produce behavior and analyze sensory

information, that area of science is called neuroscience.

What's missing from this is mentality or mental experience, or mind, or consciousness, or whatever we wish to call it, that experiential piece. Another thing that I don't want to spend a lot of time on right now is the different ways that those words are used, because in Western science there really is a very limited history of being interested in describing mind, consciousness, mental experience, and so forth. In fact, it's been almost explicitly excluded, beginning with Descartes and Newton and continuing until the end of the 20th century. The focus was always on the external word and what could be described by mathematical relations. Western scientific language is impoverished in the way those terms are used when compared to Buddhist philosophy, which has a much more elaborate and nuanced appreciation of those terms. I will use the terms loosely, and hopefully you will forgive me for that right now and we can come back and repair those things later.

There's no place in this particular hierarchy for mind as it's conceived of right now, which leads to what has been called the "mind/body problem" in Western science. That is, how is this mind thing, this mental experience, this consciousness, related to the processes that are happening in our brain and body that we can measure by our technologies and scientific analyses? I am not being exclusive to the brain here. We know that the brain is very important for the mind because if you damage the brain you get really powerful and specific damage to mental function, but there's a lot of stuff going on in the body that is also related to our mental experience. How they are connected is the question. If you put this question to most neuroscientists, they'd probably say, as most philosophers do, that we have to somehow identify these subjective internal mental processes with their objective, physically describable neural correlates. By neural correlates I mean what can we measure that's happening in the brain when this mental experience is also happening? If we're feeling happy, what kind of brain activity and body activity is related to that? If we're feeling sad, what kind of brain activity or body activity is related to that? Many folk, even though they don't know how at this point, will

simply identify that with the mental experience, but nobody knows how this happens. Nobody can answer that. They simply believe that because this framework of scientific explanation has been so successful for so many centuries, it will eventually be successful here too. We just need to study the brain more, build better fMRI machines, do more experiments with a greater diversity of people, and eventually an explanation of how these things are connected will somehow emerge from body and brain physiology. And maybe that will happen, that is certainly one possibility, even though nobody exactly knows how.

One hundred years ago or so, one of the great pioneers in American experimental psychology, a fellow named William James, was very interested in the study of the mind and how the mind is connected to the body and the brain. He actually proposed, more than a hundred years ago, that one way for the science of mind to move forward would be to develop a rigorously empirical introspective way of making observations and doing experiments. This would be somewhat like the contemplative traditions have a long history of doing, but James seemed not to have a lot of knowledge about those traditions at that point. He tried to get things like this going in American experimental psychology and it went absolutely nowhere. In fact, it got completely bulldozed by the movement that Bruce Greyson mentioned this morning, behaviorism, which stated that rather than study the mind on its own terms of subjective internal experience, we should just study the brain and the body because we're better at doing that.

But James also said something else, which was very, very profound. In a piece that he wrote back in 1895, he pointed out that all these ways of observing matter are based on the physical science of the time, and that the assumptions of those natural sciences are provisional and revisable. He said this in 1895. It was remarkable because in 1895 many physicists thought that physics was a closed book and that everything interesting had been discovered; that measuring things with more precision would be the future of physics. No group of people were ever more wrong, because just a few years later, in 1900, Max

Plank and Heisenberg were to plant the seeds of what was to become quantum theory. They didn't have quantum theory, they just had the notion that quanta of energy would lead to an enormous revolution of physics, a true revolution. By revolution, I mean that before and after these events people viewed the world in very different ways.

The world of physics was very different before and after the development of quantum theory in the 1920s by Heisenberg, Schrodinger, and Bohr. Quantum theory rose out of a necessity to describe experimental facts that were gathered in the study of atoms, but that were completely inexplicable in terms of the physics that had been developed by Newton, Maxwell, and Einstein up to the 20th century. It is, as Paul just mentioned, very much illustrated in the double slit experiment, which I won't dwell on. Just to point it out though, this slide actually does show pictures of single photons of light hitting a photographic film. You can pick out the dots one at a time, and it shows that over time they build up, illustrating an interference pattern that demonstrates that these single particles of light have somehow gone through both slits and interfered with themselves. Now I'm not going to dwell on that, except to say that this was the first hint that the way in which questions are asked in fundamental physics had an impact on the finding of the experiment. But it goes beyond that; recent experiments have demonstrated that there is a way in which the very essence of physical reality is not definable until the question is asked, which is a very profound statement. I don't have a deep enough understanding of this, and I've been struggling with it for years now, so if you don't fully understand what I say when I say that, don't worry.

The bottom line with quantum mechanics is that there is a very strong suggestion that there's something about the interaction with the physical, what we call the external physical world, that is very much intertwined in some way with our own mentality, our own decisions, our own consciousness, our own perceptions, and nobody has a clear answer to this. Many brilliant physicists, beginning with the founders and continuing to this day with many very prominent physicists, have thought about this and everyone agrees that this is a problem and no

one has a good answer to it.

The seeds are there for some very interesting stuff connecting mind and brain in some way. As was mentioned earlier, people like Bohr, Heisenberg and Schrödinger appreciated this. They also appreciated that they weren't psychologists, they weren't biologists, they weren't neuroscientists, and they didn't really know how to deal with consciousness. So they didn't really go there. They simply said there is weird stuff happening here, and the equations still work and they allow us to make predictions, and maybe someday, somebody will do something with this. Maybe this is the day.

In summary, there are a number of pieces of data that support the need for an expanded explanatory framework to describe these things that relate to our minds or our consciousness. One is the simple inability to get some kind of experiential or conscious awareness out of brain physiology, out of the movement of atoms and molecules and so forth inside our brain. There is very powerful data, described by Bruce this morning, from near-death experiences and reincarnation studies—and of course you have many more examples of reincarnation stories— that is not explained by simply saying that consciousness is a product of our brain and body working in some way. Certainly our bodies and brains are very much a piece of the picture while we're alive, but somehow there is more going on. It may be that there isn't a simple way that is graspable by us yet, or ever, to explain reincarnation, but there may be interesting and weird things going on in the movement of characteristics of our consciousness across lifetimes. There are also things that we haven't talked so much about, but for which there's an enormous amount of scientific evidence. For example, data collected over more than a hundred years of careful experimentation demonstrating things like telepathic communication between people, or precognition; having some sense of things that are going to happen that haven't happened yet. And, again, these are very common in the Buddhist tradition where people have precognitive dreams that will indicate that something is going to happen.

In the ancient traditions of India, including Buddhism, people talk about siddhis, or other special powers, that can come from long periods of practice, and which include things like precognitive and telepathic abilities. There is a lot of data, but none of it is taken seriously by Western science because there is no way that it can be explained in the framework that we have right now.

If you talk to the people who are really working at the frontiers of physics right now, folks that are involved in particle physics—the Large Hadron Collider on the border of France and Switzerland where they're banging particles together in very high energy and trying to create new things—some are very confident that any day they'll discover the Higgs–Boson and that would be the final proof that the "standard model," which is a nice package or way of describing elementary particles that has been developed over the last 30 years, will be complete in some way. I have a standing bet with some of my physics colleagues that they won't find the Higgs–Boson in the next three years in the Large Hadron Collider, and not finding it might be the most interesting thing. That would mean that there is something really missing in the way that we're conceptualizing microscopic matter. There's very interesting stuff at the frontiers of physics, way down there and in the other direction—there have been several allusions already to dark matter and dark energy which composes something like 95% of what we believe the energetic content of the Universe is—that may not be easily explicable.

It could be that there will be some completely new way of looking at the large-scale structure of the Universe that will come about before we understand these things. The day before I left for India, I was talking to one of my colleagues who is involved in an experiment to detect dark matter in some mine deep in South Dakota and he said, "You know, I don't think we're going to find anything. I think that what we will really contribute is that we will very carefully demonstrate, to the limits of experimental precision, that we can't detect it." That means that there's something really missing in the way that we conceive of the Universe and we're going to need to go

back and look at the structure of the Universe, which is very exciting. I actually believe that we are poised for a revolution in the mind sciences. The science of mind in Western science has not had any revolutions, like biology did with Darwin, or physics did with quantum mechanics and relativity and Copernicus and Newton. Mind science is really poised, and wouldn't it be interesting if whatever the revolution in mind science is, somehow it also embraced things in cosmology and there was greater insight there? That's a long shot, that's a wild one, but wilder things could happen. That's really what makes this dialogue super interesting, because the revolution is poised to happen. Perhaps a part of that would be a more deeply analytic examination of the mind, which many of you are experts at, and also the capacity to really think out of the box and to think in new ways about how to explain phenomena that may not be easily explicable from either of our perspectives. It may need some new synthesis, some completely new way of looking at things. Wouldn't it be cool if it happened while we were around in this lifetime to see what it is?

Discussion

Monastic Graduate: My question is related to biology, so this is for David. In biology when we talk about the evolution of living beings, we talk about how life began in the ocean from single-cell organisms that became multi-cellular organisms, and then primates and finally human beings. The Buddhist traditions, however, have a different point of view. They say that when life started, it had more power, mentally and physically, which gradually reduced with time. And when we talk about the physical world that we live in, we talk about how the wind element was generated first, and then the other elements, such as fire, and gradually there's also a process of how this physical world came into being. My question is: When we talk about life on this Earth, and the physical substance that is embodied in our bodies, embodied in living beings, can we say that it comes from a different planet? Or did it come from Earth? I'm talking about the origin of that first cell. How did the first cell on this planet come into being?

David Presti: That's an excellent question, and the excellence of that question really is highlighted by the fact that Western science does not have an answer. Many brilliant scientists have worked on that and are continuing to work on it. We do not have a story to explain the origin of life other than the conventional one, that with lots of time and lots of banging around, something will happen. It's one of the reasons astrobiological research is so interesting, because if you try to look for life in other places that either look the same or look different, there is value in addressing this question. Some scientists of prominence, including people like Francis Crick, who was the first to discover the structure of DNA, the co-discoverer of the structure of DNA, have suggested that life on Earth actually did come from other places in the Universe and maybe landed billions of years ago as some kind of spore or something and then evolved here. It's a wonderful question for which we don't know the answer.

Chris Impey (Moderator): The idea that life travels between two worlds is called *panspermia*, and it's a 150-year-old idea in science. Astrophysicists and planetary scientists have investigated it and taken it seriously, and the answer at the moment seems to be that transport of potentially living organisms inside rocks is quite possible within the Solar System. In fact, the conveyor belt, the inefficient transport system in the Solar System, works quite well from Mars to the Earth, because Mars has weaker gravity and less atmosphere, and the Earth is closer to the Sun. It's less efficient going the other way. Provocatively, since we know that Mars was almost certainly habitable 3 or 4 billion years ago, it is distinctly possible, but very hard to prove, that life on Earth came from Mars. There are possibilities of moving life within a Solar System.

This question of life traveling between stars has also been investigated a lot in the last decade, and it turns out that there are two issues when travelling on a rock. One, can the rock be ejected from the system, and two, does a rock take so long to travel that a microbe could survive? The answer to the second question is that microbes have been resuscitated after being dormant for 15 million years, although some consider that work controversial, and that's about the time it would take to travel between near star systems. In principle, therefore, a dormant microbe could survive the journey, but the probability of a rock being ejected from a planet and landing on a moon or a planet of another star system turns out to be infinitesimally small. Astronomical calculations suggest that life being transported between star systems is very, very unlikely, and of course if life originated elsewhere, you have essentially just shoved the problem somewhere else. You haven't explained its origin; you've just put it off to another place. You still have something to explain. That's what the astronomers have figured out.

Actually, having talked for a couple of minutes myself, we're a little over time. Let's take our break until four and let's thank David and Paul.