and restoration of reefs, wetlands and vegetation, and building of sand dunes, have the greatest potential to protect coastal communities against climate change damage. Coastal defense planning is already underway in several areas such as New York and Louisiana, recently hit by hurricanes. Conservation-based protection strategies may be added where practical to engineered barriers in the future. Nature Conservancy scientists are already using the models underlying this study to rebuild oyster reefs off the coast of Alabama - a project that has trapped sediment and dissipated wave energy that normally would have eroded the shore.

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Nature Climate Change 3: 913–918Year published: (2013)

Blood markers predict suicide risk

Suicide claims the lives of over a million people per year and is a leading cause of death amongst psychiatric patients. However, suicide may be preventable if risk could be determined and acted upon. Le-Niculescu and colleagues (Department of Psychiatry, Indiana University School of Medicine and Indianapolis Medical Center, USA) have identified differential gene expression in blood samples from patients with bipolar disorder and compared samples of those with thoughts of suicide with those who had exhibited no such thoughts. In this way, they were able to identify a number of markers that potentially predict whether suicide is a risk in individual patients. (Note that the psychological assessment did not directly ask about suicidal thoughts which some individuals may deny or choose not to share.) The molecular approach used to identify differentially expressed genes, Convergent Functional Genomics (CFG), integrates multiple independent lines of evidence to reduce false-positive and false-negative results. Specific gene expression levels of candidate blood biomarkers identified in bipolar patients were examined in the bloods of actual suicide victims available from coroner investigations. In this way, the researchers found that 6 out of the 41 most correlated expressed genes associated with suicide ideation showed a significant difference. The most significant biomarker, identified as spermidine/spermine N1-acetyltransferase 1 (SAT1), also correlated with the number of hospitalisations of bipolar subjects. A similar, though weaker, pattern was observed in psychosis (schizophrenia/schizoaffective disorder) patients. In addition to SAT1, three other biomarkers (PTEN, MARCKS and MAP3K3) were identified that showed similar but weaker correlations with suicide risk. This approach, using two simple measures for anxiety and mood, and SAT1 blood expression levels, will help to predict future hospitalisations and suicide risk.

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Discovery and validation of blood biomarkers for suicidality.

Mol Psychiatry Aug 20. doi: 10.1038/mp.2013.95. [Epub ahead of print] (2013)

Sinking land due to fish farming causes rising sea levels

We are used to being concerned about the effect of rising ocean level, as well as warming and increasing acidification, on fish populations. Now we are being alerted to the need to be concerned about the effects of fish farming on ocean levels. Higgins, Syvitski and colleagues (Department of Geological Sciences, University of Colorado, Boulder, Colorado, USA) have used satellite-radar surveillance of the Yellow River delta in China to chart the land subsidence caused by extensive aquaculture over a period from 2007 to 2011. The data show subsidence rates in the area of the fish farms as high as 25 cm per year, probably due to ground water pumping. This sinking of the land mass is equivalent to 100 times the rate of global average sea level rise (around 3 millimetres a year) caused by warming water and melting ice. Similar sinking of land mass due to groundwater pumping has been seen in Bangkok. Deltas can also sink when new sedimentation is prevented by dams or diversion of water for irrigation. The Yellow River shoreline has receded by 7 kilometres over the last two decades. Sea walls have been built to stop this erosion but until now little attention has been paid to the vertical subsidence occurring due to aquaculture. Asia produces 89 per cent of the world's farmed fish and shrimp. It is vitally important to be aware of the impact that this kind of aquaculture can have on local sea-level rise.

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Geophys Res Lett 40: 3898–3902 (2013)

The earth's habitable lifetime

For a planet to support life, it is generally agreed that we need water and a temperature not too hot nor too cold. These conditions are not static in a solar system. The luminosity of a typical star increases as its composition and chemical reactions evolve over billions of years, pushing the habitable zone (HZ) for a particular planet outward. The habitable zone lifetime, defined by boundaries encompassing conditions that will support life, may include or exclude planets during the lifetime of the star. The other important consideration is the length of time required for the evolution of complex life within the habitable zone time period. Rushby, Watson and colleagues (School of Environmental Sciences, University of East Anglia, Norwich, UK) estimate the evolution of the habitable zone lifetime of our earth to be between 6.3 and 7.8 billion years and our earth is now about 70 per cent through this time period and will continue to be habitable for about another 2 billion years. The authors used their approach to also determine the habitable zone lifetimes of 7 confirmed HZ exoplanets (extrasolar planet, or a planet outside the Solar System) and 27 unconfirmed Kepler candidates (Kepler is a space observatory launched by NASA to discover Earth-like planets orbiting other stars). This work identifies planets outside our Solar System with long 'habitable periods' – i.e., the best places to look for life. Climate dynamics such as atmospheric composition and volume will also be important. Interestingly, just as our sun brightens and the Earth becomes too hot for life, Mars will be entering the habitable zone in our solar system.

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Habitable Zone Lifetimes of Exoplanets around Main Sequence Stars.

Astrobiology 13: 833-849 (2013)

***Marilyn Monk** is UCL Emeritus Professor of Molecular Embryology at the Institute of Child Health, University College London, and Honorary Professor at Melbourne and Monash Universities, researching gene expression and its regulation in development and cancer. She is also an Alexander Technique Teacher and Psychosynthesis Counsellor.*

Expansive Nature Experiences and the Mystical: A Personal View

Matthew Colborn

The author describes his own personal experiences with nature, dubbed Expansive Nature Experiences (ENE) and discusses their affinities with Extrovertive Mystical Experiences. It is suggested that ENEs are a more common, dilute version of a full-blown mystical experience. Explanations are surveyed, from the transpersonal to the neurobiological. Then the health and ecological benefits of inducing ENEs are examined, and related to recent findings concerning Attention Restoration Theory and exposure to the natural world. The author concludes by suggesting that these experiences suggest an animistic reading of nature, and remains agnostic about whether they point to a transcendental reality.

It's early August, and I'm standing on the sea shore, looking over the North Sea. A cormorant glides parallel to the deep, blue water, the sun shines overhead and the sky is blue. I've taken off my shoes and socks, and am wading in the cool water. At my feet, in the shallows, little fragments of red and green seaweed float, hugging the tide-line. The water's pretty clear and between waves, I can see the sandy bottom. A flock of sanderling follows the surf, scurrying away whenever there's a wave, and at one point, a small flatfish, probably a dab, zooms away, heading for deeper water. I turn and stare far out to sea, and that's when it happens.

Something deep within relaxes, and my consciousness seems to expand towards the horizon. Everything holds fascination, from the gulls bobbing over the sea to the sand clouding underwater at my feet. Worries recede, and I feel a deep and increasing sense of unity with the seascape before me. My surroundings feel alive, and shot through with mood and purpose, but it's the sea that dominates. Its might is palpable, even though it's wearing a benevolent face. And at the periphery of consciousness, still held at bay by errant thoughts, hovers a greater feeling of sheer awe.

The Expansive Nature Experience

I've experienced this state of consciousness repeatedly within a natural setting, or even when contemplating living things in captivity. It's happened in the woods near my home, amongst deserts and mountains, at an aquarium, or when contemplating the sky at night. Over the years, I've found that these very personal experiences have a range of features, which include;

- A sense of expansiveness.
- A slackening of the barrier between self and the world.
- Deep relaxation.
- Deep absorption or interest or even a sense of intoxication with the natural world.
- A strong sense of *mood* within the landscape.
- A sense of purposiveness within nature.
- A sense of the truth of a strongly *animistic* as opposed to a *mechanistic* interpretation of the Cosmos.

Related experiences have long been reported by many different people from very different cultures and in widely separated times and places, and labelled in various ways. My own personal label is Expansive Nature Experience (ENE), which captures a sense of the main features. ENEs overlap with a family of Exceptional Human Experiences that have been noted by various researchers, including Maslow's Peak Experiences, meditative and other absorptive states and even Edward O. Wilson's 'biophilia.' In this article, I'd like to focus on their relation to what have been dubbed *Extrovertive Mystical Experiences*.

ENEs can be seen as a dilute version of full-blown mystical experiences, which Paul Marshall acknowledges share much with everyday experience. He characterizes Extrovertive Mystical Experiences as combining 'a sense of unity, deepened knowledge, sense of reality, altered time-experience, light, bliss and love.'[1] Shared features include an elevated consciousness of the cosmos, indescribable feelings of joyousness, a unifying vision or sense of the unity of the universe and, especially important for me, a strong sense of beauty.[2] So if Extrovertive Mystical Experiences differ in degree and not in kind from the ENE, it seems appropriate, in my view, to consider whether they share a common source.

Explanations

There have been a range of explanations offered for Extrovertive Mystical Experiences, some of which are naturalistic, and tend to look at brain-processes, others of which have emphasised their transpersonal nature. Bucke, for example, posited a cosmic consciousness, Inge and Underhill spoke of the presence of God in creation, whereas Otto posited an innate knowledge of a spiritual reality in the world.[3] More recently, Stephan Harding has interpreted mystical feelings in nature in terms of 'encounters with Gaia.'[4] Sir Alister Hardy suggested that the 'transcendental element…is fundamental: the feeling that there is a spiritual reality that appears to be beyond the conscious self with which the individual can have communion in one way or another….'[5]

More recent explanations have tended to focus on the brain. Researchers like Michael Persinger have attempted to explain these sorts of feelings as directly related to Temporal Lobe Epilepsy, and have even claimed to generate them in the lab.[6] D'Aquili and Newberg, meanwhile, carried out SPECT/

PET neuroimaging studies that showed the blocking of activity in the Orientation Association Area (OAA) in the Posterior Superior Parietal Lobes (PSPL) during meditative experiences, in addition to increased activity in brain areas associated with attention.[7] The authors claimed that these sorts of findings can explain a whole range of mystical experiences in terms of a state of consciousness they call Absolute Unitary Being (AUB).

Although I find the neurobiology interesting, I would suggest that brain studies on their own cannot fully answer questions about the origins, significance and ultimately the validity of these experiences.[8] Whilst I'm willing to consider the possibility that there was decreased activity in my PSPL when I stared out to sea on that day, it seems to me that neuroscience is more or less impotent to answer the question of whether this strong sense of unity with nature is actually *true*. William James made a similar point over a century ago, when he observed that the biological origin of a state of mind on its own cannot allow us to determine whether it's true, useful or fruitful.[9] James suggested instead that such experiences need to be judged in terms of *immediate luminousness*, *philosophical reasonableness* and *moral helpfulness*. We also need to ask whether these experiences can contribute to a healthy life.

The Benefits of the ENE

Firstly, it's important to establish that these experiences are not pathological. Persinger's attempts to identify mystical consciousness with epilepsy have been significantly criticised in recent years to the point that some have claimed that there is *no* credible evidence of any generalized association.[10]

Beyond this, it's never seemed plausible to me that these experiences are anything other than healthy. They can be distinguished from unhealthy 'highs' like alcoholic exuberance because they tend to occur in a state of deep relaxation and do not end in a reactive 'low.' Secondly, whilst cognition tends to scatter in unhealthy highs (as in the manic phase of bipolar disorder),[11] the situation's very different in the ENE, which carries with it a deep calm and stability similar, in my experience, to a deep meditative state.

This latter point flags a key therapeutic feature of these experiences, and of contact with natural settings in general: attention restoration. Eva Selhub and Alan Logan suggest that today many of us are suffering from Directed Attention Fatigue, partly because of the character of modern work, and partly because of the ubiquity of electronic media.[12] This idea stems from William James' distinction between voluntary attention, which requires effort, and involuntary attention, where one effortlessly focusses on something with intrinsic interest. Selhub and Logan note that office work tends to involve voluntary attention that requires sustained, fatiguing effort. Even worse, they suggest that our electronic media promote continuous, forced, voluntary attention, leading to stress, depression and anxiety.

Natural settings can help to reverse this trend because they provide a space to heal attention fatigue. Citing Stephen Kaplan's Attention Restoration Theory, Selhub and Logan note that immersing oneself in nature directs attention away from fatiguing voluntary attention, promotes intrinsic fascination, engages the mind significantly and finally, can fulfil a person's intentions and activities without struggle. All of these features seem directly relevant to promoting the ENE state of being.

ENEs surely need to be fostered. Firstly, as we've seen, there are demonstrable health benefits and secondly, it is through such experiences that we have a real chance of creating lasting change in our culture in the direction of sustainability and environmental protection. This is important because it seems to me that the standard ways of presenting environmental problems – from species loss to global warming – are often unflaggingly negative and rely on guilt to work. How much better, and healthier, to foster a love for the natural world via direct experience?

A Spiritual Reality?

And finally, what is the ultimate implication of the Expansive Nature Experience? What does it say about the cosmos in which we live? For me, anyway, these experiences call into question the assertion that we are alienated individuals, living in a pointless, mechanistic Universe that is devoid of purpose. These experiences, subjectively at least, suggest that the environs of the Earth are shot through with a vitality that seems immanent within a myriad of organisms and natural processes.

As for sensing the *divine* in reality, I remain agnostic, and cannot say whether these expansive feelings truly point to the transcendental, although I respect the views of those who have reached that conclusion. I do feel sympathy with William James' thoughts at the end of *Varieties of Religious Experience*, where he suggests that mystical experience points to 'something more,' beyond the manifest world. There are times, contemplating nature, when I feel this myself, but I do not possess the confidence to say exactly what that 'something more' might ultimately be. But whatever the truth, these experiences remain of huge personal importance, and for me, at least, illuminate aspects of nature that would remain otherwise invisible.

Matthew Colborn *(D.Phil, MSc. cognitive science). Author and consultant who has an academic background and a long-standing interest in consciousness research, transpersonal psychology and parapsychology. Currently working and writing in the health coaching field. Author of* 'Pluralism and the Mind: Consciousness, worldviews and the limits of science.' *(2011).*

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Beyond the Brain X, Latimer House, August 2013

Liz Archer

The 10th Beyond the Brain conference took as its theme Shifting Consciousness: Mind, Self and Brain in the 21st Century. This meeting was organised jointly between SMN and the Institute of Noetic Sciences, and marked the 40th anniversary of both organisations.

The meeting opened on Friday evening with a brief video greeting from Peter Fenwick, who could not be with us because he was in Scotland celebrating his 50th wedding anniversary! Bernard Carr spoke of the overlapping aims of the SMN and IONS, and how both organisations are concerned with understanding consciousness but have taken different approaches to investigating it. Marilyn Schlitz reminded us that both SMN and IONS had emerged out of the founding of the Society for Psychical Research, and of the need to bring discernment to our investigations of consciousness. Our aim must be to find ways of changing our worldview so that we can create a world that is more just and more in balance with our environment.

David Lorimer then spoke on the subject "Prospects for a Paradigm Shift". He discussed the tension between differing views of consciousness, and how it raises questions about the nature of science, the nature of consciousness itself, and how consciousness relates to the brain. The last of these is the 'hard' problem for science today. The belief that the brain generates consciousness is a central tenet for science[1], and many scientists assume that, in time, we will have a material explanation for precisely how the brain it does so. But huge changes are occurring our wider understanding of human consciousness, and David to cited Al Gore's concept of "Earth Inc." and global mind, and Anne Baring's recent book *The Dream of the Cosmos* as examples. Two sciences of consciousness appear to have emerged; firstly, consciousness within science (objective, experimental, rational, outside-in, third person); and secondly, science within consciousness (subjective, experiential, intuitive, inside-out, first person). He regards both sciences as valid but also incomplete.

David believes that understanding death is pivotal to understanding the nature of consciousness, and anomalous events such as NDEs challenge conventional thinking. 'Normal' science attempts to assimilate new data into its existing explanatory framework, and status or 'authoritative' opinion may be (mis)used within science to determine what is acceptable. Tensions can arise between 'informed' and 'uninformed' opinion, and he quoted Peter Fenwick's comment that anyone talking outside their own field ends up talking rubbish! Peer pressure and fear of rejection have become part of the politics of knowledge, and contentious areas of work, such as psi research, may prove to be career limiting. As a result, young students tend not to be exposed to this kind of material. David then raised the important question of how best we can work to engage young people, who he feels are genuinely interested in these issues.

The first speaker on the Saturday morning was **Mario Beauregard** from the University of Montréal. He took as his subject "The Elemental Psyche: a post-materialist perspective". Mario is the author of two important books on consciousness, *The Spiritual Brain* and his more recent book *Brain Wars*. He described how the metaphysical beliefs underlying classical science have impeded the development of mind sciences and the study of spirituality. The materialistic, reductionist and deterministic nature of classical science impacts our understanding of the relationship between psyche and brain. Science views experience as an electrochemical process within the brain, and asserts that the psyche cannot affect brains, bodies or the physical environment. Mario went on to describe research which he believes demonstrates the power of intention to modify neurobiological responses. His first study involved male student volunteers, who were shown erotic film clips as their brains were scanned. Under normal conditions this produced activation of the limbic system, but after mindfulness training the activity of the limbic system shut down. In another study he asked students to retrieve happy and sad memories; brain scans showed activation of serotonin in the limbic system in response to the happy memories, and reduction on recalling sad memories.

What is clear is that the brain is 'plastic', and that mental training will affect neurons, neural connections and the development of networks within the brain. Mario spoke of the remarkable power of placebo to change activity in the brain and body, and how meditation enhances attention, improves emotional regulation and the development of compassion. Neurofeedback enables us to control body functions not normally under voluntary control, and work in psycho-neuro-immunology has shown that mental activity can affect both the immune system and the control of genes. These techniques have proven benefit in the clinical setting.

Mario went on to discuss *psi* research. Since the effects shown in individual tests are small, it takes meta analyses of multiple studies to show the true magnitude of the results. Such analysis of studies of telepathy under Ganzfeld conditions[2] have produced statistically highly significant results (Dean Radin talked about this in more detail), and the PEAR[3] studies demonstrated the power of human later in the conference consciousness to alter the output of random generation machines. Other studies have shown that consciousness can interact with living systems at a distance. Most significant of all, though, are reports of NDEs and OBEs occurring while a subject is clinically 'dead'. When the heart stops, EEG activity ceases and the brain