Professor Basant K. Puri's Medical School Talk – Part II
Fatty Acids, Depression, Schizophrenia & Huntington's Disease

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Depression is claimed to be reaching epidemic proportions in the Western world, and many modern social factors have been blamed, such as job insecurity, isolation from family support, lack of religious belief, high divorce rate, stress from modern technology, pollution, the speed of modern life, and greater access to drugs and alcohol.

But alongside these social factors, depression is also thought to have a significant biological component, and so the main thrust of researching depression has been on neurotransmitters, such as serotonin and noradrenaline, and their mood-modifying effect. Low levels of neurotransmitters are strongly associated with depression, but have not been proved to be the cause of it, and play only one role among many in the depression story.

The pharmaceutical industry saw the huge commercial potential in creating drugs that increase brain neurotransmitters, coming up with the tricyclics and monoamine oxidase inhibitors, and more recently the Selective Serotonin Re-uptake Inhibitors (SSRIs). Most have unpleasant side-effects – the ones associated with SSRIs include nausea, insomnia, weight loss or gain, and loss of libido and ability to achieve orgasm. However, out of this morass of conflicting information and worrying treatment options, a revolutionary idea emerged. Professor David Horrobin, a pioneer of omega-3 and omega-6 essential fatty acid (EFA) research, together with Professor Puri, initially discovered that fish oil clears the depression in schizophrenic patients, and Basant Puri went on to research the role of EFAs in other brain function disorders.

Brain imaging has not only identified low brain electrical activity in depression, but Puri's Hammersmith MRI imaging research team also developed a technique which demonstrated *a reduction in grey cortex thickness in depression, and a recovery of cortical thickness with marine EFA eicosapentaenoic acid (EPA) treatment,* adding proof that EPA worked as a treatment for depression.

The most important complex lipid in brain function is phospholipid, because this is partly responsible for the smooth messaging system between neurons, ensuring that the electrical circuits are protected and insulated. If brain cell phospholipids contain predominantly saturated fatty acids, because that is what we are eating, then since saturated carbon chains tend to clump together and react slowly with other molecules, the neuronal membrane and neurotransmitter function becomes sluggish, and the brain's electrical messaging system slows down. However, when neuronal phospholipids are predominantly composed of highly unsaturated EFAs, the carbon chains are much more fluid, and the neuronal membrane neurotransmitter receptors can float freely and work at optimum speed and efficiency, resulting in more successful brain messaging system. The phospholipids found in all cell membranes, and which protect and enhance brain message connectivity, are therefore vital to a healthy brain and avoidance of depression.

So how was EPA found to be the optimal building block for these cellular membrane phospholipids? Horrobin and Puri's trials with fish oils attempted to single out the separate benefits of the various marine EFAs, and began to show that DHA, found in large amounts in the healthy brain but in reduced amounts in the schizophrenic brain, might be the therapeutic winner. But their comparative trials with DHA and EPA on schizophrenics showed that the ones who improved substantially were the ones taking EPA. Their improvement was as good as one might expect with normal anti-schizophrenic drugs, but without any side-effects. One of the associated symptoms of

continues on page 14

Professor Basant K. Puri's Medical School Talk – Part II
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continued from page 10

schizophrenia – depression – was also noticeably improved following EPA treatment. EPA was chosen as the most successful of the EFAs for treating even serious depression. It worked at least as well as, and in many cases much better than, standard antidepressant drugs, but without the side-effects these powerful drugs might impose.

Which diet and lifestyle habits might strip EFAs from the body, or hamper conversion of EFAs into the phospholipid layer?

Although these habits do not necessarily cause depression – many people who eat an extremely unhealthy diet never succumb to depression – they are a strong contributory factor to making the body's biological environment ripe for a depressive episode if other factors are in place to trigger it. These negative habits include a diet rich in saturated fat, trans-fatty acids and sugar, high alcohol consumption, cigarette smoking, and a lack of nutrients such as zinc, selenium and vitamin B_6 as might happen with constant harsh dieting. Trans-fatty acids are produced in significant amounts when previously healthy unsaturated vegetable oils are heat-hardened to make margarine and non-dairy cream used in commercial cakes and biscuits.

Basant Puri's MRI imaging research team were not only the first to develop MRI software to measure changes in brain volume and cortical thickness, but also the first to develop magnetic resonance spectroscopy enabling study of brain fatty acid chemistry, i.e. what was happening to neuronal EFAs. Results were extraordinary. Conventional medical wisdom had long dictated that adult brain tissue has no regenerative growth capacity, so the finding that *depressive brains regained volume and cortical thickness with EPA treatment* came as a complete surprise. As the grey matter is the home of neurons and neurotransmitters, if it is shrunken and unhealthy there will be fewer neurons and less mobile receptors for mood-enhancing neuro-transmitters, so serotonin levels will fall and depression may set in. When the grey matter is enriched and healthy, there will be greater abundance of healthy neurons and higher neurotransmitter levels, thus lifting depression.

Recent studies showing brain regeneration in rats induced by brain exercise, and seasonal variation in song-bird brain size (increase in size in singing season), support the view that brains are capable of growth. In the case of EPA treatment and the MRI brain size and cortical thickness changes, it is thought, although this is not yet certain, that EPA stimulates brain tissue stem cells.

Basant Puri's MRI research team have also discovered that women's brains shrink in the last three months of pregnancy, probably because the foetus is scavenging the mother's EFAs to assist its own brain development. Postnatal maternal brain scans show a gradual brain re-growth. Pregnancy is therefore a time when a good supply of EFAs to the mother's body is particularly essential, and EPA supplementation thus helps prevent postnatal depression. The mother's EPA supplementation, combined with breast-feeding, will also enhance the baby's general health and brain development.

Puri's MRI techniques have also demonstrated that *EPA treatment regenerates the schizophrenic brain* in a similar fashion to the depressive brain, besides other benefits, such as improved reading, spelling, fluency and comprehension. He has also shown that *EPA supplementation in Huntington's disease also regenerates to some extent brain tissue, with a reduction in its symptoms.*

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