
The Fruits of Meditation

Extract of the conference given by Bernard Hars in the Zen Buddhist Temple of La Gendronnière in August, 2014

Introduction

The interest of the scientists for meditation developed itself very slowly during the second half of the 20th century. Some sporadic articles were published in the West during the years 60-70. A first paper on Transcendental Meditation was published in 1975 in the "American Journal of Physiology". In France, Banquet presented in 1973 analyses of the EEG (electroencephalogram) rhythms during meditation. However, in-depth and systematic studies were led in Japan by researchers as Kasamatsu, Hirai and Akishige (to quote only the best known) from 1962-63 till the 80s. They recorded various physiological parameters, and in particular the EEG, during the practice of zazen.

From 2000 on, we saw appearing scientific studies on meditation in an exponential way. Several factors are the cause of this phenomenon: - 1) the installation in the West of experts in meditation and the creation around them of groups of followers, - 2) the will of Transcendental Meditation (MT) to give scientific arguments to its promises of personal improvement, - 3) the creation, at the instigation of the French researcher Francesco Varela, of a "Mind and life institute» (1987) supported by the Dalai Lama, - 4) but also the use of the meditation for therapeutic purposes, with the creation by J. Kabat-Zinn of the MBSR program (Mindfulness Based Stress Reduction), -5) the fact that technical factors were also improving as better technical sophistication of the EEG recordings and the development of the brain imaging, which allow to follow the brain activity.

The physiological effects of meditation

Cerebral ageing

Since 1970, life expectancy in rich countries lengthened for more than years and keeps progressing. But the main question here is not to be able to live longer, but to be able to live in good conditions.

Ageing comes indeed along with certain degenerations, in particular at cerebral level. From the age of 40 years on, the human brain loses approximately 5 % of its weight and of its volume per decade. Several studies concerning ageing subjects practicing the meditation, compared with subjects of the same age and same condition show a better preservation at the same time of the mass of grey matter (neurons) and of the intracerebral connections (white matter). A study on Zen practitioners shows also a preservation of the grey cells in various zones of the brain and especially in left putamen (a structure involved in motricity, the learning process and the memory). For these subjects, one can note not only the conservation, but also an increase of neurons in this structure. People aged 50 have a level of nerve tissues equivalent to that of the control group of subjects aged 20-30 years (Pagnoni - 2007)..

Cellular ageing

Ageing depends on several factors at the biological level, and one of these factors is an oxidation of the molecules, which causes internal damage. A study based on subject's practicing Kya Yoga reveals a decrease of this cellular degeneration (Sharma -2008). Another factor is the alteration of the telomeres (which are some kind of "hoods" protecting the extremity of chromosomes). These telomeres are maintained by an enzyme, the telomerase, which prevents their degeneration. Jacobs (2011) measured the activity of this enzyme during a retreat of 3 months of Mindfulness meditation (6 hours per day). He noticed an increase of the telomerase compared with the control group. There was also an improvement of immune cells (white blood cells) and - at the same time – the participation to the retreat improved the affectivity of the participants.

Stress

Stress is the general term which covers at the same time some physiological and some psychological effects. We can define stress as a pressure of the environment having as consequence an internal imbalance and a psychological uneasiness.

The sensibility to stress can be measured by the rate of cortisol: the lower the rate of this hormone is, the less the subjects are sensitive to stress. Tang and Posner (2007, 2014) noticed that students, after a brief training in IBMT (inspired by the Zen, 5 sessions) had a lesser secretion of cortisol after a stressing task (mental calculation and oral communication) than the control group (subjects who had relaxation sessions).

Tang (2009) compared elderly meditation practitioners with elderly sportsmen (10 years, 1 hour/day) and noticed better results for the meditation practitioners as far as the following items are concerned : - 1) quality of life, - 2) parasympathetic regulation, - 3) cortisol and immunoglobulin levels, - 4) cerebral modifications (for striatum, connections medial or cingulate cortex-striatum). The sportsmen have a lower heart rhythm and larger respiratory amplitude.

His conclusion was that sport gives better physical shape and that meditation brings an improvement of the central nervous system. The combination of both practices would therefore improve the quality of life for elderly people.

Immune system

It gathers all the defenses of the body against outside aggressions, but also against internal malfunctioning's. Inside the body, the immune system includes cells specialized in the defense against germs, and in particular the white blood cells of the blood. Some of these white blood cells are capable of secreting antibodies, which are going to allow the destruction of the pathogenic agents. Davidson (2003) measured the secretion of antibodies after a vaccination against influenza in a MBSR (Mindfulness Based Stress Reduction) group of practitioners and in a control group of subjects. He noticed a stronger answer in the MBSR group compared with the control group: their immune system was more reactive. At the same time, meditation practitioners show a reduction of anxiety after the training program (8 weeks).

Equilibrium of the nervous system

The functioning of the internal organs is unconsciously regulated by the autonomous nervous system, which is divided in two complementary systems: sympathetic and parasympathetic. The sympathetic system is more active in times of crisis, real or imaginary. It is associated with the following behaviors: fighting spirit, flight, fear. The parasympathetic acts mainly on the digestion, the growth, the immune response, and it stocks up energy reserves. The activity of these two systems is antagonistic and balances itself: when one is activated the other slows down. The sympathetic mobilizes the body for short-term urgencies, often at the expense of the preservation of good health conditions at the long term. The parasympathetic works silently and in the duration.

Numerous studies based on the physiological parameters (heart parameters, electrical resistance of the skin, breathing) show that the meditation leads to a decrease in the sympathetic system activity and an increase of the activity of the parasympathetic system activity (Tang - 2014).

Sleep

In experts in meditation, the practice reduces the need for sleep from a quantitative point of view. A study of subjects with 15 years of practice shows that their sleep has an average duration of more or less 6 hours, while in the control group the duration of the sleep is more or less of 7 to 8 hours. In beginners (MBSR), we do not observe a reduction of the duration of sleep; but at the beginning of the practice, meditation seems to bring longer periods of sleep, with a deeper quality of sleep.

From a qualitative point of view, the first observations report that sleep is of better quality in meditating groups: they suffer less from insomnia and recover better. Ferarelli (2013) noticed that the sleep of the experts in meditation presents particular characteristics: we observed gamma waves (30-50 Hz) in certain regions of the brain (parietal and occipital) where one should normally find slow delta-type waves (1-5 Hz). These modifications concern the SWS (slow-wave sleep); the SP (paradoxal of REM sleep) is not modified. This activity during sleep could participate to the reorganization of the nervous circuits.

The psychological effects of meditation

Attention

It is without any doubt the field which was the most explored. Hirai and Kasamatsu (1966) compared the reactivity of subjects in relaxation to the reactivity of expert subjects in zazen. They make them listen to a repetitive click noise. The relaxed subjects quickly became used to the sound and did not react to it any more (cessation of the blocking of the alpha waves) while the Zen group remained reactive. Thus, the brain remains vigilant during zazen; the attention is renewed every minute.

The practice of Mindfulness has an impact on the attention by improving the processing of the events from their origin. The subject is more flexible in the orientation of his attention, so that the effort to be attentive is reduced. Therefore, during an attention test, the meditation practitioners have performances than the control group. The improving in the performances goes in parallel with the length of the MBSR practice (Malinowski-2013).

Grant (2013) noticed in medical imaging a thickening of the cortex in zones involved in the attention in Zen practitioners, while these zones were decreased in subjects who have disorders of the attention as attention deficit and hyperactivity (network of the attention cingulate-fronto-parietal). The authors agreed to consider that these improvements of the attention can allow the treatment of certain pathologies (as hyperactivity as well as drug addiction, schizophrenia, psychopathy).

Pain

Several studies show that meditation can reduce the painful sensations without decreasing the sensibility. Grant and al (in 2009, 2011, and 2014) noticed in several experiments that Zen practitioners resisted better to pain than the control group: they resisted better to a nociceptive stimulus (burn). Curiously, the regions of the brain handling the pain are more active during a painful stimulation in the meditation practitioners than in the control group. On the other hand, regions concerned by affectivity and emotion are less active (it seems that the sensibility is increased, but that the emotional answer to the perception is decreased).

These results were confirmed for other meditative practices as Vipassana (Gard - 2012), and Tibetan meditation (Lutz - 2013), where we see an increase of activity in the intellectual zones receiving the pain, but a reduction in the zones giving it its value. Thus, the sensitivity to pain is maintained, but the inconvenience is reduced.

A punctual observation on a Tibetan monk practicing "compassion meditation" showed a strong resistance to pain, while this practice is associated with the liberation of opioid endogens. Love turned towards the others is therefore also beneficial for the individual.

Anxiety, stress, depression

We cannot ignore in this field the role of instigator played by Jon Kabat-Zinn, who from 1979 on created the first treatment center of the stress based on the use of meditation. For him, the Mindfulness (the full consciousness = presence open to what takes place every minute) is a mean to reduce the harmful effect of mental ruminations. Physician, he practices the Zen meditation, supervised by a Korean Zen Master (Seung Sahn) and he developed a program of stress reduction based on meditation and yoga techniques ((as breathing, body scan), programs of 8 weeks which efficiency turns out to be certain in numerous cases of psychological distress (multiple clinical reports, more than 200 hospitals using the technique in the USA). These techniques reached France and began to spread (Dr. Christophe André).

Davidson and Mc Ewen (2012) noticed that traumatizing experiences in life, especially in childhood, influence negatively the future social behavior and the well-being. We notice that stress experienced early in life brings intellectual modifications: children who were physically abused or who spent a long period in institutions before being adopted have a more important cerebral tonsil (structure associated with the fear). Yet such changes in the brain can be corrected by cognitive therapies and also by meditation. So the MBSR program is capable of causing a reduction of the tonsil in correlation with a feeling of being better.

One of the big handicaps of depression is that 73 % of the patients who receive a pharmacological treatment have a relapse within 5 years. Psychotherapies are thus needed in supplement. Among these, interventions based on Mindfulness seem rather effective (MBSR, MBCT); non-religious techniques, they are based on the meditation. Depression depends of a

malfunctioning of the representation of the self and on negative affects. Among the involved areas, the structures of the central line of the cortex (CMS) play an important role. Studies in imaging and EEG show that the practice of Zen allows regulating the thoughts in reference to the self, by modulating the function of CMS and other regions. Zazen regulates the spontaneous stream of the thoughts, by improving the control on the automatic associations of the idea (Trader -2012).

Introspection, feelings, subconscious

One of the dimensions of meditation is that the look is turned to the internal real-life experience, it is therefore logical to expect that the practitioners have a better knowledge of their mental contents and their emotional real-life experience. It is recommended not to identify oneself with these contents, but to consider them as passing events; this distance allows a better control of the feelings. As far as the access to subconscious information is concerned, Strick (2012) submitted Zen practitioners to two tests, to estimate the short-term effect of the meditation. In one of the test, the question was about free mental association of terms (for example: "book, map, world = > atlas"); in the other one, of an association directed by a subliminal term. In both cases the subjects practicing meditation have performances superior to the subjects practicing relaxation. Considering that consciousness is limited to deal with one information at the time, while the unconscious has far wider capacities, the author suggests that this better access to the unconscious information facilitates creativity.

Cognitive ageing

In a very selective and careful review of the studies on the effects of meditation on the reduction of the intellectual faculties due to ageing (normal and pathological), Gard, Holzel and Lazar (2014) point some functions which are protected by the practice of meditation.

General cognitive capacities: meditation protects the normal capacities. She can even have a protective effect against the decline accompanying the beginning of the dementia senilis.

Attention: Van Leeuwen (2009) submitted elderly meditation practitioners to a test of attention and compared them with a control group of the same age, then also with young subjects. The fact that elderly practitioners have better performances than young control subjects shows that the practice not only protects the capacities of attention, but can also improve them.

Memory: several studies report improvements in memory tests at the end of various sessions of meditation practice, but the controls are not always accurately made.

Processing speed: some data show the preservation of the psychomotor speed in meditation practitioners..

The conclusion of the authors is that - even these studies are still not numerous - they show that various meditation techniques are capable of thwarting the aged-related cognitive decline and can even increase the cognitive capacities in elderly adults.

Conclusion

We presented here only certain points which seem sensitive to meditation; several other effects are studied, mainly directed to therapeutic purposes as: regulation of blood pressure, addictions, neuro-degenerative diseases (Alzheimer), palliative care, cancer, psoriasis etc.

The first reaction may be some the incredulity towards such an extended range of effects, meditation appearing then as a universal panacea. However, we do not question neither the benefits of a healthy and well-balanced diet, nor of hygiene or even of sport in healthcare (physical and mental).

It is however necessary to remain careful as far as the therapeutic applications of the meditation are concerned. In spite of the big investment of the researchers in this domain, certain studies are not very well controlled (group of control subject's insufficient, group effect, few longitudinal studies). Keeping in mind the variety of the meditation forms, it is possible that some are better adapted either to certain pathologies or to certain subjects.

The position of Master Deshimaru was double. He was interested in the contact with scientists (neurobiologists, doctors as Dr. Chauchard, Dr. Ikemi). He was well informed about the researches of the Japanese neurologists on zazen. He agreed to serve as subject for studies in laboratory (Dr. Banquet). But he denounced the limits of a purely objective and external approach (which is only descriptive) to insist on direct and personal experiment of the practice.

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