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Epigenetics and Yoga

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Abstract

A lot has already been researched and studied on this subject, but there still remain many unanswered questions. A lot is being expected out of yoga. One hears of all kinds of amazing yogic feats. Can yoga really effect significant epigenetic changes? How far can yoga really go? What could be the directions for future study? What impact would any of this have on our DNA?

This paper seeks to explore both the subjects of Yoga and Epigenetics, and perhaps dig-out some deeper elements or thoughts with a view to discuss some perspectives and answer some questions on the subject. To the extent possible this paper shall provide research and evidence to support its contentions. Some of the claims of yoga on the mind/body present lie beyond scientific may at explanation and empirically proven evidence, as the mind/spirit connection remains elusive. Much more research and study is desired, but we all face great limitations of time and resources.

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The Current State Of Knowledge and Research

In June 2016, a pilot study was undertaken entitled – "Preliminary indications of the effect of a brief yoga intervention on markers of inflammation and DNA methylation in chronically stressed women" [1].

The study observed that –

"Yoga is associated with reduced stress and increased well-being, although the molecular basis for these benefits is not clear. Mounting evidence implicates the immune response with current studies focused on protein immune markers (such as cytokines) in clinical populations" [2-6].

"To explore the molecular impact, this pilot study uses a subsample (*n*=28) from a randomized waitlist control trial investigating the impact of an 8-week yoga intervention in a community population of women reporting psychological distress (*N*=116)".

"This study is one of the first to explore yoga and immunological markers in a non-clinical population, and is the first study to explore DNA methylation. These findings indicate that further research into molecular impact of yoga on markers of immune function is warranted, with larger studies required."

The study went on to state that –

"Overall, the study found that an 8-week yoga intervention, requiring at least weekly practice, is associated with some changes in immune protein and DNA methylation biomarkers."

It finally concluded on the note that its findings warranted further large-scale research in order to contribute to the growing literature exploring the underlying epigenetic mechanisms and its relationship with Mind-Body-Interventions and the immune system.

- November 2016 in *Translational Psychiatry* volume 6, page 965. K.N. Harness, P.F. Delfabbro, J. Ryan, and S. Cohen-Woods.

Bailey Kirkpatrick referred to the same study in the journal – 'What is Epigenetics', May 9th 2017.

"In addition to the moderate increase in the inflammatory protein, the team also assessed a popular epigenetic mark known as DNA methylation. DNA methylation is an epigenetic mechanism known to suppress the expression of genes. It's defined as the addition of a methyl group onto DNA, catalysed by enzymes known as DNA methyltransferases. When methyl groups are not present, the genes are open to transcription and can be expressed freely [7-10].

"The yoga group demonstrated lower DNA methylation of the *TNF* region as a whole. They also uncovered a moderate and significant correlation between global DNA marker *LINE-1* methylation and the women's self-reported perceived stress. However, the team cautions that the small sample size attributed

to the reduced statistical power and notes that additional research is necessary.

"This study, according to the researchers, was the first of its kind to investigate yoga and its epigenetic effects related to DNA methylation. Although just a pilot study, the results bring forth interesting insight into the molecular changes that may be occurring during and after this widespread and increasingly popular exercise activity".

In contrast to these researched views, we have the article written by David Gorsky in the Epigenetics Literacy Project, July 10, 2017. Where he writes –

"One of the most persistent narratives latched on to by advocates of "integrative medicine" is that the "mind" can somehow "heal" the body. Sometimes, the claim is that such interventions work through powerful placebo effects. . Sometimes it involves the abuse of emerging science, such overblown claims about what can be accomplished through DNA modifications of DNA and Gene expressions".

He goes on to say –

"None of this means that I don't find it fairly plausible that various exercise regimens could decrease the level of pro-inflammatory gene expression. I even find it plausible that relaxation and meditation might result in similar effects. It is, however a long stretch to claim that such activities "reprogram your DNA" in that changing gene expression doesn't require doing anything to the DNA itself, just changing levels of the proteins that regulate expression of the genes whose levels change. In any case, this is preliminary research massively overhyped, and I didn't even mention until now that it's in a *Frontiers* journal, and *Frontiers* journals are known among my colleagues for their poor peer review" [2].

At first sight one might want to throw Dan Gorsky and his paper, along with his cynicism out of the window. But hold on there; let's take a deeper look at what he says. However cynical Dan Gorsky may be on this subject, he may have a point when he says that these regimens may be able to decrease the level of pro-inflammatory gene expression, but – *"It is, however, a long stretch to claim that such activites reprogram your DNA"*. He is not very clear here about what he means by 'reprogramming' [10-15].

The ancient practice of yoga which began in India a few thousand years ago, once the purview of ascetics living in monastic seclusion, is now taught and practiced worldwide. In ancient days in India, all the great Rishis and Yogis lived and practiced yoga discipline on a daily basis for a prescribed twelve long years before they felt a sense of 'liberation'. They referred this disipline as 'Tapasacharaya'. This was how those who wanted fundamental and radical transformation practiced yoga.

A small breed of such people developed, through the practice of 'Tapasacharaya' (Yoga discipline), in Buddhism, Hinduism, and Jainism. This was thus defined as the real goal of yoga. Even today, the practice of yoga for twelve years is seen by some as the real goal of yoga. The word 'yoga' comes from its root word 'yug', which means to unite, integrate, and achieve one-ness with. They would view this as a 'reprogramming' of the 'inner-self'. Yoga for them was a way of life, a life-style. Sri Aurobindo, a famous indian sage, would often say that "Yoga is life".

Human civilization, especially in the west, constantly seeks out answers to the various diseases, disorders, or maladies of today. Solutions to problems of day-to-day experience are what sells best. Whether it is obesity, diabetes, depression, anxiety, etc., we are constantly on the lookout for better, more effective, and cheaper cures or solutions, and surely there is nothing wrong with that. Consequently, most of the studies done todate are '8-weeks' practices of Yoga once a day compared to their respective control groups.

As an initial hypothesis, the potential of the human species continues to seek new boundaries and thus create new environments. So, the question that we must ultimately ask here is how far can epigenetic change really go? What are our expectations? Will this epigenetic 'reprogramming' brings in its wake a whole host of other problems, including abnormalities?

A 2005 study, "Epigenetic Reprogramming in Mammals", *(published in 'Human Molecular Genetics, 2005, Vol. 14, Review Issue 1 R47–R58, doi: 10.1093/hmg/ddi114')* seemed to answer some questions whilst also raising some others.

"Thus, each cell type in our body has its own epigenetic signature which reflects genotype, developmental history and environmental influences, and is ultimately reflected in the phenotype of the cell and organism.

"For most cell types in the body, these epigenetic marks become fixed once the cells differentiate or exit the cell cycle. However, in normal developmental or disease situations, some cells undergo major epigenetic 'reprogramming', involving the removal of epigenetic marks in the nucleus, followed by establishment of a different set of marks".

"The most dramatic way of altering epigenetic marks experimentally is by SCNT or cloning. In particular, this happens upon fertilization when many gametic marks are erased and replaced with embryonic marks important for early embryonic development and toti- or pluripotency". The study goes on to say –

"Major reprogramming also takes place in primordial germ cells (PGCs) in which parental imprints are erased and totipotency is restored. Cells undergoing dedifferentiation, such as Cancer cells are also expected to undergo reprogramming, as do cells that can trans-differentiate. Finally, dramatic reprogramming is required following somatic cell nuclear transfer (SCNT) for the purposes of cloning and stem cell derivation for therapy".

However, and this is important: "Cloned embryo development is as variable as their epigenetic makeup: cloned embryos die at all stages of development with a variety of abnormalities".

If we study the environmental causes of past evolutionary changes, especially as related to the development of the human species, we will find enough evidence to support reprogramming

changes that occurred over a period of perhaps 3 million years of development from the *Australopithecus afarensis* of about 3 million years ago to the *Homo neanderthalensis* (30,000 years). The size of the human brain grew amongst other things. Hence we cannot rule out the great influence of our environment over a period of time on our brain-intellect-body. In comparison to which 12 years, let alone 8 weeks, is a pittance.

As apes mutated into humans (homoerectus and homosapiens), surely their genetics underwent a transformative epigenetic change, a 'reprogramming of sorts?

Today humanity is embarking on what many call '*the New Age'*. These comprise cultural changes happening at a very root level. Maybe not today, but surely eventually these changes would reflect as changes in our genetic structures and programming also.

Many to meet the demands of the market have modified the ancient practices of yoga. Only a very few schools of yoga have maintained their original positions. Perhaps there is a market for these too.

As an initial hypothesis, the potential of the human species continues to seek new boundaries and thus create new environments. So, the question that we must ultimately ask here is how far can epigenetic change really go? What are our expectations? Will this epigenetic 'reprogramming' brings in its wake a whole host of other problems? Can yoga put all this into a different perspective?

Let's take a look at yoga's viewpoint on epigenetics as explained in the 'International Journal of Yoga' –

"The membrane of every cell plays a vital role in deciding the type of input that goes into the cell. There are two types of proteins in the cell membrane, the sensor and the effector proteins. As the name implies, the sensor, similar to our sensory organs, responds to many extracellular signals that may be biochemical, vibratory or electromagnetic. Hence the cellular response — and hence, the entire body response — may be based on non-physical inputs such as mechanical movements (read yoga practices), and even thought and deliberation. Thus, in contrast to conventional wisdom, genes do not control their own activity. The proteins at the membrane control the way the gene reads the signals. Thus, like the brain in a human, the control for many environmental inputs are through the membrane, and the environment plays a significant part in the behavior of a cell, and hence, the entire organism".

"The message of epigenetic medicine is clear; the factors that control the life cycle of an organism are both nature and nurture. Although this thinking is new in medicine, it is not so in many philosophical systems of the world. Ayurveda and yoga literatures are based on the postulate that a healthy body requires a healthy mind. More so, if one is interested in the mystical aspects, one needs to transcend the mind and its many activities. Furthermore, the great Yoga teachers of present times have claimed that even genetic disorders can be managed through the practice of Yoga. We tended to take such challenges with a gram of salt. Now studies are emerging that indeed such intuitive claims can be substantiated in the laboratory. Thus, good mind–body practices and good environmental hygiene are of utmost importance in the management of many disorders. Environmental hygiene includes diet, mental attitude, and pleasant speech, all of which have been emphasized in the Yoga Sutras of Sage Patanjali".

INTERNATIONAL JOURNAL OF YOGA, Genetics, epigenetics, and pregenetics, *Thayar M. Srinivasan,* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3193653/*).*

The effects of Yoga on the human body and mind have fascinated people through the ages. All kinds of stories of yogic feats have been doing the rounds.

According to the HARVARD GAZETTE, April 18th, 2002 –

"Harvard researcher Herbert Benson, who has been studying a meditation technique known as "g Tum-mo" for 20 years, says that "Buddhists feel the reality we live in is not the ultimate one. There's another reality we can tap into that's unaffected by our emotions, by our everyday world. Buddhists believe this state of mind can be achieved by doing good for others and by meditation".

"Benson is an associate professor of medicine at the Harvard Medical School and president of the Mind/Body Medical Institute at Beth Israel Deaconess Medical Center in Boston. He firmly believes that studying advanced forms of meditation "can uncover capacities that will help us to better treat stress-related illnesses".

"Experiments with Buddhist monks practicing 'g Tum-mo' produced dramatic results. Just using the power of their minds, the monks produced enough body heat to dry wet sheets placed on them as they relaxed in chilly rooms".

"With the help of three Tibetan Buddhist monks, however, a team of scientists has demonstrated that temperature can be raised. One of the monks, wired with temperature sensors, raised the temperature of his fingers and toes by as much as 8.3 degrees centigrade-almost 15 degrees Fahrenheit-according to a recent report in the scientific journal Nature".

This now famous study resulted in Herbert Benson publishing his best-selling book – 'The Relaxation Response", which was first published in 1975. The three monks had spent many years living in a monastery, living the yoga discipline.

This now famous study clearly established that there is a link between the body and the mind. It also established the radical changes that the practice of yoga can bring about in the body/mind.

Conclusion

Earlier we saw the effect of yoga practices on the DNA. A 2016 study was able to observe the effects of yoga on DNA methylation. . *"Although just a pilot study, the results bring forth interesting insight into the molecular changes that may be occurring during and after this widespread and increasingly popular exercise activity".*

We have also just seen the scientific evidence of "major epigenetic reprogramming, involving the removal of epigenetic marks in the nucleus, followed by establishment of a different set of marks "....

The gene-environment link is clearly proven from the time of Waddington's observation of the environments effect on the wings of flies. The effects of yoga on the body have shown a significant mind-body and genetic link. The yoga used in these tests was largely very limited, once a day practices, for a given number of weeks. The three monks, who lived out a yogic life style, were not tested to determine the effects of their yoga on their DNA. Meanwhile, let's bear in mind that the long termed paleolithic to neolithic environmental evolution and its effect on body/physiology changes has also been proven.

Perhaps we presently lack the time and the means to empirically test out the entire effects of a yoga life style, or even a 12 year Tapasacharaya. But if evolution is to be believed, certainly the growing practice of mind-body-interventions like yoga, and their growing popularity, will one day have their say in our genetic makeup.

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