



శ్రీ వేపచేదు విద్యా పీఠము

VEPACHEDU EDUCATIONAL FOUNDATION

The Telangana Science Journal

Health and Nutrition

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Issue 224

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OPTOGENETICS



Ignorance is not only bliss for the ignorant, but also a major factor that contributes to various ills of the society, e.g., behaviors ranging from xenophobia to stigmatization of the sick and the strange resulting in ostracization, exclusion and isolation of the victims. The World Health Organization has shown that psychiatric disease is the leading source of disability worldwide in terms of years of life lost to death or

disability, e.g., a leprosy, cancer or AIDS diagnosis once carried more stigma than it does now. Lack of knowledge of psychiatric disease contributes to stigmatization slowing the progress in global human health resulting in an enormous global problem.

*The darkness of ignorance may be removed by shining light as the Rigvedic chants pray:*

*[Om bhur bhuvaha svaha, Tat savitur varenyam, Bhargo devasya dhimahi, Dhiyo yonah prachodayat, Asatoma Sadgamaya, Tamasoma Jyotirgamaya, Mrityorma Amritamgamaya](#)*

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(Rigveda, ~3000-1500 BC, Northwestern Indian Continent - current Iran, Afghanistan, Pakistan and Northwestern parts of the Modern Indian Union)

“What does a ~ 5000 years old ancient Indian invocation “to enlighten the minds with light” have to do with the terms optogenetics and xenophobia?” you may wonder. Optogenetics is a technique by which events within specific cells of living tissue can be controlled, by the insertion into cells of genes that confer light responsiveness. This combination of genetics and optics requires insertion of light responsive genes into cells and shining light on these cells deep in an organism, for example, the brain to understand the cells of interest.

Neurons in the body and mind can be made sensitive to light by introducing special genes, carried by a virus, which produce photoreceptive proteins. By shining light on those cells with a fiber-optic wire scientists can either activate or suppress neurons, raising the possibility exploring the dark secrets of our minds work, how different parts of the brain work and how they communicate with the rest of the brain. So far these cells and their function is an enigma to experts and scientists, let alone ordinary people, and therefore, there is a stigma associated with many disorders affecting the human brain due to our ignorance and fear of the unknown, a deadly combination that inflicts death, pain and suffering upon human societies. Scientists cannot treat all the ills of the society the root cause of which is ignorance, but hopefully they may shine light on mental disorders, a step in the direction of understanding the strangers in our brains that have been there forever, but we don’t know about them even today. The technique untangles the billions of cells in the brain, identifying what circuits influence anxiety or thirst, for example.

In addition, the optogenetic control may also be used to control certain disorders as well. Temporal lobe epilepsy is the most common type of epilepsy in adults, is often medically refractory, and due to broad actions and long-time scales, current systemic treatments have major negative side-effects. Optogenetic inhibition or activation of hippocampal neurons stops seizures rapidly upon light application, raising the possibility of detection and termination of spontaneous temporal lobe seizures by modulating specific cell populations in a spatially restricted manner<sup>2</sup>.

Psychiatric disorders include anxiety disorders, obsessive compulsive disorder (OCD), post-traumatic stress disorder (PTSD), fear, depression, addiction, autism and parkinsonism. This group of illnesses presents a major global burden. In the 2010 Global Burden of Disease report, mental and substance use disorders comprised 7.4% of total disability-adjusted life years (DALYS) globally, and 8.6 million years

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of life lost (YLL), the single greatest cause of YLL worldwide. Psychiatric disorders also pose a significant burden to individuals and their families, and a challenge for clinicians and scientists. The National Institute of Mental Health (NIMH) cites serious mental illness (SMI) as a mental, behavioral, or emotional disorder that interferes with or limits one or more major life activities. The lack of insight into the determinants of these disorders may relate to the difficulty in developing effective pharmacological treatments for them<sup>3,4</sup>.

Optogenetics is still in its infancy, but several studies show the potential of optogenetic stimulation to rapidly modify disorders related to depression and anxiety in animal models. Optogenetic technology gives a new meaning to “light therapy” that is potentially more effective and rapid and has fewer adverse effects than classic light therapy or pharmacological approaches to treat mental illness. Optogenetic approaches are revealing the circuitry and firing patterns that may elicit and stabilize depressive behavior and could be targeted for pharmacological or behavioral intervention<sup>5</sup>.

## RECIPES:

### RICE & LENTIL SALAD<sup>6</sup>

INGREDIENTS: 2 tablespoons extra-virgin olive oil; 2 tablespoons sherry vinegar or red-wine vinegar; 1 tablespoon finely chopped shallot; 1 tablespoon Dijon<sup>7</sup> mustard; 1/2 teaspoon paprika, preferably smoked; 1/4 teaspoon salt; 1/4 teaspoon freshly ground pepper; 2 cups cooked brown rice; 1 15-ounce can lentils, rinsed, or 1 1/3 cups cooked lentils; 1 carrot, diced; and 2 tablespoons chopped fresh parsley.

INSTRUCTIONS: Whisk oil, vinegar, shallot, mustard, paprika, salt and pepper in a large bowl. Add rice, lentils, carrot and parsley; and stir to combine.

## REFERENCES AND NOTES<sup>8</sup>

<sup>1</sup> Dr. Rao Vepachedu is the founder and president of [Vepachedu Educational Foundation Inc.](http://www.vepachedu.com), a 501(c) (3) educational foundation, and the Law Offices of Dr. [Vepachedu](http://www.vepachedu.com) and co-founder of [Exciva](http://www.exciva.com). For more information visit: [www.linkedin.com/in/vepachedu](http://www.linkedin.com/in/vepachedu); <http://www.avvo.com/attorneys/60201-il-sreenivasarao-vepachedu-764535.html>, and <http://www.crm-ip.com/vepachedu.html>. Contact: [svepachedu@yahoo.com](mailto:svepachedu@yahoo.com).



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<sup>2</sup> Krook-Magnuson et al., On-demand optogenetic control of spontaneous seizures in temporal lobe epilepsy, Nature Communications 4, 1376 (22 January 2013)

<sup>3</sup> Uncovering the biology of mental illness: <http://blogs.plos.org/thestudentblog/2015/06/16/biologymentalillness/>

<sup>4</sup> Burguière et al. Optogenetic stimulation of lateral orbitofronto-striatal pathway suppresses compulsive behaviors. Science. 2013;340:1243–6; <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3876800/pdf/nihms534754.pdf>

Rauch et al., Neuroscience. Illuminating the neural circuitry of compulsive behaviors, Science, 2013 Jun 7;340(6137): <http://www.ncbi.nlm.nih.gov/pubmed/23744931>

<sup>5</sup> Albert, Light up your life: Optogenetics for depression? J Psychiatry Neurosci. 39(1): 3–5 (2014 January): <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3868662/pdf/jpn-39-3.pdf>

Jovanoski, Optogenetics: Light of the Future, THE TRIPLE HELIX Lent 2012: <http://camtriplehelix.com/images/journals/issue15.pdf#page=18>

<sup>6</sup>Rice & Lentil Salad: [http://www.webmd.com/food-recipes/southwestern-rice-and-pinto-bean-salad?ecd=wnl\\_dab\\_081916&ctr=wnl\\_dab-081916\\_ld-stry&mb=s10u26bW4bX4A6f2oTmCQ%40HnVev1imbCifxQ3xyXZ4k%3d](http://www.webmd.com/food-recipes/southwestern-rice-and-pinto-bean-salad?ecd=wnl_dab_081916&ctr=wnl_dab-081916_ld-stry&mb=s10u26bW4bX4A6f2oTmCQ%40HnVev1imbCifxQ3xyXZ4k%3d)

<sup>7</sup> DIJON MUSTARD, Pronunciation: [dee-ZHOHN]: Hailing originally from Dijon, France, this pale, grayish-yellow mustard is known for its clean, sharp flavor, which can range from mild to hot. Dijon mustard is made from brown or black mustard seeds, white wine, unfermented grape juice (must) and various seasonings. <http://www.foodterms.com/encyclopedia/dijon-mustard/index.html?oc=linkback>

<sup>8</sup> In addition to the primary sources cited above, additional references include:

[New York Times](#), [Washington Post](#), [Mercury News](#), [Bayarea.com](#), [Deccan Chronicle](#), [the Hindu](#), [Hindustan Times](#), [Times of India](#), [AP](#), [Reuters](#), [AFP](#), [The Guardian](#), [Pravda](#), [Spiegel](#), [Connexion](#), etc.

**Disclaimer** All information is intended for your general knowledge only and is not a substitute for medical advice or treatment for special medical conditions or any specific health issues or starting a new fitness regimen.

“Where the mind is without fear and the head is held high, Where knowledge is free Where the world has not been broken up into fragments, By narrow domestic walls.” [Rabindranath Tagore \(1861-1941\)](#), [Gitanjali](#), 1912.

[One World One Family](#)

AUM! SWASTI!

Om! Asatoma Sadgamaya, Tamasoma Jyotirgamaya, Mrityorma Amritangamaya, Om Shantih, Shantih, Shantih! (Aum! Lead the world from wrong path to the right path, from ignorance to knowledge, from mortality to immortality, and peace!)

SWASTI! AUM!

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