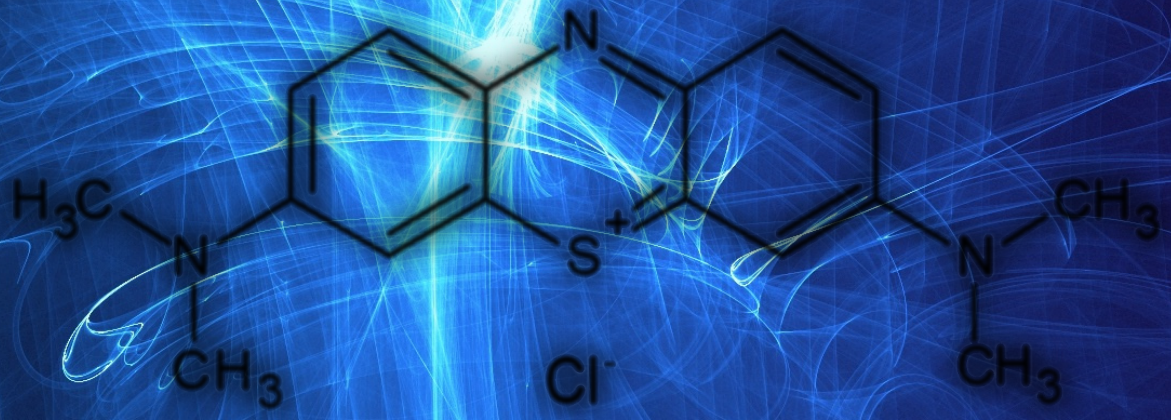


Methylene Blue Miracle

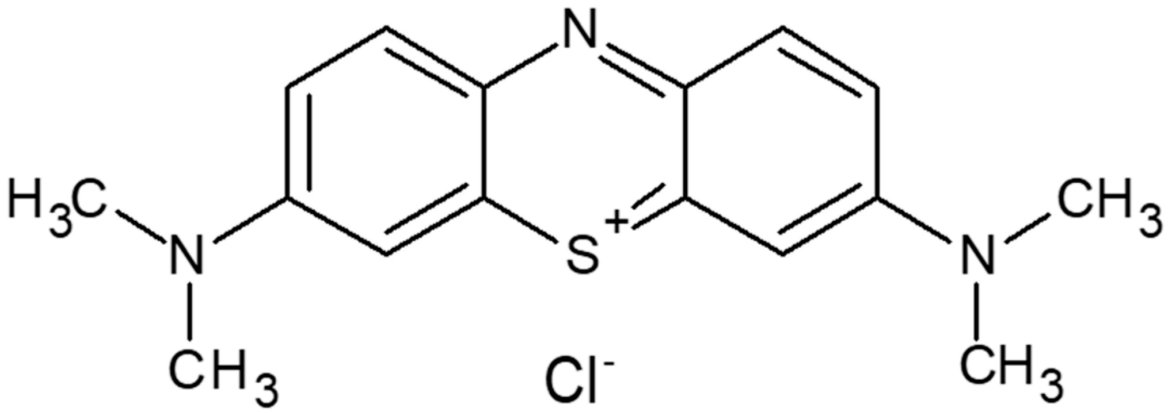
Youri Kruse

The Methylene Blue Miracle

IN 1876, the chemist Heinrich Caro synthesized a cationic blue dye for cotton. Cationic means that it has more positively charged (more protons than electrons) and can stain other surfaces. Due to its nitrogen and sulfur-containing molecules and heterocyclic compounds, methylene blue is classified as a phenothiazine. Phenothiazines are used as (a drug) to reduce nervous tension by depressing nerve functions.

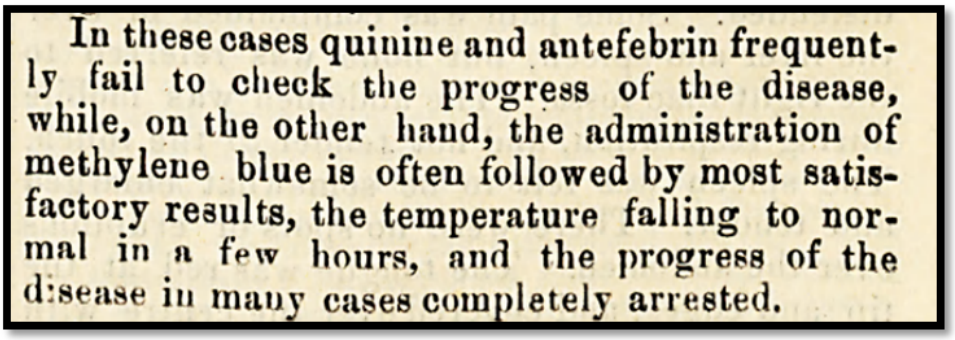
There are a number of problems with methylene blue from a pharmacy perspective. Usually, a drug patent lasts about 20 years, after which drugs become generic drugs. This makes methylene blue not very profitable. Another issue with methylene blue is its multi-faceted qualities which do not conform to cell membrane interactions and often dogmatic cell membrane theory. This makes methylene blue an awkward molecule to work with from a conventional scientific perspective. The major problem of methylene blue is its ability to lower nitric oxide. Although I argue that lowering nitric oxide is overall healthy, the overall image of nitric oxide is still seen as a healthy molecule.

The structure of methylene blue can be seen below.



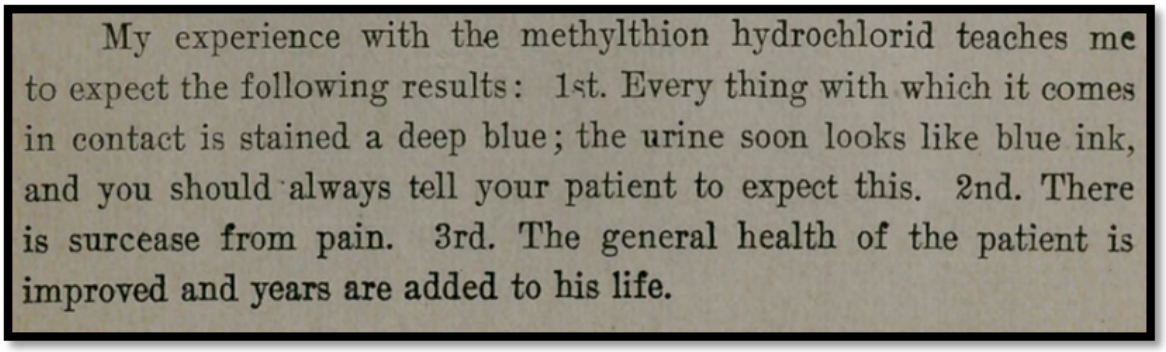
History Of Methylene Blue

One of the first scientists to experiment with methylene blue was the soon-to-become Nobel Prize winner Paul Ehrlich. Ehrlich observed that methylene blue could stain pathogens and argued that methylene blue could interfere with pathogens while leaving animal tissue unharmed. Several scientists from a variety of countries started to experiment with methylene blue. As malaria was raging in several countries, the use of methylene blue gave good results. All from the 1890s through the 1910s, methylene blue was found to benefit conditions ranging from malaria to cancer. Some examples are shown below;



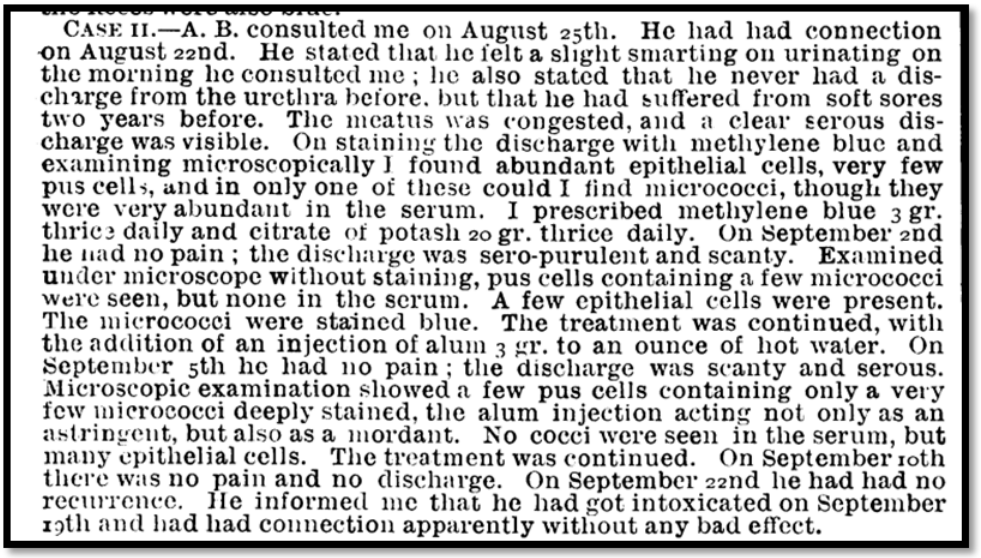
In these cases quinine and antefebrin frequently fail to check the progress of the disease, while, on the other hand, the administration of methylene blue is often followed by most satisfactory results, the temperature falling to normal in a few hours, and the progress of the disease in many cases completely arrested.

Marshall DG, Gee FW. On the Use of Methylene Blue in Malarial Fevers. Ind Med Gaz. 1893 Dec;28(12):409-410. PMID: 29001062; PMCID: PMC5172122.



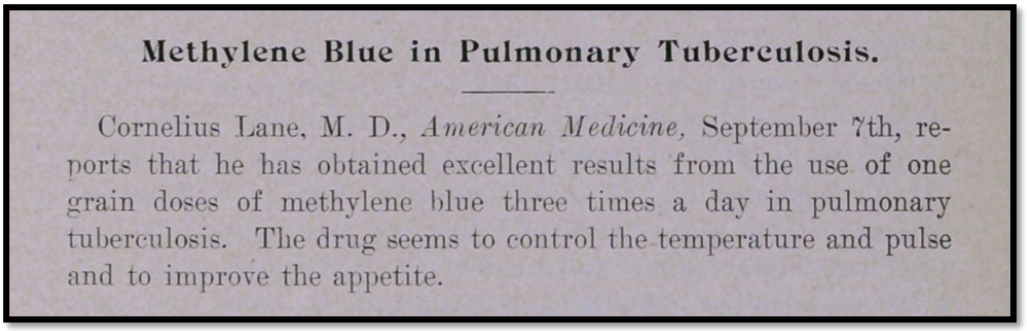
My experience with the methylthion hydrochlorid teaches me to expect the following results: 1st. Every thing with which it comes in contact is stained a deep blue; the urine soon looks like blue ink, and you should always tell your patient to expect this. 2nd. There is surcease from pain. 3rd. The general health of the patient is improved and years are added to his life.

Slack HR. Methylene Blue in the Treatment of Cancer. Atlanta J Rec Med. 1907 May;9(2):79-83. PMID: 36020088; PMCID: PMC9001582.



CASE II.—A. B. consulted me on August 25th. He had had connection on August 22nd. He stated that he felt a slight smarting on urinating on the morning he consulted me; he also stated that he never had a discharge from the urethra before, but that he had suffered from soft sores two years before. The meatus was congested, and a clear serous discharge was visible. On staining the discharge with methylene blue and examining microscopically I found abundant epithelial cells, very few pus cells, and in only one of these could I find micrococci, though they were very abundant in the serum. I prescribed methylene blue 3 gr. thrice daily and citrate of potash 20 gr. thrice daily. On September 2nd he had no pain; the discharge was sero-purulent and scanty. Examined under microscope without staining, pus cells containing a few micrococci were seen, but none in the serum. A few epithelial cells were present. The micrococci were stained blue. The treatment was continued, with the addition of an injection of alum 3 gr. to an ounce of hot water. On September 5th he had no pain; the discharge was scanty and serous. Microscopic examination showed a few pus cells containing only a very few micrococci deeply stained, the alum injection acting not only as an astringent, but also as a mordant. No cocci were seen in the serum, but many epithelial cells. The treatment was continued. On September 10th there was no pain and no discharge. On September 22nd he had had no recurrence. He informed me that he had got intoxicated on September 19th and had had connection apparently without any bad effect.

Moore J. The Use of Methylene Blue in Gonorrhoea. Br Med J. 1897 Jan 16;1(1881):140. doi: 10.1136/bmj.1.1881.140. PMID: 20756742; PMCID: PMC2432748.



Methylene Blue in Pulmonary Tuberculosis.

Cornelius Lane, M. D., *American Medicine*, September 7th, reports that he has obtained excellent results from the use of one grain doses of methylene blue three times a day in pulmonary tuberculosis. The drug seems to control the temperature and pulse and to improve the appetite.

Methylene Blue in Pulmonary Tuberculosis. Tex Med J (Austin). 1901 Oct;17(4):133. PMID: 36955664; PMCID: PMC9615702.

Another case was as follows: A young man was brought to the hospital suffering from the most violent ulcero-membranous stomatitis. The gums and the inner aspect of the cheeks were the seats of extensive ulcerations which were covered by thick false membranes.

Bacteriological examinations of the membranes revealed the presence of streptococci and various other micro-organisms, but neither diphtheria bacilli, spirilla, nor bacilli fusiformes. Owing to absence of the latter methylene blue was not at first tried; cauterisations with chromic acid in the form of crystals were ordered. The acid was applied with all the usual precautions, but the patient, who was extremely nervous, refused its repetition, and left the hospital in fear of its being used again. He was seen next day, the stomatitis being quite as severe as ever.

Chemically pure methylene blue was resorted to as a local application over the whole of the ulcero-membranous areas. The same evening there was an undoubted reduction in the amount of false membrane, and the ulcers were looking much less angry than before. The applications were repeated morning and evening, and at the end of three days the patient was well and remained cured.

Methylene Blue in the Cure of Ulcerative Stomatitis. Hospital (Lond 1886). 1909 Feb 27;45(1176):559-560. PMID: 29815979; PMCID: PMC5202016.

Methylene Blue in Malarial Fevers.—As we all now and then meet with patients who will not take quinine in any form, one may be compelled to use methylene blue. This drug (which must not be confused with methylene, a substitute for chloroform) is one of the aniline dyes. It gives a blue colour to the urine. Cardamatis of Athens (*Lancet*, February 28th, 1898) used methylene blue in 285 cases, dose ten to twelve grains for adults. In intermittents it is given ten hours before the next paroxysm; in irregular or remittent malarial fevers eight hours before the expected remission. It may be combined with quinine or better with arsenic. A "radical cure" is said to follow its use on alternate days for three weeks. It stains the tongue, lips and urine as well as the malarial parasite. It is claimed that patients using this drug become immune, even if remaining in the malarial locality. Slight cystitis may follow its prolonged use. Moore of Belfast, claims that methylene blue cuts short the acute stage of gonorrhœa (methylene blue three grains with fifteen grains citrate of potash internally *ter in die.*) It also stains the gonococcus. Manson remarks that methylene blue in two or three grain doses pushed till symptoms of cystitis appear "has a certain amount of reputation." It is probably better to begin with three grain doses and increase as necessary. The Germans use it much, and after Koch's failure to find a new parasite for "black water fever" in Africa, and his indictment against quinine, it is probable that methylene blue will be even more used, but we may remember what Osler said about the medical man who did not know how to use quinine.—(*Indian Medical Gazette*, May 1898, p. 192.)

Buchanan WJ. Medicine: Dysentery in Jails of India, 1897—How to Kill Mosquito Larvæ—Dengue versus Yellow Fever—Methylene Blue in Malarial Fevers—The Haematozoon of Goitre—Uranium Nitrate in Diabetes—Antityphoid Inoculation. Ind Med Gaz. 1898 Nov;33(11):429–31. PMCID: PMC5141218.

Methylene Blue Miracle

Since the publication of observations on the selective bactericidal action of gentian violet,[1] studies have been carried on in this laboratory with a large number of other dyes. The technique of divided plates, previously described, has been employed. The results with dyes similar in chemical structure to gentian violet have already been reported.[2] These dyes, like gentian violet, were found to prevent the growth of gentian-positive, and to be without effect on gentian-negative organisms.[3] In this communication the selective bactericidal action of a dye unrelated to gentian violet in chemical structure, namely, methylene-blue, will be reported. That this dye has bactericidal properties has, of course, long been known. It is to the selective feature that I wish to call attention.

Briefly stated, it has been found that methylene-blue, like gentian violet, is without effect on the growth of *Bacillus typhosus* and *Bacillus coli;* but that, unlike gentian violet, it exhibits a selective action when *Bacillus subtilis* and *Micrococcus aureus* are planted on divided plates containing it.

Churchman JW. THE SELECTIVE BACTERICIDAL ACTION OF METHYLENE-BLUE. J Exp Med. 1913 Aug 1;18(2):187-9. doi: 10.1084/jem.18.2.187. PMID: 19867695; PMCID: PMC2125061.

METHYLENE BLUE AND LPS

There is a general bacterial toxin that can activate an inflammatory response from our immune system. This toxin is called lipopolysaccharide (LPS) or endotoxin. LPS is an underdiagnosed aspect of health related to many health issues. LPS can impair thyroid function, weaken muscles and even cause death.

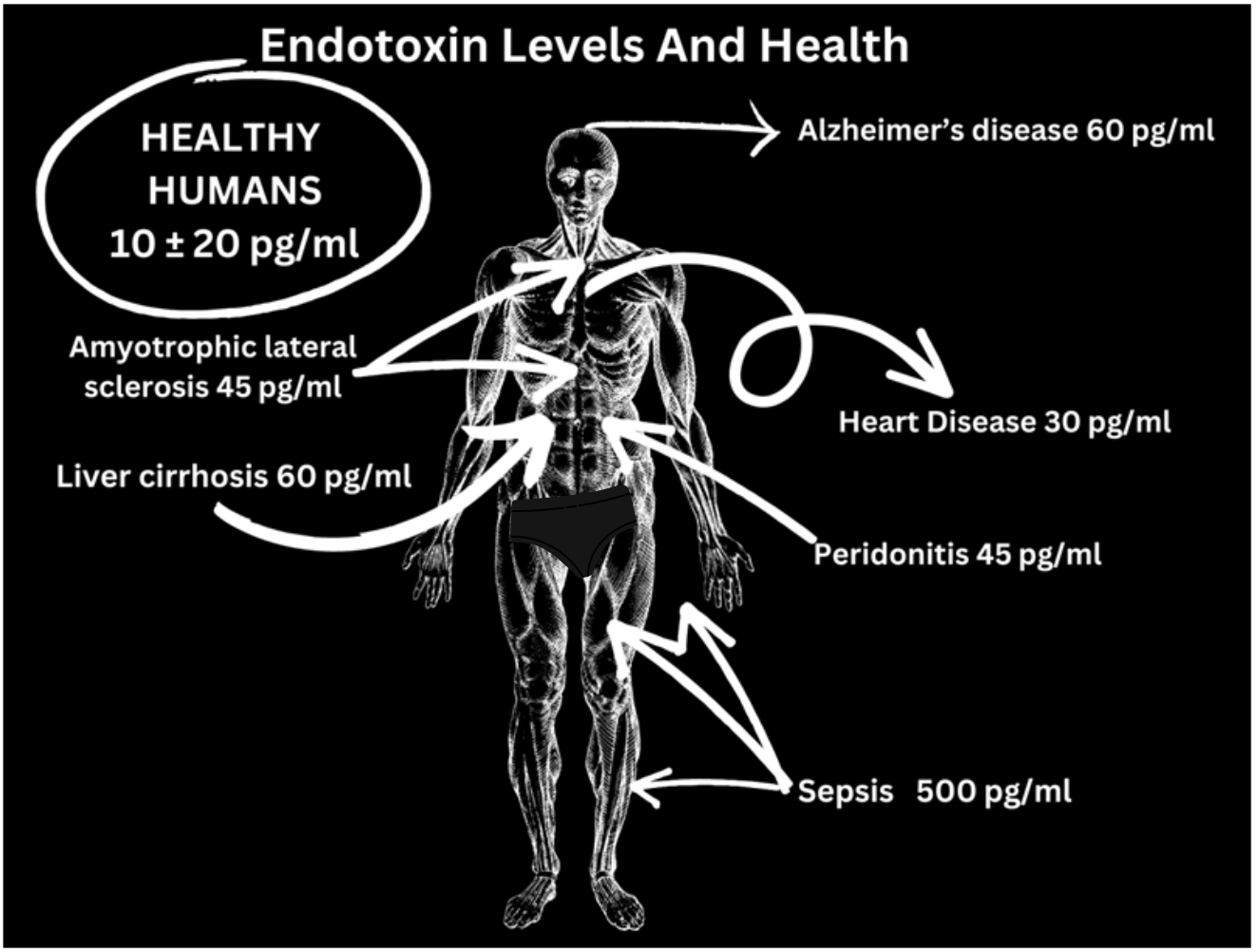
Methylene blue is a known inhibitor of LPS and can lower the effects derived from endotoxins (nitric oxide, lactate) thereby improving many conditions, for example, mental health. Reducing LPS can stop the inflammatory pathways leading to serotonin and other molecules. One major symptom of depression is called anhedonia. Anhedonia is heavily associated with serotonin and LPS, as one study remarked;

"Anhedonia, i.e., the inability to experience pleasure, is a core symptom of major depression that can be assessed in rodents with the intracranial self-stimulation procedure... Previously, it has been reported that systemic bacterial lipopolysaccharides (LPS) strongly activates the immune system to release proinflammatory cytokines, that induces anhedonia in rats.. Interestingly, previously we have shown that LPS-induced anhedonia is not observed in serotonin (5-HT) transporter knockout (SERT−/−) rats"

Korte-Bouws GAH, van Heesch F, Westphal KGC, Ankersmit LMJ, van Oosten EM, Güntürkün O, Korte SM. Bacterial Lipopolysaccharide Increases Serotonin Metabolism in Both Medial Prefrontal Cortex and Nucleus Accumbens in Male Wild Type Rats, but Not in Serotonin Transporter Knockout Rats. Pharmaceuticals (Basel). 2018 Jul 5;11(3):66. doi: 10.3390/ph11030066. PMID: 29976854; PMCID: PMC6160917.

Methylene Blue Miracle

LPS are rarely discussed but are a big part of disease states. Furthermore, many recommendations and treatments currently given increase LPS, some of them include estrogen, omega-6 fatty acids, and many kinds of radiation therapies. Actually, some scientists have advised against radiation during infection as LPS could further increase damage. Below are the plasma endotoxin levels (LPS), in health and disease states;



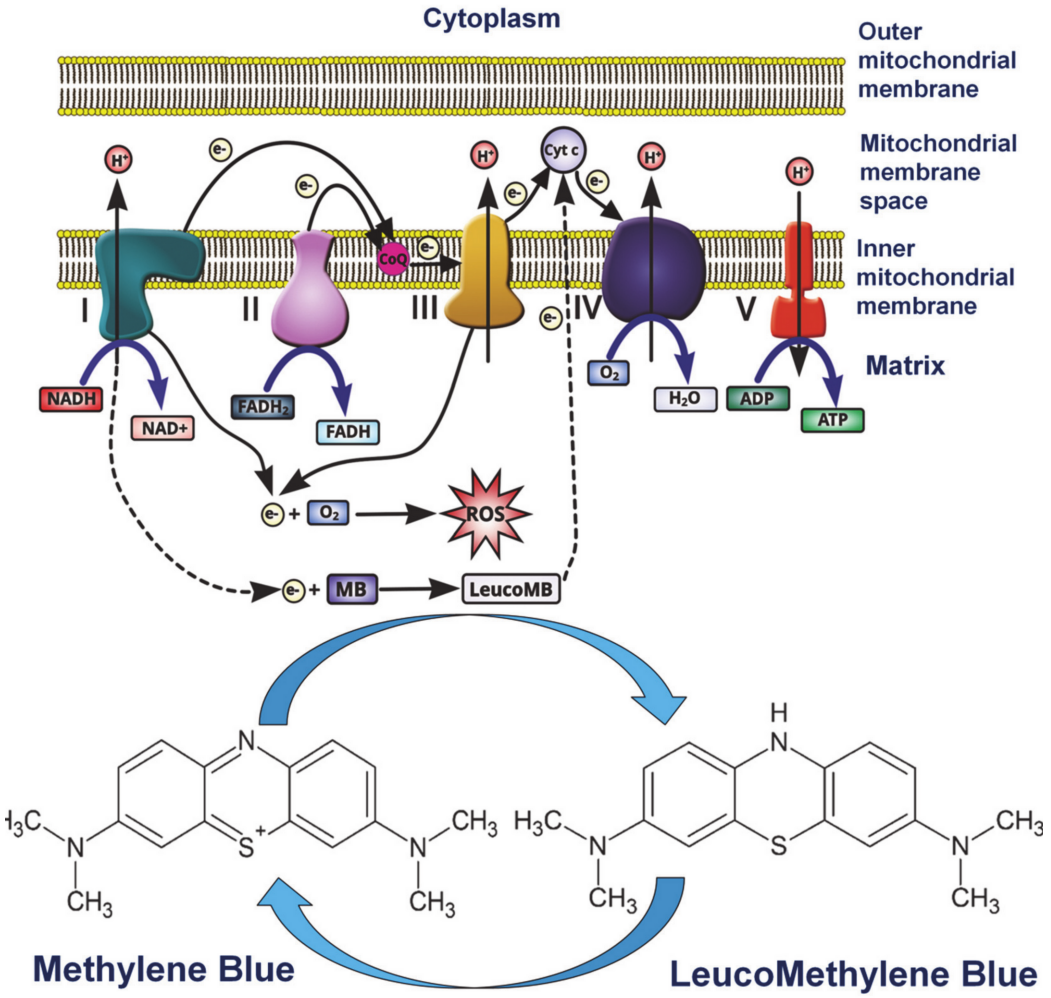
METHYLENE BLUE & THE MITOCHONDRIA

One problem with aging is faulty mitochondria. These faulty mitochondria can be caused by damaged mitochondrial DNA, increased reactive oxygen species (ROS), and a variety of other reasons. The excess of ROS and or lack of anti-inflammatory molecules can result in a lack of electron acceptors in the mitochondria. The mitochondria are the energy-producing organelles in the cells and produce ATP. About 98% of oxygen in the body is destined for the mitochondria. The role of oxygen is to accept hydrogen to become water. If electrons are not accepted, oxygen can not be reduced and energy production is reduced.

Methylene blue has the ability to accept and donate electrons. As the different complexes in the mitochondria are passing around electrons for oxygen to be accepted, any disturbance in this process can accumulate damage and ROS. Methylene blue can accept electrons and bypass the different (possibly bypass faulty) enzymes. In this reaction, methylene blue becomes leucomethylene blue. See below.

"MB receives electrons from NADH through Complex I, converting to leucoMB. LeucoMB can directly transfer these electrons to cytochrome c, re-oxidized to MB. Therefore, MB has the potential to protect cells against oxidative stress under pathological conditions."

Xue H, Thaivalappil A, Cao K. The Potentials of Methylene Blue as an Anti-Aging Drug. Cells. 2021 Dec 1;10(12):3379. doi: 10.3390/cells10123379. PMID: 34943887; PMCID: PMC8699482.

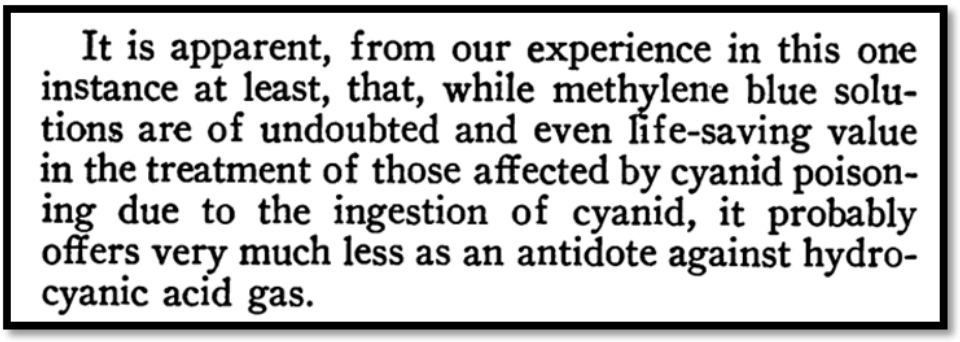


Nedu, M.-E.; Tertis, M.; Cristea, C.; Georgescu, A.V. Comparative Study Regarding the Properties of Methylene Blue and Proflavine and Their Optimal Concentrations for In Vitro and In Vivo Applications. Diagnostics 2020, 10, 223. https://doi.org/10.3390/diagnostics10040223

This ability of methylene blue to sustain energy production while the different mitochondrial enzymes are impaired makes methylene blue an antidote for different kinds of poisons.

METHYLENE BLUE AS AN ANTIDOTE

Methylene blue can act like oxygen and keep the system going while being poisoned. The electron-carrying abilities and antidote capabilities were observed in the 1930s after carbon monoxide and cyanide poisoning. Many examples of the life-saving actions of methylene blue have been reported, as is shown below;



It is apparent, from our experience in this one instance at least, that, while methylene blue solutions are of undoubted and even life-saving value in the treatment of those affected by cyanid poisoning due to the ingestion of cyanid, it probably offers very much less as an antidote against hydrocyanic acid gas.

Geiger JC, Gray JP. Cyanid Poisoning: Additional Note on Its Treatment with Intravenous Methylene Blue Solutions. Cal West Med. 1935 Nov;43(5):339-42. PMID: 18743431; PMCID: PMC1759910.

One of the attributes of methylene blue is to correct mitochondrial function and increase carbon dioxide function. The improvement of mitochondria function increases with CO2 production. Studies from around the 1960s showed that methylene blue increased CO2 levels.

Carbon dioxide is the most important extracellular and intracellular regulator of pH. CO2 can regulate pH quickly by taking and depositing H+ ions in all cells. When CO2 is formed during oxidative respiration, this acidic molecule must be exhaled from the body. There is an exchange of oxygen for carbon dioxide and protons. The formation of CO2 decreases pH levels at the tissue levels, this lowering of pH promotes oxygen release by decreasing the affinity of hemoglobin for oxygen. Oxygen is released turning oxyhemoglobin into deoxyhemoglobin. CO2 does not get attached to the hemoglobin, instead, carbonic anhydrase converts the CO2 in the red blood cell into bicarbonate ion.

The increase of protons decreases pH levels in the red blood cells, thereby releasing o2 (Bohr effect). CO2 mixed with H20 (water) will turn into H2CO3-, which can act as a buffer with HCO3- + H+. H+ will combine with hemoglobin. One group of enzymes that turns CO2 into bicarbonate and H+ are the carbonic anhydrases.

$$CO2 + H2O \rightleftarrows HCO3- + H+$$

Inhibiting the carbonic anhydrases can have benefits, as one study acknowledges.

"CAs catalyze the hydration of CO2 to produce bicarbonate and a proton. This reaction is important for pH homeostasis, overturn of cerebrospinal fluid, regulation of CBF, and other physiological functions. Humans express 15 CA isoforms with different distribution patterns. Recent studies provide evidence that CA inhibition is protective to NVU cells in vitro and in vivo, in models of stroke and AD pathology. CA inhibitors are FDA-approved for treatment of glaucoma, high-altitude sickness, and other indications"

Lemon N, Canepa E, Ilies MA and Fossati S (2021) Carbonic Anhydrases as Potential Targets Against Neurovascular Unit Dysfunction in Alzheimer's Disease and Stroke. Front. Aging Neurosci. 13:772278. doi: 10.3389/fnagi.2021.772278

One good way to inhibit the carbonic anhydrases enzymes is by thiamine intake. Thiamine is also known to increase CO2 by increasing ATP production.

METHYLENE BLUE AND PESTICIDES

The development of new pesticides sprang mostly out of the First and Second World Wars. Worldwide, almost 3 billion kg of pesticides are used annually at an increasing rate. Currently, many kinds of synthetic (also carbon-based) pesticides are increasing with unhealthy effects.

Many pesticides are based on the defensive mechanisms of plants. One of the most common pesticides are the deltamethrins, which is a derivative from pyrethrins, which are found in the flowers of the chrysanthemum. The deltamethrins are commonly found in combination with a host of pesticides and have been found in eggs, milk, and a variety of vegetables.

Mostly animal research shows a significant association between deltamethrins and reductions in testosterone and thyroid dysfunction (human studies are very limited). One of the ways in which deltamethrins are harmful is by inhibiting the mitochondria, thereby reducing available energy. Some research shows that deltamethrins inhibit sites located between Complex II, and Complex III. Methylene blue is known to bypass these complexes and avoid ATP interruptions.

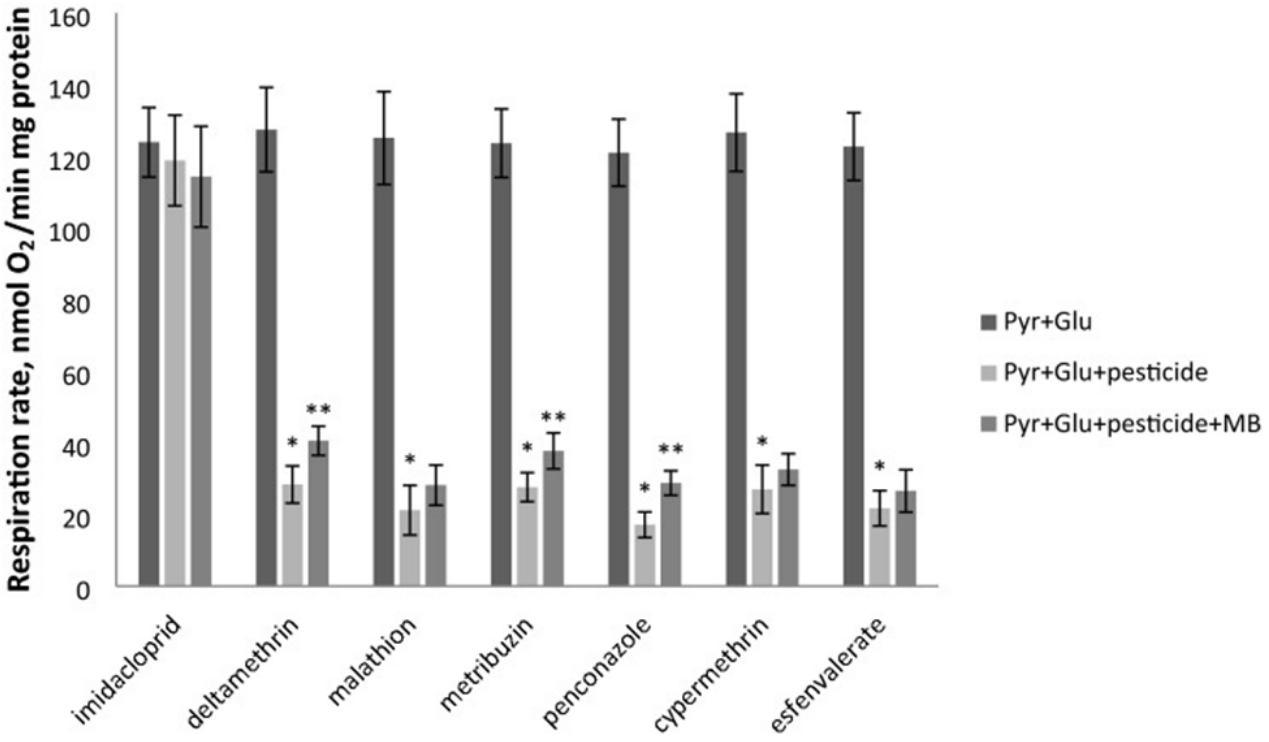
When bees are supplemented with methylene blue in the nectar, mitochondria are performing better. Although oxygen consumption is not as high as without pesticides, adding methylene blue significantly improves mitochondrial conditions. Suggesting the researchers to conclude that adding methylene blue to the bee's nectar opposes inhibition of the mitochondria by the pesticides.

"MB can be added to the syrup used for feeding bumble bees, which might be convenient for the insect treatment in both indoor (greenhouses) and outdoor environments."

Syromyatnikov M, Nesterova E, Smirnova T, Popov V. Methylene blue can act as an antidote to pesticide poisoning of bumble bee mitochondria. Sci Rep. 2021 Jul 19;11(1):14710. doi: 10.1038/s41598-021-94231-3. PMID: 34282204; PMCID: PMC8289979.

Below you can see the differences between a variety of pesticides with and without methylene blue versus controls.

Methylene Blue Miracle



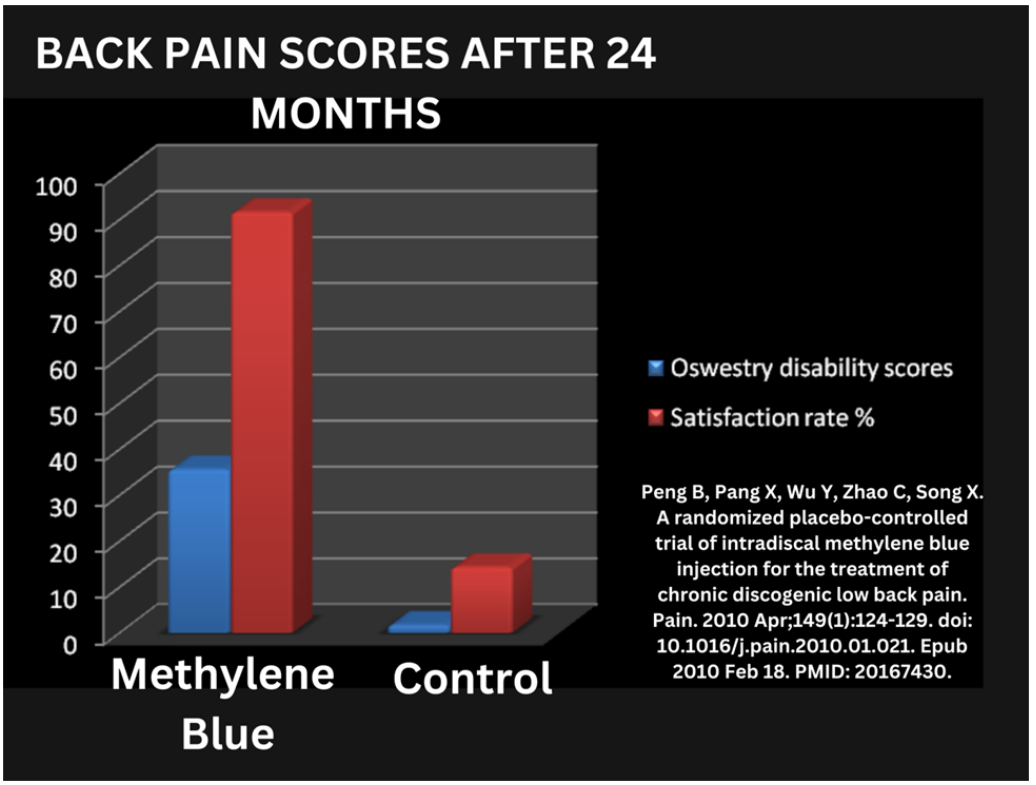
Syromyatnikov M, Nesterova E, Smirnova T, Popov V. Methylene blue can act as an antidote to pesticide poisoning of bumble bee mitochondria. Sci Rep. 2021 Jul 19;11(1):14710. doi: 10.1038/s41598-021-94231-3. PMID: 34282204; PMCID: PMC8289979.

Beyond pesticides and known poisons, methylene blue can also counteract the negative effects of frequently used medicines. One of those medicines is metformin, this drug is often used for diabetes. In case of metformin overdose methylene blue therapy has been shown to be very effective.

Methylene Blue Miracle

MORE RECENT FINDINGS

One of the most impressive actions of methylene blue is its pain-killing abilities. A 2010 study found that injecting methylene blue into the disks of people with back pain experienced tremendous improvements versus people with back pain without treatment, after 24 months. See the results below.



There are several possible ways how methylene blue contributes to pain reduction. One of the ways is by energizing the cell and making the cell less excitatory. Caffeine and aspirin are both known molecules that energize cells and especially in combination reduce pain.

The lowering effects of nitric oxide are another way in which methylene blue contributes to pain reduction. The reduction in nitric oxide due to inhibition of NOS by methylene blue is often associated with a lessening of pain, for example headache. A third way in which methylene blue can decrease pain is by interfering with the so called channel pores. Researchers argue that inhibition of voltage-gated sodium channels (VGSC). See the example below

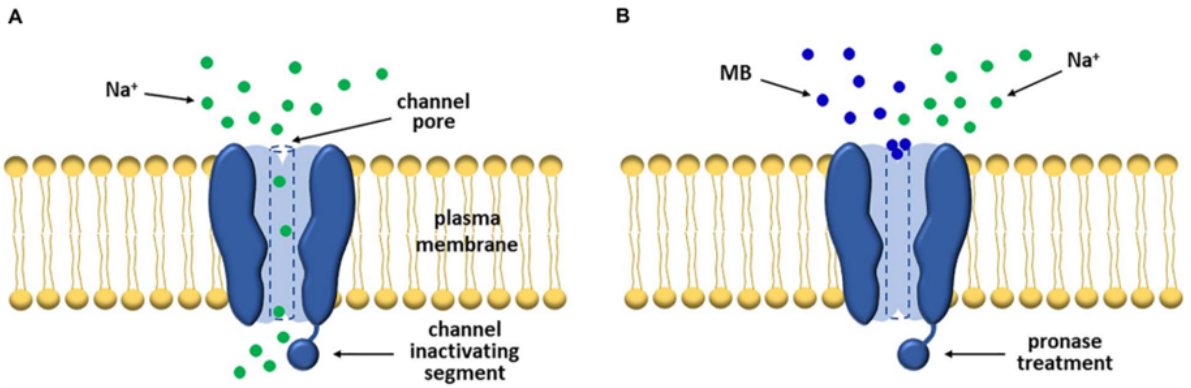


FIGURE 2 | MB significantly attenuates sodium currents by blocking VGSCs. **(A)** In general, VGSCs allow sodium ions to flow into the cell in the activated state. **(B)** However, early researchers found that the gate and sodium currents of the channels were markedly suppressed post-MB treatment. And notably, this event was maintained even after pronase treatment. Thus, they interpreted this event as MB functions as a pore blocker rather than an inactivation enhancer.

Lee SW and Han HC (2021) Methylene Blue Application to Lessen Pain: Its Analgesic Effect and Mechanism. Front. Neurosci. 15:663650. doi: 10.3389/fnins.2021.663650

Methylene Blue & Nitric Oxide

One problem with methylene blue is the view on nitric oxide. Nitric oxide was a known pollutant that came from smoking, residing in smog and the destroyer of ozone. In 1987 nitric oxide was found to be present in the human body, and was named endothelium-derived relaxing factor (EDRF). At that time nitric oxide was known to be cytotoxic and was known to inhibit DNA synthesis and mitochondria functioning.

Although the toxic effects of nitric oxide were well known, the vasodilatation abilities of nitric oxide had a novel practical effect that could rake in billions for the pharmaceutical industry. Some researchers suggested that Nobel laureate Dr. Louis Ignarro made such groundbreaking work in nitric oxide that even general people would associate erectile dysfunction with a "nitric oxide pill".

Pfizer noticed the research and moved their research from vasodilatation and angina to vasodilatation and erectile dysfunction. Pfizer focused on phosphodiesterase inhibitor, sildenafil, which enhances nitric oxide (NO) metabolism (for more information on how Pfizer created an erectile dysfunction market by altering definitions, see The Rise of Viagra: How the Little Blue Pill Changed Sex in America. Meika Loe. New York University Press. ISBN 0 8147 5200 4).

Although initial reports found no issues with sildenafil citrate, later reports put sildenafil citrate in a more negative light, as one review noted;

"Post-marketing surveillance data after the approval of sildenafil citrate by the US FDA revealed significant cardiovascular problems, including sudden cardiac death, related to the use of sildenafil citrate (4). As of February 1999, the US FDA had received 401 reports of death among men who had received a prescription for sildenafil citrate over the prior 10 to 11 months. These included 219 cardiovascular events (MI, arrhythmia, cardiac arrest, collapse), 140 sudden deaths, and 18 cerebrovascular accidents"

Shinlapawittayatorn K, Chattipakorn S, Chattipakorn N. Effect of sildenafil citrate on the cardiovascular system. Braz J Med Biol Res. 2005 Sep;38(9):1303-11. doi: 10.1590/s0100-879x2005000900003. Epub 2005 Aug 26. PMID: 16138212.

Sildenafil citrate does improve erectile dysfunction but not fertility. Sildenafil citrate is known to increase both nitric oxide and nitric oxide synthase (NOS is the enzyme that makes nitric oxide). Several studies show that an increase in both nitric oxide and NOS lower fertility levels in men (and women). This is worrisome as younger people are using drugs like sildenafil citrate at increasing levels. One review noted the following about the relationship between NO (nitric oxide) and male fertility;

"NO features a twin impact on sperm performs, so under physiological conditions, NO plays a vital role in normal sperm production and motility. Low NO levels have been shown to increase sperm motility.., capacitation.. and zonapellucida spermbinding protein.., whereas a number of studies have shown a negative effect of high NO levels in seminal plasma on human sperm motility"

Yousefniapasha Y, Jorsaraei G, Gholinezhadchari M, Mahjoub S, Hajiahmadi M, Farsi M. Nitric oxide levels and total antioxidant capacity in the seminal plasma of infertile smoking men. Cell J. 2015 Spring;17(1):129-36. doi: 10.22074/cellj.2015.519. Epub 2015 Apr 8. PMID: 25870842; PMCID: PMC4393660.

In 2011, old mice were treated with methylene blue in drinking water for about 3 months. After the 3 months some surprising results. Beyond the 100% and 50% increase in complex IV of the mitochondria in the brain and heart respectively, a typical decline in grip strength was avoided. There also was a 39% decrease in MAO!

Methylene Blue And Serotonin

Serotonin is usually broken down by monoamine oxidase enzymes. Methylene blue is known to inhibit monoamine oxidase. High doses of methylene blue can inhibit to such an extent that serotonin toxicity can occur. This usually occurs with patients using methylene blue intravenously, while several studies show that 100 % of patients with serotonin toxicity were on serotonin drugs. Less is known about oral supplementation of methylene blue and serotonin toxicity. The inhibition of monoamine oxidase could also increase levels of dopamine, which is known to yield benefits. There is limited information about methylene blue and MAO-B. MAO-B is the enzyme that breaks down dopamine. It is known that methylene blue protects the neurons that secrete dopamine and often increases dopamine. Below is the way serotonin is broken down by MAO-A.

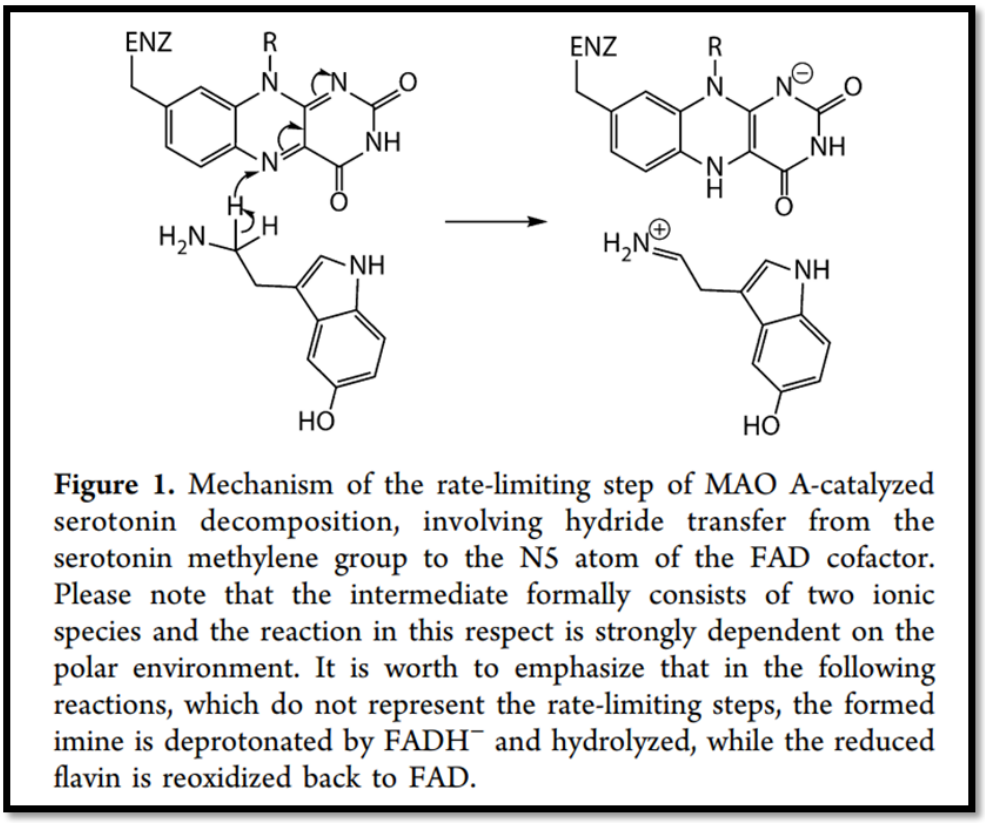


Figure 1. Mechanism of the rate-limiting step of MAO A-catalyzed serotonin decomposition, involving hydride transfer from the serotonin methylene group to the N5 atom of the FAD cofactor. Please note that the intermediate formally consists of two ionic species and the reaction in this respect is strongly dependent on the polar environment. It is worth to emphasize that in the following reactions, which do not represent the rate-limiting steps, the formed imine is deprotonated by $FADH^-$ and hydrolyzed, while the reduced flavin is reoxidized back to FAD.

How Monoamine Oxidase A Decomposes Serotonin: An Empirical Valence Bond Simulation of the Reactive Step. Alja Prah, Miha Purg, Jernej Stare, Robert Vianello, and Janez Mavri. The Journal of Physical Chemistry B 2020 124 (38), 8259-8265. DOI: 10.1021/acs.jpcb.0c06502

Although lowering serotonin by MAO-A is potentially healthy, reducing serotonin in the first place is probably better. As most of the serotonin comes from the intestines, having a healthy gut and avoiding serotonin-provoking foods, for example adding gelatin in foods to limit tryptophan. As MAO-A is a contributor of reactive oxygen species and inflammation, inhibiting MAO-A can have some healthy attributes.

The nitric oxide lowering qualities of methylene blue can also aid in keeping dopamine high.

"Methylene blue is commonly regarded as an inert dye, but has recently been shown to act as a potent reversible monoamine oxidase (MAO) inhibitor with a strong preference for MAO-A inhibition.. Because the inhibition constant is in the nanomolar range, even small doses of methylene blue (less than 1 mg/kg) may exert clinically relevant MAO inhibition.3 This effect is enhanced because methylene blue is rapidly absorbed in nervous tissue where, in rat models, it reaches brain concentrations ten times higher than in serum.....Low doses of 0.7-1 mg/kg methylene blue intravenously may already give rise to clinically relevant MAO inhibition"

Top WM, Gillman PK, de Langen CJ, Kooy A. Fatal methylene blue associated serotonin toxicity. Neth J Med. 2014 Apr;72(3):179-81. PMID: 24846936.

Doses ranging from 15mg per day have potent anti-depressive actions on clinically depressed people, but some studies show results with a 300 mg a day methylene blue supplement. I personally think scientists want to get results and use high doses of methylene blue. My personal experience with 0.1 mg methylene blue a day (suspended in water) are very noticeable. Effects range from more energy, temperature increase to a surprisingly effective treatment against a host of illnesses. Whenever I feel a sickness coming, a 0.1 mg intake of methyelene blue twice a day quickly, the sickness quickly disappears.

CONCLUSION

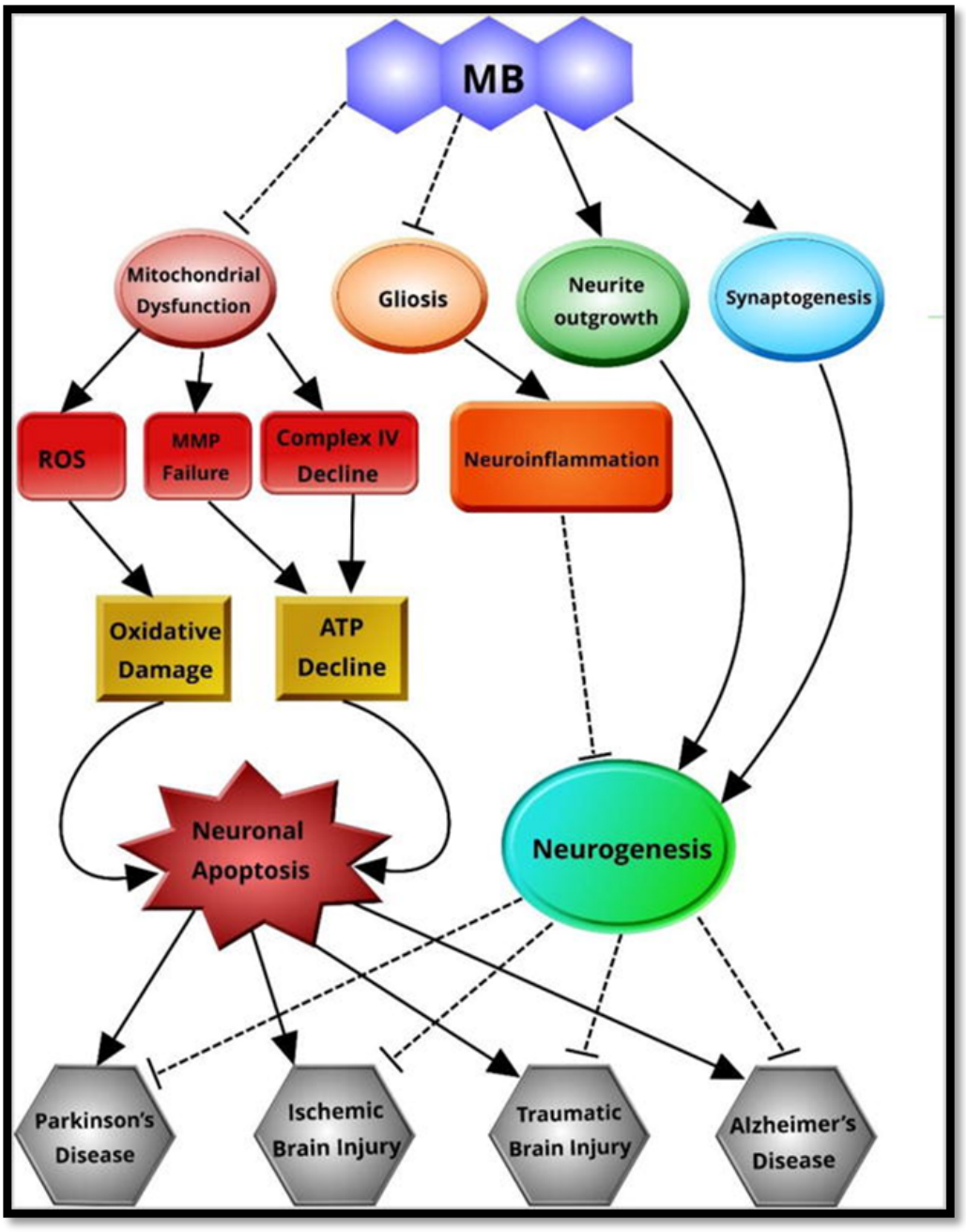
Methylene blue is a molecule with a great variety of uses. From LPS and bacteria inhibition, upregulation of mitochondria, and inhibition of nitric oxide. Several studies show that a high dose of methylene blue has negative effects, while a low dose has positive effects. Especially animal studies show that higher doses of methylene blue have negative effects. As methylene blue increases the respiratory rate, enough foodstuff should be taken to avoid an accumulation of the stress molecules.

As methylene has a preference for neurons, issues with a neurological origin and an excess of nitric oxide could have a great benefit. Currently, methylene blue is used for Alzheimer's and Parkinson's disease, traumatic brain injury, and ischemic brain injury.

As the negative effects of nitric oxide will become more obvious in the future, methylene blue has got a good future. Another trend in favor of methylene blue is that many individual vendors are offering methylene blue at a pharmaceutical grade.

See the graph below.

Methylene Blue Miracle



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