Methylene blue

The promise for a healthier, longer life?

An E-Book by Casey

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Foreword

In a conversation I was asked the following question: "Methylene blue, have you ever heard of it, it helps with all kinds of ailments, did you know that? I've been using it myself for a while and I have to say, I notice the difference."

Hmmm, a panacea, interesting.....

Panacea, Helps the Sick, by J. Gazola (18th century) –
Transferred from en.wikipedia.

To be honest, I had never heard of it, I thought. Until I remembered that blue speck from my pathology study many years ago. So hop, let's look back at how that was again.

And yes:
Methylene blue appears to be an alkaline dye and is mainly used in histology and pathology for staining cells and tissues in preparations, so that certain structures become more visible under the microscope.
When I did some further research, I discovered that it also had therapeutic effects.

Discovery of the therapeutic effect of methylene blue:
The therapeutic effect of methylene blue was only noticed in the 19th and 20th centuries, when scientists discovered that methylene blue not only acted as a dye, but also had

biochemical effects. It was first used in medicine as an antimalarial. In the early 20th century, during the search for cures for tropical diseases, methylene blue was tested as a potential treatment for malaria. It was found to be effective, although it was later replaced by other, more targeted drugs.
In addition, several other therapeutic uses of methylene blue have been discovered.

Thus, the biochemical effects of methylene blue, such as its antimicrobial, neuroprotective, and antioxidant properties, were only discovered over time. Then they also looked at how these properties could be useful.

Googling
So I went on the internet to see what I could find about it. Indeed, I came across several sites and blogs that praised the methylene blue dye straight to the heavens, it would be a blessing for humanity. That required further research, which led to this booklet.

Funny detail, I gave the first draft to read to the person who put me on this track and who agreed that after use there was indeed an increase in blood pressure, among other things. That is measurable, of course, but that is not the case with everything. It is never always in medicine (nice contradiction) for sure what causes a change in the body:
'Is it the substance that was administered, or any substances that were added to it, a placebo or nocebo effect, or was there an unknowingly change before the drug was administered?'

Structure of the booklet
In short, much of what was claimed required further literature research with sometimes disconcerting results. Is the drug methylene blue now controversial as a therapeutic?

No, not that either, but it is certainly not a panacea either! In fact, it can do good in some situations, but it can also cause damage in other situations. So I wouldn't be able to use it myself, for example, but that aside.

I have listed a few things for you, but start with an introduction to discuss methylene blue in general and in a next chapter I will list a number of warnings for you, certainty above all....

The booklet is an e-book, which means that it contains hyperlinks to various sections within the book as well as to external sources. It is certainly not complete, but it will certainly help to get a more realistic picture about methylene blue. In the Introduction I give the different chapters and here and there subheadings. There are also a number of appendices that go into more detail about specific therapeutic goals.

Although this is certainly not a novel, I still hope you enjoy reading it

Introduction

Methylene blue, there is quite a bit of fuss about that. Because oxidative processes can shorten our lifespan, cause all kinds of generative disorders and are one of the promoters of cancerous processes, this special molecule has recently been in the spotlight, especially in the alternative medicine world.

- **Is that justified?**

In a search on this subject and because the answer concerns 'all of us', I wrote this book. It is certainly not complete, but more of a summary of what is currently known about it. I don't make any recommendations here, not even recipes and such, but it's more meant as information that you can't get so easily otherwise.

Can methylene blue indeed extend our (healthy) lifespan?
Indeed, methylene blue acts as a NO inhibitor (nitric oxide inhibitor), especially by inhibiting the so-called **guanylate cyclase** , an enzyme normally activated by nitric oxide (NO). This enzyme plays a crucial role in the production of **cyclic GMP** (cGMP), which in turn promotes vasodilation (dilation of blood vessels). By inhibiting NO, methylene blue lowers the amount of cGMP, which can reduce vasodilation and potentially increase blood pressure. This effect may be useful in certain medical conditions, such as sepsis or hypotension, where promoting blood circulation is essential.

Could this be beneficial for longevity and the prevention of cancer?
There are several aspects to consider when discussing the effects of methylene blue as a NO inhibitor in the context of longevity and cancer prevention:

- **Lifespan**:
  - *NO and service life:*
    Nitric oxide plays a role in vascular health and the maintenance of blood circulation. NO has benefits for blood pressure and blood flow, which is important for organ and tissue health, and may contribute to a longer lifespan by reducing cardiovascular disease.

  - *Methylene blue and longevity*:
    If NO is inhibited, it can affect blood circulation and vasodilation. Evidence suggests that methylene blue, due to its effects on mitochondria and oxidative stress, may play a role in improving cellular energy production and reducing oxidative damage, which could be beneficial for long-term health. However, methylene blue is not directly associated with lifespan extension, and it is not yet fully understood how the NO-inhibiting effect specifically affects lifespan.

- **Cancer prevention**:
  - *NO and cancer:*

  NO plays a dual role in cancer.
  - On the one hand, NO can promote the growth of tumors by improving blood circulation in tumors and supporting the tumor environment.
  - On the other hand, NO can also *inhibit* tumor growth by activating the immune system and exerting harmful effects on cancer cells.

  It is therefore a complex mechanism, and the role of NO in cancer depends on the circumstances.

- **Methylene blue and cancer**:

Inhibiting NO with methylene blue may potentially affect tumor growth, but this effect is not fully understood.

- On the one hand, inhibiting NO can limit tumor growth by reducing blood flow to the tumor,
- On the other hand, NO can also help with the immune response that attacks cancer cells.

Evidence suggests that methylene blue may protect against oxidative damage and inflammation, which could indirectly contribute to preventing cancer cells from developing. However, there is no solid clinical data to support the use of methylene blue as a cancer preventative.

In summary, it can be said that:

- Methylene blue is a NO inhibitor by inhibiting guanylate cyclase, which reduces cGMP production and vasodilation. This effect can be useful in certain medical situations, such as sepsis or low blood pressure.

- The effect of methylene blue on longevity and cancer prevention is not yet fully understood. There is some evidence that the action of methylene blue may improve cellular health through mitochondrial protection and reducing oxidative stress, but its effect on longevity or cancer prevention still needs to be further investigated.

Thus, the use of methylene blue in cancerous processes or in prolonging lifespan is still the subject of research, and it is important to be cautious about drawing definitive conclusions without further clinical studies and evidence.

The use of the physical substance 'methylene blue' is therefore absolutely not recommended, except under the strict medical supervision of qualified specialist doctors.

Methylene blue is also offered as a homeopathic remedy and is said to provide effective results according to empirical evidence. Digital homeopathy in particular can be of good service here, because then the exact necessary dose can be determined periodically, such as weekly, daily and even several times a day. This can be effective (if indicated) and (almost) without risks, especially when prescribed by a qualified homeopath. Using it on your own initiative is certainly not recommended!

In the hope that this book can contribute to a good understanding, I close by thanking my good colleague and friend Ina, who put me on this track.

Warning

Methylene blue is a compound with several therapeutic uses, including treating methemoglobinemia, urinary tract infections, and even as a dye in certain medical procedures. However, there are specific circumstances or physical limitations in which **methylene blue should not be used as a therapeutic agent**.

Do not use methylene blue in the following physical conditions:
Severe renal impairment (renal failure):

- Methylene blue is excreted primarily through the kidneys, and severe renal impairment (renal failure) can prevent proper excretion, which can lead to toxicity.

- If a person has severe kidney dysfunction, methylene blue can accumulate in dangerous amounts in the body, which can cause side effects such as hemolysis or serotonin syndrome.

In case of kidney failure, it is important to be careful with the use of methylene blue (MB), as the substance is mainly excreted through the kidneys. When kidney function si decreases, the

body cannot process the substance properly, which can lead to toxic accumulation and side effects.

In the context of kidney failure, methylene blue is better avoided at the following stages:

- **Stage 3** or Advanced Renal Failure (GFR < 30 mL/min/1.73m²):
  In advanced renal failure or chronic kidney disease stage 3 (where the glomerular filtration rate, GFR, is below 30 mL/min/1.73m²), the use of methylene blue may be risky. This is because kidney function is severely impaired and the kidneys are unable to excrete the substance effectively.

  Methylene blue accumulation can lead to side effects such as hemolytic anemia or other toxic effects, as the body cannot adequately dispose of the substance.

  Extra caution should be exercised when taking concomitant diuretics at this stage. Combine MB only after consulting a doctor.

- **Stage 4 and 5** (End-stage Renal Disease, ESRD):
  In end-stage renal failure (stages 4 and 5, where the GFR is < 15 mL/min/1.73m²), it is unwise to use methylene blue. At these stages of kidney failure, the kidneys virtually stop functioning, and the substance will quickly accumulate in the body, which can lead to severe toxic reactions.

  Dialysis can partially replace the function of the kidneys, but even then, the use of methylene blue should be approached with great caution, as dialysis may not be fast enough to properly remove all substances.

In short:

- Methylene blue is *not recommended* in patients with chronic renal failure in stage 3 or higher, especially if renal function is severely impaired (GFR < 30 mL/min/1.73m²).

- In stage 4 and 5 renal failure (end-stage renal disease), the use of methylene blue is usually ***too*** *risky* because of the danger of toxic accumulation.

  In cases where methylene blue is really needed, use can be done under strict medical supervision, possibly with renal replacement treatments such as dialysis.

G6PD deficiency (Glucose-6-phosphate dehydrogenase deficiency):

Methylene blue can cause hemolysis (breakdown of red blood cells) in people with G6PD deficiency. This is because the drug can induce oxidative stress, which can be dangerous for these people, leading to hemolytic anemia.
Therefore, methylene blue is contraindicated for patients with G6PD deficiency.

Risk of Serotonin Syndrome (when used with certain medications):

- Serotonin syndrome is a potentially life-threatening condition that can be caused by an excess of serotonin in the brain. Methylene blue has monoamine oxidase (MAO)-inhibiting properties, which means it can interfere with serotonin metabolism.

- When methylene blue is used in combination with other medications that affect serotonin levels, such as selective serotonin reuptake inhibitors (SSRIs), serotonin-norepinephrine reuptake inhibitors (SNRIs), or tricyclic antidepressants, it can increase the risk of serotonin syndrome.

Caution should be exercised when using methylene blue in combination with these medications, and it should not be used in people who are already experiencing serotonin syndrome or when the risk of serotonin toxicity is high.

Allergy or hypersensitivity:

- Methylene blue is an allergen for people who are sensitive to it.
  People with a known allergy or hypersensitivity to methylene blue or its constituents should avoid its use, as it can lead to allergic reactions, including rashes, respiratory problems, or even anaphylaxis.

Pregnancy and lactation:

- The safety of methylene blue during pregnancy and breastfeeding has not been well established. While some studies suggest that it may be safe in certain doses and conditions, caution is advised.

- Methylene blue can cross the placenta and pose risks to the developing fetus, especially in the first trimester.

- It can also pass into breast milk, which can affect the infant. Therefore, it should only be used in pregnant or nursing women when the benefits outweigh the risks and under the supervision of a healthcare provider.

Severe liver function limitations (liver failure):

- Like renal function impairments, severe liver dysfunction can impair metabolism and excretion of methylene blue, increasing the risk of toxicity.

- In patients with severe hepatic impairment, caution should be exercised and methylene blue should be avoided if possible.

Serious cardiovascular diseases:

- In some cases, especially when used via intravenous administration, methylene blue can cause blood pressure changes, both increases and decreases. It can worsen conditions such as severe hypertension or hypotension.

- Patients with severe cardiovascular disease, especially those with a history of high blood pressure (hypertension) or heart disease, should only use methylene blue under strict medical supervision.

Use on Newborns or Infants:

- Methylene blue is associated with hemolysis in newborns and young infants, especially in those who are premature or have underdeveloped liver function.

- Avoid use on neonasts, unless absolutely necessary.

Conclusion:

Methylene blue is a useful therapeutic agent for certain conditions, but its use is limited or contraindicated in certain populations and under specific conditions, such as severe renal impairment, G6PD deficiency, serotonin syndrome, and pregnancy. Always consult a healthcare professional before using methylene blue, especially in individuals with the conditions listed above.

Here are some additional points of attention for methylene blue regarding conditions such as hormonal disruptions, cancer treatments, skin conditions or liver ailments:

Hormonal disruptions:

- There are no direct indications that methylene blue affects hormonal balance. However, due to the MAOI inhibiting properties of methylene blue, it can indirectly affect serotonin levels, which can affect neurotransmitter systems in the brain. This is especially important when taking concomitant serotonin-promoting medications, but there is no direct link between MB and hormonal disruptions as there is with some medications or treatments for hormonal disorders.

Cancer treatment:

- Cancer treatments (such as chemotherapy or radiation) can weaken overall health and affect the immune system. Methylene blue is often used as an antiseptic or to treat methemoglobinemia, but there is no specific evidence to suggest that methylene blue is directly harmful to cancer patients.

- Caution should be exercised, especially when there are serious liver or kidney problems due to the cancer treatment itself. For example, chemotherapy can put a strain on liver and kidney function, and methylene blue can pose additional risks in these patients, such as accumulation in the body.

- Interaction with medications that cancer patients commonly use, such as serotonin-like drugs or immunosuppressants, can increase the risk of side effects.

Skin conditions:

- Methylene blue is often used topically (through the skin) for certain skin conditions or as a dye in medical applications. However, there is a risk of allergic reactions in people with a hypersensitivity to methylene blue. The use of methylene blue for skin conditions should be done with caution, especially in people who are sensitive to dyes.

- There is no strong evidence that methylene blue causes direct damage to the skin, but it can trigger skin irritation or allergies in people who are sensitive to it.

Liver ailments:

- As mentioned above, methylene blue can be harmful to people with severe liver problems. The liver plays a key role in the metabolism and excretion of many substances, including methylene blue. In people with severe hepatic impairment, the use of methylene blue may increase the burden on the liver and may increase the risk of toxic side effects.

- Liver conditions, such as cirrhosis or hepatitis, can slow down the breakdown of methylene blue, which can lead to a toxic buildup in the body. In liver diseases, methylene blue should only be used under strict medical supervision.

In short:

There are no specific warnings for hormonal conditions or for use during cancer treatments, but methylene blue may have interactions with other medications commonly used in these conditions. Its use should always be carefully considered, especially in case of liver or kidney problems, and under medical supervision. In skin conditions, methylene blue can be irritating or allergenic, especially in hypersensitive individuals.

Homeopathic Uses of Methylene Blue

A homeopathic dilution and potentised in an LM application may, if indicated, be safe to use. Nevertheless, one will have to continue to monitor oneself or the client closely and take a step back if the condition worsens or additional symptoms. Caution before anything.....

An LM dilution can be made by, for example, 1 drop of MB 1% solution to 100 cl of water with 10% alcohol. Add the water in a few phases and shake (potentize) vigorously 15 times each time. If you are in possession of an Asyra PRO / Qest4 or similar bioresonance device, methylene blue can be used to imprint on LM via this device and potentiate 20 x.

Disclaimer

The information in this book is for general information purposes only and is not intended as medical advice.

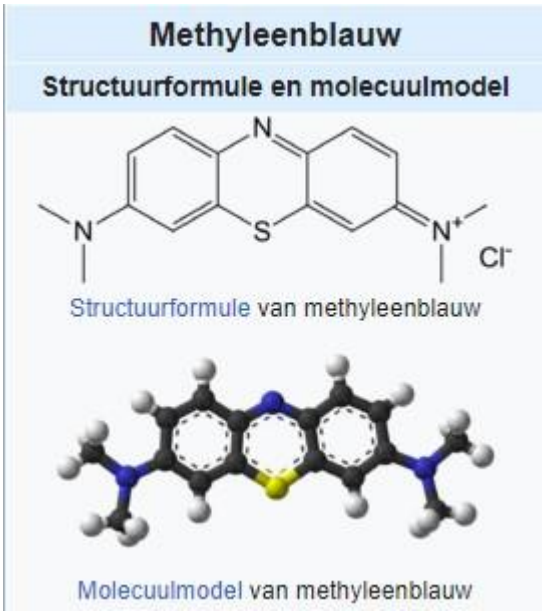
While the author has made an effort to provide accurate and up-to-date information, it is important to understand that medical knowledge is constantly evolving, and the information in this book may not be complete or current.

Always consult a qualified physician or other healthcare professional with any questions about your health or before attempting any new treatment method or therapy. Never rely solely on the information in this book as the basis for medical decisions, and never disregard professional medical advice or delay in medical treatment based on anything you have read in this book.

The author shall not be liable for any harm or damage resulting from the use or application of the information contained in this book.

Methylene blue = Methylthionine

Methylene blue is a fairly large molecule and a versatile substance with various applications, both within regular and homeopathic medicine.



By Benjah-bmm27 - Own work, Public domain,

Methylene blue is a chemical substance that is also called methylthionine in the medical world. The substance has the formula C16H18ClN3S and is also known as mehthyl(ene)thioninium cloride. Methylene blue is widely used in microbiology. This is because methylene blue stains a dead cell, but not a living one. It is also applied therapeutically, often with great promises often made by non-scientists, such as in the article by Daan de Wit.

As is often the case, bold claims are made in blogs, posts on Facebook, but also websites, who checks that and then what? This creates all kinds of theories that contain (partial) truths, but are essentially incorrect.

In the above website, two things related to Corona are mentioned as an example. Methylene blue is said to have been at the basis of the so-called 'corona fighter' HCQ, hydroxychloroquine. In one sentence, two inaccuracies are linked here, creating a third inaccuracy: methylene blue, like HCQ, could fight the corona virus and be effective in protecting against corona. But what are the facts? To show how triggy it can sometimes be to mix up facts, a short discussion of this.

Methylene Blue and Hydroxychloroquine:
Methylene blue and hydroxychloroquine (HCQ) are chemically completely different. Still, there are some similarities in their mechanism of action, which could go some way to explaining why methylene blue is sometimes mentioned in connection with HCQ.

- Methylene blue has antiviral and antimicrobial properties and has been suggested in previous studies as a potential candidate for treating viral infections, including those from coronaviruses.
  It works in a variety of ways, including:
  - the inhibition of viral replication and
  - reducing oxidative stress in cells.

- Hydroxychloroquine, a modified version of chloroquine, is a drug that was originally used to treat malaria and autoimmune diseases such as lupus and rheumatoid arthritis. It gained worldwide attention as a potential treatment for COVID-19 in the early phases of the pandemic, as it could inhibit viral replication by intervening in the cellular processes that use the virus to multiply, such as:
  - acidifying (acidifying) endosomes in the chromosome and
  - inhibiting the release of viral particles into the cell.

Was HCQ indeed such a good corona fighter?
The effectiveness of hydroxychloroquine (HCQ) against COVID-19 has become a contentious topic, especially given the initial enthusiasm about the use of HCQ. What were the reasons for wanting to use HCQ as a remedy for corona?

1. **Necessity:** In the early stages of the pandemic, there was a great need for effective treatments, and HCQ seemed like a promising candidate. Why:
2. **Small studies:** A few small studies suggested a positive effect, but these studies often had methodological shortcomings. Later it turned out to be virtually ineffective in practice.

Further (later) research showed that the conclusions drawn in the initial phase were unfortunately based on incorrect information and misinterpretations. They had nothing else, so this was the famous straw that was grabbed with both hands....

- **Original expectations**:
  - In the early stages of the COVID-19 pandemic, hydroxychloroquine was investigated for its anti-viral properties demonstrated in vitro (in laboratory conditions). It was believed to reduce the viral load and limit the severity of the infection.

  - Indeed, certain studies suggested some efficacy against the coronavirus (SARS-CoV-2), leading to the use of HCQ in clinical settings, particularly in the initial phase of the pandemic.

- **Later studies and findings**:
  - However, large randomized controlled trials and clinical trials conducted later showed that hydroxychloroquine in real-life applications was *neither* effective in preventing nor treating COVID-19. In many cases, it was even associated with side effects such as heart problems (such as QT interval prolongation) and kidney damage with long-term use.
  - The WHO Solidarity trial and other large studies indicated that hydroxychloroquine did *not* offer significant benefits for reducing mortality or speeding recovery in COVID-19 patients.

- **Conclusion on HCQ as a corona fighter**:
  - Given the conflicting findings of clinical trials and the absence of evidence for substantial benefits, hydroxychloroquine has not been shown to be effective as a treatment for COVID-19 and is now no longer recommended by the World Health Organization (WHO), the U.S. FDA, or other health authorities for the treatment of COVID-19.
  - Although it may have had *some* influence in some cases in the early stages of a corona infection (immediately after an infection), it was eventually overtaken by other, more effective treatments, such as remdesivir, monoclonal antibodies, but especially vaccines.

Methylene blue and HCQ compared in this context:

- *Hydroxychloroquine* is not derived from methylene blue or vice versa. Although both substances have antimal properties and can be considered similar in that context, the chemical structures and lineage of both substances are different.
  - *Hydroxychloroquine* is a derivative of chloroquine, which in turn is derived from quinine, or quinine (from the bark of the cinchona tree).
  - *Methylene blue*, on the other hand, as a dye, has a completely different chemical structure and a completely different mechanism of action.

Summary:

- Methylene blue was not the direct basis for the development of hydroxychloroquine.
- Hydroxychloroquine ultimately proved **ineffective** for treating COVID-19 based on clinical evidence from later large studies, despite initial interest.
  It was also eventually no longer recommended by health authorities for COVID-19 treatment.

What else can be said about this website?

There are still a number of inaccuracies and misleading claims in this article about methylene blue.

Is there a scientific basis for the benefits of methylene blue?
Yes, the article https://pmc.ncbi.nlm.nih.gov/articles/PMC3087269/, published in 2010 on PubMed Central (PMC) titled "Methylene Blue as an Antioxidant: The Effects on Mitochondria and Metabolism" (PMC3087269), provides good scientific support for some of the claims about methylene blue, especially in the context of its role as an antioxidant and its impact on mitochondria and metabolism. But mind you, this is a dated article, in the meantime more research will certainly have been done and more scientific facts will have come to light.
This article 2021 does indeed show some progress, but unfortunately only in the laboratory and therefore mainly on paper and based on previous, dated studies: https://pmc.ncbi.nlm.nih.gov/articles/PMC8699482/

Methylene Blue as an antioxidant:
The scientific article discusses methylene blue as an antioxidant that protects mitochondria from oxidative stress, which is in line with the claims made in the article you shared. Oxidative stress is an important mechanism in aging and many neurodegenerative diseases, such as Alzheimer's, and methylene blue has been shown to reduce the production of reactive oxygen species (ROS). This is also a point that is scientifically well substantiated in the PMC article. The article explains that methylene blue helps protect mitochondria from the damage caused by excess free radicals.

Improvement of mitochondrial function:
Another important claim that the PMC article supports is the influence of methylene blue on mitochondria. The mitochondria are the power plants of the cell, and the theory presented in the scientific paper is that methylene blue can contribute to the improvement of the functioning of these cells, in particular by promoting the electron transport chain in the mitochondria. This leads to improved energy production, which could have the potential to affect various health problems.

Neuroprotective effects:
The article also supports the claim that methylene blue has neuroprotective effects. It is stated that methylene blue is able to protect the brain from damage caused by oxidative stress, which also contributes to the protection against neurodegenerative disorders such as Alzheimer's and Parkinson's. This fits with the paper's claim that methylene blue can help treat neurological disorders.

Scientific quality:
The difference between the scientific article and the broader claims you encounter in the first article has mainly to do with the degree of evidence and the type of studies that are presented. The PMC article discusses methylene blue in a more controlled and scientific context, focusing mainly on in vitro (laboratory) and animal models. The results of these studies are promising, but the translation to clinical applications in humans is a complex process and requires further research.

Daan de Wit's article presents claims that are much broader and often more speculative in nature, such as the idea that methylene blue can help cure cancer or influence age processes. Many of these claims are not always supported by solid clinical studies, and the use of methylene blue as a kind of "miracle cure" is often approached with more caution in scientific circles.

Clinical evidence and safety:
While the PMC article shows positive results in laboratory studies and animal studies, it is important to emphasize that much more clinical evidence is still needed to confirm the effectiveness of methylene blue for human health in various applications. In Daan de Wit's article, methylene blue is often presented as a panacea, but the scientific community is usually cautious about drawing too far-reaching conclusions without robust clinical studies and well-controlled experiments.

Conclusion:
Thus, the PubMed article provides scientific support for a number of benefits of methylene blue. However, it is important to emphasize that many of the claims about methylene blue, such as its use as a miracle cure for a wide range of conditions, go far beyond the current scientific consensus. Further research is simply needed to confirm its effectiveness and safety in humans. In science, caution is advised when extrapolating promising results from laboratory studies to broader medical applications and unfortunately this takes time, often a lot of time.....

Proven and more or less proven facts about methylene blue:

- Methylene blue inhibits guanylate cyclase, leading to reduced cGMP production.
- Methylene blue helps with hypoxia and hyperdynamic circulation in conditions such as liver cirrhosis and hepatopulmonary syndrome by inhibiting nitric oxide synthase (NOS).
- Methylene blue improves blood pressure and heart function in septic shock by inhibiting nitric oxide production.
- Treatment of methemoglobinemia:

- Antimicrobial and antioxidant action:
- Neurodegenerative disorders such as Alzheimer's and Parkinson's:
- Improving cognitive functions:
- Treatment of cyanide poisoning:
- Migraine and neurovascular disorders:
- Photodynamic therapy for cancer:
- Treatment of depression by affecting serotonin systems:
- Sepsis and Septic Shock:

Methylene blue as a general application:

- **Medical dye:**

Methylene blue has long been used as a dye in medical procedures, such as staining tissues during surgery or identifying bacteria in a lab.

- **Treatments with Methemoglobinemia**:
  One of the established medical uses of methylene blue is in the treatment of methemoglobinemia. This is a condition in which hemoglobin has oxidized and can therefore no longer transport oxygen effectively. Methylene-blue helps to reduce methemoglobin back to its normal state (the oxygen atom is removed, as it were, so that the oxidation is eliminated).

  In rare cases, too high a dose of methylene blue can itself cause methemoglobinemia, although this is also treated with methylene blue itself.

- **Antidote** (antidote):
  One of its most well-known uses is as an antidote to certain types of poisoning, such as methemoglobinemia. In this process, part of the hemoglobin in the blood is converted into a form that can carry less oxygen. Methylene blue can help reverse this process.

- **Experimental applications:**
  A lot of research is being done on the potential applications of methylene blue in various conditions. Some examples are:
  - *Neurological disorders*: There is some evidence that methylene blue may be protective against damage to nerve cells and therefore potentially useful for conditions such as Alzheimer's and Parkinson's.
  - *Inflammatory diseases*: Methylene blue has anti-inflammatory properties and is therefore being studied for the treatment of various inflammatory diseases, including low back pain. ○ *Sepsis*: In sepsis, a serious infection that can lead to organ failure, methylene blue is being studied for its potential to improve blood circulation and limit damage to organs.

- **As an antimicrobial application:**
  - *Bacterial infections*: Methylene blue has antimicrobial properties and is sometimes studied for the treatment of bacterial infections, but it is not as common as traditional antibiotics.

  - *Viral infections*: There is also some evidence that methylene blue has antiviral properties, but its use in clinical practice for viral infections is limited. It has been studied for its antiviral properties, particularly against certain viruses such as HIV and hepatitis C. It works through a mechanism called photoactivation (when exposed to light), producing reactive oxygen species (ROS) that can damage viral particles.

Note: This photo-activated methylene blue has been used in laboratory settings for viral inactivation, but its practical application for viral infections in humans is not yet well proven.

- *Parasitic and fungal infections*: Methylene blue is being investigated for parasitic infections, and there is also use in fungal infections, but its effectiveness in these cases is still largely experimental.
  It is believed to work by disrupting the cellular processes of pathogens, such as inhibiting growth or disrupting their metabolism. However, its effectiveness in treating specific bacterial or fungal infections is still the subject of research. It is not usually used as a first-choice treatment for infections.

- **Urinary tract infections (UTIs):**
  - Methylene blue is sometimes used for UTIs to treat bacterial infections in the urinary tract because it has mild antimicrobial effects.

- **Malaria**:
  - Methylene blue has been studied as a potential treatment for malaria, especially in areas where more common antimalarial measures may be less effective. It has shown some activity against the malaria parasite in certain laboratory studies.

Methylene blue in conjunction with infrared light

Methylene blue also has a photochemical effect and for that reason it is often used therapeutically in combination with infrared light. In this way, it could promote the therapeutic effects. There are several reasons why this combination can be effective:

Photodynamic operation
Methylene blue has photochemical properties, which means it can react to light. When methylene blue is exposed to infrared light, it can be activated and initiate a process that produces reactive oxygen species (ROS). These ROS can damage harmful bacteria or other unwanted cells, which can be helpful in treating infections, inflammation, or even for improving blood flow and tissue repair.

Improved absorption of methylene blue
Infrared light can improve the absorption of methylene blue into the cells and tissues. This is because infrared light penetrates deep into the skin and underlying tissues, making it easier for methylene blue to achieve its therapeutic effects.

Cell dynamics and energy production
Infrared light can affect the mitochondria in cells, which are responsible for energy production. This type of light can stimulate the mitochondria, causing the cells to produce more energy. When combined with methylene blue, this stimulation can increase the effectiveness of the

treatment by improving the ability of cells to respond to the photochemical effects of methylene blue.

Anti-inflammatory effect
Both treatments, methylene blue and infrared light, have anti-inflammatory properties. Infrared light stimulates circulation and reduces inflammation, while methylene blue can help reduce cellular damage and inflammation. Together, they can therefore help treat inflammation-related conditions, such as mastocytosis.

Application in phototherapy
Infrared light is widely used in medicine for various phototherapeutic applications, such as pain relief and tissue repair. When methylene blue is combined with infrared light, the combined effects can aid repair, repair damage to cells, and even help fight certain infections or diseases.

In short, the synergy between methylene blue and infrared light enhances the effectiveness of the treatment by promoting photochemical reactions, enhancing cellular energy production, and stimulating the healing of damaged tissue. This makes the combination attractive for treating various conditions, including those related to inflammation and the body's defenses against pathogens.

Homeopathic Uses

Methylene blue is also used in homeopathy, in digital homeopathy the exact necessary dose can be determined periodically and even daily and can penetrate deep into the body cells by means of various techniques.

According to William Boericke MD, Materia Medicum:

According to the homeopathic literature in the *Materia Medica*, methylene blue (also referred to as **"Blue"** in some cases) is used for a variety of conditions, including:

Disorders:

- Neuralgia and neurasthenia (nerve-related disorders)
- Malaria
- Typhoid fever (in which it can relieve symptoms such as tympanitis, delirium, and fever)
- Infections with pus
- Gonorrhoidal rheumatism and cystitis (bladder infection)
- Back pain and sciatica
- Later stages of stroke (according to homeopath Gisevius)

Symptoms:

- Trouble, chorea (involuntary movements) and epilepsy
- Nephritis (acute kidney inflammation), and scarlatina nephritis (kidney inflammation after scarlet fever)

Dilutions:

- At lower dilutions (such as up to D3 or 1% solution), methylene blue can give a greenish color to the urine, which is known as a characteristic effect of the substance.
- It is also mentioned that the use of lower dilutions can lead to bladder irritation, which according to the literature can be antidoted with nutmeg.

Topical applications:

- 2% solution can be used locally for chronic otitis (ear infection) with a bad-smelling discharge (do not do that yourself, this is possibly for a doctor).
- 1% aqueous solution is often applied to ulcers and abscesses of the cornea (do not do this yourself, this is possibly for a doctor).

Dosage:

- The dosage indicated in homeopathy for a D3 dilution is 2 to 3 times a day.

Please note:

The instructions for use in homeopathy always depend on the specific complaints, the potency of the remedy and the experience of the treating physician. It is important to note that the above uses and dosages relate specifically to homeopathic dilutions, and not to the usual pharmacological uses of methylene blue (as in a 1% and 2% solution).

In homeopathy, methylene blue is also used to treat a wide range of complaints, including:

- **Fatigue:**
  Methylene blue is sometimes used to reduce fatigue and increase energy.

- **Infections:**
  It is also used for infections, especially when there are bacterial or fungal infections. The homeopathic version of methylene blue could be used for symptoms related to infections, such as inflammation or fever.

- **Skin problems:**
  Some homeopaths use methylene blue to treat skin problems such as eczema.

- **Uti**
  There are cases where methylene blue is used homeopathically for urinary tract infections or problems with urine output, to affect the urinary tract and support recovery from infections in this area.

- **Improving Circulation**

In homeopathy, methylene blue can be used to promote the circulation and oxygenation of tissues.

- **Diabetes**
  Enhance mitochondrial functions, improve insulin sensitivity, and because of its antioxidant properties.

- **Treatment of Mental or Emotional Complaints**
  In homeopathy, methylene blue can also be proposed for mental or emotional disorders. This could range from anxiety and depression to specific cognitive problems. The remedy would be chosen based on the patient's symptoms and energetic state, as is common in homeopathy.

- **Inflammation and swelling**
  Methylene blue can also be used in homeopathy to treat inflammation, such as joint pain or muscle inflammation. Its use could be aimed at relieving pain and promoting healing by reducing the inflammatory response.

- **Detoxification and detoxification**
  Methylene blue can help detoxify the body, especially in removing toxins or toxins. This would be related to the antiviral and antibacterial properties of methylene blue.

Regular applications are therefore:

- Methemoglobinemia
- Sepsis
- Low vascular resistance
- Severe neurotoxicity due to ifosfamide.

The various applications will be discussed in detail below.

How does methylene blue work on a cellular level?

Methylene blue is a complex molecule with various mechanisms of action at the cellular level. Some of the most important are:

- *Redox properties*:
  Methylene blue can change between different oxidation states. This property makes it an effective electron acceptor, which is important for processes such as the electron transport chain in the mitochondria.

- *Antioxidant:*

In some situations, methylene blue can act as an antioxidant, neutralizing harmful free radicals.

- *Inhibition of certain enzymes*:
  Methylene blue can inhibit the activity of certain enzymes, such as tyrosine kinase. This may be important in the treatment of cancerous processes

- *Cell membrane change:*
  Methylene blue can affect the properties of the cell membrane, which can affect processes such as cell division and cell death, also important in cancerous processes.

Methylene blue consequently works in a variety of ways, including:

- *Oxidizer:*
  It can act as an oxidizing agent, affecting the metabolic processes of bacteria, fungi, and viruses.

- *Antioxidant:*
  In some contexts, it can also function as an antioxidant, protecting cells from oxidative damage.

- *Photodynamic Therapy:*
  When exposed to light, methylene blue can generate reactive oxygen species that could damage microbes. See also under the heading Methylene blue in collaboration with infrared light

In short, the exact action of methylene blue depends on the specific cellular context and the concentration of the molecule in a solution. Often the effect has only been established in a laboratory and has not yet been clinically proven, which is noted!

What clinical studies are currently underway regarding methylene blue?

There are currently numerous clinical studies underway worldwide investigating the efficacy and safety of methylene blue in various conditions. These studies focus on, among other things:

- *Neurological disorders:* Alzheimer's, Parkinson's, stroke

- *Cancer:*
  Various types of cancer, including skin cancer, blood cancer, and brain tumors

- *Heart disease:* Heart failure, ischemia

- *Infectious diseases:* Sepsis, urinary tract infections

- *Mitochondrial disorders*
  To find the latest information on specific trials, you can search clinical trial databases such as ClinicalTrials.gov.

Neurological disorders

- Alzheimer's and Parkinson's:
  As mentioned earlier, methylene blue is being investigated for its potential neuro-protective properties. There are studies that suggest that it can reduce the formation of certain proteins associated with these diseases.

- Brain damage:
  Methylene blue is also being studied for the treatment of brain damage after stroke or trauma. It could help improve blood flow to the brain and limit the damage.

Cancer (see also in the appendices) • *Photodynamic therapy:*

Methylene blue is used in a form of cancer therapy called photodynamic therapy. This involves inserting methylene blue into tumor cells and then activating it with laser light. This leads to the production of reactive oxygen species that destroy the tumor cells.

- *Other applications:*
- Research is also being conducted into the potential role of methylene blue in other types of cancer, such as leukemia and melanoma.

Heart disease (see also in the appendices)

- *Ischemia:*
  - Methylene blue may help to improve blood flow to the heart in patients with ischemia, a condition in which the heart does not receive enough oxygen.

- *Heart failure:*
  - There are indications that methylene blue can improve heart function in patients with heart failure.

Other applications

- *Infections:*

In addition to sepsis, methylene blue is also being studied for the treatment of other infections, such as urinary tract infections.

- *Mitochondrial disorders:*
  Methylene blue can improve the function of the mitochondria, the power plants of the cell. This makes it a potentially interesting substance for the treatment of mitochondrial disorders.

Potential Risks and Benefits of Methylene Blue *Benefits:*

- *Wide range of potential applications:*
  Methylene blue is being studied for the treatment of a wide variety of conditions.

- *Relatively cheap and easy to produce:*
  Compared to many other experimental drugs, methylene blue is relatively cheap and easy to produce.

- *Safety profile:*
  While side effects may occur, methylene blue is generally considered safe at the right dosage.

Risks:

- *Side effects*:
  Possible side effects include nausea, vomiting, headache, dizziness, increased blood pressure, and changes in heart rate.

- *Interactions with other medications*:
  Beware! Methylene blue can affect the effect of other medications.

- *Unknown long-term effects*:
  Insufficient research has yet been done on the long-term effects of methylene blue.

- *Not suitable for all patients*:
  Methylene blue is not suitable for everyone, for example people with certain medical conditions or who are taking certain medications.

Potential negative side effects and toxicity

Methylene blue can have side effects, especially when used improperly or in high doses. Some known side effects include:

- *Allergic reactions:*
  Rashes, itching or swelling may occur.

- *Gastrointestinal complaints:*
  Nausea, vomiting or abdominal pain.

- *Serotonin syndrome:*
  Methylene blue can interact with certain medications that affect serotonin levels (such as selective serotonin reuptake inhibitors, SSRIs, and antidepressants such as MAOIs), which can lead to serotonin syndrome, a life-threatening condition.

- *Methemoglobinemia:*
  In rare cases, too high a dose of methylene blue can itself cause methemoglobinemia (a condition in which the blood cannot carry oxygen properly), although this is also treated with methylene blue itself.

- *Color change of Urine:*
  Methylene blue can turn the urine blue, which is harmless but can be distressing.

- *Disruption of blood pressure:*
  In some cases, methylene blue can affect blood pressure, especially in people with low blood pressure or underlying heart problems.

- *Toxicity at high doses:*
  At high doses or improper use, methylene blue can be toxic, limiting the safety of the application as a treatment option.

What does science say about this?
While there are promising research findings on the regular applications of methylene blue, it is important to note that much of this research is still in an experimental stage. More research is needed to assess the efficacy and

Methylene blue is a chemical compound that has various medical and scientific uses. Interest in the use of methylene blue in viral, fungal and bacterial infections has increased in recent years. Below is an overview of the (often experimental) applications.

Methylene blue is being studied experimentally in low back pain, controlled nerve blocks, and sepsis.

- *Low back pain and nerve blocks*
  Methylene blue is being studied in connection with low back pain, especially in pain caused by nerve compression (such as herniated discs or intervertebral discs). In some

cases, methylene blue is used experimentally to block nerve tissue or to temporarily numb nerves.

- *Nerve blocks:*
  In animal studies, methylene blue has been used as part of injected therapies to block nerves locally. The thought is that methylene blue could potentially affect nerve conduction by interfering with the functioning of certain enzymes involved in pain signal transduction. It could help relieve pain caused by overactivity of nerves in the spine or by the "acting on the nerve" effect in the intervertebral discs.

- *Effect on pain:*
  There is some evidence that methylene blue may have analgesic effects in nerve-related pain, but this research is still in experimental stages and is not generally recognized or approved for routine use in low back pain. The methods are promising, but the use of methylene blue for this purpose still needs to be further investigated.

Sepsis

Methylene blue is used experimentally in the treatment of sepsis, a life-threatening infection associated with inflammation throughout the body. Sepsis can lead to organ failure and is often caused by bacterial infections, but can also be caused by viruses or fungi.

- *Effects on Sepsis:*
  Methylene blue could potentially help treat sepsis due to its ability to reduce the production of reactive oxygen species (ROS) and oxidative stress, which can help regulate the inflammatory response in the body. This could, in theory, help reduce the systemic inflammation typical of sepsis. There is also evidence that methylene blue can modulate nitrite synthase activity, which could help stabilize blood pressure in septic shock.

- *Bacterial and anti-inflammatory effects:*
  Methylene blue has antimicrobial properties, so it could theoretically help fight infections that contribute to sepsis. In addition, it can improve circulation by dilating blood vessels, which can also be beneficial in septic shock, where blood pressure is extremely low.

- *Research:*
  The studies on methylene blue for sepsis are in its early stages, and while some preclinical studies and clinical trials suggest that it may offer benefits, it is not yet a mainstream treatment for sepsis. Doctors currently use standard treatments, such as antibiotics, supportive care and vasopressors, while methylene blue could potentially

be an additional treatment in the future if further studies continue to yield positive results.

Other Uses of Methylene Blue

In addition to the above-mentioned uses, methylene blue is also being investigated experimentally for other conditions, such as:

- *Diseases of the nervous system*:
  The role of methylene blue in diseases such as Alzheimer's and Parkinson's is being looked at, as it may help improve mitochondrial function and reduce oxidative stress in brain cells.

- *Healing of Wounds:*
  Because it can promote blood flow, methylene blue is sometimes examined for the treatment of wounds and skin infections.

While methylene blue offers some promising therapeutic benefits, side effects can occur, especially when used in large quantities or without medical supervision, see above.

Summary

Methylene blue is used experimentally for applications such as low back pain, controlled nerve blocks, and sepsis. The results of the studies are promising, but the use of methylene blue for these conditions has not yet been widely accepted or approved for general use. More clinical research is needed to fully establish the effectiveness and safety of methylene blue for these applications. If you're considering using methylene blue for any of these purposes, it's important to discuss this with a doctor or specialist to properly assess the potential benefits and risks.

What are the biggest challenges?

Despite the promising results of some studies, many questions remain unanswered. Some of the biggest challenges include:

- *Side effects:*
  Methylene blue can cause side effects, such as nausea, vomiting, and headaches. It is important to find the right dosage to maximize efficacy and minimize side effects.

- *Tissue penetration:*
  To be effective, methylene blue must reach the target cells in sufficient concentrations. This can be challenging, especially when treating tumors or organs that are difficult to reach.

- *Interactions with other medications:*
  Methylene blue can interact with other medications a patient is taking. This can affect the efficacy of both methylene blue and the other medications.

- *Photodynamics*
  Light therapy works obviously, that is: in a laboratory, but in the body, in body tissue, it is a completely different story.

Attachments

The theoretical concern about MB

There is some theoretical concern about the possible influence of methylene blue on receptors and cellular mechanisms, such as those of hormones, neurotransmitters, enzymes, and even nerve synapses. This is because methylene blue affects a number of biochemical and physiological processes, and although this is often investigated in the context of photodynamic therapy or antioxidant activity, the effects on receptors and enzymes can be broader.

Some potential concerns regarding these systems are discussed below. The concern about the influence of methylene blue on the receptors, such as the estrogen receptors, for example, stems from the way methylene blue can interact with cellular signaling pathways and biochemical processes, although this is not yet a well-documented problem in the scientific literature. The possible concerns that theoretically exist are based on the properties of methylene blue and its influence on cellular processes:

Interaction with cell respiration and mitochondria
Methylene blue acts as an electron acceptor in cell respiration, which means that it affects the mitochondria. Mitochondria are not only the power plants of the cell, but also play a role in the regulation of various cellular signaling pathways, including those involved in cell growth, differentiation, and survival. Because hormone receptors (such as estrogen receptors) are also involved in these processes, methylene blue could potentially affect the way cells respond to hormonal signals. This could lead, for example, to changes in cell growth or differentiation, especially in cells that exhibit hormonal sensitivity.

Oxidative stress and receptor dynamics
Methylene blue can lead to the production of reactive oxygen species (ROS) when exposed to light (such as in photodynamic therapy), or when it interacts with other cellular components. Oxidative stress can have an impact on the functioning of receptors, including those for estrogen, by damaging the structure and function of proteins (such as receptors). This could theoretically lead to changes in the way hormonal signals are received or processed by the cells.

Effect on gene expression and cell cycle
There is evidence that methylene blue can affect gene expression, leading to changes in the production of proteins involved in the cell cycle and cell growth. Since estrogen and other hormones are heavily involved in regulating the cell cycle (e.g., promoting cell growth), methylene blue, through its influence on gene expression, could indirectly affect the way cells respond to hormonal signals. This could potentially affect processes such as cell division, which is important for understanding the effect of methylene blue in hormone-sensitive tumors or tissues.

Hormonal sensitivity and tumor growth
In the case of certain hormonal susceptibility cancers, such as breast cancer (which often has estrogen receptors on the tumor cells), methylene blue could affect the effectiveness of hormone therapy through its interaction with the receptors involved in the growth of these tumors. However, this is a theoretical scenario, and there is little direct evidence that methylene blue actually affects hormone-sensitive tumors through receptors such as the estrogen receptor.

Hormonal balance and antioxidants
There is some concern about how antioxidants like methylene blue can disrupt hormonal balance. Antioxidants can modulate the effects of some hormones by neutralizing the reactive oxygen species that are often necessary for the functioning of certain hormonal signals. This could, in theory, change the way hormones function, but again there is little evidence that methylene blue directly affects hormone receptors in this sense.

Neurotransmitter receptors
Methylene blue has neurochemical properties and can influence the activity of various neurotransmitter systems. There are some indications that methylene blue can affect the functioning of certain neurotransmitters, such as:

- *Serotonin:*
  Methylene blue has the potential to affect the functioning of the serotonin system, possibly by interfering with the serotonin receptors and the breakdown of serotonin. For example, there is a certain effect of methylene blue as a serotonin inhibitor in higher concentrations. This may have an implication for people taking serotonergic medications, such as antidepressants (for example, SSRIs), as methylene blue can potentially increase the risk of serotonin syndrome.

- *Dopamine:*
  There is evidence that methylene blue also acts on the dopamine system, especially by influencing the breakdown of dopamine. This can potentially affect the dopamine receptors and the functioning of dopamine in the brain, which is important for motivation, movement and mood. However, this effect is relatively researched, and methylene blue is usually not considered the primary therapy for disorders of the dopamine system.
- *Other neurotransmitters:*
  There is some concern that methylene blue may also affect other receptors involved in glutamate, GABA, and acetylcholine, although evidence for this is scarce. Given the impact methylene blue can have on cellular signaling and oxidative stress, it can indirectly affect the regulation of neurotransmitters in the brain.

Enzymes
Methylene blue has enzymatic interactions, mainly due to its role as a reducing agent and antioxidant. It can affect the activity of various enzymes, for example:

- *Monoamine oxidases (MAOs):*
  Methylene blue is an inhibitor of monoamine oxidase (MAO), an enzyme involved in the breakdown of neurotransmitters such as serotonin, dopamine, and norepinephrine. This effect can enhance the action of these neurotransmitters, but it can also affect the interaction of methylene blue with other drugs that affect the MAO system (such as MAOIs), which increases the risk of side effects such as hypertensive crises.

- *Cytokines and inflammatory enzymes:*
  Evidence suggests that methylene blue may affect the activity of pro-inflammatory enzymes such as cyclooxygenase (COX) and lipoxygenase (LOX), which are involved in inflammatory responses. This can modulate the immune response and potentially affect the action of enzymes involved in various physiological and pathological processes.

Nerve synapses
Methylene blue also affects synaptic activity and communication between nerve cells. It can act on the action of neurotransmitters and synaptic vesicles that release these substances into the synapse, which can affect synaptic transmission.

- *Synaptic vesicle release:*
  Methylene blue can affect the release of neurotransmitters from synaptic vesicles, possibly by inhibiting the ATP-dependent processes necessary for the release of neurotransmitters in the synapse. This could lead to changes in the way signals are transmitted between nerve cells.

- *Neurotoxicity and cell communication:*
  At higher concentrations, methylene blue can be neurotoxic, which can affect synaptic communication. This can lead to disruptions in the normal functioning of the nervous system, especially if it is combined with other drugs that affect neurochemical pathways.

Oxidative stress and synaptic plasticity
Methylene blue can contribute to oxidative stress, which may affect synaptic plasticity, the ability of nerve cells to adapt to new signals. This plasticity is essential for memory and learning. By increasing reactive oxygen species (ROS), methylene blue can affect the function of synapses in both a positive and negative direction, depending on the context and concentration.

Important side note:
Thus, while there is theoretical concern about the interaction between methylene blue and hormone receptors and synapses, there is currently little direct scientific evidence that these interactions are harmful or significant. The concern is mainly based on the broader mechanisms of methylene blue in cellular processes (such as oxidative stress and influence on

the mitochondria) that could indirectly affect the functioning of receptors or hormonal signals. It is for the sake of completeness that I also mention these concerns here.

Methylene Blue and COVID-19: A Much-Discussed Combination

The link between methylene blue and COVID-19 has been widely debated since the beginning of the pandemic.

Why methylene blue?

The interest in methylene blue in relation to COVID-19 is mainly based on the following properties of this substance:

- Antioxidant effect:
  Methylene blue can help to neutralize harmful free radicals, which can play a role in the damage that the coronavirus causes in the body.

- Anti-inflammatory properties:
  It can reduce inflammation, which is important in severe cases of COVID19.
- Improving oxygen supply:
  Methylene blue can improve oxygen delivery to the tissues, which is especially important in patients with severe lung problems due to COVID-19.

What do the studies say?

Several studies have been conducted on the potential benefits of methylene blue in COVID-19. Some studies suggest that methylene blue may reduce the severity of the disease and shorten recovery time. However, other studies have not shown any clear benefits.
It is important to note that much of this research is still in its early stages, and more large-scale, well-controlled studies are needed to draw definitive conclusions.

Important notes

- *No approved treatment:*
  Methylene blue is not an approved treatment for COVID-19. Its use outside of a clinical trial is outside of established medical guidelines.

- *Side effects:*
  As with any medication, side effects can occur when using methylene blue.

- *Individual differences:*
  The effectiveness of methylene blue can vary from person to person.

Sepsis and vitamin C and methylene blue

A recent and still experimental medical use of methylene blue is the treatment of severe blood pressure drop in sepsis. This drop in blood pressure is caused by disruption of the nitric oxide balance in the smooth muscle cells and endothelial cells of the vascular wall, where nitric oxide (NO) is responsible for relaxation of the vascular wall. This relaxation leads to a drop in blood pressure. The disruption of the nitric oxide balance is caused by various stress enzymes.

The action of methylene blue is based on antagonistic action on nitric oxide receptors, inhibiting the action of the enzyme guanylate cyclase (an enzyme that inhibits the conversion of guanosine*triphosphate* to *cyclic* guanosinemonophosphate, an important secondary messenger in metabolic processes in the cell, catalyzes) and the direct scavenging of nitric oxide (NO). Because it affects the vascular tension regulation of the entire vascular system, this can result in reduced blood flow to the liver and especially the kidneys. Additional therapy to prevent damage to these vital organs is therefore used.

There are certainly similarities between the way methylene blue and intravenously administered vitamin C (vitamin C in high doses) are used in some clinical applications, such as in the treatment of sepsis. Both substances are being studied experimentally for their potential beneficial effects on circulation, inflammation, and bacterial infections, but they work in different ways. Here is a comparison of their effects and uses:

Operation and mechanism of Methylene Blue:

- Methylene blue has properties that affect cytochrome c oxidase in the mitochondria, which helps improve cellular respiration and promote oxygen uptake by cells. This can be useful in diseases such as sepsis, where blood circulation and oxygenation of organs may be disrupted.
- It also acts as an antioxidant, helping to reduce oxidative stress, which can help reduce the systemic inflammation that occurs with sepsis.
- Methylene blue can also help stabilize blood pressure by regulating nitrites in the body, which can be helpful in septic shock, where blood pressure is often extremely low.

Action and mechanism of Intravenous Vitamin C:

- Vitamin C (ascorbic acid) has strong antioxidant properties and is often administered in high doses to combat oxidative stress, which can contribute to cell damage and inflammation in sepsis.
- It can also help regulate blood pressure and strengthen capillary integrity, which can help reduce the damage caused by septic shock.
- Vitamin C supports immune functions and promotes the body's repair processes by promoting collagen production and tissue repair.
- It also has antimicrobial properties and can help fight infection.

Application of both in Sepsis

Both methylene blue and vitamin C are being studied for their potential benefits in treating sepsis:

- *Methylene blue* is often studied for its ability to improve oxygenation, stabilize blood pressure, and modulate inflammatory responses in cases of sepsis.

- *Vitamin C* is mainly used for its powerful antioxidant properties that can reduce the inflammatory response, reduce damage to cells and tissues, and improve immune function. It also has the potential to support blood pressure and help maintain organ function.

Application of Both in the Treatment of Infections

- *Methylene blue* has antimicrobial properties, and although it is not as widely used as antibiotics, in some cases it is being investigated as part of the treatment of infections that contribute to sepsis. It could be able to help fight bacteria, fungi, and other pathogens by lowering the oxidative stress associated with infections.

- *Vitamin C* also has antimicrobial properties, especially in high doses. It can support the functioning of the immune system by strengthening the white blood cells involved in fighting infections.

Administration and Effects on the Body

- *Methylene blue* is usually administered intravenously in low doses for acute situations such as sepsis or septic shock. The side effects can occur at higher doses, such as difficulty breathing or staining of the urine.

- *Vitamin C* is often administered intravenously at high doses (such as 25-50 g per day) to enhance the effects on oxidative stress and immune function mentioned above, especially in severe infections. However, intravenous vitamin C can also cause side effects, such as blood sugar disorders with long-term use or high dosages.

Safety and Effectiveness

Both therapies are still in the experimental stages. There is some scientific support for the use of both substances, but neither is currently a standard treatment for sepsis.

- *Methylene blue* has limited approval in clinical settings for sepsis treatment, although it may be useful in specific cases, such as in stabilizing blood pressure.

- *Intravenous vitamin C* is a subject of intense research, and although many doctors consider it an adjunct therapy, it is not (yet) routinely used for sepsis, except in clinical research settings.

Conclusion

Although methylene blue and intravenous vitamin C share some similarities in their use in sepsis and circulatory problems, they work through different mechanisms. Both substances offer antioxidant effects and may help regulate blood pressure and reduce the inflammatory response, but their uses and dosages differ. The effectiveness of both treatments is still being investigated, and neither is currently a standard treatment for sepsis.

Organ failure, such as kidney failure, treatment with methylene blue and vitamin C

The action of methylene blue (MB) and intravenous vitamin C (IVC) in organ failure, and specifically kidney failure, can be compared based on their different mechanisms of action, applications, and potential benefits. Both are being studied in medical and experimental settings for their effect on organs, but they work in different ways and are applied in different ways.

Below is a comparison of methylene blue and intravenous vitamin C in the context of kidney failure and other forms of organ failure.

Mechanisms of action of methylene blue:

- *Antioxidant effect:* Methylene blue has a strong antioxidant effect. It can help neutralize free radicals and reduce oxidative stress, which is important in kidney failure, where oxidative damage to the kidney cells can contribute to the progression of the disease.

- *Methemoglobin reduction*: MB is often used to reduce methemoglobin (an abnormal form of hemoglobin), which improves oxygen transport in the blood. This can also indirectly improve oxygen supply to organs, which is important in kidney failure.

- *Improving mitochondrial function*: MB has been shown to improve mitochondrial function and therefore increase cellular energy production, which is essential for cells that suffer from oxygen deficiency, such as kidney cells in kidney failure.

- *Antimicrobial effect*: MB also has antimicrobial properties, which can help reduce infections that can cause complications in kidney failure, such as sepsis.

Mechanisms of action of Intravenous Vitamin C (IVC):

- *Antioxidant activity*: Like MB, vitamin C is a powerful antioxidant that helps protect the body from oxidative stress. In kidney failure, oxidative damage plays an important role in the worsening of the disease, and vitamin C can help limit the damage to kidney cells.

- *Strengthening the immune system*: Vitamin C plays a crucial role in supporting the immune system, which is important for patients with kidney failure, as their immune systems are often weakened and they are susceptible to infections.

- *Improves iron absorption*: Vitamin C improves the absorption of iron from the diet, which can help treat anemia, which is common in people with kidney failure.
- *Increases oxygen uptake*: In kidney failure, oxygen levels in the tissues can decrease, and vitamin C can improve oxygen uptake by promoting blood vessel function and improving overall circulation.

Application of both in Renal Failure

- *Methylene Blue:*
  - In kidney failure, MB is used experimentally, especially in cases of sepsis (a common complication of kidney failure). Sepsis can seriously affect kidney function through inflammatory reactions and reduced blood flow. MB can improve blood circulation, reduce oxidative stress, and support mitochondrial function, which can help maintain kidney function.

  - MB is also being studied for reducing pain and improving blood flow to certain organs. In kidney failure, it can improve microcirculation, which can be beneficial for maintaining kidney function.

- *Intravenous Vitamin C:* ○ Intravenous vitamin C is commonly used in kidney failure, especially in patients on dialysis. It may help reduce oxidative stress, improve the immune system, and promote iron absorption in anemia.

  - In some cases of kidney failure, vitamin C can also lower blood pressure and reduce inflammation. There are studies that show that vitamin C can increase the risk of kidney stones, so its use should be carefully monitored.

The effects of both on organ failure

- *Methylene blue:*
  - *Kidney function*: Due to its benefits in the areas of oxidative stress, microcirculation, and mitochondrial function, MB can theoretically contribute to the maintenance of kidney function in kidney failure. In animal studies, there is evidence that MB may improve kidney function, but its use in humans is still being investigated.

  - *Sepsis*: MB is sometimes administered intravenously in patients with sepsis, a serious infection that can lead to organ failure, including kidney failure. It can

help improve blood pressure and oxygen transport, which is important in the treatment of sepsis.

- **Intravenous Vitamin C:**
  - *Kidney function*: Vitamin C has a role in reducing oxidative stress, which can help slow the decline in kidney function. Studies show that vitamin C may be helpful in reducing the damage that occurs from chronic diseases, including kidney failure.

  - *Strengthening the immune system*: In kidney failure, the immune system is often weakened, which increases the risk of infections. Vitamin C can boost the immune system, which can indirectly help reduce complications such as infections that worsen kidney failure.

What are the potential risks of both, if any?

- *Methylene blue:*
  There are few reported serious side effects of MB in renal failure, but its use should be monitored with caution, especially in patients with impaired renal function. As mentioned earlier, MB can have side effects such as blue discoloration of the urinary system and, in rare cases, serotonin effects (when used in combination with other serotonergic agents).

- *Intravenous Vitamin C:*
  Kidney stones: The main risk of high doses of vitamin C in kidney failure is the increased risk of developing kidney stones, especially oxalate stones. This is because vitamin C can be converted into oxalate in the body, which can build up and cause kidney stones, especially in people with weakened kidney function. However, this is a hypothesis, while others argue that vitamin C will actually reduce oxalic acid levels by binding with it and being excreted...

- Increased strain on the kidneys: In people with severe kidney failure, the body is less able to process vitamin C efficiently, which can lead to a buildup of vitamin C in the blood and increased strain on the kidneys.

Conclusion

The action of **methylene blue** and **intravenous vitamin C** in renal failure has some overlaps, such as antioxidant activity and the ability to improve microcirculation and mitochondrial function. However, both remedies are applied through different mechanisms and have different advantages and disadvantages:

- **Methylene blue** may be useful in improving blood flow and supporting mitochondrial function, especially in sepsis, but its use is still experimental.
- **Intravenous vitamin C** can help reduce oxidative stress, support the immune system, and improve iron absorption, but there are risks such as kidney stones and increased strain on the kidneys at high doses.

Methylene blue and colloidal silver compared

Methylene blue and colloidal silver are both substances that are being investigated in some alternative medicine applications for their antimicrobial properties, including bacterial, viral, and antifungal effects. However, there are important differences in their mechanism of action, uses, and safety, so it's important to compare the two carefully.

Comparison between the mechanisms of action of methylene blue and colloidal silver:

- *Methylene blue*: It has antimicrobial properties and is believed to kill bacteria, viruses, and fungi by disrupting their cellular processes, such as inhibiting the respiratory chain in microorganisms. It is well documented to work on certain pathogens, such as in the treatment of methemoglobinemia and sepsis. It is also being investigated for antiviral and antimicrobial applications.

- **Colloidal silver**: Colloidal silver contains small particles of silver that exhibit antimicrobial properties by attaching to the cells of bacteria and viruses and disrupting their enzymes and DNA, which damages cell structure and prevents growth. It is often promoted as an "all-killing" solution, but the effectiveness and safety of colloidal silver are controversial.

Bacterial and viral treatment:

- *Methylene blue*: There is reasonable evidence that methylene blue has antimicrobial properties and may help with certain infections. For example, it is used in the treatment of urinary tract infections and sepsis. There is also research on the use of methylene blue as an antiviral agent, especially against viruses such as HIV and herpes simplex, but its clinical application is limited and mainly experimental.

- *Colloidal silver*: There are claims that colloidal silver can kill a broad spectrum of bacteria, viruses, and fungi. Some research suggests that it may be effective against bacterial infections, but the evidence for antiviral effects is weak. However, there are significant concerns about the safety of colloidal silver with long-term use, such as the development of argyria (a rare condition in which the skin turns blue or gray due to silver accumulation).

Safety and side effects:

- *Methylene blue*: It is used in medical settings for certain conditions and may generally be safe when used for a short period of time and under medical supervision. Side effects may include headaches, dizziness, gastrointestinal upset, and in rare cases, allergic reactions.

- *Colloidal silver*: Although it is promoted as safe in some alternative medicine, there are significant concerns about its safety with long-term use. Long-term intake of colloidal silver can lead to argyria (discoloration of the skin) and other health problems such as kidney damage and disruption of the gastrointestinal tract. The FDA and other health authorities warn against the use of colloidal silver for medicinal purposes.

Anti-discriminatory capacity:
The term "anti-discriminatory" here refers to the ability of a substance to be broadly effective against different types of pathogens, without selectivity for certain microorganisms. In this case, you could say that both methylene blue and colloidal silver possess antimicrobial properties, but they don't work in the same way and have different spectrums of activity.
In terms of anti-discriminatory ability, both substances work broadly against certain pathogens, but methylene blue is more targeted and documented for specific medical applications, while colloidal silver has broader claims, but is less scientifically supported. When it comes to safety, methylene blue would generally be considered safer and more controlled for use in medicine, while colloidal silver carries more risks.

- *Methylene blue*: This indeed has a broad spectrum of action against certain bacteria, viruses and fungi, but is not as broadly acting as colloidal silver. For example, its effectiveness against viruses is less well documented than against bacteria.

- *Colloidal silver*: It's often promoted as an "all-killing" solution, but as mentioned earlier, there are serious questions about its effectiveness and safety. It is more broadly active against bacteria, but the claims about viral and parasitic effects are less well substantiated.

Conclusion:

- *Methylene blue* has proven antimicrobial, antiviral, and antifungal properties, but is typically used in specific medical contexts, such as sepsis and methemoglobinemia. It is relatively well-researched and is considered safe for medical use when used under supervision.

- *Colloidal silver* also has antimicrobial properties, but there are many more concerns about its safety and effectiveness, especially with long-term use. It has a broader "all-killing" potential, but the scientific backing is limited and the risks, such as argyria, can be severe.

Methylene blue and NO compared

Methylene blue and nitric oxide (NO) both act in the walls of the blood vessels and can therefore affect blood circulation, but in different ways.

- NO promotes vasodilation (dilation) by increasing the production of cGMP,
- Methylene blue inhibits guanylate cyclase, which counteracts the action of NO and can promote vasoconstriction.

Both substances have potential therapeutic uses, but the context in which they are used is very different.

Difference in research and use:

- Methylene blue is often studied for its neuroprotective and mitochondrial effects,
- NO is mainly used for vasodilation and improving blood circulation.

However, methylene blue and nitric oxide (NO) treatment (usually in the form of NO precursors or as a therapeutic gas) do have some overlaps in their action, but they work through different mechanisms in the body.

A comparison of these two:

- ***The Mechanism of Action methylene blue:***
    - *Inhibition of guanylate cyclase:*
    - Methylene blue works by inhibiting the guanylate cyclase, an enzyme involved in the production of cGMP (cyclic GMP). This enzyme plays a crucial role in the action of nitric oxide (NO) in the body. NO normally stimulates guanylate cyclase, which leads to increased production of cGMP and subsequently relaxation of the blood vessels, which lowers blood pressure and improves blood flow.

    - *Antioxidant properties:*
    - Methylene blue has strong antioxidant properties, which protects it from oxidative damage and can support mitochondrial function.

    - *Mitochondrial function:*

    - It also improves mitochondrial function by protecting against oxidative stress and promoting energy production in cells.

    - *Neuroprotection:*

  - Methylene blue may have neuroprotective properties by reducing the accumulation of harmful proteins, such as tau and alpha-synuclein, and by protecting cells from free radical damage.

- **The mechanism of action of nitric oxide (NO):**
  - *Vasodilation by cGMP:*
    NO acts as a signaling molecule that increases the production of cGMP in target cells, leading to vasodilation (dilation of blood vessels), relaxation of smooth muscle cells, and improvement of blood flow. This has beneficial effects in conditions such as hypertension, heart disease and lung disease.

  - *Immune system:*
    NO also plays an important role in the immune system by fighting bacteria, viruses and parasites. It can also contribute to inflammatory processes and the regulation of blood pressure levels.

  - *Neurotransmission:*
    NO acts as a neurotransmitter in the brain and plays a role in brain function, including memory and learning.

Applications and effects

- ***Methylene blue:*** ○ *Blood circulation:*
  Methylene blue can improve blood circulation by inhibiting guanylate cyclase, which is the opposite of the action of NO. This means that methylene blue can block the action of NO by preventing the breakdown of cGMP.

  - *Treatment of sepsis and hypotension:*
    It is being investigated as a potential treatment for sepsis, where it may help raise blood pressure and improve circulation. This is because, due to the guanylate cyclase inhibition, it can promote vasoconstriction (narrowing of the blood vessels), which can be useful in hypotension (low blood pressure).

  - *Neurological disorders:*
    Methylene blue is also studied in the context of neurodegenerative disorders such as Parkinson's and Alzheimer's by protecting mitochondria and reducing oxidative damage.

  - *Mitochondrial Health and Oxidative Stress:*
    By protecting the mitochondria from damage, methylene blue may improve overall cellular health, which may help treat various conditions, including heart failure and neurological diseases.

- ***Nitric oxide (NO):***
  - *Vasodilation and blood pressure:*
    NO is often used therapeutically to lower blood pressure, especially in conditions such as heart failure, pulmonary hypertension, and angina. It causes dilation of the blood vessels, which promotes blood flow.

  - *Treatment of respiratory diseases:*
    NO is sometimes used in the treatment of respiratory problems such as asthma and chronic obstructive pulmonary disease (COPD), as it helps with the relaxation of the airways.

  - *Neuroprotection and memory:*
    In the brain, NO acts as a signaling molecule for communication between nerve cells and can help with cognitive functions such as memory and learning. It is also being investigated as a potential agent to treat neurodegenerative disorders.

Comparison and overlaps

- *Similar effects:*
  Both methylene blue and NO can affect blood circulation, but through opposite mechanisms. While NO increases the production of cGMP, causing vasodilation, methylene blue inhibits guanylate cyclase and reduces the effects of NO. This means that methylene blue can have a vasoconstrictive effect, while NO promotes vasodilation.

Therapeutic applications:

- *Methylene blue* is often used in cases of *hypotension* (low blood pressure) or sepsis, where it can help raise blood pressure through vasoconstriction.

- *NO* is used in conditions where vasodilation is useful, such as *hypertension* or respiratory disease.

- *Neuroprotection:*
  Both substances have neuroprotective properties, although through different mechanisms: ○ *Methylene blue* protects against oxidative damage and affects mitochondrial function.
    - *NO* is involved in neuroplasticity and neurotransmission in the brain.

Side Effects and Safety

- Methylene blue:

Side effects can include headaches, gastrointestinal upset, and blue urine (which is normal).
However, high doses of methylene blue can cause toxicity.

- *Nitric oxide (NO):*
  Side effects of NO therapy are usually mild and can include headaches, dizziness, and low blood pressure, especially when using inhalation of NOgas.

Methylene blue and cancerous processes

Methylene blue is being investigated for its potential applications in cancer treatment, although its use in this context is still in an experimental stage and is not widely used in mainstream clinical practice. However, there are several hypotheses and lines of research that suggest that methylene blue may potentially help manage cancer, especially due to its effects on cellular processes and tissue structures. Some of the main mechanisms of action and ways in which methylene blue could potentially contribute to cancer treatment include:

- **Antioxidant properties**
  Methylene blue has antioxidant properties, which means that it can neutralize free radicals in the body. Since oxidative stress plays a role in the onset and progression of many cancers, methylene blue may help prevent cancer or inhibit the growth of cancer cells by reducing this stress.

- **Inhibition of mitochondrial function of cancer cells**
  Cancer cells often show increased metabolic activity and abnormalities in their mitochondria (the cell's power plants). Methylene blue is known to affect the functioning of mitochondria, and some studies suggest that it could interfere with energy production in cancer cells. This could reduce the survival of the cancer cells by affecting their energy supply.

- **Inhibition of tumor growth by inhibition of guanylate cyclase**
  Methylene blue inhibits an enzyme called guanylate cyclase, which is involved in the production of cGMP (cyclic guanosine monophosphate). cGMP plays a role in the regulation of blood flow, cell division and the action of certain hormones. Disruptions in the guanylate cyclase cGMP pathway may contribute to cancer development. By reducing the activity of this enzyme, methylene blue could potentially contribute to inhibiting tumor growth.

- **Cancer induction via photodynamic therapy (PDT)**
  Methylene blue can be used as a photosensitizer in photodynamic therapy (PDT). This is a treatment method in which a photosensitive agent (such as methylene blue) is

introduced into the body and then activated by light. When exposed to light, methylene blue generates reactive oxygen species (ROS), which damage the cells. When this process is directed at cancer cells, it can lead to their destruction. This technique is already used to a limited extent for the treatment of skin cancer and tumors that are superficially located, but experiments are being conducted with applications for deeper tumors.

- **Induction of apoptosis (programmed cell death)**
  Some studies suggest that methylene blue may play a role in promoting apoptosis (programmed cell death) in cancer cells. Apoptosis is a process in which damaged or uncontrollably growing cells self-destruct. Promoting apoptosis in cancer cells can help to slow or stop the growth of tumors. Methylene blue could potentially stimulate this process by influencing intracellular signaling pathways that regulate cell death.

- **Inhibition of angiogenesis**
  Angiogenesis is the process of forming new blood vessels to provide oxygen and nutrients to tumors. Cancer often tends to promote angiogenesis to support the growth of tumors. There is some evidence that methylene blue may be able to inhibit angiogenesis, which could help to reduce the supply of blood to tumors and thus slow the growth of cancer.

- **Antibacterial and antiviral effect**
  Since infections and viruses contribute to the development of some types of cancer (such as the human papillomavirus, which is linked to cervical cancer), the antibacterial and antiviral activity of methylene blue may play an indirect role in the prevention or treatment of cancers caused by such infections.

- **Symptom relief in cancer treatment**
  There is also research into the possibility of using methylene blue as a supportive treatment in combating the side effects of conventional cancer treatments, such as chemotherapy and radiation. Methylene blue has analgesic properties, which can help relieve pain and discomfort caused by cancerous tumors or their treatment. It can also help to improve the overall condition of patients with cancer by supporting the overall health of cells and tissues.

- **Reducing metastasis (metastasis)**
  There is a theory that methylene blue could help reduce cancer metastasis, or the process by which cancer cells spread to other parts of the body. This could happen due to its influence on the cell adhesion and migration of cancer cells, although this hypothesis needs further investigation.

Although clinically not (yet) or hardly applied, this is allowed via (Digital) Homeopathic fitting and the results are promising!

Mastocytosis and hypermastocytosis

Both conditions involve abnormal proliferation or activation of mast cells, leading to excessive release of substances such as histamine, proteases, and other mediators that can cause inflammation and tissue damage.

- **Mast cell stabilization**

  Mastocytosis and hypermastocytosis are often accompanied by an abnormal increase in mast cells in various tissues, such as the skin, liver, spleen, bones, or gastrointestinal tract. These mast cells can release excessive histamine and other pro-inflammatory substances, leading to symptoms such as itching, rashes, pain, swelling, and even systemic reactions such as anaphylaxis. Methylene blue has been shown in some studies to be able to stabilize mast cells, reducing the amount of histamine and other mediators that are released. This can help relieve the symptoms of mastocytosis and hypermastocytosis.

- **Anti-inflammatory properties**

  Methylene blue has anti-inflammatory properties, which may be important in the management of mastocytosis and hypermastocytosis. In these conditions, inflammatory responses play a major role in damage to tissues, including the skin and internal organs. By reducing inflammation, methylene blue could help reduce the damage to tissues and relieve symptoms such as redness, pain, and swelling.

- **Antioxidant effect**

  In mastocytosis and hypermastocytosis, inflammatory mediators and free radicals can further damage the tissues. Methylene blue has antioxidant properties and can help to reduce free radical damage, which could be beneficial for protecting tissues from the damage caused by excessive mast cell activity.

- **Avoiding Vascular Damage**

  Mast cells can also cause damage to blood vessels, which can lead to vascular instability, bleeding, or reduced blood flow to certain tissues. Methylene blue, as mentioned earlier, has the potential to improve blood circulation and reduce damage to blood vessels. This could reduce the vascular complications of mastocytosis, such as bleeding or decreased blood flow.

- **Possible Protection of Organs**

  In cases of systemic mastocytosis (involving multiple organs), methylene blue may potentially contribute to protecting organs from damage from the excessive release of mast cell mediators. This could, in theory, help preserve the function of organs such as the liver, spleen, or intestines

- **Symptom reduction in Acute Flare-up**

  Methylene blue could also be useful during acute episodes of mast cell activation (flare-ups), where sudden, severe symptoms occur due to the abundant release of histamine and other substances. The stabilization of mast cells and the anti-inflammatory effect could help to reduce these acute symptoms.

Caution and Limitations

Although methylene blue has promising properties, it is important to emphasize that its use in mastocytosis and hypermastocytosis has not yet been well researched in clinical studies. It is also important to understand that the conditions are often complex and involve different types of mast cell problems, which means that treatments must be tailored to the individual patient.

In addition, there are possible side effects of methylene blue, especially with long-term use or high doses. It is essential that the use of methylene blue is always done under the supervision of a doctor, especially in the case of serious conditions such as mastocytosis and hypermastocytosis.

(Digital) Homeopathically applied this is allowed and the results are promising!

Methylene blue and heart failure

Methylene blue is being investigated as a potential treatment for heart failure in some cases, although its use in this context is primarily experimental and not widely accepted in mainstream medicine.
(Digital) Homeopathically applied this is allowed and the results are promising!

There are several mechanisms that contribute to the potential of methylene blue in heart failure:

- **Improving mitochondrial function**

  Methylene blue is known to affect the mitochondrial respiratory chain, which can improve energy production in cells. Since heart cells have high energy requirements, methylene blue may help improve energy production in the heart. This could support the function of the heart, especially in heart failure, where energy production in heart cells is often disrupted.

- **Reduction of oxidative stress**
  Heart failure is often accompanied by increased oxidative stress, which causes damage to cells and tissues. Methylene blue has antioxidant properties and can help reduce free radical damage. This can help protect heart tissue and improve heart function.

- **Vasodilation (dilation of blood vessels)**
  Methylene blue can help improve blood circulation by dilating blood vessels. This can lower blood pressure and improve blood flow to vital organs, including the heart. For people with heart failure, promoting better blood flow can help to improve oxygen and nutrient delivery to the heart.

- **Regulation of heart rate**
  There is evidence that methylene blue may have an impact on heart rate regulation due to its effects on ion channels in heart cells. This can be useful in treating certain types of cardiac arrhythmias that often occur with heart failure.

- **Improving hemodynamics**
  Methylene blue can improve hemodynamics (blood circulation) by affecting blood pressure and heart contractility. This can help to improve heart function, especially in people with heart failure who experience impaired heart function and insufficient circulation.

- **Inhibition of the enzyme guanylate cyclase**
  Methylene blue inhibits the action of guanylate cyclase, an enzyme involved in the production of cGMP, a molecule that dilates blood vessels and affects the heart muscle. By inhibiting this enzyme, methylene blue can modulate the effects of cGMP, which can help to improve blood pressure and heart function.

- **Use in vasoplegia and sepsis**
  In some cases, methylene blue is being studied to treat vasoplegia (a condition in which the blood vessels do not constrict properly), a condition that can occur in severe forms of heart failure, such as sepsis or shock. Methylene blue is used in such cases to improve vascular tone and stabilize blood pressure, which can help to improve circulation.

Methylene blue and the sex hormones

There is limited research on the interaction between methylene blue and sex hormones, such as estrogen, progesterone, and testosterone. Although methylene blue is mainly known for its applications in photodynamic therapy and as an antioxidant, it is still important to understand

how the mb can potentially relate to the various hormones, especially in the context of hormonal balance and the influence of methylene blue on certain biological processes.

The following considerations can be made in this regard:
As mentioned above, methylene blue works primarily through its photochemical properties, which when combined with light can lead to the production of reactive oxygen species (ROS) and affect various cellular processes. This can lead to cellular oxidation or improvement of tissue repair processes. However, with hormones, there is little direct evidence that methylene blue has a direct impact on the production or level of estrogen, progesterone, or testosterone. Discussing the most important hormones in turn, remember that although there is talk of female and male hormones, all the hormones are both female and male, only the amount produced and physical effect is different. In addition, they are known as sex hormones, but their action is much greater than that:

Estrogen
Estrogen is an important female sex hormone that affects various bodily functions, including the immune system, bone health, and reproduction. There is no significant evidence that methylene blue directly affects the action of estrogen. However, in some cases, methylene blue is being investigated for its potential influence on inflammation and immunological responses, which could indirectly affect hormonal balance, but this is not (yet) well documented.

Progesterone
Progesterone is another important female hormone, best known for its role in reproduction and the preparation of the uterus for a possible pregnancy. As with estrogen, there is no direct evidence that methylene blue affects the action or levels of progesterone. However, if methylene blue affects inflammation or cellular responses, it may indirectly affect hormonal balance, but specific effects on progesterone have not been well studied.

Testosterone
Testosterone is the primary male sex hormone, but it also plays a role in women, albeit at lower levels. There are no significant studies that show that methylene blue directly affects the production or functioning of testosterone. Perhaps it could indirectly influence certain metabolic processes, but this is not a common area of research.

Nevertheless, users report positive effects, how can that be explained?

Methylene blue and hormone receptors
There is some theoretical concern (see here) about the influence of methylene blue on hormone receptors, especially when it comes to its interaction with receptors that are important for cell growth and division, such as estrogen receptors. However, the effect of methylene blue on these receptors is not yet well documented in scientific literature.

Possible influences on metabolism and circulation

Methylene blue affects cellular respiration and metabolism by affecting the mitochondria. This could potentially indirectly affect overall hormonal balance, as hormones are often involved in cellular energy balance and metabolism. But again, this is mostly theory and there is little direct evidence that methylene blue specifically affects hormonal levels like testosterone, estrogen, or progesterone.

Conclusion:
Although methylene blue affects various biological processes, there is no well-documented evidence that it directly affects the production or action of estrogen, progesterone, or testosterone. The interactions between methylene blue and these hormones are not yet widely studied, so it is important to be careful when combining methylene blue with hormonal treatments. If you are considering methylene blue in combination with hormone therapy or other hormonal treatments, it is wise to discuss this with your doctor or treating specialist.

Methylene blue and diabetes

Methylene blue is being investigated for various therapeutic applications, including potential benefits in diabetes. There is not yet enough solid scientific evidence to say that it is a proven treatment for diabetes.

So there is some scientific interest in using methylene blue as a potential treatment option for diabetes, especially because of the benefits it may have in improving insulin sensitivity and reducing oxidative stress. However, most of these findings still come from preliminary animal studies or laboratory studies, so there is no clinical evidence (yet).

(Digital) Homeopathically applied this is allowed and the results are promising!

Below is some explanation of why methylene blue could possibly be beneficial and what research results there are so far.

Possible beneficial effects of methylene blue for diabetes:

- *Improve Insulin Sensitivity:*
  There is some evidence from animal studies and laboratory studies that methylene blue may improve insulin sensitivity. It could promote the functioning of mitochondria (the power plants of cells), which may improve glucose uptake in cells. Since insulin sensitivity is often reduced in type 2 diabetes, improving mitochondrial function could theoretically help improve glucose control.

- *Antioxidant Properties:*
  Methylene blue has antioxidant properties, which means it could potentially help reduce oxidative stress. Oxidative stress plays a role in the onset and progression of

diabetes and the complications associated with it, such as cardiovascular disease and kidney damage. By reducing oxidative damage, methylene blue could theoretically contribute to controlling the disease and preventing complications.

- *Promoting Mitochondrial Function:*
  Mitochondria play an important role in the energy balance of cells, and in people with type 2 diabetes, the mitochondria are less able to function. There is some evidence that methylene blue may improve mitochondrial function, potentially contributing to better blood sugar regulation.

- *Antidiabetic potential in animal studies:*
  Some animal studies have shown that methylene blue could have antidiabetic effects. In certain studies in mice, a reduction in blood sugar levels and improved insulin sensitivity was observed after treatment with methylene blue. This suggests that methylene blue could potentially be a useful adjunctive therapy for diabetes management.

Restrictions and Precautions:
While the results from laboratory and animal studies seem promising, there are no large, well-controlled clinical trials in humans that show that methylene blue is effective for treating or managing diabetes. This means that it is still too early to recommend methylene blue as a regular treatment for diabetes.

In addition, it should be noted that methylene blue can have negative side effects in some cases, especially if it is not properly dosed or if it interacts with other medications, such as those used in the treatment of diabetes. Therefore, it is crucial to consult with a doctor before using methylene blue or any other new agent as part of diabetes treatment.

Methylene blue as a painkiller

Methylene blue is not usually considered a primary painkiller in the classical sense. However, there is some evidence from scientific research that methylene blue could indirectly contribute to pain reduction in certain circumstances. However, this effect is mainly due to its other properties, such as reducing oxidative stress and inflammation, which can play a role in pain.

For postoperative pain, especially after surgical procedures in the skeletal structure, other, approved pain relievers, such as NSAIDs, acetaminophen, or opioids, are often more effective and direct in relieving pain.

Possible mechanisms for pain relief:

- *Antioxidant effect:*

Methylene blue has powerful antioxidant properties. After surgery, especially surgical intervention in the skeletal structure (such as bone fractures, joint surgery, or other orthopedic procedures), significant oxidative stress is often released, contributing to inflammation and pain. By reducing oxidative stress, methylene blue can help to relieve the pain that stems from inflammatory processes. However, this is an indirect effect, and the extent to which this helps with postoperative pain has not yet been well established in clinical trials.

- *Possible improvement of mitochondrial function:*
  Methylene blue is known for its ability to improve the function of mitochondria, the power plants of cells. This could contribute to faster healing of tissues after surgery, potentially helping to reduce postoperative pain through a more efficient healing process and repair of damaged tissue. However, this effect is more often associated with recovery after injury or surgery, rather than direct pain relief.

- *Reducing inflammation:*
  Since methylene blue also plays a role in reducing inflammation, it can help to relieve the pain often associated with inflamed tissues after surgery. Inflammation-related pain is a common symptom after surgical procedures, so it's possible that methylene blue could provide some relief due to its anti-inflammatory properties.

Pain after Operations on the Skeletal Structure:
Methylene blue could theoretically play a limited role in supporting tissue repair by reducing inflammation and limiting oxidative stress, but it would not act directly as an analgesic like regular pain medication.

After surgery on the skeletal structure, such as repairing a bone fracture or operating on joints, the pain can often be the result of a combination of factors, such as:

- Tissue damage during surgery,
- Inflammation due to the repair process,
- Nerve damage, • Muscle cramps or muscle tension.

Methylene blue and neurodegenerative disorders

Methylene blue is being investigated as a potential treatment option for several neurodegenerative disorders, including Parkinson's disease, Alzheimer's disease, and Lewy body dementia (LBD), as well as other degenerative brain disorders. Methylene blue shows promising properties for the treatment of neurodegenerative diseases, particularly due to its antioxidant activity, stabilisation of harmful proteins and mitochondrial protection. However, although the experimental results are promising, there is not yet sufficient clinical evidence in

humans to recommend methylene blue as a common treatment for these conditions. Further studies and clinical trials are therefore still necessary to confirm its effectiveness and safety.

There are several ways in which methylene blue could potentially affect these diseases, although it is of course still in experimental stages.

General mechanisms of action of methylene blue in Degenerative Brain Disorders:

Methylene blue appears to have a number of mechanisms that may be beneficial for the treatment of neurodegenerative disorders, such as:

- *Antioxidant effect:*
  Protecting brain cells from free radical damage.
  Slowing down protein aggregation: Avoiding the accumulation of harmful proteins such as alpha-synuclein and tau.

- *Mitochondrial protection:*
  Improving energy production in brain cells, which is important in conditions such as Alzheimer's and Parkinson's, where mitochondrial dysfunction plays an important role.

- *Enhancement of neuroprotective pathways:*
  It can activate certain protective mechanisms in the brain that reduce damage to nerve cells.

Research Results and Clinical Studies

Several animal studies and laboratory studies have been conducted investigating the action of methylene blue in neurodegenerative disorders. The results are promising, but there is a lack of comprehensive clinical studies in humans. In most studies, methylene blue is tested at relatively low doses, often via intravenous administration or oral ingestion in controlled conditions.

For example:
In some animal studies, methylene blue has helped to reduce neurological decline in Parkinson's and Alzheimer's by inhibiting the formation of harmful proteins and improving mitochondrial function.

Beware!
However, there is still insufficient evidence to recommend methylene blue as a standard treatment for these conditions in humans at this time.
(Digital) Homeopathically applied this is allowed and the results are promising!

Methylene Blue and Parkinson's Disease (PD)

Parkinson's disease is a neurodegenerative disorder characterized by the breakdown of dopaminergic neurons in the substantia nigra, a brain region involved in motor control. There is evidence that methylene blue may have protective effects on brain cells in Parkinson's:

- *Antioxidant properties:*
  Methylene blue has antioxidant properties, which can help to reduce free radical damage. In Parkinson's, oxidative stress plays an important role in the degeneration process of brain cells.

- *Stabilization of mitochondria:*
  The mitochondria (the power plants of the cells) play a crucial role in neurodegenerative diseases such as Parkinson's. Methylene blue has been shown in some studies to protect mitochondria from damage and potentially improve energy production in brain cells.

- *Inhibition of neurotoxic processes:*
  Studies in animal models have shown that methylene blue can reduce the breakdown of dopaminergic neurons, potentially slowing the progression of the disease.

- *Reduction of alpha-synuclein aggregation:*
  In Parkinson's disease, the accumulation of the protein alpha-synuclein plays an important role in the formation of Lewy bodies, which damage brain cells.
  Evidence suggests that methylene blue may reduce alpha-synuclein aggregation and alleviate the toxicity of these accumulations.

Methylene Blue and Alzheimer's Disease

Alzheimer's disease is characterized by the accumulation of the protein beta-amyloid and the formation of plaques in the brain, as well as the accumulation of tau protein in neurofibrillary tangles. Methylene blue also has potential as a treatment for Alzheimer's, although much research is still needed:

- *Inhibition of tau protein aggregation:*
  Methylene blue has been shown to reduce the aggregation of tau proteins in some laboratory studies and animal models. This could help to reduce the neurofibrillary tangles characteristic of Alzheimer's.

- *Reduction of amyloid-beta accumulation:*
  There is evidence that methylene blue may reduce beta-amyloid deposition, although this mechanism is not yet fully understood.

- *Improvement of mitochondrial function:*
  As with Parkinson's, methylene blue can protect the mitochondria from damage, which is important in the context of Alzheimer's, where mitochondrial dysfunction is common.

Methylene Blue and Lewy Body Dementia (LBD)

Lewy body dementia (LBD) is a neurodegenerative disorder characterized by the accumulation of Lewy bodies (the same accumulations of alpha-synuclein found in Parkinson's) in the brain, leading to cognitive decline and motor symptoms. Methylene blue may be potentially useful in the treatment of LBD through the following mechanisms:

- *Neuroprotection:*
  Due to its antioxidant properties, methylene blue may protect against the damage caused by the accumulation of alpha-synuclein in the brain.

- *Progression delay:*
  In animal studies, methylene blue has been shown to slow down the neurodegeneration caused by Lewy bodies.

- *Improving cognitive functions:*
  Since LBD also causes cognitive decline, it is being investigated whether methylene blue can reduce or stabilize cognitive decline by reducing the toxicity of Lewy bodies.

Side Effects and Safety

Although methylene blue has promising properties, it is important to be careful with the dosage and administration, as it can cause side effects previously reported above, such as:

- *Headache*
- *Changes in the color of urine* (which is normal, but can be concerning for some patients)
- *Upset stomach*
- *Rare allergic reactions*
- *High doses can also be toxic to the brain and other organs*

Important: With (digital) homeopathic remedies, these side effects will occur very rarely and therefore not probably!