tibb institute
A Science of Medicine
The Art of Care

Part 3: The Physiology and Psychology of Colour

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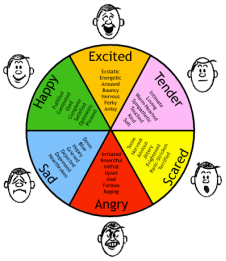


Colours provoke emotional feelings and they are part of everything, from nature and rainbows to man-made creations. Colours have a physiological, psychological and social impact on a person's health, wellbeing and status in the world; from the positive stimulating effects of warm colours, to the mental relaxation and soothing effects of cool colours.

Colours set the mood and tone of the environment by impacting on one's senses and affecting one's perception of the symbolic meaning which is being portrayed. It is a means of communicating one's feelings and self-expression, and it is well known for its biological attraction.

A number of studies have elaborated on the relationship between the human body and colours. Light is energy, and colour is considered to be the interaction of energy and matter. There is a specific wavelength, frequency, and energy for each colour. Einstein maintained that the human body works in harmony with the electromagnetic/energy system of the universe.[1]

"Everything in life is vibration" (Albert Einstien)

The Physiology of Colour

The autonomic nervous system (ANS) functions ***involuntarily*** as it controls the nervous system as well as regulating the muscles of the heart and smooth muscles.[2]

Smooth muscles are responsible for contracting the hollow organs, such as the bladder, gastrointestinal tract and the blood vessels.[3]

The ANS is considered to play an integral part in ***homeostasis*** due to the regulation of blood pressure, contraction of hollow organs, gastrointestinal responses to food, focusing of the eyes, as well as temperature and sweating. Colours generate electrical impulses and magnetic currents, or fields of energy that activate the biochemical and hormonal processes in the human body.[1] A recent discovery identified that the retino-hypothalamic tract leads directly from the retina to the hypothalamus, which links colours to the ANS.

The ANS regulates the sympathetic and the parasympathetic systems, both of which have opposite functions, namely, red is energetic; blue is sedating, and green *mediates* between both the sympathetic and parasympathetic nervous systems.[4]

Red simulates the posterior hypothalamus and therefore the ***sympathetic*** nervous system. Red and yellow provoke anger. All colours in the red spectrum – from red/orange to yellow, have a ***stimulating*** effect.[4]

The **sympathetic nervous system** causes ***dilation*** of the blood vessels which ***increases*** blood flow, heart rate and blood pressure. This results in a surge of energy in times of emergencies, as in the "***fight-or-flight"*** response, preparing the body for strenuous physical activity. The body thus receives ***well-oxygenated blood*** which is rich in nutrients for the tissues that need it, especially the skeletal muscles. The heart rate and blood pressure is increased, as well as oxygen circulation to the vital organs. Liver glycogen is converted into glucose and peristalsis of the gastrointestinal tract (digestion and salivation) is temporarily inhibited.[5]

It also stimulates blood clotting when wounded to minimise the loss of blood. Pupil size and peripheral vision is improved. The symptoms and illnesses associated with sympathetic nervous system dominance are those of fight/flight, and include: hypertension, hypercholesterolemia, fast arrhythmias, heart disease, type 1 diabetes, anxiety, panic attacks, hyper vigilance, and poor sleep.[6]

Colours which stimulate the circulation, such as red, orange and yellow, will exert qualities of heat. ***Heat*** expands and relaxes muscles, loosens tension and soothes pain. However heat may aggravate inflammation.

Blue stimulates the anterior hypothalamus, which contains the main regulating part of the ***parasympathetic*** nervous system. This means that all colours in the bluish spectrum, from blue/green to blue and violet, normally have a ***sedating,*** digestion-activating, sleep-inducing effect.[4]

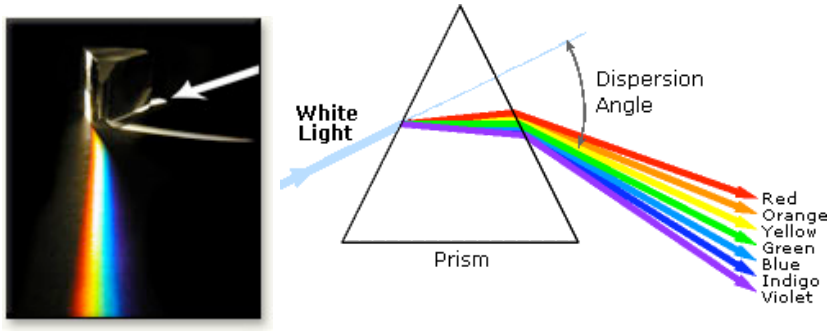
The **parasympathetic nervous system** causes ***contraction*** of the blood vessels which ***deceases*** blood flow, resulting in a decrease of the heart rate and blood pressure. It also causes ***relaxation*** of the muscles which help to conserve energy during rest. It also regulates the basic functions of the body such as ***digestion and urination.*** Stimulation of the ***parasympathetic*** nervous system can be summarized as the ***rest and digest*** response, as this returns the body functions back to normal: blood pressure lowers, heart rate slows down, gastrointestinal peristalsis is turned on again and the liver starts producing new glycogen.[5]

The salivary glands, gastric and intestinal motility are stimulated which facilitates swallowing, ingestion and absorption of food and nutrients. The chemical breakdown of food in the intestine is promoted by enzymes of the exocrine glands of the

pancreas. The storage of nutrient molecules within the tissues is enabled by the release of insulin from the pancreatic islets. The parasympathetic nervous system enables the contraction of the urinary bladder which results in urination. It also controls contraction of the pupils of the eyes so that the lens can adapt for near vision.[2]

Colours which suppress the circulation, such as violet and blue will exert qualities of coldness. ***Cold*** contracts and ice reduces inflammation, so it's good for arthritis or muscle strains from an inflammatory nature. However cold may cause cramping.

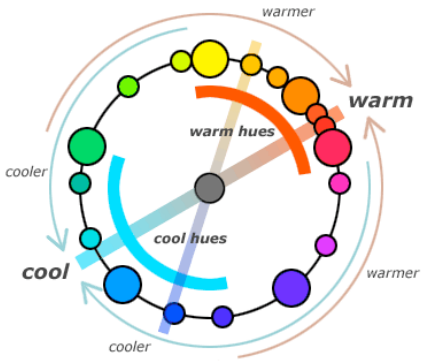
Sir Isaac Newton's Prism of Colours



(Left): Newton and the Colour Spectrum. (Right): Visible and Ultraviolet Spectroscopy.[8]

Sir Isaac Newton proved that, by setting up a prism near his window, it projected a spectrum of colours. The diagram above on the left shows that light enters the prism from the top right, and is refracted by the glass.[7] The diagram above on the right shows that violet is bent more than the yellow and red, so the colours separate. He concluded that white light is made up of seven different coloured rays.[8]

The Four Qualities of Colour



(9) This diagram depicts warm hues (from yellow to red violet) and the cool hues (from green to purple). The colour red is a warmer colour than magenta, because red is closer to orange; but both are warm colours in comparison to violet.[9]

1. **Hue** is generally defined as a ***source colour,*** one of the twelve basic colours on the colour wheel. Knowing the root hue allows one to mix the colour that he or she sees, using a basic palette.

2. **Value** is the ***lightness*** or ***darkness*** of the colour relative to white, black, and grey.
3. **Intensity** is the ***brightness*** or ***dullness*** of a colour, often determined by the amount of white or complement has been mixed with it. It is measured relative to the brightest colour wheel hue that is closest to the colour. Often the words **chroma** and **saturation** are used interchangeably with intensity.
4. **Temperature**, ***"warm"*** colours of red, yellow and orange, or ***"cool"*** colours of blue and violet.[10]

Primary, Secondary and Tertiary Colours

(11)

Primary Colours are the building blocks for all other hues, and cannot be created by mixing any other pigments. They are ***blue, yellow,*** and ***red.***

Secondary Colours are each created from mixing two of the primary colours. They are ***orange, green,*** and ***violet.*** Like the primary colours, they are equidistant from one another on the colour wheel.

Tertiary Colours are formed by mixing a primary and secondary colour. They are ***yellow-green, yellow-orange, red-orange, red-violet, blue-violet*** and ***blue-green***.[11]

Newton claimed that certain colours would ***clash*** together if they were in ***direct opposition*** to each other, such as ***red and purple,*** or ***yellow and green.*** In Tibb opposing qualities cannot exist together either, as nothing can be positive and negative, hot and cold, moist and dry at the same time. The relationship of heat, moistness, coldness and dryness has a direct bearing on the health status of an individual. ***Heat*** is generally more ***favourable than cold*** for maintaining the proper ***balance*** and general health of the body.[12] Health will only be maintained as long as the overall quality of the humours is in harmony with the overall quality of the individual's temperament.

The Visual Pathway

Colour is a property of a surface or substance resulting from absorption of certain of the incident light rays, and reflection of others, falling within the range of wavelengths adequate to excite the retinal receptors….between infrared and ultraviolet.[13]

Colour vision begins with photoreceptors in the eyes which convert light information into electrical signals in the brain. Rods are receptive to the amounts of light, and cones are sensitive to colours. Each colour has different wavelengths, which we see as reflected wavelengths of light from cones and rods in the eyes.

The optic nerve travels from the retina, past the pituitary gland via the temporal lobe to the occipital lobe of the brain, where this part of the visual system is in touch with the conscious part of our brain of the environment.

The colour of the iris is determined by the amount of melanin it contains; the darker the eyes, the more melanin and the more light is absorbed, as light waves pass through the eye, and the less light is available to reflect within the eye. The pathway of light to the brain is highlighted as follows:

- Light is refracted by the cornea and enters the chamber of the eye through the pupil.
- The iris dilates in bright light and constricts in dim light.
- Light passes through the lens and the image is inverted on the retina.
- Light is absorbed by photoreceptors, which forms into patterns of electrical signals, which are transmitted via the optic nerve to the visual cortex of the brain.
- Light passes from the retinal nerve ganglion to the hypothalamus. The functions of the body are regulated by the hypothalamus and the pituitary of the brain.
- The optic nerve fibres transmit nerve impulses from the brain to the spinal cord, from where the impulses travel to the pineal gland. The ***pineal gland*** is also known as the ***'light meter'*** of the body, which interprets information that one sees.[14]

Optical Illusions

A colour contrast is an illusory tinge of complementary hue or brightness induced by a vivid hue or luminance on the area surrounding it in the visual field.[13] The wavelengths of light travel at different speeds through different mediums. Light waves travel slower in water than in the air, and bend when they move from the air to the water. For example, a stick will appear to look broken in a glass of water, and a finger will appear to look larger. Different colours are created from the reflection and

absorption of light.[15] It is more difficult to tell apart varying shades of the same colour, as there are not so many words which assigns to these different shades.

An afterimage is a type of optical illusion in which an image continues to appear briefly even after exposure to the actual image has ended, which can either be positive or negative afterimages. For example:

- Positive afterimage
  If one stares at a very brightly lit image or scene for about 30 seconds, one will experience a positive afterimage for a few seconds, after closing one's eyes, as the image will still be seen as the original one in the same colours and brightness.
- Negative afterimage
  The colours that one sees are inverted from the original image. For example, if one stares for about 30 seconds at a red image, one will see a green afterimage.[16]

The Temperature of Colour

Colour temperature has been described most simply as a method of describing the colour characteristics of light, usually either warm (yellowish) or cool (bluish), and measuring it in degrees of Kelvin (°K).[17] The temperature of red colour is about 1800k, the yellowish white –similar to the midday colour when the sun is shining is 6000 k. The blue colour temperature amounts to 10000k.

The ***kelvin scale*** is an absolute temperature scale in which the unit of measurement, the kelvin, is equivalent to the degree Celsius; the ice point therefore being at 273, 15 kelvins and the boiling point of water being 373, 15 kelvins.[13]

The temperature of colour is its perceived warmth or coolness. ***Cool*** colours (with a bluer base) tend to ***recede,*** while ***warm*** colour temperatures (in the red and orange families) are perceived as ***advancing***.[19]

This is why red is used to signal danger, stop signs and the Red Cross sign; whereas mountains fading in the distance appear to be in shades of blue.

"Blue mountains are distant from us, and so cool colours seem to recede".
J.W. von Goethe

Tibb, however, places emphasis on the quality of the colours and its relation with the temperaments, as well as its corresponding effects on the body by the autonomic nervous system. Each food and drink has a degree of heat or coldness, which either promotes or slows down metabolism. The heating foods are necessary for the body to achieve and maintain a complete metabolic digestion of foods.[20]

Jung utilised the principles of yang and yin in the symbolic power of colour and its significance in the expression of emotions through painting. The colours of ***yang*** are ***warm, colours,*** such as red, orange, yellow and magenta. The colours of ***yin*** are

cool, colours, such as blue, violet, turquoise and green. Babbitt related ***yang*** colours as being ***magnetic***, whereas ***yin*** colours are ***electric***. Both yang and yin exert opposite and complementary qualities; either enhancing or diminishing, warming or cooling, and active or passive, respectively.[22] Jung believed that colour enabled people to explore the deep, unconscious part of the psyche and to integrate it with the conscious part in order to achieve 'wholeness'.

"Temperature is an attribute of colour or characteristic of a pigment." Artists refer to temperature by the degree of warmth or coolness measured when one colour stands in relationship to another colour, creating a measure of contrast.[21] Temperature is also a measure of the average kinetic energy due to thermal equilibrium with other systems.[13] When the temperature of colours is increased, colours move from the long metric wave to the short metric wave, namely from red colour to the yellow colour then to the blue colour then to the violet then the ultraviolet colour and finally the black colour. Finally, when the temperature increases much more, colours turn dark or deep till they become black.

Avicenna believed that cancer is a tumour which arises from 'burning' of the black bile humour, due to the increase of heat which has become pathological. He also described that a tumour swelling is a manifestation of the 'boiling' of the black bile at its junction with the organ, and that the crablike tracks of the cancerous tumour tends toward blackness, green and heat. Frostbite initially appears dark red in colour on the hands and face after exposure to sub-zero temperatures, advancing to black in the advanced stages.[20]

Gerard's research in the 1970's revealed that exposure to warm colours increased respiratory movements, frequency of eye blinks, cortical activation and palmar conductance (arousal of the ANS). Warm colours consistently showed a more pronounced pattern of stimulation. Cool colours showed opposite effects by acting as a relaxant and tranquilizer for anxious individuals, lowering blood pressure, providing relief from tension, alleviating of muscle spasms and reducing eye blink frequency.[1]

Why does the colour red appear to be warmer than blue?

When we get ***warm*** more blood is circulating at the surface of the skin which gives it a ***rosy*** colour. When we get ***cold*** the body tries to conserve heat by diverting blood away from the surface of the skin in order to supply more blood to the vital organs, giving the skin a ***bluish*** appearance.

Our perception of colour may also be related to our everyday experience of how we view hot and cold colours. The flames of a fire appear to be yellow and orange, as the burning process beaks up bonds in the molecules of carbon and hydrogen which emit yellow light, which is hot and dry. If there are more particles of soot, it will act like blackbody particles, emitting the colour of red. It is not as easy to see objects which have been exposed to very high temperatures; therefore the colour blue is not

seen as often.[23] The molecular properties of water make it bluish-green in colour, which is cold and moist.

Oxygen supply influences the colour of the flame. A low-oxygen fire contains lots of uncombusted fuel particles and will give off a yellow glow. A high-oxygen fire burns blue. So candle flames are blue at the bottom because that's where they take up fresh air, and yellow at the top because the rising fumes from below partly suffocate the upper part of the flame.[24]

Blue flames are not always hotter than yellow flames, because the colour of light emitted by the flame depends on which atoms and molecules are in the flame. Each atom or molecule has certain special frequencies (colours) at which it absorbs and emits light. Sometimes that's more important than the temperature of the flame in setting the colour.[25]

Manifestations of Colour Changes

Various chemical compounds can be used to alter the colour in a flame, as is used in fireworks, for example: red colours is obtained by using lithium and strontium; orange with calcium, yellow with sodium; green with barium and copper and halides; blue with copper; violet/purple with potassium, and white/silver with aluminium, magnesium and titanium.[26]


Left: Yellow flame from sodium chloride. Middle: Green flame from Borax. Right: Violet flame from Potassium chloride.[26]

Icebergs are formed from the glacial ice that has built up from snow falling on the Antarctic continent over millennia. This ice consists of pure fresh water. As seawater is drawn deep under the ice shelves by the oceanic currents, it becomes extremely cold. Under certain conditions it can freeze to the base of the ice shelf. Because this ice is formed from seawater, it differs from the freshwater ice of the ice shelf. Often, the frozen seawater contains organic matter and minerals, causing it to have a different colour and texture. Thus icebergs broken off from the ice shelves may show layers of the pure **blue-white glacial ice** and **greener ice** formed from frozen seawater. As the bergs become fragmented and sculpted by the wind and waves, the different coloured layers can develop striking patterns.[27]

The Transformation of Light Waves

The molecular structure and pigmentation of each object enables the light rays to be mixed, absorbed and reflected in various speeds and intensities. Objects which ***absorb*** more light rays and thus reflect less light back to the eyes, appear to be ***darker*** and deeper in colour, whereas lighter objects ***reflect*** more light, appear to be ***lighter*** and more intense in colour. A ***transparent*** object will ***transmit*** light.[15] If, for example, one holds a white piece of paper on one side of a glass filled with red liquid, the light will transmit a red colour of the liquid onto the paper. An object is

coloured because of the light it reflects, and all the other colours are absorbed into that specific object.[28]

The foetus in the womb is able to distinguish between light and dark. At birth infants can see shapes, but they can only see black, white and grey. After a few weeks of life they are able to see the first primary colour of red, and by the age of 3 months they are able to see the full spectrum of colours.

The Psychology of Colour

Individual colour preferences have a huge impact on the body, mind and soul, as well as on the economy in general, due to particular associations which people attach to the meanings of colours. Colours have deeply rooted emotional responses which influence decisions which people make, from the cars they drive to the clothes they wear.
Warm colours include red, orange and yellow, which evoke emotions, ranging from feelings of warmth and comfort, happiness and vibrancy, to feelings of anger and hostility. Blue, green and purple colours are known as cool colours, which are often described as calming and soothing, but can also evoke feelings of sadness or indifference.[29]

Colours reflect different emotions, moods, attitudes, personalities, characteristics and messages. Colours may inspire, energise and create a sense of calmness, happiness, sadness, uneasiness, or anger. It can be attention seeking, provoke passion, alert one in the event of danger; it can denote loyalty, compassion, confidence and a team player; it can denote power, efficiency, elegance and style; or it can portray a sense of cheerfulness, playfulness and excitability.

Certain colours alter mood states and can change patterns of behaviour, for example: ***bright*** colours ***reflect more*** light, as in the colour of ***yellow*** which may ***over-stimulate*** the mind, causing strain and ***irritability.*** However the right shade of yellow painted on the walls can positively stimulate the mind in a classroom setting. Conversely ***dark*** colours ***absorb*** more light, as in the colours of black, purple, violet and blue, have a ***sedating,*** digestion-activating, sleep-inducing effect.
Goethe understood the relationship between colour and emotions, as did Luschner, the latter, who believed that colour preferences revealed a person's basic personality traits. He indicated that a person who had a preference for the colour of ***red*** has an ***assertive*** personality type, who is ***outgoing*** and with a ***strong will,*** as in the Sanguinous/Bilious temperament. Conversely, a person who dislikes red indicates that he is shy and possibly withdrawn from society, which may be linked to the Melancholic/Phlegmatic temperament.
The colour clothing that one wears also reflects one's emotions, and at the same time it portrays to other people how one would like to be perceived, such as confident, loyal, passionate or a team player. Very often people come to work wearing the same colours. This may be a reflexion of the sharing of emotions, personal information and work issues, which subconsciously are translated into

patterns of psychological interpretation of the emotions elicited by the milieu of the work environment.

According to Sheila Dicks, a professional style coach, “the colours you wear in a professional setting are about so much more than mere fashion or style. Colours send subconscious messages, and can affect your mood, as well as the mood of the workers around you."[30]
“Mood dressers are people who are in-tune with their emotions and dress accordingly”.[31]

The Influence of Hormones on Mood

Photoelectric energy influences the functioning of the pituitary gland which controls the hormonal system and hence coping mechanisms, emotional and stress relations.[32]

The ***pineal gland*** in the brain produces the hormones of serotonin and melatonin. ***Serotonin*** is a neurotransmitter in the brain, which has been linked with mental disturbances such as schizophrenia and hallucinations. It is a ***stimulant*** which is produced during daylight (yellow of the sympathetic nervous system and the Bilious temperament). ***Melatonin*** has a chemical pathway which enables an organism to respond to light and synchronize bodily functioning with diurnal and seasonal variations. It is linked with ***sleep*** (blue of the parasympathetic nervous system and the Phlegmatic temperament), and it increases when it is dark, but it also has a depressive effect[1] (too much blue causes depression). Where daylight and artificial lighting in the interior of buildings are inadequate, the natural suppression of melatonin production during the day fails and may be accompanied by feelings of depression.[32]

Studies on sleep disorders, depression, seasonal affective disorder and post-traumatic stress disorder suggested that signs, symptoms, and biologic markers associated to these psychiatric disorders are due to marked alterations in melatonin and serotonin levels.[33]

Neurophysiology of Colour

Modern neuropsychology maintains that memories are colour-coded and that distinct frequencies of colour can reactivate synapses in the brain which were previously blocked. Repressed memories of a physical or emotional trauma are held in the hippocampus and amygdala of the limbic system of the brain. These memories can be accessed and treated with the correct colour wavelength, with, for example wearing colour glasses with the recommended colour, and other treatment options.

Colours can have two distinct and often opposite effects. Because of the color-coding of emotions, treatment with colour can either trigger the expected colour with a physiological reaction, or enable the release of a related colour coded emotion or problem. For example: blue light will usually have a sedative effect, but if a person

was molested by his mother when he was a toddler, and she was wearing a blue bra at the time, blue may cause sympathetic arousal (distress) in this person until the trauma is healed.

The complexion constantly changes according to the fluctuation of the emotions and the difference in the state of health, for example: blushing or extreme anger may turn the face reddish in colour; cyanosis has a bluish colour, and jaundice has a yellow complexion.

In Tibb ***warmth*** is associated with blood, fire, life force energy, growth, movement, joy, as well as an outgoing, enthusiastic and optimistic temperament. A glowing complexion from a fever is also associated with warmth. From an ***emotional*** perspective, ***warm*** colours of ***red and yellow*** are ***extrovert,*** inviting, happy and cosy, and ***stimulate*** the body, such as the Sanguinous and Bilious temperaments. Warm colours are best used in conditions which require energising, such as in depression and lethargy, but not in conditions such as ADHD or hypomania, which would further exacerbate energy levels.

In Tibb ***coldness*** has characteristics which are completely opposite to warmth, namely those of phlegm and black bile, with a compassionate and perfectionistic temperament. Coldness is also associated with death. The ***cooler*** colours of ***blue, violet*** and ***green*** are ***introvert***, such as the Phlegmatic and Melancholic temperaments, which would be more suitable for disorders of hyperactivity and anxiety.

<u>The Colour of Emotions</u>

From a ***physiological*** perspective ***warm*** colours ***enhance*** human metabolism, increase respiration rate, raise blood pressure and increase circulation; whereas ***cooler*** colours have antiseptic and anti-inflammatory qualities, and which ***slows down*** metabolism, and induces sleep.

From a Tibb perspective, ***joy*** and happiness, as well as ***anger*** and aggression, have qualities of ***heat,*** which is linked with the ***Bilious*** Temperament and the colour of ***yellow***, which is associated with a fiery temperament. ***Sadness*** is opposite to joy, and has qualities of ***cold,*** which is inked to the ***Melancholic*** Temperament and the colour ***purple/violet***, which is associated with the serious and pessimistic temperament. ***Fear*** *is the opposite of anger, and* has ***cold*** qualities, which is linked with the ***Phlegmatic*** Temperament and the colour ***blue,*** and which is associated with its calm, controlled and even temperament.

The mind and emotions are the most powerful energies on earth, and people associate certain colours and language with emotions.

- “I’ve got the blues,” or ‘down in the blues’ (blue slows us down and makes already slow people depressed. as in the Phlegmatic temperament).

- "I am in a black mood" (as in Melancholic temperament)
- "I am green with envy" (envy is a liver emotion and the correct colour is yellow/green.
- "Red-Hot love" (red brings out emotion in people - including sexual passion).[4] 'In the pink of health'; 'looking at the world through rose-coloured spectacles'; 'red carpet treatment'; 'and 'business is in the red'.[34]

Conclusion

Colour has a physiological, psychological and social impact on a person's health, wellbeing and status in the world; from the positive stimulating effects of warm colours to the mental relaxation and soothing effects of cool colours. Colours set the mood, state of mind and tone for any environment, situation or healing therapies. Colour influences our emotions, our actions and how we respond to various people, situations and ideas. Reds and yellows stimulate the senses and produce feelings and thoughts of warmth and comfort, whereas blues and violets/purples are associated with coldness.

Every colour has its own specific wavelength and frequency, from stimulating and energetic qualities, to calming and more subdued ones. This generates specific biochemical and hormonal responses, which influence the physiology and autonomic nervous system. Certain colours alter mood states and can change patterns of behaviour. The use of colour therapy can be applied to the body to alter its functioning.

References

1. Samina, T.; Azeemi, Y, and Raza, S.M. (2005). *A Critical Analysis of Chromotherapy and its Scientific Evolution.* Evid Based Complement Alternat Med. Dec 2005; 2(4): 481–488. [Online]. Available http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1297510/
2. Mc Corry, L.A. (2007). *Physiology of the Autonomic Nervous System.* Am J Pharm Educ. Aug 15, 2007; 71(4): 78. [Online]. Available http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1959222/
3. No author. (2014). *Educational classes online: Smooth muscle.* [Online]. Available http://www.uic.edu/classes/phyb/phyb516/smoothmuscleu3.htm
4. Klinghardt, D. (2003). *The Neurophysiology of light.* Journal of Optometric Phototherapy, March 2003, pg.35-40. [Online]. Available http://www.klinghardtacademy.com/Articles/The-Neurophysiology-of-Light-The-Five-Pathways.html
5. Koopman, F.A.; Stoof, S.P.; Straub, R.H.; Van Maanen, M.A.; Vervoordeldonk, M.J., and Tak, P.P. (2011). *Restoring the Balance of the Autonomic Nervous System as an Innovative Approach to the Treatment of Rheumatoid Arthritis.* Mol Med. 2011 Sep-Oct; 17(9-10): 937–948. [Online]. Available http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3188868/

6. Mead, V. (2014). *The Sympathetic Nervous System.* [Online]. Available http://www.veroniquemead.com/sns.php
7. No author. (2013). *Image: Newton and the Colour Spectrum.* [Online]. Available http://www.webexhibits.org/colorart/bh.html
8. No author. (2013). *Image: Visible and Ultraviolet Spectroscopy.* [Online]. Available http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/Spectrpy/UV-Vis/spectrum.htm
9. MacEvoy, B. (2009). *Colour Temperature.* [Online]. Available http://www.handprint.com/HP/WCL/color12.html
10. *Ekperigin, N. (2013). Itten's Colour Wheel.* [Online]. Available http://colorwheelco.com/colortheory/ittenscolorwheel.php
11. No author, (2012). *Basic Colour Theory.* [Online]. Available http://www.colormatters.com/color-and-design/basic-color-theory
12. Bakhtiar, L. (1999). *The Canon of Medicine – Avicenna.* USA: Great Books of the Islamic World, Inc.
13. Saunders. (2007). *Dorland's Illustrated Medical Dictionary.* USA: Elsevier.
14. Wills, P. (2013). *Colour Healing Manual. The Complete Colour Therapy Programme.* London: Singing Dragon – an imprint of Jessica Kingsley Publishers.
15. Klotsche, C. (1993). *Colour of Medicine. The secrets of colour/vibrational healing.* USA: Light Technology Publishing.
16. Cherry, K. (2013). *What Is an Afterimage?* [Online]. Available http://psychology.about.com/od/sensationandperception/f/afterimages.htm
17. No author. (2010). *Image: Colour Temperature & Colour Rendering Index Demystified.* [Online]. Available http://lowel.com/edu/color_temperature_and_rendering_demystified.html
18. No author. (2014). *The colours of fire.* [Online]. Available http://kaheel7.com/eng/index.php/earth-science/74-the-colours-of-fire
19. Cole Harris, P. (2013). *Understanding Colour Schemes With The Colour Wheel.* [Online]. Available http://budgetdecorating.about.com/od/usingcolor/ss/color_wheel_10.htm
20. Chishti, G.M. (1991). The Tradtional Healer's Handbook. A Classical Guide to the Medicine of Avicenna. USA: Healing Arts Press.
21. No author. *(2007). Art Apprentice Online.* [Online]. Availablehttp://www.artapprenticeonline.com/artstudies/learnctr/colortheory/edlearnctrcttemp.html
22. Sun, H. & Sun, D. (1999). *Colour Your Life. How to use the Colour Reflection Reading for insight and healing.* London: Biddles Ltd, Guildford and King's Lynn.
23. Furlanetto, S. (2001). *Why do we view red as the hottest colour but hottest stars are blue?* [Online]. Available http://www.madsci.org/posts/archives/2001-03/984443967.As.r.html

24. Keany, L. (2011). *20 Things You Didn't Know About Fire.* [Online]. Available http://discovermagazine.com/2011/oct/20-things-you-didnt-know-about-fire
25. Jessica'. ((2014). *Why are blue flames hotter than yellow flames?.* https://van.physics.illinois.edu/qa/listing.php?id=1545
26. No author. (2014). *Flame test – Colouring Fire.* [Online]. Available http://www.amazingrust.com/Experiments/how_to/Flame_Test.html
27. Nicol, S. (2004). *Why icebergs can have colours and stripes.* [Online]. Available http://www.antarctica.gov.au/about-antarctica/environment/icebergs-and-ice/icebergs
28. No author. (2013). *Light and Colour.* [Online]. Available http://www.fi.edu/color/
29. Cherry, K. (2013). *What Is the Opponent-Process Theory of Colour Vision?* [Online]. Available http://psychology.about.com/od/sensationandperception/f/opponproc.htm
30. Mandell, L.J. (2010). What Message Is the Colour You're Wearing Sending? [Online]. Available http://jobs.aol.com/articles/2010/12/27/meaning-of-colors-at-work/
31. Desy, P. L. (2013). *Holistic Healing. Colour Therapy and Your Wardrobe.* [Online]. Available http://healing.about.com/od/colortherapy/ss/color-therapy-and-your-wardrobe.htm
32. Edwards, L. & Torcellini, P. (2002). *A Literature Review of the Effects of Natural Light on Building Occupants.* [Online]. Available http://www.nrel.gov/docs/fy02osti/30769.pdf
33. Radeljak, S.; Zarkovic-Palijan, T.; Kovacevic, D., and Kovac, M. (2008). *Chromotherapy in the regulation of neurohormonal balance in human brain – complementary application in modern psychiatric treatment.* Coll Antropol. 2008 Oct;32 Suppl 2:185-8. http://www.ncbi.nlm.nih.gov/pubmed/19138024
34. Seven, L. (2013). *Alternative Healing Through Chromotherapy.* USA: Amazon Publishers.