

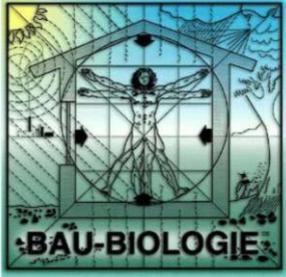
International Institute for
Bau-biologie® & Ecology

IBE 204.4

IBE 204.4 Natural Colors



**BRINGING TOGETHER TECHNOLOGY AND DESIGN
METHODS TO PROVIDE THE INFORMATION
NEEDED TO CREATE HEALTHY HOMES AND
WORKPLACES**



Natural Colors – IBE 204.4

Welcome

*Thank you for choosing IBE for your educational needs. Current environmental realities demand a new approach to ensuring that our homes, schools and office buildings support the health and wellness of all who dwell there. We strive to provide the latest information and cutting edge methodology on the vital, complex relationship between the natural and the built environments. May you find your educational experiences enlightening, and take this knowledge out into your community for the benefit of all. **Michael Conn**, Executive Director, Institute for Bau-Biologie & Ecology.*

Course Navigation

You will find that it is very easy to navigate through this course.

- Progress through the lessons using intuitive navigation tools. When you study, make sure to be aware of and use all supporting materials, such as pdf files, video and audio clips, links to other websites or relevant articles or papers, as well as the online forum.
- The last lesson will give you the option of downloading an electronic version (PDF) of the course. Please be aware that this information is copyright protected.
- When finished, you will be ready for the test. These tests are "open book" and are designed to help you evaluate your understanding of the subject.
- When you have finished the entire Course Pack, a Certificate of Completion is available on-line.

By using the Forum feature, students can share information and solve problems. We would like to see truly interactive discussions take place.

Please be advised that links to third party information may not reflect or support the Building Biology viewpoint. However, it might be of some interest to see how other people, groups, institutions, etc. argue the same subject.

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Lesson 1 – Introduction to Color

Introduction to Humans and the Color Spectrum

The sun is the original source of all light and color, of all warmth and life on planet Earth. Following natural laws, the wonderful "world of colors" radiates life-force energies and creates unique effects. Colors form the fundamental elements of art and culture. In all great civilizations, colors play an important role, highlighting psychological and aesthetic, mystic and religious, allegorical and symbolic aspects as well as bodily functions.

The earliest evidence of color pigments and paint-grinding equipment was recently unearthed in a cave at Twin Rivers in Zambia. Archeologists believe this evidence is about 400,000 years old.¹ Prehistoric rock paintings date back as far as 35,000 B.C. Most of them are found in Eurasia. The paintings in the cave at Chauvet-Pont-d'Arc,² France, for example, are among the most ancient (31,000 B.C.) and the most spectacular (rhinoceroses, lions and bears). Rock paintings can also be found in the Americas, though they tend to be of much younger age. Besides cave painting, body painting also held great symbolic significance. Because certain natives of North America loved to stain their bodies red, which also served as a mosquito repellent, early European settlers referred to them as "red man." Colors were not purely decorative, they were considered to have fundamental cosmic powers and were also used as healing agents.



For the most part, this unity between humans and color has been lost. Our modern scientific approach has not only deconstructed this holistic approach, but has also destroyed our living connection to color. As a result, many of us – including professionals such as architects, designers and painters – feel overwhelmed when asked to make color choices for a room or an entire building. Obviously, we have lost touch with the human experience of subtle color intimacy. Learning about color theory is a step in the right direction. However, we also need to retrain our senses and expose them to full-spectrum colors.

It takes more than a color theory to create harmony in our living environment. The following course module will therefore not only look at physical data, but also explore the color effects on our human body, mind and emotions. The color advice provided in the course module is based on this holistic approach.

Footnotes:

¹ *Earliest Evidence of Art Found* by [BBC News 2 May 2000](#).

² [Cave of Chauvet-Pont-d'Arc](#).

Lesson 2 – Color Terminology and Theory

Color Terminology

Light is a form of electromagnetic vibrations. White light is divided into its component colors through the use of special prisms or water drops (e.g. rainbow). The components of visible light vary in wavelength, ranging from 380 to 740 nm (nanometer = 10^9), and in frequency, ranging from 790 to 405 THz (terahertz = 10^{12}).

Color	Wavelength Range	Frequency Range
Purple	380 – 430 nm	790 – 700 THz
Indigo	430 – 450 nm	700 – 670 THz
Blue	450 – 520 nm	670 – 580 THz
Green	520 – 565 nm	580 – 530 THz
Yellow	565 – 590 nm	530 – 510 THz
Orange	590 – 625 nm	510 – 480 THz
Red	625 – 740 nm	480 – 405 THz

Source: Wikipedia Article on Color

Vibration Frequencies of Colors

Color is the effect of light waves bouncing off or passing through objects. In fact, if there were no light, there would be no color. Each object has its own unique absorption or reflection pattern. An object appears to be black, for example, when 100% of the incoming light waves are absorbed. The color white is produced when 100% of the incoming light is reflected. Actually, black and white are not true colors.

White (average)	ca. 80%
Yellow	ca. 60%
Green	ca. 30%
Red	ca. 25%
Blue	ca. 20%
Black	ca. 10%

Reflectance Values of Colors

Reflectance values are indispensable to brightness design, which determines the usability of a given room, creates mind-body effects, and impacts the solar heat gain of a building. Knowledge of how the color of building materials affects their surface temperatures is an important tool in passive solar design. The following example illustrates this point:

Surface Temperatures of Ceramic Tiles

(Time: 6 p.m. air temperature: 27 °C/80 °F orientation: west wall)

White	38 °C/100 °F
Ivory	46 °C/115 °F
Red	55 °C/131 °F
Blue	60 °C/140 °F
Black	67 °C/153 °F