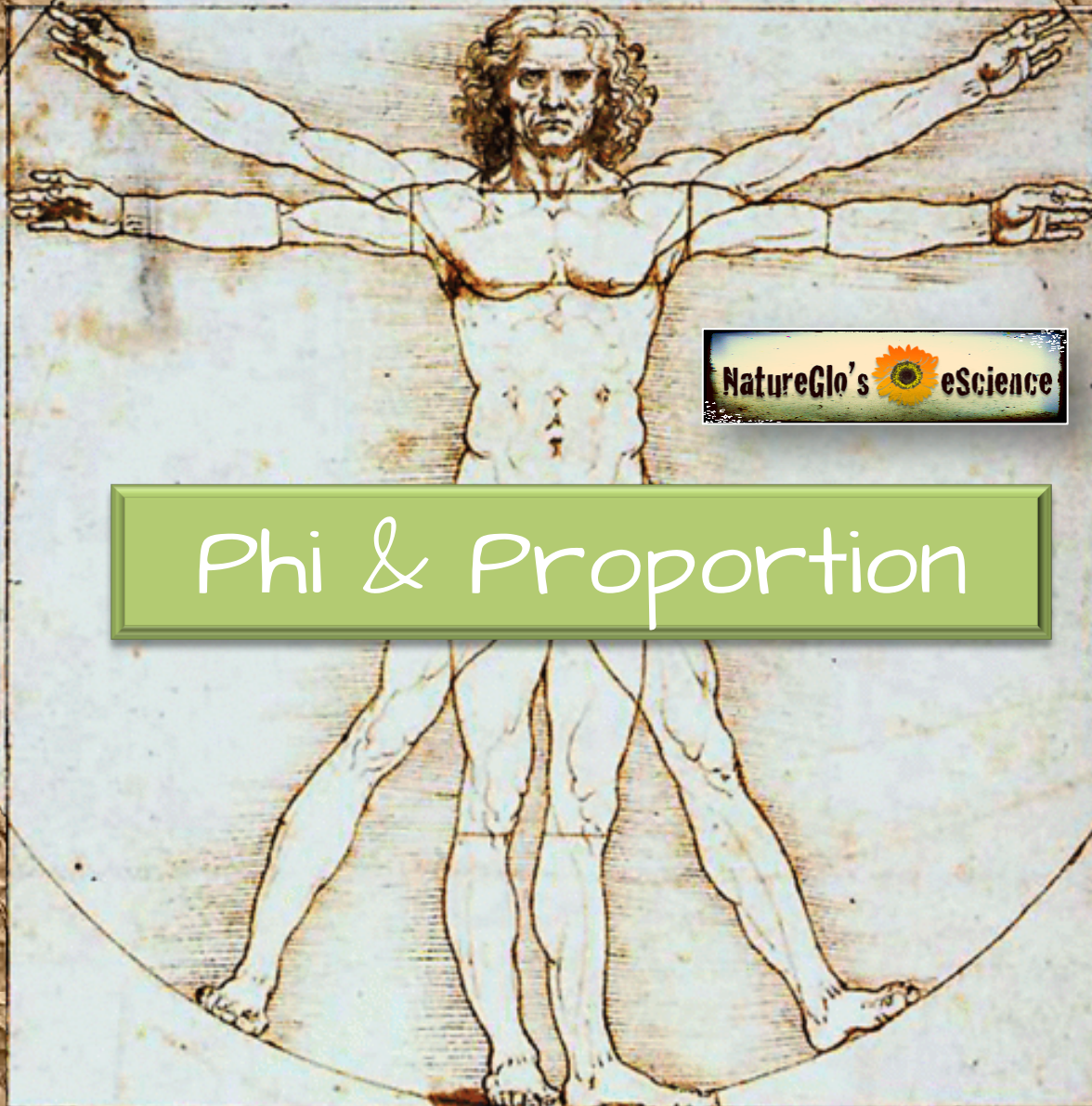


# The Human Body:



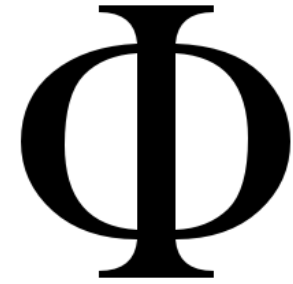
NatureGlo's  eScience

# Phi & Proportion



# What is the Golden Ratio?

- Greek letter "phi" shown right
- Special number denoting beauty & order
- Appears many times in geometry, art, architecture and nature including the human body
- Represented by shortened form 1.618



Φ

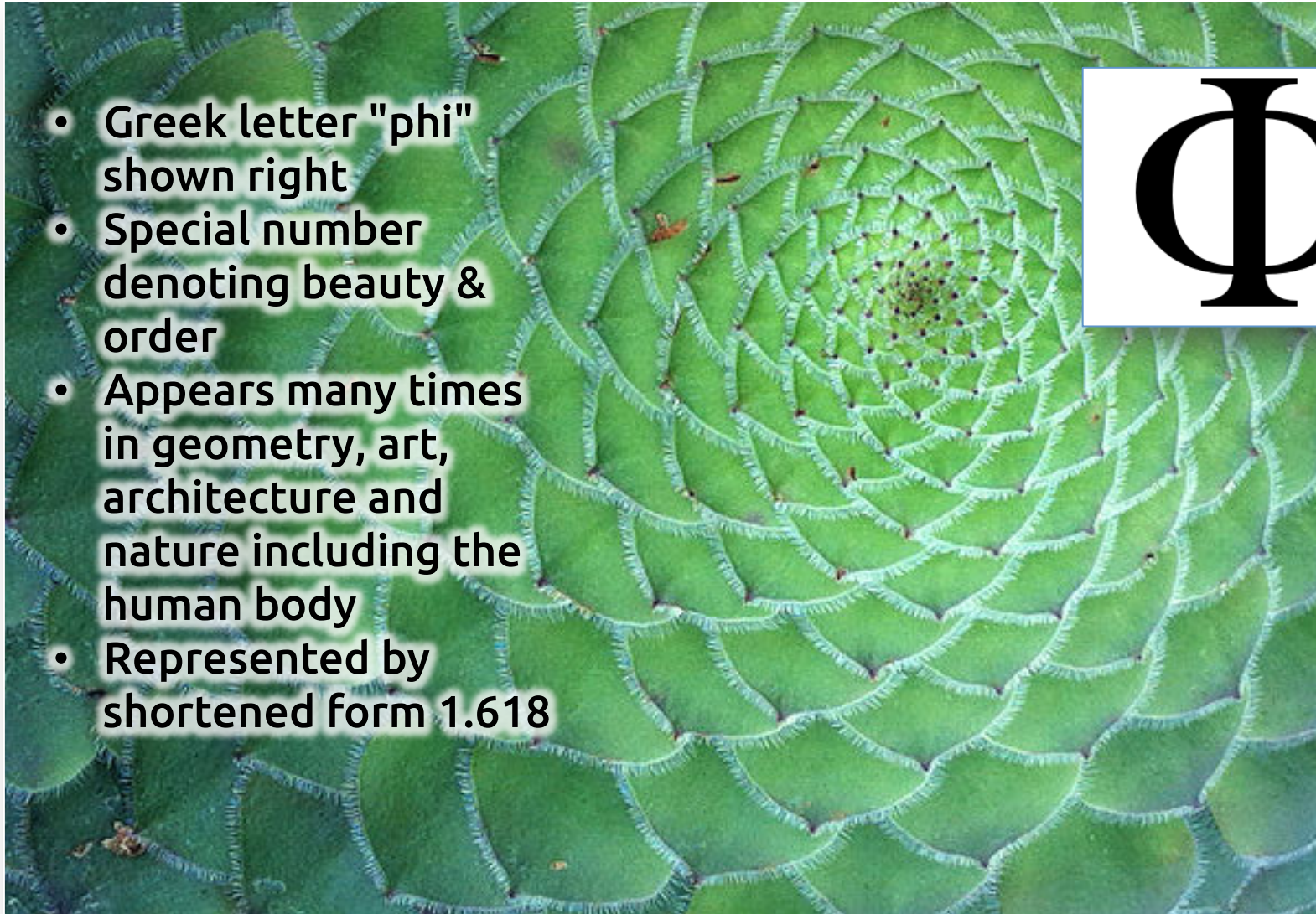
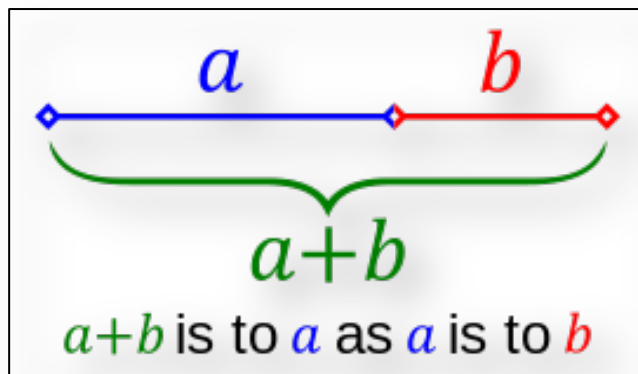


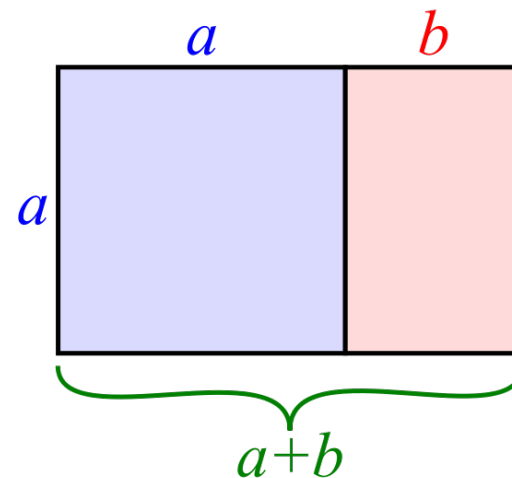
Image – A Saucer plant, exhibiting a logarithmic spiral with the golden mean, a common pattern found in nature. Photographed by Max Ronnersjö.

# The Divine Proportion in Mathematics

- 2 quantities if ratio same as ratio of sum to larger of 2 quantities
- The figures below illustrate geometric relationship



“The golden ratio (phi) represented as a line divided into two segments  $a$  and  $b$ , such that the entire line is to the longer  $a$  segment as the  $a$  segment is to the shorter  $b$  segment.” Illustration & quote by Stannered.



“A golden rectangle with longer side  $a$  and shorter side  $b$ , when placed adjacent to a square with sides of length  $a$ , will produce a similar golden rectangle with longer side  $a + b$  and shorter side  $a$ .” Illustration & quote by Ahecht.

# The Human Body & the Golden Ratio

## Average human body

- Distance between navel and foot is 1 unit (green), the golden section of person's height (red line) = 1.618
- Distance between wrist and elbow (yellow line) is golden section of distance between finger tip and elbow (cobalt blue)
- Distance between knee and foot (purple) is golden section of distance between navel and feet (green)

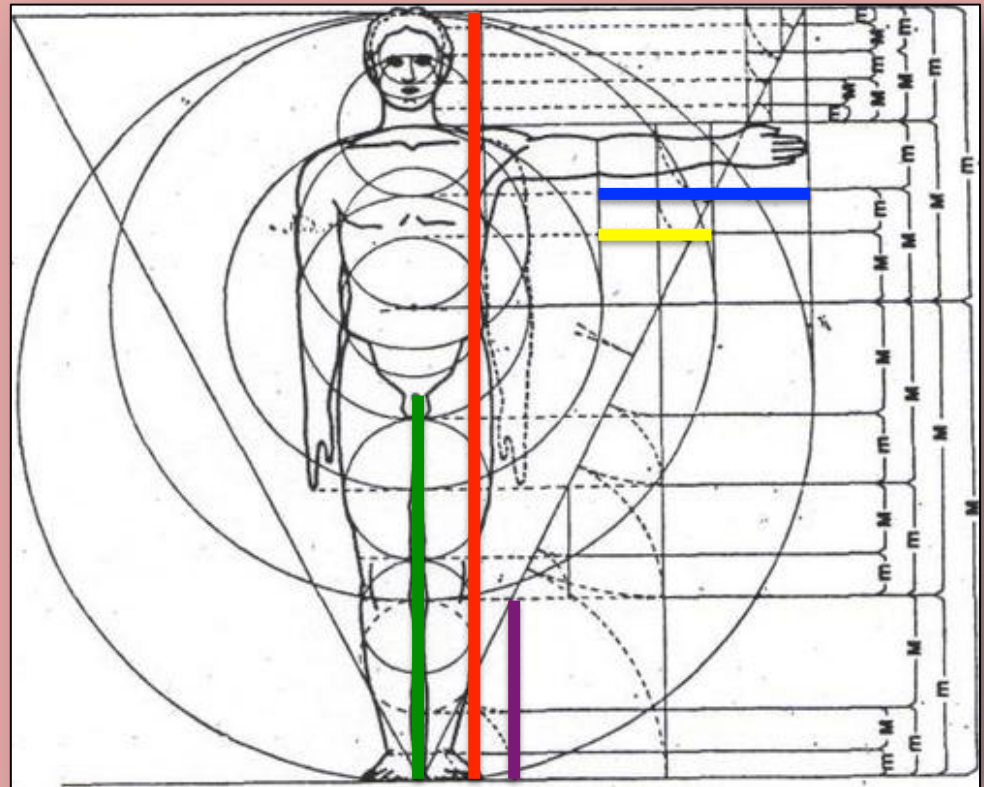


Image in the public domain.



# **The Human Body & Proportion**

- Variation in anatomical proportions between people
- References to body proportions - found in art, measurement, medicine
- In measurement - body proportions often used to relate two or more measurements based on body

**Background Image –  
Miss Belgium beauty**

# Human Proportion In Art

- Human proportions – usually standard range; artists use to create idealized artwork standards

## Figure drawing

- Human figures usually drawn in proportion save for abstract art
- Basic unit of measurement - 'head'; used by artists to establish proportions of human figure
- Head - distance from top of head to chin

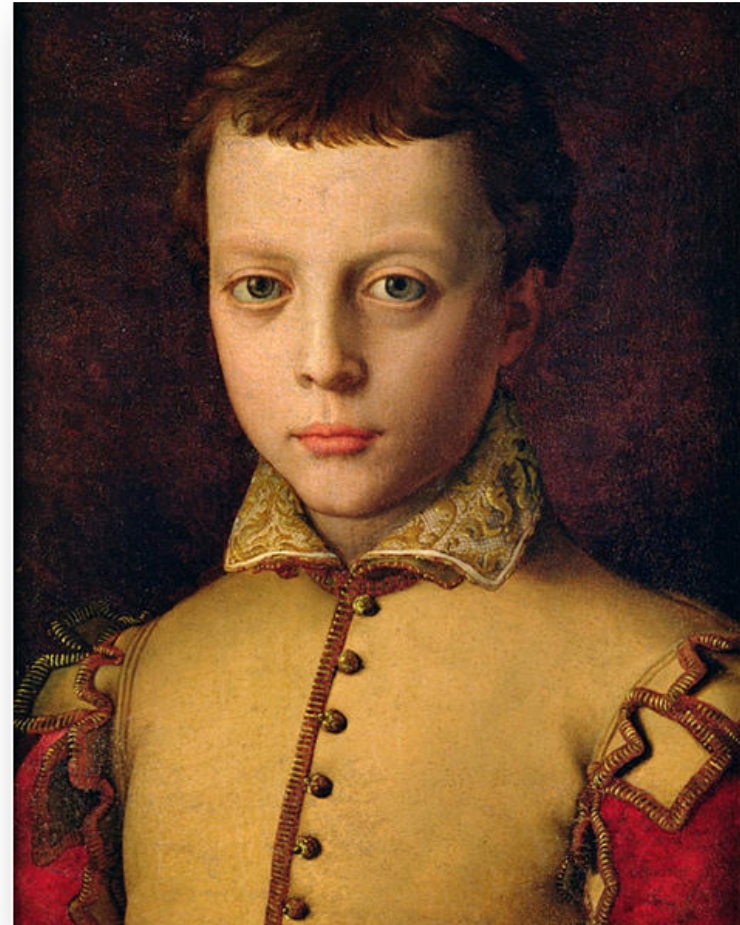


The Elder Sister by William-Adolphe Bouguereau(1825-1905). Image in the public domain.



## **Proportions Used in Life-size Figure Drawing**

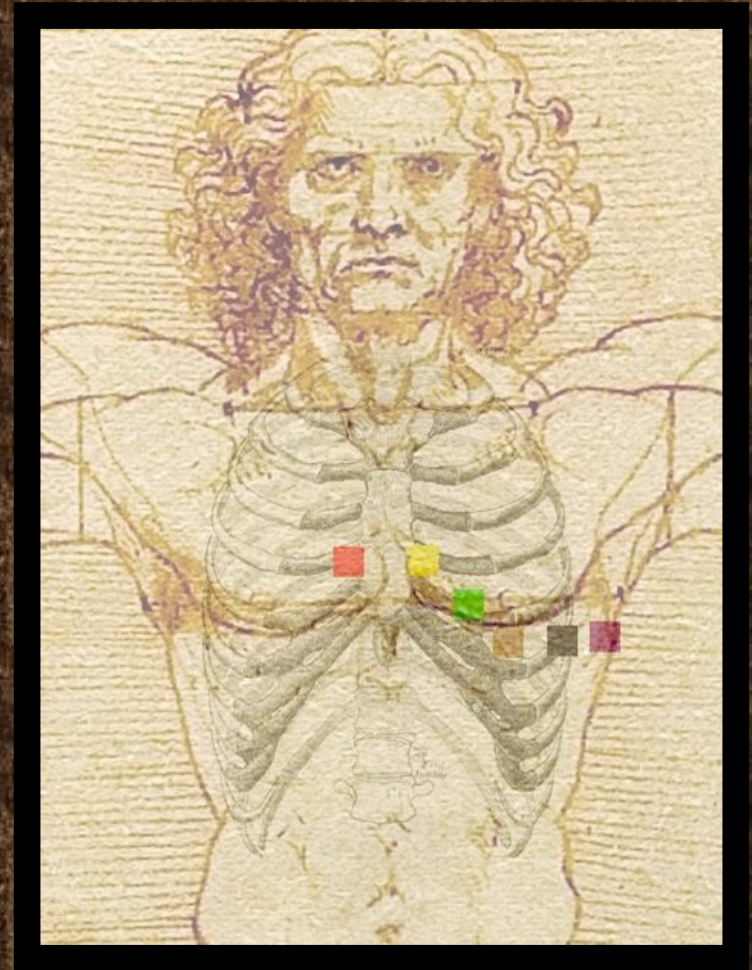
- Adult = 8 heads tall, with head size = 9 inches
- Heroic figures (gods and superheroes) – 8 ½ heads tall
- 10 year old = 7 heads tall; head size = 7 ½ inches
- 5 years old = 6 heads tall; head size = 7 inches
- 1 year old = 4 heads tall; head size = 6 inches



**Ferdinando I de' medici as a child painted by Italian Bronzino (1503–1572). Image in the public domain.**

# Leonardo da Vinci's Vitruvian Man

- Leonardo's belief - ideal human proportions governed by harmonious proportions which also govern universe
- Ideal man - would fit cleanly into circle as his famed "Vitruvian man" drawing
- Only some proportions of Vitruvian man exhibit Golden ratio



The Vitruvian Man showing proportional markings. Image in the public domain.

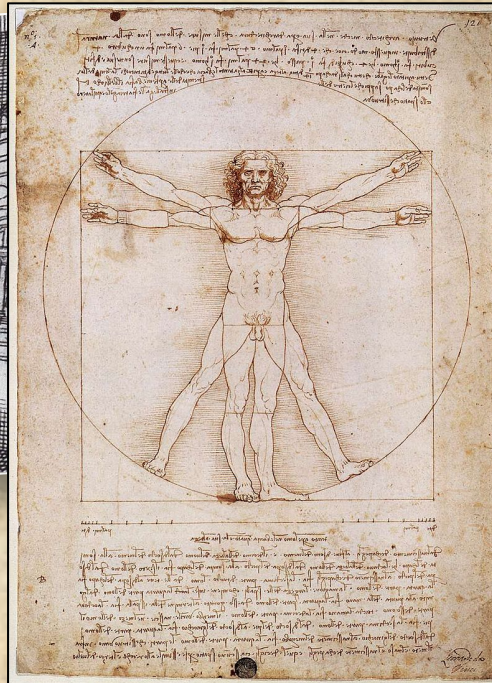


# History of the Vitruvian Man

- 1487 - world-renowned drawing created
- 1<sup>st</sup> century BC – Marcus Vitruvius' (Roman writer, and engineer) notes included from his writings on drawing



Marcus Vitruvius making a presentation.  
Image in the public domain.



The Vitruvian Man by Leonardo da Vinci.  
Image in the public domain.

- Pen and ink drawing - male figure in two superimposed positions with arms and legs apart
- Drawn in circle and square
- Other names - sometimes called *Canon of Proportions* or, *Proportions of Man*

# The Vitruvian Man Notes

- Notes come from Vitruvius' Book III of Treatise *De Architectura*
- Notes describe ideal human proportions with geometry
- Book stored in *Gallerie dell'Accademia* in Venice, Italy
- Human figure principal source of proportion among classical orders of architecture
- da Vinci's Drawing named in honor of Marcus Vitruvius

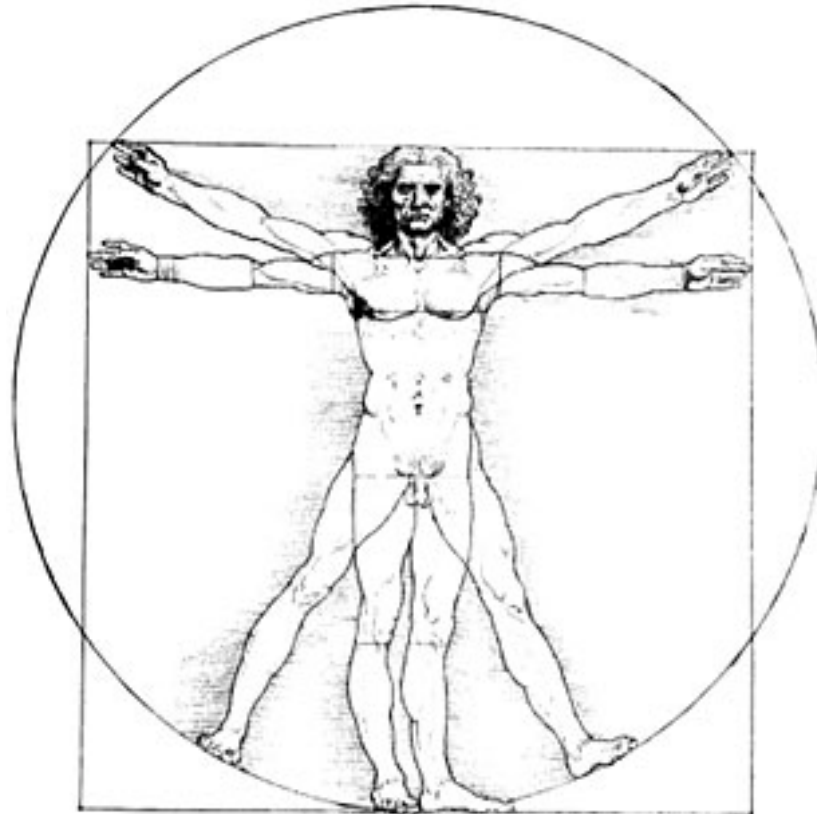


**Architectural book written by Vitruvius.**



## Vitruvian Man: Subject and Title

- Blend of art, science & nature during Renaissance
- Text – 2 parts, above and below image
- First paragraph of upper part reports Vitruvius: "*Vetruvio, architect, puts in his work on architecture that the measurements of man are in nature distributed in this manner, that is:*
- *a palm is four fingers*
- *a foot is four palms*
- *a cubit is six palms*
- *four cubits make a man*
- *a pace is four cubits*
- *a man is 24 palms*



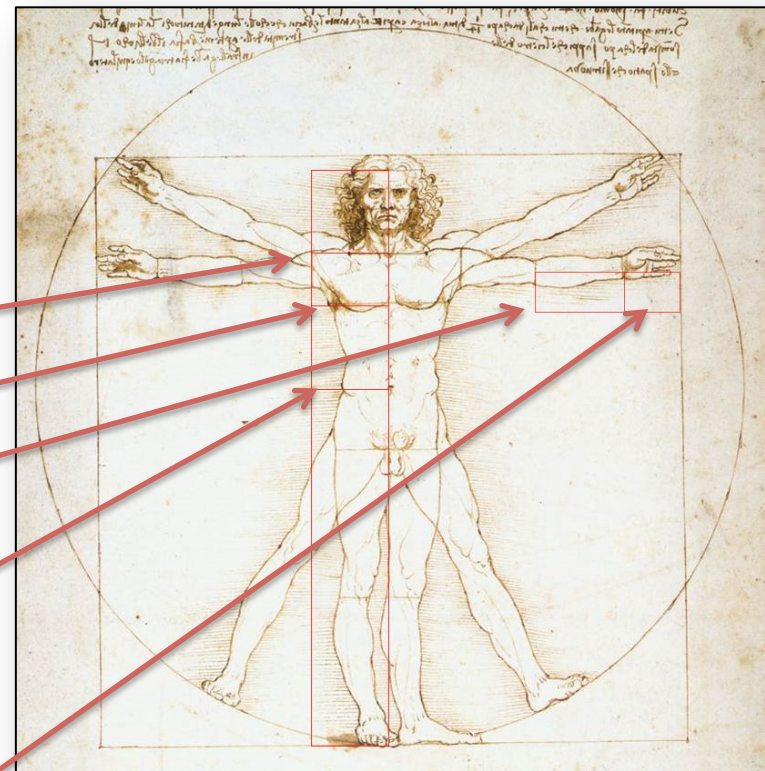
**The Vitruvian Man.**

# The Vitruvian Man & the Golden Ratio

The Vitruvian Man was drawn to represent fractional measures and is not based on the golden ratio. However, The Vitruvian Man does have some golden ratio proportions shown & illustrated below.

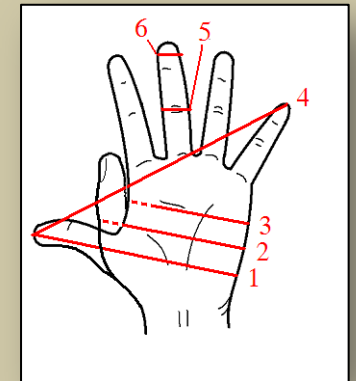
In the distance from the Da Vinci's guide line drawn at the hairline to the guide line at the foot, the following are all at golden ratio points:

- Collar bone guidelines
- Guidelines for pectoral nipples
- Distance from Da Vinci's guide line drawn at the elbow to the guideline at the fingertips
- Navel - often associated with golden ratio of height total and not hairline height
- Hand base – at golden ratio point



Gary Meisner Goldenratio.net





## The Notes Conclude:

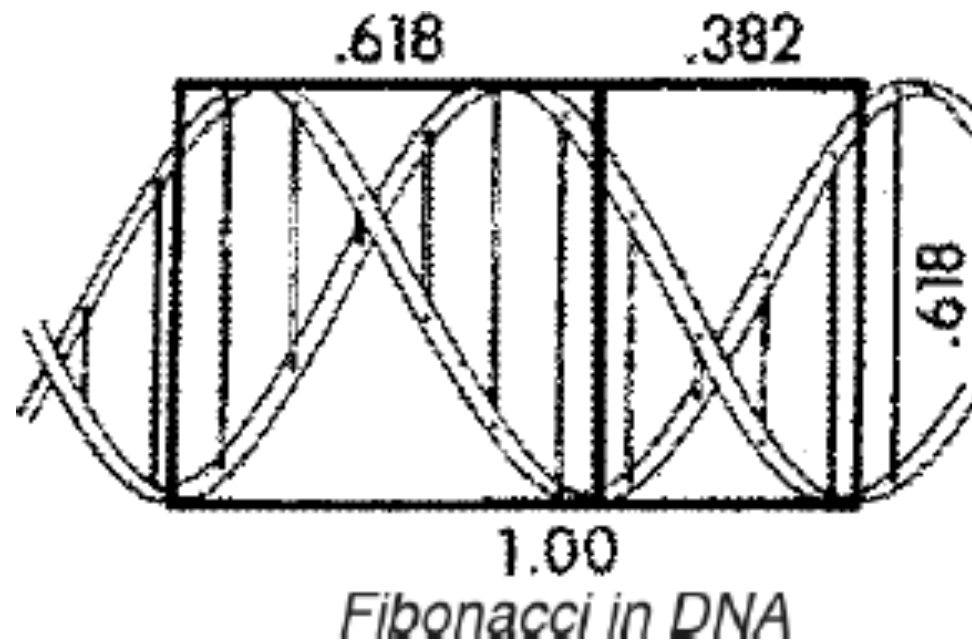
- Points determining proportions - marked with lines on drawing
- Below drawing – a line equal to side of square divided into four cubits; outer two divided into six palms each, two of which say "palmi"
- Outermost two palms - divided into four fingers each; each say "diti"

A "palmi" showing measurements.



## DNA & the Golden Proportion

- One double helix revolution spiral measures 34 angstroms long by 21 angstroms wide for each full cycle
- 34 and 21 are Fibonacci numbers; ratio, 1.6190476 closely approximates Phi, 1.6180339

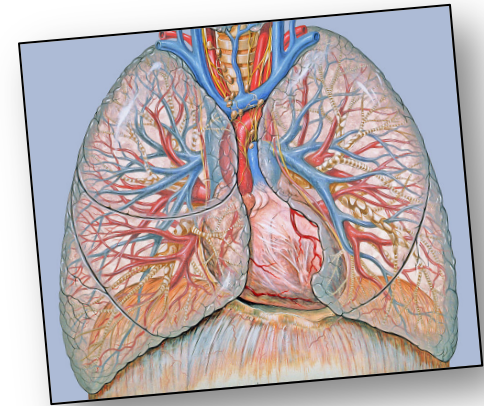


# Patterns Found in the Human Body

- Fractals – lung network, brain network, arteries and blood vessels
- Spirals – human ear cochlea, swirling hair pattern on heads, fingerprints



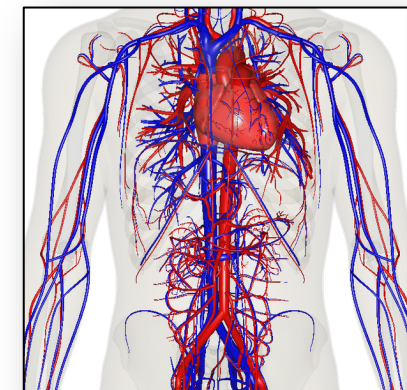
Model of a human ear revealing the spiraled cochlea by José Braga.



The lung's fractal network by Patrick J. Lynch.



Human brain fractal neurons from Pixabay.



Circulatory system showing the fractal network of the heart with blood vessels, veins and arteries by BodyParts3D/Anatomography.



Learn more about the divine proportion of the human body and the Vitruvian Man by visiting Natureglo's eScience MathArt Virtual Library resource page below.

<http://hascmathart.weebly.com/human-body-proportions.html>



**Image – A fragment of an ancient Roman measuring rod on display at Vidy Roman Museum. Perhaps this rod was used in Vitruvius' day. Photographed by Rama Cc-by-sa-2.0-fr.**

# References Used

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5. Wikipedia article, The Vitruvian Man, [http://en.wikipedia.org/wiki/Vitruvian\\_Man](http://en.wikipedia.org/wiki/Vitruvian_Man) Retrieved 2010-08-20

Image - *Study of a Sleeping Child* oil on cardboard by  
Václav Malý (1874–1935). Image in the public domain.



**Thank you  
for watching!**

**Painting by William-Adolphe  
Bouguereau (1825-1905) -  
*The Bohemian* (1890) in the  
public domain.**

