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George Clooney, the cauliflower, the cardiologist, and phi, the golden ratio

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The challenge for scientists of all disciplines is to discern basic patterns and laws of nature that can be described mathematically—all this in a universe generated apparently from chaos and influenced by random events.

The "golden ratio" is one such phenomenon and has been known to mathematicians since ancient times. Two quantities are in the golden ratio when the ratio between their sum and the larger one is the same as the ratio between the larger one and the smaller. The Italian mathematician Leonardo Pisano, often known as Fibonacci, discovered the sequence (which was named after him) from which phi (Φ), the golden ratio, can be calculated. Stakhov et al show in a review that Φ (1.6180339887...) can be found in many aspects of nature and art.¹

Leaf branches and the florets in a cauliflower head exhibit Φ proportions. The proportions can also be found in architecture of the past (such as the Notre Dame cathedral in Paris and even as far back as the Parthenon in Athens) and were consciously adopted by more modern architects, such as Le Corbusier. Even in the structure of DNA, Φ has its place. The DNA molecule is 3.4 nm (34 angstrom) long and 2.1 nm (21 angstrom) wide, resulting in a length:width ratio of 1.61905.¹

Similarly, evidence exists that Φ is also present in the design of the human body. For example, in the "perfect" body, Φ can be found by splitting certain distances (such as head to pelvis, or fingertip to wrist) into numerous segments—for example, mouth and nose are found at Φ proportions of the distance between the eyes and the chin. The American actor George Clooney exhibits the golden ratio in his face proportions).

Anecdotal reports have been published on the importance of Φ in cardiovascular physiology. A heart beat that produces a Φ relation between the T waves in an electrocardiogram has been reported to represent a state of health, peace, and harmony.¹ However, surprisingly little exploration of Φ relations has been undertaken in medical research. One problem is that very large datasets are needed to reduce the effects of random error.

We hypothesised that Φ can be found in important biological variables, such as arterial blood pressure. The Vorarlberg Health Monitoring and Promotion programme, covering a primary care based cohort of 166 377 people (mean age 42 years) in the far west of Austria, has offered routine screening periodically over two decades.² We evaluated the ratio between systolic and diastolic arterial blood pressure at first visit in the cohort database. Although the systolic:diastolic blood pressure ratio in the whole population

was 1.6235, the mean ratio was 1.6180 in the participants who did not die during the 20 year observation period and 1.7459 in those who did. This finding suggests that blood pressure values in "well" individuals, but not in those who are at risk of dying, exhibit the golden ratio. Although this finding is not likely to be of practical relevance for individual clinicians, at a population level this may be an important phenomenon and should be investigated in other cohorts.

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