

The human spine

Configuration, development and pathological tendencies in the rhythmic system's solid foundation

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Dedicated to Hartmut Vogel who taught us to look for the essential nature of things in their origin.

■ Abstract

The human spine is—next to lung and heart—considered to be the third organ of the human rhythmic system. Its embryonic development clearly shows a relationship to the individual nature, the I, of the human being. Spinal conditions such as herniated nucleus pulposus in adults are considered in the light of vertebral-column developmental dynamics; the equilibrium between buoyancy and gravity, powers of light and substantiality, is seen as determining spinal development and health. At substance level, the corresponding polarity is between phosphorus and calcium, in dynamic terms between lordotic areas of high spinal mobility on the one hand and kyphosis on the other, which may also lead to fusion of vertebrae.

■ Keywords

Vertebral Column
Rhythmic System
Notochord
Intervertebral Disk
Herniated nucleus pulposus
Osteochondrosis
Osteoporosis
Calcium phosphate
Calcium carbonate
Scheuermann's disease
Lumbosacral transition
Cranio-cervical transition
Cervicogenic vertigo

The specific configuration of the human vertebral column

When back pain limits the ability to stand without support we become aware of the significance of being upright. The human form is able to hold a unique position between heaven and earth. It owes this to the vertebral column which—sensitive perceiving the situation with regard to balance—seeks the upright anew at every moment. It can be instantly and actively taken out of this for any form of movement, then to return again to its unstable balance. The way in which the spine is placed in and against the line of gravity makes the upper extremity independent of support from the trunk, ultimately giving the hand perfect freedom of a kind not achieved anywhere in the animal world. This provides the basis for the human capacity for active intervention. With the shoulder girdle relieved of gravity and the head raised into “weightlessness”, as it were, above the spinal column, it becomes possible for the word to be freely created.¹ To understand the significance of these effects which ultimately arise from the spine, consider a cow. The front legs bear the heavy load of a massive body; the head hangs heavy, held by mighty neck muscles. The configuration of muscle and bone immediately shows that the creature (with its impressive metabolic functions) can only produce a dull “moo” sound. The human neck muscles are relatively slight, and largely relieved of their supportive function; they may, however, be as finely modulated as are the delicate muscle fascia of the larynx or the subtle muscles of the face and tongue.

The spine of vertebrate animals more or less forms an arc from anterior to posterior extremity; this may be tensed for a leap or (cf. snake, fish) swung sideways, but shows a functional form that differs fundamentally from that of the human spine. The human axis also is not a straight rod, but shows rhythmic alternation of rest and mobility. The resting position of the head bases on the vaulted form of the occiput which has developed by fusion of cranial vertebrae. These gave up their articulated mobility in relation to one another. This kyphotic gesture of perfect rest is immediately followed by the most mobile part, the cervical spine, which permits the head to turn and incline in all directions. The basic form

Note

¹) For detailed descriptions, see Verhulst J. (1)

of a healthy cervical spine is distinctly lordotic. We shall see in what follows that lordosis always signifies mobility, whereas kyphosis leads to rest. This is immediately apparent in the thoracic spine below; slightly kyphotic, it goes slightly forward towards a thorax made up of the ribs that arise from it. Continuous rhythmic movement lives in this space, yet the axis which determines it is largely at rest. The lordosis of the lumbar spine on the other hand permits to-and-fro motion in the vertical direction when walking, and also rotation in the horizontal and sideways inclination. There follows a section of fused vertebrae, immobile in itself and making up the kyphotic sacrum. This directs the weight of the body via the ileosacral joints—with minimum mobility—to the solid pelvis and then the legs. The coccyx, rudimentary in humans, is inconstant in its curvature.

The rhythmically organized configuration of the spine separates and relates above and below, buoyancy and gravity, mobility and rest, sensory and limb activity; it makes it possible for the human being to be “one who looks up” (*anqropos*, *anthropos*) and yet stands firmly on the ground.

The vertebral column as an organ of the rhythmic system

One secret of the vertebral column shows itself in the middle part. The 12 pairs of ribs starting from the transverse processes of the thoracic vertebrae create the chest cavity which is closed at the top and opening up further down; it is both mobile and at rest, the lungs expanding and contracting with it as inner and outer, mediating air and blood. The heart beats in this space, receiving and holding the stream of venous blood coming from source areas in the organs and combining forces with the heart to transform it in the arterialized pulse which is sent from center to periphery. In the course of respiration, there is a continuous slight coming upright and moving back, followed by going down again and forward. Looking at these rhythmic processes we see how heart, lung and vertebral column are a whole, one relating to the other, with movement changing from one to the other—the rhythmic system as Rudolf Steiner described it. The role of the vertebral column in this has not been considered until now, but it shows itself all the more clearly the more we consider that every movement of the thoracic organs converts into pressure changes in the venous plexus in the spine, giving impulses to a stream of liquor which pulses from the thorax to both the head and the sacrum. During interventions in the posterior cranial fossa one can actually see this rhythmic stream of liquor like a rising and falling surf.

In the middle of the body, with its rhythmic movement, lives our feeling, the true soul element of the human being—every pleasure, every pain shows itself in changes in our breathing, pulse beat and posture. The rhythmic system has its vital focus in the cardiovascular functions, where fluid and solid, respiratory gases and inner warmth come together. In the lung, the system opens up to the outside world, connecting with it even in our speech. The basis, the support for the middle hu-

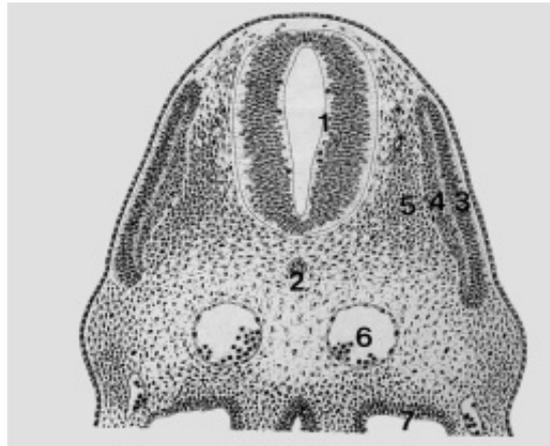


Fig. 1.
Section through
embryo 4 mm long
(26 days old) (from
(2), p. 826)
1 Neural groove
2 Notochord
3 Dermatome
4 Myotome
5 Sclerotome
6 Aorta

man being, also in terms of mineral and solid matter, lies in the vertebral column.

The spine's connection not only with feelings but also with the development, the evolution of individual human nature does not infrequently show itself during midlife crises. The contrasts and polar opposites that give rise to biography are taken to extremes at this time, and have greatest power to destroy. The human middle, with its balancing function, is itself under threat from this. Herniated nucleus pulposus, infarct-like by nature, thus shows maximum frequency between the 35th and 40th years of life. It should never be seen as a purely mechanical process, for it is always part of the whole of life.

It has become evident that the development of the vertebral column cannot be the outcome of random mutation and selection under the pressure of changing environmental conditions, but must be seen as having been brought about from the very beginning to make human freedom possible. Below, the phylogenesis of the vertebral column will be considered to show how it relates to the individual nature of the human being.

Vertebral column development

The leitmotif of the first week in embryonic development is the *unity* reflected in the spherical form. The ovum has this form and so do the morula, a mulberry-shaped group of cells, and the hollow blastocyst. Differentiation into the duality of embryoblast, the future embryo, and trophoblast, the future placenta, marks a new motif at the end of the first week. Division into two is the key feature of the second week, which begins with the embedding of the blastocyst in the uterine mucosa. Secondary developments, as it were, are the primary yolk sac beneath and the amniotic cavity like a firmament above the future embryo, which initially spreads as a two-dimensional oval plane between the two. It has two layers at first, the primitive endoderm which connects with the yolk sac, and above this the ectoderm which relates to the amnion. We then have an above and below, though the other dimensions in space are not yet defined. The third week marks the development of a third primordial tissue and of a body axis which will later be established by the vertebral column. With the appearance of this axis, anterior and posterior, left and right are also deter-

Fig. 2.
Transverse section
through an 18-day-
old embryo, 1 mm
long. At the center,
the temporary po-
sitioning of the
head process in the
endoderm (from
(2), S. 114).



mined, creating the preconditions for subsequent three-dimensional development of the original germ disc. At about the center of the disc, endoderm and ectoderm fuse in a stripe-like feature known as the primitive streak. The stream of cells arising through division in this region moves to the front (now identifiable) between the primordial germ layers to give rise to the head process. This happens on the 17th day. Other material flows laterally between ectoderm and endoderm to form the intraembryonic mesoderm. This begins to fill up the “inside” which now exists. In the 5th chapter of his monumental *Humanembryologie*, (2) K. V. Hinrichsen says that as the head process develops, germinal material is for the first time orientated “towards a future bodily form.” The development of this first preembryonic (we can only speak of an embryo once a three-dimensional body exists) structure with organ character, marks a key moment in development: “for the first time, the germinal material is thus orientated towards a future bodily form. The development of a head process ... establishes that an individual will arise from the germ which has so far developed”. (3) Up to this point it was still possible for identical twins to develop in a process of separation, but once the axial organ has developed, the germinal tissue clearly belongs to a single individual. This scientific discovery runs parallel to one made by Rudolf Steiner in his spiritual-scientific investigations concerning the relationship of a purely spiritual individual who goes through a sequence of alternating lives on earth and periods of existence in the spiritual world: “From the moment of fertilization onwards, this descending individual spirit belongs together with the outcome of physical reproduction ... This spiritual individual who is descending does not, however, have an influence on the development of the physical human being in the early days following fertilization ... Intervention happens from about the 18th, 19th, 20th and 21st day after fertilization; then something which has descended from a higher world is already working with the developing human being.” (4)

The configuring influence of the individual spirit thus begins at the moment which embryologists call “individuation”. It seems that here (as in many other cases) discoveries made independently and heterochronically

in both natural and spiritual science substantiate and illuminate one another. It may be mentioned in passing that these aspects may be of significance in the discussion of ethical issues.

Before we look at further development of the vertebral column, let us consider the development of the whole. In the third week, the chorion still shows the uniform spherical form, wholly enveloping the germ in a sphere. Later this will be the limited placenta, the source for the provision of nourishment and oxygen. Rudolf Steiner described this sphere as being connected with the cosmic I of the human being, whereas the ray of the head process evidently is connected with daytime I-activity directed towards the body. If we visualize the whole germ with its intra and extra embryonic structures in vertical cross-section, the head process appears as a dot within the peripheral chorion that lies around it forming a circle. Both relate to the human I, each in its own way. They embody the earthly core of the incarnating spirit and its periphery, which is connected with its ground and origin. This comes alive for us in the *Point/Circle Meditation*.

The head process and the notochord which arises from it then become the starting point for significant further developmental processes in the embryonic body. First, mesenchymal tissue gathers in somites and lateral plates on either side of the cord (more about this below). These will later develop into the muscles of the back and in due course of the limbs. The neural groove, taking the place of the primitive streak in the region of the ectoderm, will close up over the neural groove to form the neural tube—a process induced by the cord itself. Beneath the cord, the aorta will appear, initially as a pair, and beneath this the coelenteron develops from a folding process in the yolk sac. The cord, the first organ to have appeared, is at the center of these evolving organs. It is the seed for crystallization and a precondition for realization of the developmental impulses. Later it will become part of vertebral column development (Fig. 1).

Before we consider the further destiny of the cord and its influences, let us consider its qualities. The original head process changes into the plate (also to be considered below) and then the notochord. This provides the first actual supportive organ in the embryo. It is an elastic, flexible, turgid rod extending from what will later be the adenohypophysis to the region of the future coccyx. The cord itself is quite undifferentiated, and yet all segmental differentiation of the body is due to its influence. A strong perichordal sheath encloses the spherical cells with their high water content, thus allowing for the high fluid pressure inside which gives the structure its elastic firmness. The first collagen develops here, as does a glycosaminoglycane-containing matrix rich in silica, and the differentiating influence which the cord has on surrounding structures is probably mediated by these.

The structure, its large, round, translucent cells having a high potassium content, is reminiscent of conditions in the plant body, which characteristically has similar cells.

Note

2) The actual sequence is not the more familiar I A O, but A O I.

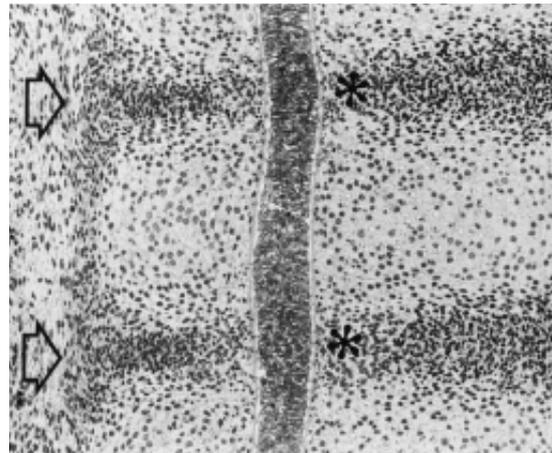
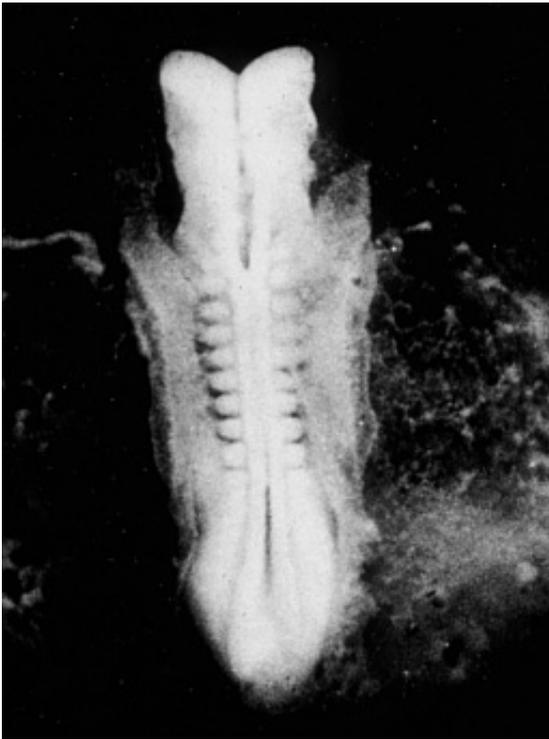


Fig. 3. Dorsal view of a 22-day-old embryo. Neural groove beginning to close up, and metameric somites progressively developing (from (2) S. 130).

Fig. 4. Longitudinal section through evolving vertebral column in 40-day-old embryo, 12 mm long. The "oscillation" of the cord at the center of the "vertebral column field" is clearly in evidence (from (2) S. 829). The arrows mark the beginnings of intervertebral discs, preceded by densification of cell aggregates in the cord at their level (asterisks).

Having considered the sculptural powers of the cord, let us consider its musical qualities. "Chorda" is Greek for "string", hence "monochord". The basic characteristic of a string is its power to oscillate. The head process does in fact perform a basic oscillation which, by the way, is probably typical of the human germ. The first axis phenomenon (looking through the amnion from above) is a streak-like increase in growth in the ectoderm. The head process develops between ectoderm and endoderm, and in its lower part (later this will be ventral) it fused with the endoderm below at the apex of the coelenteron (Fig. 2)—now referred to as the prechordal plate—only to separate from the endoderm again and return to the center. The central position is thus not primarily given; coming from the ectoderm, stopping at the center for a moment, connecting with the endoderm, and then returning to a central position, it gradually finds itself. The earliest axial development in the human being thus goes through the dorsiventral oscillation which later will be so typical of the human vertical column in its outer form. Starck, the embryologist, asks for this specifically human process, the significance of which has not yet been understood, to be merely described, not rushing into interpretation. People with real experience of eurythmy will see here the "archetypal I A O" gesture,² where the human being goes back to open up to the world above, inclines forward to turn to the earth, and finally freely finds the middle position that belongs to him.

The first stages of neural development can only come in the presence of cord material, and this is even more the case for its rhythmic metameric differentiation (Fig. 3). Following removal of the cord, the neural tissues will merely develop an undifferentiated nerve plate; spinal nerves, vertebrae and intervertebral discs do not develop. The differentiation of the whole body also is rhythmic

metamerism initially (ribs, muscles of the trunk, dermatome and myotome sequences are later consequences of this basic differentiation for the body). The process begins with the development of somites at the conclusion of the 3rd week and moves down from the occipital to the caudal region. The somites which develop from the mesenchymal tissue of the mesoderm differentiate from the outside inwards into dermatome, myotome and sclerotome. The latter is involved in the development of the bony vertebral column. Cell concentrations soon appear rhythmically in the tissue surrounding the cord; they are the beginnings of intervertebral discs. The cord itself now also shows densification of cells in these regions. Their configuration suggests the nodes in an oscillating string. The more loosely organized region in between, around which the vertebra will form, seems to correspond to the antinode (Fig. 4).

A cross section through the developing intervertebral disc shows the cord at the center—its configuration reminiscent of a bar magnet, with iron filings ranged around it, or the sun establishing the order for the planets that orbit it—and around it the cells of the future nucleus pulposus lie loosely and those of the future anulus fibrosus more densely packed in concentric orbits (Fig. 5). The growth movement of the vertebrae which follows presses the central parts of the cord into the region of the discs. With cell boundaries progressively dissolving, they are involved in developing the nucleus pulposus. In terms of substance, therefore, the nucleus has, as it were, a "homeopathic" share in the original axial form and the central inductor of vertebral column and nervous system development (Fig. 6).

The undifferentiated primordial notochord thus induces the development of a rhythmically organized organ, the vertebral column, and this in turn breaks it down into rhythmically concentric fragments. The polar arrangement of the column of vertebrae that initially are performed in translucent cartilage but grow opaque as calcium is deposited in them and they become subject to gravity, and the intervertebral discs which retain their original translucency, are equally induced by the notochord. It is the "oscillation" of the cord which brings about their alternation. The discs retain qualities of their origin not only by being rich in silica and transparent but

Fig. 5. Cross section of embryo c. 2 months old, 30 mm long. Differentiation of future anulus fibrosus and nucleus pulposus visible, with remnants of the inductive, ordering cord at the center (from (2) S. 830). Arrows mark the border between anulus fibrosus (external) and nucleus pulposus (internal). Asterisk marks vertebral body.

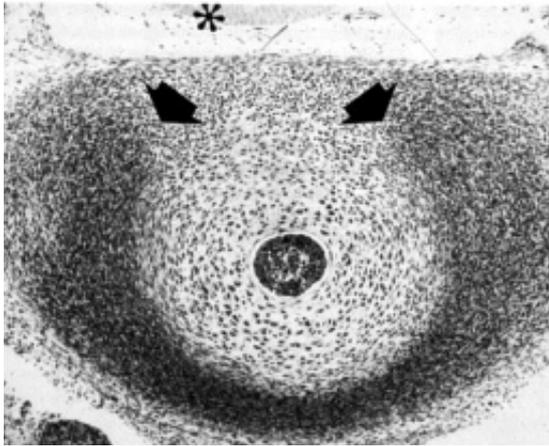
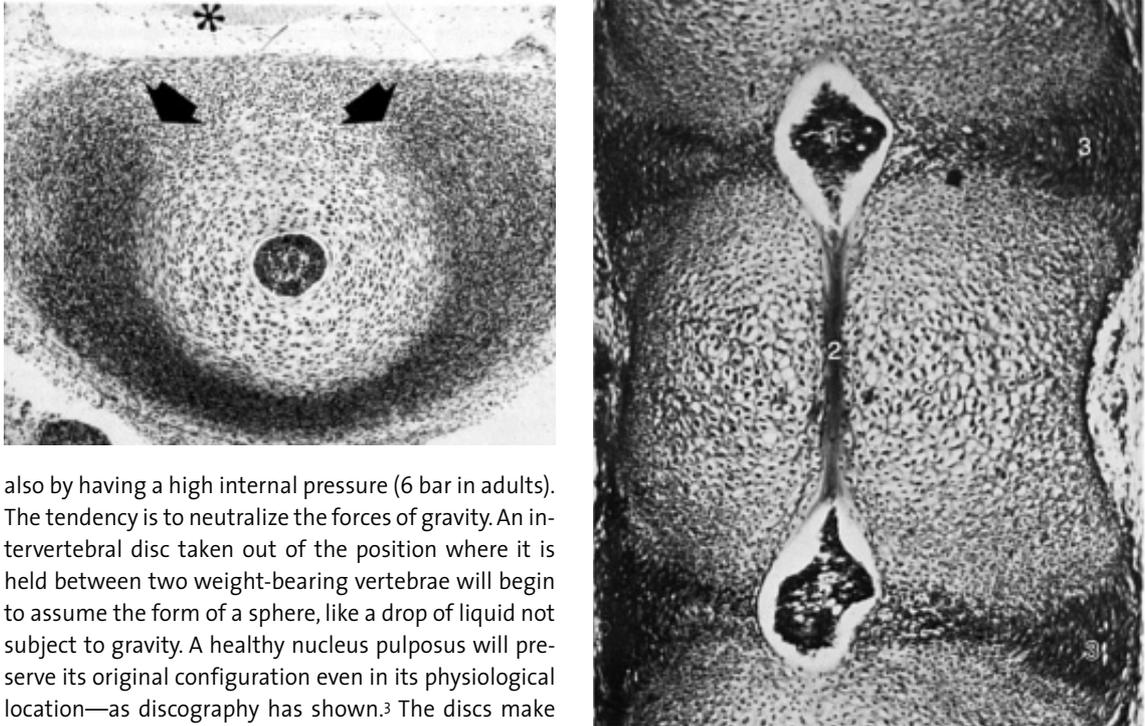


Fig. 6. Longitudinal section through vertebral column, 40 mm SSL, c. week 11. Horizontal growth pressure from the vertebral body compresses and fragments the cord, causing it to shift vertically. In the discs [3], parts of the cord [1] come to lie in the nucleus pulposus; the original lumen in the vertebral body is obliterated [2] (from (5) S. 192).



also by having a high internal pressure (6 bar in adults). The tendency is to neutralize the forces of gravity. An intervertebral disc taken out of the position where it is held between two weight-bearing vertebrae will begin to assume the form of a sphere, like a drop of liquid not subject to gravity. A healthy nucleus pulposus will preserve its original configuration even in its physiological location—as discography has shown.³ The discs make buoyancy and mobility possible, whilst the vertebrae that have no discs between them are finally completely ossified (at age 28 to 30 in the sacral region), and this makes them the abutment for the force of gravity.

Substance aspects in vertebral column development

As the child matures and becomes ready for earth, hemopoiesis moves to the vertebrae. It had originally started in the periphery of the yolk sac, had then been located in liver and spleen, and now finally moves to bone. The very heart of our dealings with iron enters into the inside of the most solid structure in the body where gravity takes powerful effect, though it also enables us to extend and rise up against it. The planet Earth has the highest iron content in the solar system, and there is much to suggest that its core consists of this metal. We also find iron in our own inmost part. In the blood is re-connects us with the world, going out from here via respiration.

The intervertebral discs are bloodless, on the other hand. They do have a vascular supply in fetuses and infants, but involution begins with the second year of life, with the disc bloodless at age four.

The ventral column of massive vertebral bodies and intervertebral discs just described, which relates to gravity, has as its polar opposite the column of vertebral arches lying dorsal to it. Here mass loses significance. The column encloses primarily the dural sac, with the myelon floating in it almost weightless, due to Archimedes' principle. The enclosed space, which contains the clear CSF, is a space for buoyancy, for light. The column of vertebral bodies permits only a relatively limited degree of movement; the column of vertebral arches with its numerous "small vertebral joints" is designed for mobility. The total surface area of these joints is greater than that of all other joints in the body together.

The gesture of emphatic involvement with gravity in the anterior, and the preservation of buoyancy in the posterior vertebral column is also evident in the type of ossification. The vertebral bodies ossify from a core at the center (enchondral). The process starts in the region of the thoracolumbar transition and proceeds from there—downwards, but predominantly upwards. The ossification of the arches starts from the periphery and is periochondral, proceeding from the uppermost cervical vertebrae downwards.⁴

We have previously shown how simple aquatic life-forms such as the oyster originally surround themselves with a skeleton consisting mainly of calcium carbonate which gradually increases in size as deposits are added. The oyster thus becomes more and more subject to gravity (the transparent larvae still float in the surface water). At the level of the fishes, rich in phosphorus, a differentiated skeleton appears, permitting intensive and differentiated locomotion against gravity. Such skeletal differentiation and individualization demands a new kind of "building material". Apatite (or rather calcium hydroxyl apatite) has a (relatively) high phosphate content. Phosphorus is related to light. The name itself means "vehicle for light", and the element is characteristically phosphorescent in the dark. Phosphorus is a vehicle for light; carbon dioxide, subject to gravity, extinguishes light (we may think of a burning candle being extinguished if we dip it into the CO₂ lake at the bottom of some caves). Alkaline phosphatase activity is characteristically an indicator for bone metabolism. This is not the case with oysters, their skeleton being insoluble. The substance of our bones (a percentage of it also being calcium carbonate) inherently has a certain equilibrium between forces of gravity and buoyancy. Comparative quantitative analyses have not been done, to our knowledge, but qualitatively

speaking the emphasis is more on the carbonate in the massive vertebral body, which is subject to gravity,⁵ whereas the phosphate predominates in the fine, mobile arch surrounding the light space.⁶

A second important polarity at substance level is between calcium and silica. Silicon dioxide, or silica, is crystalline in its dry form in rock crystal. It also has a genuine relationship to water, however, binding it to produce a gel. All gel-like (basic) substance in us contains silica and has its properties. In the natural world, such gel-like forms of silica are found in agates, and above all opals. The latter contain large amounts of bound water, which are also necessary for the luster of their colors (silica also exists in opal-like form in many plants, e.g. horsetail and bamboo).

Our life begins in clarity, free from gravity, and transparently, and then moves progressively into gravity and growing opacity. It is not surprising, therefore, that the translucent part of the eye has a high silica content, though it also grows more opaque as we age, like the intervertebral disc which originally was transparent and turgid, and articular cartilage, which gradually grows friable. On balance, the silica content continues to decrease, whilst the calcium content increases—particularly also in the vascular system. It is interesting to see that attempts are made today to increase calcium levels in the body by generous doses of calcium and vitamin D. As we shall see, with pathological processes it is not so much a question of the total amount of a substance but rather of getting the right distribution.

Wrong distribution of buoyancy and gravity—basic principles of spinal column pathology and suggestions for treatment

Let us go back to the vertebral column. In many respects we have so far established that there are areas with the emphasis on being subject to gravity and others that relate specifically to light, the two forming a rhythmic sequence. Anthroposophical readers may at this point recall a meditation from the Young Doctors' Course where these spheres of activity are characterized:

Yet ne'er shall power of light
take hold of power of weight
Nor shall power of weight
penetrate power of light
For if power of light
takes hold of power of weight
and power of weight
enters into power of light
then world goes awry
as body and soul
are bound up in corruption.

And it is also clearly stated that "That corruption is disease".

Below, it will be shown in how far this also relates to the basic tendencies in spinal pathology and these can be understood in the light of it. Initially this will be with reference to some pathological conditions that manifest in the intervertebral discs.

When an adolescent's spine develops Scheuermann's disease, clinically evident as pain and postural changes, the nucleus pulposus herniating upwards or down into the vertebral body, we can immediately see how part of the element which above was said to be characterized by "power of light" is wrongly moving into the domain of the force of gravity.⁷ At the same time we perceive that this creates a situation on the threshold of adult life which is similar to one that was physiological at the embryonic stage. The notochord as precursor of the nucleus pulposus was then located at the center also of the vertebral body. Falling back into an earlier developmental state is a general pathogenetic phenomenon which we also see in pneumonia, for instance. The lung derives from the gut, but in its location above the diaphragm it should postnatally be filled with air. In pneumonia the lung shows the tendencies belonging to a gland. The alveoli fill up with exudate, and the lung becomes similar to another organ derived from the gut, the liver. We therefore rightly speak of hepatization of the lung in that case. Scheuermann's disease is a striking example of a statement made by Rudolf Steiner with reference to general pathology, which is that a pathological process is in fact a healthy one which develops at the wrong time in the wrong place.

With Scheuermann's disease the nucleus pulposus erupts in the vertical, with herniated nucleus pulposus in the horizontal direction. Instead of counteracting the forces of gravity, the nucleus breaks through the annulus fibrosus. Due to pressure or—even more so—osmotic effects and above all due to its high potassium content,⁸ it may then irritate sensitive nerve endings in the longitudinal ligament or even affect a spinal nerve which leads to the typical radicular symptoms. Severe pain results, sometimes radiating along the affected nerve and causing paresis, and loss of muscular mobility due to a corset-like permanent contraction of the autochthonic back muscles. "Power of weight" has irrupted into the domain where weight should not prevail.

Similar to the way in which separating processes develop in the course of life in the clear vitreous body with its high silica content, subjectively apparent in "spots before the eyes", separation of water and water-binding glycosaminoglycane matrix also occur in the disc, with progressive dehydration. Herniated nucleus bulbusus does not have anything to do with such "aging processes". In fact, the probability of developing it decreases as people get older, among other things probably also because of the reduction in internal pressure. It also means that the loss of body height (by c. 1%) due to the discs being "expressed" during the day is no longer fully made up for during the night as people get older; we start to shrink (osteoporotic collapse of vertebrae may worsen this physiological process dramatically, being pathological in that case). As mentioned, herniated nucleus bulbusus shows the highest incidence between the 35th and 40th years of life, i.e. in midlife, with patients often feeling that demands from outside determine their life, and there is a loss of inner buoyancy, with heaviness pre-

Notes

- 3) Personal communication from Michael Hübner.
- 4) It is interesting in this context to see that Rudolf Steiner spoke of the (ahrimanic) principle which aims to bind human nature to matter (and is also connected with gravity) as acting from below upwards in the body. This corresponds to the predominant ossification process in the vertebral bodies. He said that the (luciferic) principle which aimed to make us free of the body (i.e. sought "lightness") acted from above downwards, which corresponds to the ossification tendency in the vertebral arches. The spine as a whole is in balance, like the Christ principle as characterized by Rudolf Steiner. This unfolds freely between the two polar opposite and one-sided tendencies. (6)
- 5) Its form may of course also change. The trabeculae do reveal a marvelous inner light structure. It is merely a question of relative tendencies.
- 6) Rudolf Steiner also took a look, in a similar way, at the emphasis seen with these two calcium compounds in the neck and head of the femur, (7) which encouraged us to make this study of the vertebral column.
- 7) It is evident from the above study of the substances why in homeopathy Calcium phosphoricum is often an important medicament on this indication. An outstanding anthroposophical medicament for this is Stannum comp. This combines apatite (a natural calcium phosphate), gold to convey psychic powers of uprightness (Scheuermann's disease tends to show itself in the crisis of puberty) and connect with the incarnation origin, and tin, which is particularly effective in regulating connective tissue fluids.
- 8) These are the main factors in choosing microinvasive treatment, a currently used method which is certainly often effective, consisting in local lavage using physiological saline.

Notes

9) Taking matters in hand oneself can sometimes prove helpful at quite an early stage. I recently had a patient with a large sequestered herniated nucleus pulposus and incomplete paresis who showed marked improvement when—a few days after the incident—he wrote to his parents, endeavoring to resolve a difficult situation.

10) The pancreas is the central digestive gland. Here we show maximum self-assertion in the face of the outside world, to have the power to dissolve it completely and ultimately make it the basis for creating one's own substance. On the one hand many back problems go hand in hand with digestive disorders, on the other, stimulating the active confrontation with the outside world which the human I is seeking can also prove significant in a transferred sense with back problems. One indication that the medicament is taking effect can be marked stimulation of diuresis, no doubt largely due to the horsetail component.

11) In this medicament, potentized common horsetail (*Equisetum arvense*) and horse chestnut (*Aesculus hippocastanum*) surround a preparation of peat. Stagnation in connective tissue followed by hyperacidity (typical of moorland), pain and muscle tension can be resolved with this medicament. Body-related psychotherapy has many techniques (e.g. craniosacral therapy) that will help to release overwhelming experiences that have become bound to the muscular body memory close to the back and then maintain pathological changes in the region, so that they can be worked through. *Solum uliginosum* comp. also comes into this. Apart from this it has proved extraordinarily effective with muscular pain aggravated by climatic influences, above all changes in the weather, and external influences of all kinds (including psychic ones).

dominant. This often also relates to heaviness in the psyche, which will likewise show itself in wrong posture. A mechanical factor, if present at all, is merely an occasional cause as a rule. Instead, one sees general strain, and not too infrequently also a real connection with inner feelings of knowing no way out, or of humiliation. The proverb of the last straw breaking the camel's back is very apt in this sense. Herniation will very often arise on the basis of an existing weakness in the rhythmic system, its roots often going back to the 2nd seven-year period in life, the most important period in the development of the psyche. Physical or surgical measures addressed to the local problem will therefore not prove adequate (though they may, of course, be indicated); it is rather a matter of establishing a new connection between the I and the body and the region which is so profoundly and originally bound up with its activities in the living body. We need to encourage the practicing of inner uprightness and together trace the more deep-seated causes of the condition and encourage the patient to work through these. Ultimately that has to be an active balancing out, done of one's own volition, of one-sided demands and burdens; powers of buoyancy must be cultivated where weight has gained too much power. Pain may be transformed from a bad thing which one wants to get rid of as quickly as possible into a teacher who helps to track down one-sided bias and to experience the function of the back in a living way. When pain is acute, this may, however, lead to being held in the ban of such a (painful) experience, and we must free the patient from this. This may be done with warming, relaxing external applications such as ginger or arnica packs, for instance, injections with medicines such as potentized *Stannum* to reduce swelling, or potentized analgesics such as *Rhus toxicodendron* or *Colocynthis*. In principle treatment will follow the order: first getting treated, then progressively taking action oneself, which does, of course, mean a gradual transition as a rule.⁹ Subsequently it will then be a matter of taking the one-sided bias of a turn that will frequently have come to the fore in this way and placing it in the space immediately in front, which is the field of vision and also the sphere where we take actions with a purpose, the sphere that lies before us. This must be related to the area behind me, the sphere of the back, which is also the sphere whence the original goals came. If we recall how in embryology we saw that the original impulse for the whole differentiation of the body came from the dorsal aspect, we realize that this is the sphere from which we took our origin, connecting with the living body, that it is a sphere of inscrutable intentions from which our most profound original goals arose and which we must rediscover. Physiotherapists often say today that our ventral musculature has shortened, demonstrating the imbalance in which we are caught up because most work is sedentary today, with attention and activity largely directed to the sphere that lies before us. In undoing the imbalance in our attention to what lies before and what lies behind, the above-mentioned external applications can help

(probably giving people the first experience for a long time of this sphere, or at least do so in a painfree and pleasant way), and also with rhythmic massage, remedial gymnastics, eurythmy therapy, listening practice, and meditation. There are many possibilities for medical treatment, especially also with substances connected with silica, though we only mention this briefly. It is not by chance that *Bambusa* and *Equisetum* play a particular role in the composition of the well-proven *Disci* preparations. They are plants from the family of grasses that show strong rhythms and impressive stability and capacity to oscillate. As already mentioned, they can be seen to work with silica processes in a living way, depositing quartz in opal form. They particularly mediate powers of lightness and can vitalize a deteriorating connective tissue matrix. Given on their own or in other compositions (e.g. *Pancreas/Equisetum*¹⁰ or *Solum uliginosum comp.*¹¹) they often act deeply in cases of disc lesions. Potentized discs, having a proportion of healthy nucleus pulposus which in substance and process terms relates to the origin of the spine, establish a relationship to the inherent etheric healing powers that give rise to regeneration and healing.

The bony vertebral column also shows the basic gestures of pathology. These are polar opposites with regard to their relationship to gravity and buoyancy. With osteochondrosis, forces of gravity take hold of the column of vertebral arches. The bluish, translucent articular cartilages diminish, chalk deposits weigh down the arches, even forming structures to fill the spaces between them, so that the most mobile part of the vertebral column grows rigid. Chalk dynamics take hold of it, the space for light becomes subject to gravity. In extreme cases the spinal marrow, originally floating freely in the CSF, is caught and held between spondylophytes.

The situation is different with osteoporosis. Here the bone matrix dissolves and finally the mineral salts also disappear from a vertebral body which is getting lighter and lighter. No longer an abutment for gravity, it turns into a fragile web that threatens to collapse under the weight of the body. Powers of buoyancy gain the upper hand, something one often also perceives in the individuals concerned who can have a somewhat unearthly, almost birdlike aura, especially with high-turnover osteoporosis. Phosphorus dynamics enhance dissolution (as in bird bones with their high phosphorus content, bones that may even contain air). Lightness and excessive light quality take hold of the sphere of gravity which finally threatens to crumble. It is not uncommon for the calcium migrating from the vertebral column to be deposited in the vessels. Many an X-ray picture of a vertebral column that is getting progressively more transparent will also show the elastic aorta changing into a rigid chalk tube. This maldistribution of calcium called "transmineralization" does not mean absolute calcium deficiency.

In the *Agaricus comp./Phosphorus* preparation, calcium from shells—representing the forces of gravity—and phosphorus—the element of the degenerative tendency just described—are pharmaceutically brought in-

to a new equilibrium. Substances from simple living plants act as mediators to counteract dissolution of the matrix and stimulate regeneration. In eurythmy therapy, the “U” sound can help establish a relationship to gravity and rest, which would counteract the general trend in osteoporosis.

The vulnerable areas in the spine

Lumbosacral transition

The localization of the different pathological tendencies in the spine does not show random distribution. Whilst Scheuermann’s disease affects the thoracic spine, the most mobile parts of the spine in the lumbar and cervical regions are particularly prone to herniation of the nucleus pulposus. These are the lordotic areas characteristic of the human axis. The human center of gravity is at the level of the lumbosacral transition. Human beings came upright out of the horizontal of the animal around this point. This is also where the majority of disc prolapses occur.

Craniocervical transition

This mysterious point has the craniocervical transition for its opposite, another area of transition from the most profound rest to maximum mobility and vice versa. Very early in embryonic development the five uppermost evolving vertebrae were kyphotic, soon fusing to form the immobile occipital bone. In the second month, the next seven cervical vertebrae develop the lordosis which will be characteristic for the cervical spine for the rest of life.

The depth of the relationship which develops between head and trunk in this transition area is evident if we take a closer look at the cervical region. Here the respiratory and food passages cross in a site which is both decisive and dangerous for terrestrial creatures. Numerous reflexes protect the separation between air and water in this site, where the consciously tasted and shaped bolus goes down into the sphere of the unconscious. The thyroid shows itself to be a regulator at this level, a kind of “respiratory center” for the chemistry in us. A bit more cranial to it lies another crossing point—that of the pyramidal or corticospinal tracts which serve to transmit impulses that steer conscious voluntary motor functions. The crossing motif creates conscious awareness, something eurythmy also teaches us when the cross-over “E” gesture leads to touch and awakens conscious awareness.

The wide range of crossing phenomena in the human central nervous system has been considered by Friedrich Rothschild,¹² for whom the bodily form reflected the concentration and focusing of self and world experience. It is not surprising then to find the reticular formation in the region of these cross-overs, a neural organization which conveys vigilance and alertness. The respiratory center, which lies cranial to this, is involved in the rhythmic organization of respiratory flow. A general signature for the region is emerging, showing that it influences the shaping of rhythmic processes in the body in many ways (further examples to follow). It is directly

connected with what we call the rhythmic system, which is inseparably bound up with life itself. Life can only be prevented from sliding into its deadly extreme by continually restoring the balance through rhythm. It is no exaggeration to call the craniocervical transition the “vital center in human beings”, (11) nor is it by chance that manipulation in this region (with the aid of the rope, garotte and guillotine) was used only too frequently to “promote people from life to death”.

Elegant embryological experiments¹³ have demonstrated a whole series of further, at first sight unexpected, relationships between craniocervical region and trunk. It has been shown, for instance, that the first occipital somites are involved not only in developing the fine cervical muscles that position the head and the muscles of the tongue, but also the laryngeal muscles¹⁵ governing the subtle rhythmic vibrations of the air that enable us to utter sounds and develop speech. It has also been shown that the blastema of the pronephros derives from the region of the embryonic cervicooccipital transition, with the parts of the urogenital system which show rhythmic movement (renal pelvis, ureter, vas deferens and tubes) evolving from it. The developmental movements of the heart, central organ of the rhythmic system, that lead to the crossing of aorta and pulmonary artery are dependent on the change from occipital kyphosis to cervical lordosis. Transposition of the major vessels is a regular occurrence in the absence of neural crest cells in this particular region. Finally it has been demonstrated that neural crest cells from the first seven somites migrate to the intestine where they form the intramural enteric nervous system which governs motion and is nowadays referred to as the “brain of the gut”; this is important for perception of emotions arising “from the gut”. (14)

All these relationships substantiate the impressive relationship between vertebral column and rhythmic system. What is more, the craniocervical transition appears as the downright inductor of the rhythmic system and shaper of rhythmic processes in the trunk which itself (and with it the whole vertebral column) has arisen by induction from a rhythmic process in the notochord. We also see the fundamental original relationship between head-and-neck region and whole body, and above all those parts of it that are directly connected with the psyche. The many relevant experiences gained with craniosacral therapy can thus be seen in their right context.

Lordosis of the cervical spine develops early on, but from the second month onwards soon disappears in the overall kyphosis of the embryo’s body. Birth, which involves leaving the embryonic resting state and entering into the outside world, results in propulsive extension of the spine. In the newborn, this is still like a straight rod, with the double S-form only developing gradually as the child comes upright. The craniocervical area is subject to particular stress in the birth process and remains unstable for some time after birth (until about the 5th month). The area is nowadays given considerable significance with sudden infant death syndrome (SIDS). Among oth-

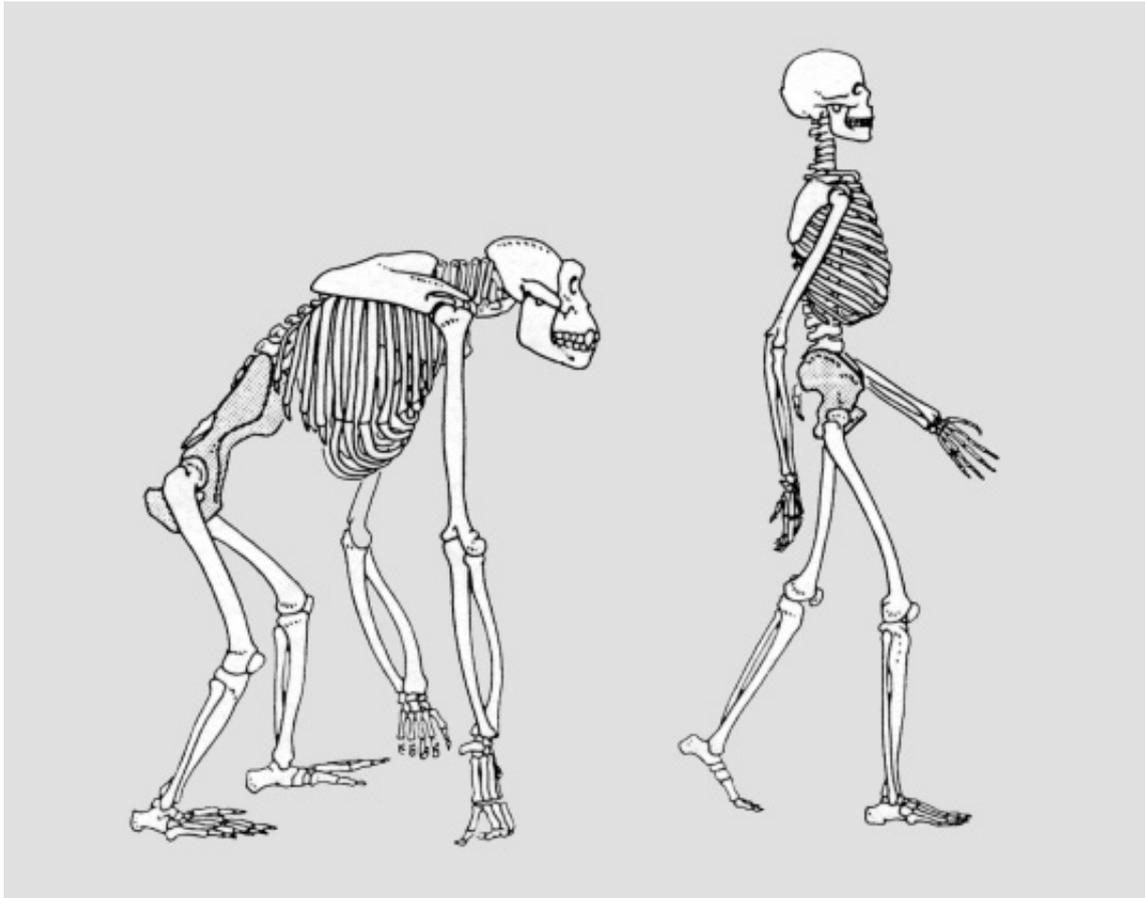
Notes

13) He arrives at the following insight in his book, which is somewhat mysterious in places: “The structure of the central nervous system as a whole and the form and position of its individual structures reflect the bodily experiences mediated by the relevant centers”. (9) Earlier, Carl Gustav Carus wrote in a more general way: “The body is the physical reflection of the soul, the soul the meaning of the living body.” (10)

14) These facts, discovered in 1987, (12) impressively substantiate statements made by Rudolf Steiner in 1921 (13), that the larynx should be seen as a metamorphosed occiput.

15) This in itself makes it necessary to have careful attunement between vestibular functions and spinal posture. The phenomenon of cervicogenic vertigo, clinically undoubted but disputed by many in theory, has its origin here. In terms of evolution, too, there can be no doubt but that the freeing of the head from the movement of the body in general (vi.) called for separate and differentiated perception of the head’s position relative to the body that went beyond vestibular perception, which is bound to the head. A separate perception of position is needed within the cervical spine, and this may of course also be subject to pathological changes. From the phenomenon of motion sickness we are familiar with the “mismatch” between visual and vestibular perception causing nausea. In a similar way, cervical malposition and function may trigger “uncharacteristic” bodily sensations that are difficult to describe and experienced as “vertigo” by patients. In view of the lack of agreement between pathological bodily perception, with the world perceived in the usual way at a different sensory level, the impression of something false, something that “cannot be”, arises.

Fig. 7.
Freedom and the bound state—the relationship between gravity and buoyancy is immediately evident in the human and gorilla skeleton (from (1) p. 165).



16) Rudolf Steiner made this the starting point for his lectures to members of the medical profession. (15)
17) Humans evolve progressively towards freedom, with the configuration of the spinal column gradually developing. Animals move downward from a condition which originally is closer to the human and freer. Thus the skull of anthropoid apes is still quite similar to the spherical human skull at birth. It is above all with the onset of sexual maturity that the region of the jaws grows forward, and the whole form then becomes subject to gravity. Loss of the ability to learn goes hand in hand with this change in the physical form (experimentally anthropoid apes were even shown to have some capacity for speech) and a play drive, which means openness. Then anything that has developed becomes fixed and developmental potential is lost, including cognitive faculties gained earlier (e.g. experimental capacity for the written language). It is actually possible to speak of prepuberty dementia developing in apes.

er things the role of the twist between head and trunk in the sleeping position has been seen in association with SIDS.

The area of the cervical spine in particular shows fundamental differences between animals and humans. In many mammals it is dominated by muscles to hold the head, so much so that the neck does not appear as a recognizably distinct part, with the head sunk down into the trunk, as it were. In other cases the neck is extended like a rod, for instance in the giraffe, whose whole neck is supported by seven cervical vertebrae—as in humans—but these are enormously elongated. Nowhere does one see the free, mobile play around the plumb line which we have in the human spine. Humans are taken into this middle axis—which is not physically apparent—by their organ of balance, taking this into an equilibrium that is always new when at rest, as perceived and set by the labyrinth.¹⁶ Unlike animals, whose visceral cranium grows out anteriorly, humans hold this growth impulse back. The visceral cranium thus comes to be positioned beneath the neurocranium, resulting in the overall spherical form of the head. The propulsive tendency in cranial development is held back just as much in humans as is their overall movement form. In animals, with their horizontal spines, the overall form of the spine is arched. Like the arched back of a cat, it may be tensed in a global kyphosis which is then released in a propulsive leap. The growth tendency of the animal's visceral cranium corresponds to this. The snout is often like an added

extremity. In humans, the mouth becomes the region where the word is freely created. The reconfiguration of the jaws and teeth is paleoanthropologically the earliest and surest indication that skeletal remains found are human and not close to apes. The fundamental difference in general form is particularly impressive and has a tragic note in the case of the primates, who are close to us at the bodily level. A gorilla skeleton shows how much the creature is bound to gravity¹⁶ and that words cannot arise freely from its mouth parts. In humans, head and oral parts are not bound in this way. Comparison of gorilla and human skeletons clearly shows that humans are designed for freedom, whilst the animal is subject and bound to be fixed and wholly subject to gravity.¹⁷ (Fig. 7)

The whole human form on the other hand is characterized by freedom in unstable equilibrium. The human movement form lives in an erect spine oscillating between behind and in front, gravity and buoyancy in the above and below are brought into balance. The original dorso-ventral swing shown by the notochord, the original I A O we know in eurythmy and which originally showed itself in the spatial form, reappears in the dynamic movement form at every step we take. The alpha of the embryonic form shows itself again in the omega of the fulfilled function.

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