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Grounding Structural Concepts in Physical Reality

Ida Rolf consistently stressed the importance of „gravity, an unexplored factor in a more human use of human beings". Examining this contention more specifically and concretely immediately leads to realizing that gravity as a physical force permanently interacts with other forces. These are normal force which acts from the ground up on the body and upwards at every level of the body as well as tensional elastic forces always present in the fascial net.

This necessitates a more exact definition of structure and function. And this in turn results in a rational argument for Ida Rolf's normative statement of an ideal which she called „normal structure". Normal structure (and Normal Function) is the answer to the questions of which structure permits best balance, optimal support, most length, and maximum economy of function.

Ida Rolf has changed our thinking about the body dramatically. Looking back from the vantage point of the present development of her theory, three seemingly simple but decisively novel insights stand out as the foundation for the field of Structural Integration.

1. There is a structure to the body which is different with everyone and with every body.

2. Gravity is a factor of overriding importance when structure and function of the human body are under consideration.

3. The structure of the human body can be changed to a considerable degree by manual intervention.

The last point gave rise to the practice of Structural Integration. The first two form the base on which the theory of Structural Integration builds. Exploring these two insights to their depth reveals that an entirely new set of premises, concepts, and models is needed, and that this leads to entirely new conclusions concerning the structure and function of the body.

The notion of a structure dilferent to every body calls for the development of a system which permits us to describe different structures precisely and unequivocally. Possession of such a system would be indicated by the hypothetical situation in which a Rolfer would be able to correctly assign a certain number of structural descriptions to the photographs of the respective persons. This system would also be an essential precondition for sustaining our claim to Structural Integration: the descriptions before and after an intervention or a series of interventions would be different and should allow us to clearly identify the more integrated structure[1].

This second point, proving our contention that we integrate structure, has been cause of constant embarrassment to Rolfers. The dilemma shows up clearly in a rather broad study by Wolf Wagner

[1] *There is an important difference between describing different structures and a structural change in one and the same body. For differentiating between the structures of different persons we can largely rely on qualitative differences, for example an anterior vs. a posterior pelvic tilt. If we assess structural changes in the same person, we usually have to be satisfied with quantitative differences, for example less of an anterior tilt after than before a session.*

(Notes on S.l. 87, p.2). Wagner presented photographs of clients who had received either Rolfing®, a Reiki session, a massage, or no treatment between before and after pictures to a number of Rolfers. The Rolfers were not able to distinguish between the results of the three methods and sometimes even saw structure having been integrated where the models had just walked around the table between pictures.

A breakthrough happened however when Jan Sultan published his paper "Towards a Structural Logic" (Notes on S.I. 86, p.12). Sultan was the first to examine a number of qualitatively different features of the body. Among these were the shape of the skull and the thorax, the shoulder girdle drawn forward or back, the depth of the spinal curves, rotation of the ilia around the transverse axis of the hip joint, femoral rotation, high or low arches of the feet. Drawing from the bipolar dimension of craniosacral motion, these features could structurally be in one of two opposite directions. The important implication was that the neutral point between the two would be "normal".

Sultan discovered that the direction of deviation was not random with these features but tended to come in two distinctly different and coherent patterns[2]. This permitted him to state that structures were "organized" in one or the other pattern. He called them the "internal" and the "external" type. Bodies which conformed clearly to one of the two types he called "congruent", those which presented a mixed picture "conflicted". The basic type was to be diagnosed by the "pressure preference" of craniosacral motion or "through averaging the congruent characteristics".

This original form of the internal/external system had some obvious weaknesses which led to further questions. As a system, the way the basic type was determined did not seem very satisfactory. More importantly, the description did not allow a clear understanding of how gravity affects the two types; and what internal or external organization meant for the fascial net could not easily be deduced[3]. These difficulties are probably due to the fact that the types were described in anatomical language.

The typology could be rendered more relevant by placing it firmly in the structural field, using the block model and variations thereof. With regard to the primary importance Ida Rolf assigned to "horizontalizing the pelvis", an anterior pelvic tilt was used to determine internal structure, a posterior tilt external structure (Notes on S.I. 89, p.15). Using gravity, the direction of the pelvic tilt can reliably be diagnosed in most bodies as Willi Harder and I have shown (Notes on S.l. 88, p.6).

The block model also demonstrated that sagittal pelvic shift was of equal importance as tilt. An anterior or posterior shift roughly corresponds to the body being bent forward or backward. The consequences concerning gravity's effect on the body and the nature of the fascial net are immediately obvious. The consideration of pelvic tilt and pelvic shift shows that four different combinations exist. This results in an enlarged typology of four different types: the regular and the locked-knee internal, the regular and the symmetrical external (Notes on S.I. 89, p.15). These types are both sufficiently similar and sufficiently different from each other to warrant recognizing

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[2] *It is not clear why this is so. It can be speculated that the fascial net, by its design, goes in one or the other pattern with extension and flexion of the spine.*

[3] *Sultan stipulated different "transmission lines" for internals and externals. Their status is still unclear. They are not derived from the internal or external pattern but form an independent observation. They seem to be of some practical value in strongly deviated congruent structures where they perhaps represent lines of "maximal shortness" in the fascial net.*

them as separate structural entities.
A more general examination of the block model shows that each block is determined qualitatively by six bits of data, three for its position and three for its orientation (Notes on S.I. 87, p.25). Tilt and sagittal shift largely determine the front-to-back organisation of the body. Side-tilt and side-shift describe its left/right dimension. Examining rotation around the vertical axis leads to the viewpoint of standard rotation (Notes on S.I. 91, p.2). Finally, shift in the vertical dimension is the subject matter of "structural dynamics" (Notes on S.I. 89, p.31)[4].

The six criteria for qualitatively determining position and orientation of a pelvic block theoretically result in 2^6 or 64 different combinations. However, because of standard rotation and because side-tilt and side-shift seem to be linked very closely, we have to consider only 2^4 or 16 different combinations in practice. If we assume the situation to be similar with all the seven blocks the Rolf logo depicts, we arrive, for the whole body, at a total of 16^7 or about 260 million different combinations from the block model alone. That number would be immensely larger if we also accounted for quantitative differences and if we considered intrasegmental shape in addition!

Structure and the Fascial Net

The creation of a descriptive system depends on an exact definition of what is meant by "structure". Unfortunately, Ida Rolf does not provide a clear-cut textbook definition. In salt crystals, she says, "structure is a relationship among atoms". She goes on to state that "structure (relationship of units of any size in space) is experienced as behavior" (Rolf, p.3l). In this dark and rather puzzling statement, "behavior" is a functional category, not a structural one, and it refers to the behavior of the body in the gravity field. There is an important difference between salt crystals and the human body: with salt crystals, the relationship among atoms does not change much functionally. In the body, it does so all the time, quickly, and to a large extent. The analogy, and its subsequent development by Ida Rolf, is not very informative and is even misleading. It suggests that salt crystals are "all structure" while human bodies are "all function".

We get a more promising lead from the statement (about structure) that "it is decidedly not posture" (Rolf, p.29). "Posture", like "behavior", is a functional term. An erect body always has posture, be it good or had. A first demand we pose on a useful definition of "structure" is that it be clearly differentiated from "function". A second demand is that the definition be applicable. This means that it must allow us to describe different structures verbally, in tune with our search for a descriptive system. Finally, we want the definition to be in the semantic field of the term "structure" which is given by Webster's Dictionary as "the arrangement of all the parts of a whole". Keeping in mind the first demand, structure should be a spatial relationship of parts which is constant over short periods of time, thus excluding the permanent ephemeral change of shape the body undergoes functionally. Thus, a tentative definition can be made:

Structure is the spatial arrangement of all the parts[5] of the body, determined primarily by the fascial net, as it manifests in the absence of any muscle activity in the body and with no outside forces acting on the body.

This spatial arrangement can be called the "structural body". It is evident that we can never see

[4] *Structural dynamics differ from the other dimensions in that the "neutral point" cannot be defined exactly.*
[5] *The term "parts" could mean the segments in the block model or the bones and muscles, or even the fasciae in the anatomical model. As a cautionary measure it should be taken in the most general sense, however, as an example of the spatial arrangement of all the atoms making up a body at a given time.*

the structural body directly because there always exists muscle activity in the body, and outside forces are always acting on the body. Muscles and outside forces distort the shape of the structural body. The structural body must always be deduced from the actual shape of a real body. "Structure" is a more abstract term than "function". In the above definition, fascia is given primary importance as the "organ of structure".

The function of fascia is first that of a container (Rolf, p.38). Fascia keeps the body together and prevents it from flowing apart, from ending as a puddle on the ground. If its firmer constituents, the bones, are considered, it is fascia which makes a skeleton out of an otherwise unseemly heap of bones[6]. This primary function of fascia leads to what is probably the most basic model for the body from a physical point of view: the hydrostatic balloon[7]. The integrity of the balloon is maintained by a functioning relationship between pressure inside and tension in the walls of the balloon, in fascia. All forces acting in and on the body result in changes of pressure and tension. The shape of the structural body is determined solely by the fascial net[8].

The balloon model necessitates a definition of the fascial net which is different from the anatomical one: the fascial net is the whole of all predominantly collagenous membranes of the body which are capable of carrying tension[9]. We arrive at a system of "bags inside bags" (Wolf Wagner in Notes on S.I. 86, p.24), and it can be speculated that its integrity is heightened further by a pressure gradient which may be small between outer and inner bags.

The hierarchical system of "bags inside bags" is illustrated by looking at a cross section through the mid-thigh, where all the bags are arranged along the long axis of the thigh. The largest bag is formed by the body stocking, represented anatomically by the fascia membranacea[10]. It contains four major bags, namely the periosteal bag for the femur and three bags for the muscle compartments of the hamstrings, the adductors, and the knee extensors[11]. These conpartmental bags in turn are made up of several still smaller bags. In the case of the hamstring compartment these would be the myofascia proper of the m. semitendinosus, the m. semimembranosus, and the m. biceps femoris with its caput longum and caput breve. Each of these muscle bags consists of a number of still smaller bags, the "secondary bundles", ensheathed by the perimysium externum. Finally, each of these is composed of bags formed by the perimysium internum which encloses the "primary bundles" of muscle fibrils[12].

Muscles come into the picture only when function is to be considered. As anatomical entities, muscles are taken care of in the model: they form the viscous content of fascial bags at various levels. What remains is their physiological property of exerting active tension. The degree of active

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[6] *What makes a classroom skeleton a skeleton out of a heap of bones is the bolts, screws, and wires which hold the bones in place. None of this represents anything in a real body.*

[7] *It doesn't matter much that the content of the balloon is often more viscous than water, something jelly-like. Neither does the gas in lungs and intestines change the character of the body as a hydrostatic balloon much. This seems to be true only for fairly integrated bodies, however*

[8] *It is assumed that the bones as the "ossary factor" of structure fit the fascial net perfectly*

[9] *The definition includes much more than is called "fascia" in anatomy: besides the body fascia and the myofascia proper also the periosteum, the peritoneum and the pleura, the "liver capsule" and the meninges, etc. More linear elements like tendons and ligaments can be interpreted as linear reinforcements in primarily planar fascia.*

[10] *The structural body can more exactly be said to start at the body stocking, the deep layer of the superficial fascia. The skin and its organs would then not be part of the structural body although they may sometimes have gravitational relevance especially when their weight is distributed unevenly.*

[11] *A few slim bags containing nerves and blood vessels would have to be added for completeness' sake.*

[12] *The system could be extended to the muscle fibrils or muscle cells enclosed by a stocking of reticular fibers, although they would not fall under the proposed definition.*

tension, and its distribution through the body, is covered by the concept of the “tonus pattern” (Notes on S.I. 89, p.36). The tonus pattern is the functional element in the living body. Together with the structural body it produces function: movement and posture.

As far as changes of body shape are concerned, we are now able to sharply distinguish between structure and function. A change of shape caused by a change of the fascial net is a structural change. It is plastic in nature. A change of the tonus pattern also changes the shape of the body, but this change is elastic in nature.

Gravity and Normal Structure

Gravity is often misunderstood even though it is the essential key to Ida Roll‘s concept of normal structure. In classical physics, gravity is one of the two basic forces acting between material bodies on the human scale, the other being the electromagnetic force. “Force” in physics refers to something intangible. The concept of force is based on the observation that physical bodies, made of matter, behave in certain highly predictable and exactly calculable ways. Gravity is used to describe the fact that such bodies move towards each other at an increasing speed unless other forces intervene. Gravity as a force is an “explanatory principle”. This is best understood if one looks at the behavior of physical bodies as if a mutually attractive force acted on them.

For our purposes we can neglect the gravitational force a human body exerts on the earth. Gravity is the force with which the earth attracts the human body. If it is the only force present all the atoms which make up the body move in exactly the same direction at exactly the same rate of acceleration: the body is in free fall in a vacuum. Obviously, gravity does not compress the body. In standing or lying on the ground, the human body does not move toward the center of the earth. This is not because gravity acts differently. In the physical description, this is so because the gravitational force is neutralized by the normal force the ground exerts. The term “normal force” is a convenient way to sum up the electromagnetic force the ground exerts on the body. Similarly, with a body floating in water, gravity acts exactly the same way it does on a body standing or in free fall. In this case, gravity is neutralized by resisting forces exerted by the floor and the walls of the pool in which the body floats.

Gravity and normal force compress and bend the body. The question then becomes, how is the body best held up in this clinch of opposing forces? The answer is “straight” if the body is solid, although the answer is also true for a cylindrical balloon. The term “best” needs to be examined more closely, however. In Ida Rolfs block model, the stack of rectangular blocks holds up best if the blocks are aligned vertically. The blocks are in an indifferent equilibrium which is similar to stable equilibrium. The body, however, is not built for sturdy stability but for fluid flexibility.

The nature of the body’s equilibrium is unstable or labile, not stable or indifferent. This can be illustrated by replacing the seven blocks of the Rolf logo by seven billiard balls stacked neatly on top of each other. Labile equilibrium is in the nature of a Platonic idea, which means that the mind can conceive it but that in reality it does not exist and cannot be made to exist. In a stack of billiard balls, however neatly stacked, there must always be forces present which neutralize gravity’s destructive effect[13]. The better aligned the balls are the less force is needed, for example by the hands holding up the stack. Ideally, for a perfectly vertical alignment, the amount of these necessary forces approaches zero. If we assume (not entirely correctly) that this neutralizing force

[13] *In the following, statements about gravity always imply normal force.*

comes from muscles, the amount of force needed is proportional to the energy the body expends to maintain a certain arrangement. The way the blocks are aligned is related to a corresponding amount of force and energy expenditure. Ida Rolf defines "normal alignment" as "a vertical alignment of each block's gravitational center; there must also be no rotation or tipping of the segments" (Rolf, p.33). This leads to a definition of normal structure when she adds, concerning the "elastic sack" enclosing "our blocks as well as our man", that normal alignment results in a "strain free system". In this phrase Ida Rolf seems to use the term "strain-free" in a colloquial sense. Physically, there is always some tensile strain in the fascial net. This term should be replaced by "tensile strain exactly balanced all around the body". For "tensile strain" we also use the term "passive tension" to clearly separate it from "active tension" produced by the tonus pattern of the musculature. Passively tensed fascia exerts elastic forces on the body.

In real bodies, the fascial net is never perfect. If we could bring a body to normal alignment exactly, unbalanced passive tension would occur in the stretched fascial net. Thus, while gravity would ideally not disturb the body in normal alignment, unbalanced passive tension would cause it to collapse immediately. If we imagine this collapse to happen in slow-motion, we would find that the elastic forces decrease quickly as the body collapses. However, the gravitational forces would increase because with progressing collapse the body deviates more and more from normal alignment. We therefore have one maximum of disturbing forces with vertical alignment where the effect of unbalanced stretched fascia is strong. The other maximum is in a strongly collapsed arrangement because of the marked effect of gravity. Somewhere in between there is a minimum where the sum of the disturbing gravitational and elastic forces is smallest. That arrangement can be called the "structural point" (Notes on S.l. 9 I , p.26).

At the structural point, stance for a given structure is most economical when the least amount of active tension is used to neutralize the minimal amount of the combined gravitational and elastic forces causing collapse. The structural point is different for different structures qualitatively and quantitatively. This means that the geometry of bodies is different at their respective structural points and that the degree of energy consumption is different. The structural point could serve as a measure for the degree of integrity a structure possesses. The closer the structural point is to normal alignment, the more integrated the structure would be. The task of integrating structure could be formulated as getting the structural point closer to the normal alignment[14].

Normal structure can be defined as a fascial net which in normal alignment does not display any unbalanced passive tension, the elastic forces present neutralizing each other perfectly. This definition can be misleading and even dangerous, however, if too straightforward conclusions are drawn from it. This seems to happen not infrequently in bodywork when rigidity and shortness of the fascial net are perceived exclusively as resistance. The seemingly logical course of action is then to soften everything as much as possible in order to radically reduce resistance to standing in the normal alignment. This "logic" is fallacious for several reasons:

1. Both the notion of normal alignment and an elastic sack with absolutely balanced passive tension are Platonic in nature; they cannot be realized as a matter of principle. This means that there always exists some amount of disturbing force which must be neutralized. If fascia is extremely soft, the job must be done entirely by muscles. This is neither economical physically nor comfortable. Instead, fascia which is less soft exerts some passive tension which in the right

[14] *This is more of theoretical interest than of practical value. It is hard to get a clear notion of where the structural point is. Certainly asking a person to stand "with minimal effort" will not produce it. Actually, the concept is more useful to determine the structural type by observing in what direction the body collapses.*

places serves to partly neutralize the disturbing forces. This relieves the muscles to some degree from their work load and is therefore more economical.

2. It is impossible to soften the whole fascial net to the point that the body appears to be without fascia. Imbalances always remain. Since secondary shortness, which has a function in holding up the body, seems to respond more quickly to treatment than primary shortness, these imbalances in shortness would paradoxically be heightened by “general softening” (Notes on SI. 90, p.27).

3. The “ossary factor” makes it impossible to realize normal structure: bones are never shaped perfectly[15].

4. The body is not meant to stand motionless but to move constantly. In movement, the body necessarily deviates far away from normal alignment. With “no fascia”, the job of taking the body away from normal alignment, or from bringing it back towards it, would be up to muscles alone. With a functioning fascial net, especially if the body moves in normal function, this job is accomplished to a large degree by the elastic forces that stretched fascia exerts.

These theoretical problems, which are highly relevant to the practice, are rooted in the double nature of fascia. On one hand, fascia by its shortness resists the body’s tendency to be upright and move easily. On the other hand, fascia is the “organ of support” (Rolf, p.37) and makes function easier[16]. Fascia always seems too hard or too soft, and sometimes both, depending on the widely differing demands body function poses. A simple resolution for these two conflicting aspects does not seem to exist. Certainly, a compromise won’t do. In practice, a favorite term of Ida Rolf’s appears to work best, although it is impossible to define exactly: fascia should be resilient.

Physics, Structure, and Function

Structural Integration has been defined as changing the structural body in the direction of normal structure. Some indications have been given why this is not a simple undertaking. There are experiential and theoretical considerations which strongly suggest that random structural changes nearly always produce structural disintegration[17]. This means that all but a few selected interventions in a given structure must be expected to be disintegrating. A better understanding of structure and its integration is clearly needed.

While normal structure forms the concept which is central to that of integration, there are more aspects to “integration”. One is the notion of “patterned order” (Rolf, p.29) which, especially as it relates to freedom, is highly unclear. Another, more practical problem is the fact that an integrated structure[18] is not just different in composition compared to its former state; it is also less stable, more strongly subject to disintegrating influences but possibly more open to further positive change, too. Finally, structure is also a process, albeit a slowly moving one.

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[15] *We cannot determine the absolutely perfect shape of bones. A necessary condition would be that by their shape they do not disturb the normal alignment of a normal structure in any way. In practice, the “ossary factor” limits the degree of integration which is possible for a real structure.*

[16] *A “fascialess” body would constantly demand an inordinate amount of energy to move if it is assumed to be functional at all.*

[17] *The fact that a client feels great, that a symptom is relieved, or that a dysfunction is “cured” constitutes in itself no argument for structure also having been integrated.*

[18] *An “integrated structure” is a structure which has been brought closer to normal structure.*

In practice, it seems promising to approach Structural Integration as an attempt at getting this process under way. The concept of normal structure is essential in that it provides orientation for the direction in which this should happen.

The system of Structural Integration rests on physical considerations because Ida Rolf stressed the role of gravity and fascia with the elastic forces it exerts. These forces are a matter of mechanics, a branch of classical physics. Their importance comes up when one asks why normal structure, as defined by Ida Rolf in strict and ideal terms, should indeed be normal. After all, her definition makes all real structures "abnormal", a term which sometimes presents misgivings to some who don't distinguish clearly between rational theory and emotional content.

A simple answer is that normal structure is normal because Ida Rolf said so. This constitutes a belief and effectively prevents any attempt at a rational understanding. Another frequent answer is that normal structure is conducive to health in a therapeutic or preventive sense. Although this is probably true, health, healing, and wellness do not operate in absolute terms. They are conceptually based on a certain range of normal within which it is meaningless to differentiate between "more" or "less healthy"[19]. An answer could also come from aesthetic considerations, which would then lead to hopeless entanglements of widely varying subjective values.

By taking force and energy into account, the problem finds a logical solution in absolute terms. If a structure is sought that permits the most economical function, Ida Rolfs normal structure is the answer. Any structure deviating slightly from normal (and this includes all real structures) is not capable of operating at the same low level of energy expenditure normal structure is. This can be called the "economical premise" of the field of Structural Integration. The consequences are far-reaching if this premise is accepted[20]. It follows, since economy concerns function, that integrating structure is not an end-goal. If it "is a physical method for producing better human functioning" (Rolf, p.29), it is in the service of producing more economical function as the physical base of "better human functioning".

Ida Rolf seems to have believed that better structure automatically entails better function. This is only partly true - more with some clients, less with others. An ideally normal structure could function in many different ways with different corresponding levels of energy expenditure. The most economical way of functioning is "normal function", defined exactly as is normal structure (Notes on S.I. 91, p.6)[21]. The end-goal of Structural Integration would then logically be to make normal function possible where it was not before, and to improve on it where it was possible before.

The question is interesting why nobody developed the concept of structure, and that of normal structure, before Ida Rolf. Similarly, the question of what constitutes the most economical form of a given movement or posture is so obvious that it appears strange that nobody should ever have examined it seriously. After all, for three hundred years a countless number of sharp minds and reputed scientists have struggled with the problems of the body's function. The answer is

[19] *The different configurations of the spine depicted in Rolf, p.208, are in fact all normal if the term is used in the context of health (or of anatomy). None of them is normal in the structural sense.*

[20] *If it is not accepted, "anything goes", meaning that everything is wide open to subjective interpretation and a consensus based on logical argument cannot be reached.*

[21] *This concept of normal function is completely different from the way the term is used in the context of medicine, therapy, and sports.*

necessarily speculative, but it seems probable that the enormous success of the science of anatomy[22] is responsible for this curious fact.

Anatomy is a highly developed science and possesses an immense explanatory power - a large array of questions are answered by it. However, it is usually forgotten that anatomy does not simply describe the body as it is, it works with a certain model of the body. This anatomical model traditionally starts with the description of the hardest facts, the “bones”, which are then put together to form the “skeleton". “Muscles” are added, and other elements are used when the need arises. This results in what could be called the “bone/muscle” model of anatomy. Common sense then leads to the seemingly logical conclusion that the skeleton supports the body by the bones bearing its weight, and that the muscles by way of “working” hold it up and move it around. Common sense then explains the existing state of knowledge. There is nothing to be said against it if its conclusions are satisfactory. But there is an aggravating fact which obscures the question: random structures in random function are explained fairly well, although not entirely satisfactorily, by the “bone/muscle” model. But with a well integrated body moving in normal function, it fails completely.

A new and different model is needed that is better capable of answering our questions about the body's function. The concept of the structural body provides exactly what is needed. In it, all the forces acting on and in the body can be represented as compressional and tensile strain. This is the precondition for being able to deduce where how much muscle tension is minimally necessary for a given movement or posture. And this again makes it possible to determine that structure which of all structures allows the most economical function: normal structure. It further allows us to select out of the many various forms a given movement can take that which is most economical: normal function.

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[22] *There is an interesting historical fact which may be connected with this. When the consideration of function departed from anatomy, as the new science of physiology, the functional aspect of movement and posture remained with anatomy.*