THE PRIMARY PHENOMENOLOGICAL SYMBOLIC PROCESS OF LIVING MATTER: ON "MOLECULAR DISIDENTITY''

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ABSTRACT

In this brief paper, some further global phenomenological consequences of the results obtained in previous studies by the author, are presented. Rather than going into molecular details, we are content with conditioned probability theory here. The term ''primary process'' is introduced, pointing to the molecular realm, in contrast to the ''secondary realm'', the nervous-system dependent processes. These concepts of the ''secondary'' processes are detailed in a forthcoming paper, focusing on the ''Mind/Matter'' problem (Balázs, 2015a). Here we would like to concentrate on the ''primary'', molecular realm, if only in an admittedly phenomenological way, with the focal point of a so-called ''molecular (dis)identity''. The consequences of state space extension is discussed, the state space containing besides *finite*, atomic bound quantum mechanical Hilbert state spaces, also symbolic (automata-*''metaphorical''*), virtual, *classical states*. The ''extension'' of the state space thus referres to *additional classical* states, obtained by direct sum procedures, leading to a non-invariant subspace. The notion of ''symbols'' in the molecular realm corresponds to generalized ''coordinates'' of molecular shapes and refer here to mathematical ''transition functions'', *connecting dynamically* wavefunctions of *sterical complementing* molecular shapes in the underlying quantum dynamics. We extend our analysis of the ''primary biological symbolic processes'' to our central proposed quantum physical ''molecular disidentity'' which arised because of the emergence of these two, joint (quantum mechanical/classical) representations in molecular state spaces, having come about in an original primeval ''Heisenberg–event''. It may have been a global, *endophysical* ''self–transition'' (''excitation'') being *relaxed* by an internal ''reverse'' time process. Molecular ''disidentity'', explained in the text as pointing beyond its pure physical self-identity, in other words, the ''primary'' *symbolic* process, thus is indirectly relaxed by self–replication (daughter cells as individual entities), leading to the identity of the parent living organism with the surrounding Universe in this special, biological, indirect route. This mechanism is particularly clear at multicellular organisms.

Keywords: Conditioned information processing, ''molecular disidentity'', routes of return, quasiclassical dynamics.

INTRODUCTION

''*Natural*'' or biological ''symbolic'' processes are two–level phenomena. The ''primary'' or molecular process (directing metabolism, also molecular ''self''–replication) acts inside the cell. The ''secondary'' or nervous–system dependent process entails instincts (''drives''), up to the conscious human mind (Balázs, 2015a). The ''secondary'' process, *ruling the ''primary'' one*, is a *representation* of the ''primary'' one, probably with the same ''mechanisms'' and ''goals'' than those of the ''primary'' process (Balázs, 2015a). *Phenomenology* means that here we do not discuss the molecular ''hardware''/''software'' of

the *molecular intracellular processes* (''automata-metaphor'' (Balázs, 2015b)), we are content with a phenomenological conditional probability (informational) description.

Recently, we have proposed a theoretical frame for the physical *origin* and basis of the *primary* fundamental life process (Balázs, 2013,2014). It was shown, that without some elementary discussion of the (natural) *biological symbolic process*, this life process cannot be described adequately. ''Natural symbol'' here in the primary process, tentatively and phenomenologically, means a mathematical function, with both its argument and value of a generalized ''coordinate'' (function), thus is in fact an *operator*, which dynamically orders two *complementing* molecular shapes to each other, this space-mappings, reflecting progressing internal/external *time complementations* (i.e., that of the internal reverse time evolution) being its primary function.

We try to deduce a concept, unknown in inanimate Nature: ''molecular disidentity''. In order to deduce it, however, we must recapitulate and also add new results obtained by the author: the origin problem, the internalized ''reverse'' time evolution problem, and the whole global (internal/external) time evolution, the inversion symmetry recovered in divisions (''self''-reproduction) in an indirect (*via* natural symbols space-mapped) way. Our discussion is strictly phenomenological, of the synthetic type.

The basic suggestion is that the fundamental life process finds its origin as a quantum theoretical *global*, ''endophysical'' ''self–measurement'' event, ''measurement'' understood in the "Heisenberg-event" sense of Stapp (1993).

As it was pointed out elsewhere, the symbolic side of life may have been probably born together with the chemistry of life, specifically, that of the *genetic code* as "*measurement record*" (compare Pattee, 1971). It is supposed (Balázs, 2013,2014) that there arised a time-inversion symmetry breaking endophysically too, concomitant with *every quantum measurement* (e.g. Belinfante, 1975). The emerging *internal* ''reverse'' time evolution, together with the simultaneous *sterical* object/device (polymeric molecular) relations, might have been *internalized* from the boundary surface where the supposed *global endophysical (time-inversion) symmetry breaking may have taken place*, in order to *save* the strongly constraining *(retro-)causality*. Space-mappings, from their very origin, is *the very function and reflections of the time-complementation in space as sterical complementation* (e.g. the ''molecular phenotype'' (Waddigton, 1969), i.e., enzyme action)).

While the corresponding operator is the essence of ''primary (molecular) symbols'', its mathematical description is rather complicated, in relation with the Symbolic Tensor Calculus (in connection with ''complementation''), and is not recapitulated in details here. The conclusion is that the arisal of a primary *internal driving force of (an energy-driven) time-reversal symmetry restoring process*, corresponds to the fundamental attribute of the global (primary) life process. Specifically, it is this *internally arised*, *autonomous* (''contextual'') time evolution, at any level of complexity, which is universal in biology (Balázs, 2013,2014), not only at the molecular, ''primary'', but also at the ''secondary'', nervous system–dependent processes, too (Balázs, 2015a).

In this brief paper a tentative phenomenological unified *physical* theory of the (biological) *primary, molecular symbolic* process is expounded. What remains to be done, in view of our previous results, is to unite the above mentioned elements into a hopefully consistent, global, if nonetheless tentative and phenomenological, synthesis. Note that e. g. Newell (1980) and

Pattee (2000) extensively studied *physical symbol systems*. We will use, in this respect, first of all Pattee's decades old results, as his studies were directed specifically towards theoretical biology.

We adopt here the view that the origin of the primary symbolic process can also be viewed as a *material self–excitation* (measurement quantum *transition*) which remains *locally trapped* by the specific nucleic acids as *measurement records* (Pattee, 1971) (the genetic codes being the *last effects* of an *internally reversed global endophysical* measurement chain).

This follows from quantum theory: the *endophysical* Hamiltonian *matrix* of the protobiological system referres to the time-evolution of *possibilities* as potential quantum transitions wheras the eigenvalues of it to *stationary* (energetically excited) states as self-measurement (*actualized*) outcomes. So the necessarily *classical* measurement correlation the endophysical ''self–measurement'' between the state of the (*reversed*) "object system" (proto–proteins) and that of the *reversed* "measurement device" (nucleic acids) persists over a (theoretically) infinite time period (*in vacuo*).

Thus, in a sense, polymeric RNA, after the retrocausal reversal, can be considered to be an (ordered) excited *state* of the *oligomeric mixture.* (For the ''classicality'' of the *symbolic state*, see the Correspondence Principle of the Copenhagen interpretation: $h \rightarrow 0$ leads to a quasiclassical *symbolic wavefunction* with *classical spatial coordinates*, so to a kind of ''quasiclassical'' internal dynamics (Balázs, 2015b) with classical spatial structures. Note here that we use the term ''symbolic state'' to refer to the initial *(spatial)* molecular wavefunction upon which the ''symbolic operation'' may have arised.

This picture, following from the time-energy complementarity, would seem to conform to the Stapp (quantal-) theory of the subjective process (of the human *conscious* mind), stating that the subjective (symbolic) process, (and hence *its origin*) is a special kind of *quantum transition* (Stapp, 1993).

It is precisely this dichotomy (coexistence) between object and its *internal measurement record within one and the same* (*quantum mechanical*) *system* which comprises the *origin* of the relaxation–oriented internal reversed time-process, in other words, leads to a *"drive''* (to coin an ethological expression), in our interpretation, *for physical identity with the rest of the Universe* in accordance with its pure physically disintegrating internal reverse time evolution.

It was argued by us (Balázs, 2013,2014,2015b) that $\{\mathbf{q}_j >\}$, the ket-vectors over quantum dynamical spatial coordinates correspond to ordinary quantum-theoretical states ("slave" states) under the proper primary *symbol-related* states, the "bra" vectors $\{< \mathbf{Q}^i\}$. In this way, there are two, inequivalent Hilbert space representations of the system under study in state space, the symbolic space being split off and, following Everett (1973), imbedded into the fundamental space (Balázs, 2015b). It is only that here the *two* Hilbert spaces are positive metric (''affine'') spaces.

The crucial step in constructing a "symbol-constrained" dynamics (e. g. Balázs, 2015b; Pattee, 2000) is the symbol- induced constraint of $< \mathbf{Q}^i$ over $\mathbf{q}_j >$ in a *projective way*, in a kind of "overlap integral" (Balázs, 2015b),

$$< \mathbf{Q}^{i} \mid \mathbf{q}_{j} > = g^{i}{}_{j} \qquad (1)$$

where $g^{i}{}_{j}$ is the positive metric tensor element between the split-off ''dual'' ''bra'' $\{< \varphi^{i*}\}$ and basic space state ''ket''vectors, $\{\chi_{j}>\}$.

This internal, basically self-interaction forms a *kind of quasiclassical dynamics*, symbol-related (below: ''symbolic'') wavefunctions as *virtual measurement* (''*excited*'') *states* (thus through the extension, overdetermining, the state-space) in a recursive manner (compare Balázs, 2014, 2015b). As *only off-diagonal elements contribute to the subsequent projectors* (other than the fixed point of self-reproduction) *the symbolic state of every respective subsystem referres to a quantum mechanical subsystem other than itself* (Balázs, 2015b).

This is, in fact, which comprises the phenomenon of *material* ''disidentity'': the system has "virtual", constraining symbolic states (but depending on the pure quantum mechanical ''slave'' states, amounting to ''weak'', indirect self–reference, nonlinearity) above the underlying quantum states, coupling to it, and *refer (correspond)* to related *evolutionally fixed, other-than-itself* (quantum mechanical) part-systems.

This is expressed by (Balázs, 2014,2015b):

1) the existence of a joint ("dual", symbolic) representation, and, in that,
2) the symbolic states are defined with reference to their *object state as* (iconic) *law–like* states (Balázs, 2015b; Peirce, 1932), and

3) these symbolic states obey the Mesoscopicity Postulate of us (2015b) of *loss of (quantal-) details as it is the requirement for a controlling constraint* (Pattee, 1973), manifesting the proposition that a biological *gross mesoscopic structure is dependent on*, but is *not identical with*, its (however physically coordinated) elements. It is the (reduced, first order) molecularly *projected* statistical operator as *particle density function*, *rather than the* quasiclassical *wavefuction itself, which is relevant (well-defined*) in this respect (i. e. during the course of the phenomenological *controlling dynamics*) (Balázs, 2015b).

This is because the quantum dynamics, as ruled by the symbolic states, is *teleonomic rather than being simply causal* (Kineman, 2011), so the *interaction Hamiltonian is ill–defined externally*, as was pointed out by Elsasser (1966). This arbitrariness (''unprogrammability'', Gunji (1992) experienced from outside is determined by the internal self-constraints time series. This is, basically, the same problem of structural self-reference as the *self*duplication of Neumann's automata (resolved by the universal copying unit (Neumann, 1966) or Varela's Brown logic treatment of general self–reference, the latter referring to specifically biological self-maintenance ("autopoiesis") (Balázs, 2015b; Varela, 1975,1979).

Also, we arrived at the result, that this scheme corresponds to "endogenous exophysics" in the quantum algebraic theory of Primas (see Primas (1992, 1993,1994); also Balázs (2013,2014,2015b).

Below we discuss in more detail the above summarized relations.

Our main motivation of the present paper is to give a more clearcut exposition of the main general molecular *internal* processes of possibly *all* biological organisms , as to their *origin*, general *''goal''* (if it exists, as we believe), so direction, *ruling mechanisms*, and as the

consequences of them, their inevitable destination, forming the raw material of evolution. We concentrate on *individual* systems, discussed in a more superficial, phenomenological way first.

We rely in the proposed synthesis mainly on our own past results as advocated in several above cited previous papers.

DISCUSSION

Elements of Group Theory

The primary charactristics of *time* is first of all *causality*. This causality is *broken* in quantum measurements (e.g. Belinfante, 1975), in particular in the advocated *endophysical (bidirectionally symmetric)''self–measurements''* (see below).

Recapitulating very briefly Wigner's group theoretical arguments (1959), the quantum mechanical operator of time evolution in the Schrödinger picture, is $\mathbf{U}\ exp - i\,\mathbf{H}\ t$, where **U** is a unitary operator. Using operator **Θ**,

$$\begin{aligned} \mathbf{\Theta}\,\Phi_0 &= \mathbf{\Theta} \sum a_\kappa \Psi_\kappa = \sum a^*_\kappa \Psi_\kappa \\ &+ \\ \mathbf{\Theta}\,\Phi_1 &= \mathbf{\Theta} \sum b_\kappa \Psi_\kappa = \sum b^*_\kappa \Psi_\kappa \\ &= \alpha^*\,\Phi_0 + \beta^*\,\Phi_1. \end{aligned} \tag{2}$$

So the time reflection operator is on one hand antilinear. (Here the Ψ_κ-s are wavefunctions belonging to different eigenenergies.) Introducing operator **K** of complex conjugation, $\mathbf{\Theta} = \mathbf{U}^{\ddagger}\,\mathbf{K}$, $\mathbf{\Theta}\,\mathbf{K} = \mathbf{U}^{\ddagger}$. This later is the normal form of *antiunitarity*. It belongs here, that $(\mathbf{\Theta\,\Phi}, \mathbf{\Theta\,\Psi}) = (\mathbf{\Phi}, \mathbf{\Psi})$, so $\mathbf{\Theta}^2 = c1$, from where $c = \pm 1$.

Below we show that in this way reversed time - *t induces a nonequivalent internal* representation, which is *twice* nonequivalent: once as an asymmetric component, but also it is in its time symmetry (Wigner's ''c'' case).

The unitary and antiunitary operators and the corresponding Hamiltonians of ''environment'' (however we define it) on one hand and the chemical evolutional vesicule, which may have been corresponding to an already intact endophysical ''object'' entity on the other, might have corresponding a tensor product quantity of the the two realms (according to ''exophysics'', see also below).

Thus the symmetry of time inversion has been extensively studied by Wigner (1959). He deduced a group theoretical representation (case ''c'') where the different time directions' representations are not equivalent, yet do not lead to extra degeneracy. We start from this observation. ''Forwards'' time is represented by unitary, the ''inverse'' time to antiunitary symmetry operators. So:

$$\mathbf{U}\ exp - i\,(\mathbf{H} + \mathbf{H'})\ t \rightarrow \textit{endophysical self-measurement of matter}$$

$$\rightarrow (\mathbf{U}\ exp\ i\,\mathbf{H'}t^* + \mathbf{U}\ exp - i\,\mathbf{H}\ t) \rightarrow (\mathbf{U}^{\ddagger} + \mathbf{U}^{\dagger})\,(\mathbf{\Psi}_{surroundings} \bullet \mathbf{\Psi}^*_{vesicule}) =$$

$$= \mathbf{U}^{\dagger}\,\mathbf{\Psi}_{surroundings} + \mathbf{U}^{\ddagger}\,\mathbf{\Psi}^*_{vesicule} \tag{3}$$

Here **H** is the Hamiltonian of the (''immediate'') environment, **H'** is that of the proto–vesicule, ● is the tensor product, according to Primas' analysis. **H + H'** will be referred to below as $\mathbf{H}_{total}$, ''+'' being the direct sum. t^{*} arises as the *internalization of the* $t^{*} > 0$ *constituents of the complete ''measurement outcomes'' of the primordeal endophysical spontaneous ''self–measurement'', ''Heisenberg-event'', with* t^{*} *value* $\neq 0$, and it is in this way how may have emerged – τ, the *internal* reverse time parameter. (The mathematical consistency appears to be fullfilled, as the two time parameters, as well as the space coordinates are different, independent ones, and the two (unitary and antiunitary) operators need not be the adjoint of each other.)

The process must have been carried out *without internalization* (*i.e.,was excluding out*) *this endophysical ''self- measurement'' event* in an originally purely bidirectional time symmetric, endophysical World, i. e., excluding out the *complete loss of retrocausality, the very causal break* (i. e., loss of bidirectional endophysical time symmetry) at $t^{*} = 0$. As noted above, presumably in this way may have emerged the internal time parameter – τ, evoluting along internally towards time inversion symmetry, and + *t* may have progressed along as the time parameter of the rest of the surrounding Universe. Although time inversion symmetry does not imply invariant quantity in physics, it is not a group theoretical symmetry without an exact inverse. Wigner did not deal, too, with time inversion symmetry *breaking*, and in this way with the *coexistence* of forwards and reverse causality. As repeatedly emphasized above, Primas stated according to his quantum algebraic analysis, that there is a tensor product between the exophysical system and the measurement device (generally, the environment).

In this way, summarizing, the symmetry which is broken belongs to the symmetry classification of Wigner's c) case, $(\Xi, \boldsymbol{\Theta}\ \Xi) = (-\ \Xi, \boldsymbol{\Theta}\ \Xi)$ (where **Θ** is the antiunitary operator), the coexistence of the two time directions *not* arising from the two solutions of the relativistic ''wave''–equations, rather, from the *necessary causal nature of time, broken in the spontaneous symmetry breaking of endophysics upon an ''exophysical'' measurement (termed here ''endogenous exophysics''), and excluding out of the system the acausal break (so acausality) by internalizing ''reverse'' causality right after the causal break.* This distinction is, in fact, the distinction of the ''observing'' (W*) system and its environment. In summary, the overall process is, tentatively,

$$\mathbf{U}\ exp - i\,\mathbf{H}\ t \rightarrow \mathbf{U}\ exp - i\,(\mathbf{H} + \mathbf{H'})\ (t - t^{*}) \rightarrow \mathbf{U}\ exp - i\,(\mathbf{H} + \mathbf{H'})\ t^{\dagger} =$$

$$\mathbf{U}\ exp - i\,\mathbf{H}_{total}\ t^{\dagger}\ , \text{where}$$

$$\mathbf{I}\ (t^{\dagger}) = \mathbf{I}_{1}\ (+\ t) + \mathbf{I}_{2}\ (-\ t^{*}), \text{ultimately}$$

$$\left| +\ t \right| = \left| -\ t^{*} \right|. \qquad (4)$$

Here $t^{\dagger}$ is the inversion symmetric time parameter, $-\ t^{*}$ is the internal antiunitary (reversed) time parameter (denoted throughout –τ), $\mathbf{I}\ (t^{\dagger})$ is the composite one–dimensional group theoretical representation, $\mathbf{I}_{1}\ (+\ t)$ and $\mathbf{I}_{2}\ (-\ t^{*})$ is the inequivalent representations of forwards and reverse time, the sign ''+'' denotes the direct sum (except for the sign of time). *Ultimately*, we have, as noted above, Wigner's ''c'' two inequivalent representations of the time inversion *symmetry*. The *internalized* ''measurement outcomes'' may have been longer (*t*RNA–like) RNAs with their *complementing spatial structures and the fitting measurement devices proto–proteins.*

The external +t evolution dominates the internal –τ one, but from the very characteristics of causality, the latter ''drives'' to fully complement the former. As noted above, the internal time reversal process possibly reversed the two spatial structure measurement outcomes, RNA/DNA becoming the ''cause'' and the proto–enzyme the ''effect'' (as ''device/object'' reversal).

It should be added, that $\mathbf{H}_{total}$ is not selfadjoint inbetween *divisions* (''self''-reproduction).

The above considerations form the basic quantum mechanical structure of our study.

Measurement Self-Excitation and ''Endogenous Exophysics''

To begin developing the points outlined above, subsequently after the endophysical (self-) measurement time-inversion symmetry breaking, exposed in the **INTRODUCTION** and above, the appearance of the (reversed, irreversible) phenomenon is first of all *internal*. It is corresponding to altered internal quantum states and the symbolic (''virtual'') states with (reversed) measurement record + memory classical spatial coordinates, which are then *quasiclassical* spatial coordinates. The symbolic *quasiclassical* states can be expanded *via* the metric tensor $g^{i}{}_{j}$ in the proper *quantum dynamic ket vector state space* of its own positive metric Hilbert space (Balázs, 2015b; Everett, 1973).

Quantum algebraically, the measurement irreversibility being internal, the (W*) quantum algebraic structure remains the appropriate mathematical frame for the system (Balázs, 2015b; Primas, 1992,1993,1994) but the ''exophysical'' statistical states of a quantum description are constrained (conditioned) *internally by the system itself* to an *almost dispersion-free "ontic" state* (Primas, 1993) like in an *endophysical* description. This is what we experience as (microscopic) self-control and *external ''unprogrammability'', autonomy* (Gunji, 1992,1993,1994), *internal contextuality in Rosen's sense (relationality,* Kineman, 2011*) and internal/external anticipatory* (Rosen and Kineman, 2005) yet (internally programmed) automata–like behavior (Balázs, 2015b) of living matter.

This type of *internal relational* self-constraint (control) series calls for an *internal projection operator algorithm* (recursion) *description* as described by us (2015b). Similar usage of the terms "self"- and "internal" measurement was introduced by Pattee (1971) and Matsuno (1989). The equation

$$<\varphi^{j} = \sum g^{i}{}_{j}\, \chi_{i} > \qquad (5)$$

referring to the imbeddment of the ''bra'' vectors of the split off ''dual state space'' (the symbolic state space) into the fundamental (quantum mechanical) ''ket'' state space gives rise to the *internal* tensor product factorization

$$\mathbf{\Psi}^{\ddagger} = \sum_{i \neq j} g^{i}{}_{j}\,(t_{j})\,\chi_{i}\,(\mathbf{q}_{i}) > \bullet < \varphi^{j}\,(\mathbf{Q}_{j}) \qquad (6)$$

which expresses the *tensor product factorisation* of Primas (1992,1993,1994) of the ordinary quantum dynamical and symbolic state functions of subsystems of our (*internal*) *exophysics,* according to Primas' analysis. (Here $\mathbf{Q}_{j}$ and $\mathbf{q}_{i}$ denote the mesoscopic (classical) collective coordinate of the *j*th, and quantum dynamical spatial coordinate of the *i*th *mesoscopic unit* (subsystem), ● is the tensor product; the parenthesis by W* referres to the *endogenous* nature of the ''system'' (Balázs, 2015b) (''endogenous exophysics'' (Balázs, 2015d).

The term "endogenous exophysics", more closely, referres to such a special phenomenological description of the primary life process where:

1)

As noted above, after the breaking of the holistic symmetry of the Galilei group, the endogenous quantum laws (see Primas (1981,1992,1993,1994), the phenomenon of time-inversion (Primas, 1992) is *internal*, referring to the subsequent, successive *inside* (self-) measurements-controlling event-chains (see e.g. Matsuno's *internal measurement* (1989)) in the quantum mechanical frame of the living organisation. There arise *internally, serially measuring entities* upon the proper ''ket'' subsystems *of their proper positive metric pure quantum mechanical Hilbert space.* The endophysical *original* ''*einselection*'' (reduction of state, Guilini *et al.* (1996) is assumed as may have happened between the proto-protein-enzyme and RNA-constituents parts at an *interface* (of the endophysical quantum system and the rest of the Universe), the latter as ''the system'', the former as its ''environment''. (This is conceived according to the *original* ''measuring device'' with its memory states and its ''object'' *in the ''non–orthodox'' decoherence picture* of quantum theory, where the ''measurement device'' is the surrounding Universe. The origin of both time and space dimensions, accordingly, might have remained at the proper boundary interface.)

It might be added, that Balázs has put forth a conceptual picture of the gradual transformation of *endophysical* quantum *dynamics* to *exophysical* quantum *measurement* in primordeal times (2013,2014).

This event may have involved a subsequent step where the (EPR) "openness" was substituted, in general chemical evolutional time, by a disentangled (very selectively) *closed* quantum system, which is *measuring from inside* the surroundings (Balázs, 2014) and concomitantly *is measured externally (by the surroundings).* Quite independently, the symbolic (internal) constraints, as noted above, are also (macromolecular) *''internal measurements''* (Matsuno, 1989).

2)

The partial Boolean projection onto the endogenous exophysical measurement ''device'' (Primas, 1981) is internal, but, as its *extended body*, actively projects ("*traps*", constrains) the energy excitations of the external world *to uphold its original* (*primeval*) *internal excitation*, to be *relaxed gradually*, in an indirect special biological route, of progressively sustaining these very excitations *in its space-mapped way* (amounting to self-maintenance), up to division.

This process, in fact, comprises *metabolism.*

3)

In this sense, the living system is subject to its environment (is a very restrictedly open system) in the form of a *constrained* internal-external dynamics where the system as "measurer" is constrained relationally internally (as symbolic control) by endogenous measurements of historical origins, fit to survival, to follow a *special route* of time reversal to the fixed point of self-reproduction, where the return to endophysics is realized (for the original ''holistic'' individual, Balázs 2015c). This, in fact, comprises the biological *time-*

cycle (Balázs, 2014), and determines the ''*damping*'' of the special internalized material ''excitations''.

4)

The life-cycle of the individual organisms is thus internally projected, autonomous, goal-directed (teleonomic) process even though, in the final analysis, is energy-driven. This energy-dependence, in fact, can only be *realized* as *internally conditioned, semantic* (contextual, relational) *information-content, driven* by the internal reversed time process (so also energy).

Note that Matsuno showed (1998) that *every* time process gives rise to *some kind of information*, thus so does our internal time reversal process, too, only a very special one.

5)

Thus, *in the positive metric affine Hilbert state space coordinate system of the organism*, the system is very restrictedly *open*, so is coupled to a practically *infinite number of degrees of freedom*. *In our external* coordinate system, by the coming about conscious human observers, we externally observe the *closed, self-distinctioning, hidden* aspect of this *primary, internal* time evolution (Balázs, 2015c). The endogenous projection algorithm (metabolism) is what corresponds to the internal/external partial Boolean projections of the self- (information-) constrained (W*) system as internal/external *measurements* on its own internal pure quantum mechanical sterical part–systems and also on the quantum mechanical/classical surroundings (Balázs, 2015b).

The state space of the physical system is therefore *extended* by the imbeddment of the symbolic states into the quantum mechanical ones, but these "virtual" symbolic states are introduced *additional* to the underlying pure quantum dynamical state space as the basis of symbolic constraints (Pattee, 1971;Balázs, 2015c) (overdetermination, (Balázs, 2015a)).

Internal Conditioned Information Processing and Quasiclassicality

It was argued in Balázs (2014) and noted above, that the symbol-constrained internal dynamics of living organisations is a kind of *quasiclassical dynamics*, where classicality is introduced *via* the *projective* map on the phase space cordinates (Balázs, 2015a):

$$F \,\big|: \{\mathbf{q}_i, \mathbf{p}_i\}^n{}_{i=1} \rightarrow \{\mathbf{Q}_j, \mathbf{P}_j\}^N{}_{j=1}\,. \qquad (7)$$

Here *n* is the number of quantum mechanical phase space coordinates (spatial coordinates and the corresponding momenta set) and *N* is the number of additional (overdeterminating) ''*classical*'' degrees of freedom.

It was then supposed by us (2015a), that it was the *mesoscopic* (*classical*-) couplings of freedoms with the the purely quantum mechanical ones, which allows for classicality in the system's dynamics, i.e. the arisal of the quantity $\hbar_{ij}$, defined as the corresponding couplings of diagonal phase space cells *h, giving rise to* $h_{ii}, h_{jj} < h$. This nonlinear relation is meant as the physical relation which is "using up" the probability (stochasticity) of the individual (ontic-) interpretation (Primas, 1993), based on the *liberated ''freedoms''* (uncertainties) as *choice* (eq. (10)).

The underlying internal *conditioned "semantic*" information–control of one spatial subsystem over the (regressively temporal) consecutive other one, *both being space-mapped entities*, corresponds to a *temporal correlation* according to an *internal cyclic time parameter* - τ (representing the internal time–inversion process), which is imbedded in the (*external*) (serial, Newtonian) positive quantum dynamical time parameter of +*t* as $t' = \left| + t \right| - \left| - \tau \right|$, to give the discrete semigroup $t' \rightarrow exp\ \Delta\ t_{i\,j}/w$ (Balázs, 2015a). This is the basis of the *off–diagonal*, regressive, internal projection operator algorithm (the ''metabolic'' processes).

The internal *conditioned information flow depends on* - τ and referres to an *unidirectional* time evolution in a necessarily *internally originated* external (exo -) description (Primas, 1981,1992,1994). I. e., the external forward time evolution is (reversedly) irreversible, hence the probability measures of (W*) states are non-commuting, in addition to the ordinary quantum theoretical commutation relations *which also refer to the time parameter-dependence of the probabilities* (*the proper sources of the measurement outcomes*).

Hence conditioned information is the realizations of the phenomenon of the symbol-constrained dynamics. To investigate its nature as the primary basis of the living state, *natural symbol* should be considered once more, if only in a phenomenological way.

The continuous time evolution group in the Schrödinger picture $\{\exp - i\ \mathbf{H}_{total}\ t\}$ is contracted to a semigroup (by $\mathbf{\Psi}^*$ (- τ) and expanded in the fundamental Hilbert space $\mathbf{\Psi}$ (+*t*) following the spontaneous endophysical symmetry-breaking Heisenberg–event. The spatial pattern of Ψ_j ($\mathbf{Q}_j$) spans a symbolic (related) set of wavefunctions which, as internal control-component, constrains the underlying quantum dynamics as *an indirect control over itself*, (the constraining classical degrees of freedom *depend* on the quantal ones, as has been noted above, see also Balázs (2015a)). This latter relation is resolved in a kind of *quasiclassical dynamics* in the *h*, $h \rightarrow 0$ (Copenhagen) sense, comprised of pure quantum mechanical and pure classical degrees of freedom. The failure of the biorthogonality is, in principle, the *origin of internal dynamics as a self-constrained one*, and is brought about by the splitting off the ''inverse'' (*''coupled dual''*) space.

Putting it in a somewhat qualitative way, the *stochastic* (*probability*-) *freedom* in the event field gained by the system at the narrowing of the quantum mechanical indeterminedness (eq. (10)), is turned into the very self-constraints over itself which, upon diagonalisation of the ''matrix'' of the phase space, is expressed by the global relation $\sum_{i\,j} h_{i,\,j} \sim \mathrm{N}\ h$, where N is a very large number. (Here the $h_{i,\,j}$ -s are the system-dependent off-diagonal irreducible coupling constants between pure quantum mechanical and classical complementer observables in phase space.)

The ''symbolic'' set {Ψ(Q)} is symbolic in the Post sense (1965), in that *it referres to, and in effect underlies, the steps of the internal time process* while its spatial coordinates being *functions of classical space* structures. In this respect, it is questionable, whether pure classical systems would also serve appropriate frame for *self*-constraint: there is no *a priori stochastic freedom* upon which the controlling states could develop.

In fact, *through the primary internal time process along* -τ biological symbol itself determines the event-chain in accordance with the overall *drive for structural stability*, subordinated to the fundamental ''drive'' for regressive self–reproduction (Balázs, 2013,2014,2015a,2015c), through space-mappings, the space structures belonging to successive (reverse, *regressive*) time points.

This is accomplished through the ''endogenous exophysical'' *internal* tensor product components as projectors

$$\left|\mathbf{q}_i>\bullet<\mathbf{Q}^j\right| * \left|\mathbf{q}_k>\bullet<\mathbf{Q}^l\right|\ldots \rightarrow g^k{}_j \left|\mathbf{q}_i>\bullet<\mathbf{Q}^l\right|\ldots \quad (8)$$

The subsequency of the projectors *is*, as follows from the above, *not physically determined* (quantum dynamics), rather, *internal (regressive) time-correlations* order the spatial subsequency relations to keep the route in accordance with the *internal time inversion.* That is, the inside primary time process, as *regressive repetition* of the primordeal life-cycle, *proceeds along a well–defined special indirect nonlinear biological route* towards the aforementioned (*molecular*) *identity* (see the latter also below).

The endogenous basic *conditioned information relations* of the living state are in fact *semantic information relations* in the above sense: the occurrence of a symbolic state determines to a large extent the occurrence of a micro–state of a part-system *other than itself* (anticipatory *relational contextuality* (Rosen and Kineman, 2005)).

It is defined as

$$I^{i,j} = log_2 \frac{P(i|j)(-\tau_2)}{P(-\tau_1)(i)P(-\tau_2)(j)} \rightarrow \sum_k \left(\frac{\partial^2 C_k^*(-\tau_k)}{\partial C_i(-\tau_i)\partial C_j(-\tau_j)}\right)_{-\tau=-\tau(k)} > 0 \quad (9)$$

Here $P(i|\ j)$ is the probability of quantum mechanical ''monomer'' *state j* occurring if monomer state *i* is the previous state in the time-series, wheras $P(i)$ and$P(j)$ are the independent probabilities of the occurrence of the respective quantum states in the absence of conditioned correlations, but in the presence of quantum dynamic correlations; subscripts *i*, *j*, *k* refer to quantum mechanical state functions of the *i*th, *j*th and *k*th subsystems (the latters corresponding to the built-in monomeric states), in the *i*th, *j*th, *k*th time moments. The *C* – s and *C** - s are the time–dependent expansion coefficients of the corresponding purely quantal monomeric states in a biopolymer. The conditioned (semantic) information is, in fact, expressing the difference between ordinary serial quantum probabilities $P(i)$ and $P(j)$ as the *actual serial subsequency space relations of the monomeric states i and state j*. (We keep in mind, as an example, the central DNA(/RNA)-controlled protein synthesis as a string-processing process.)

This is of course a phenomenological description.

It should be pointed out that the dependence of state *i* on state *j is not reversible (''central dogma'', for example).* The conditioned relation expresses the fact that the subsequency of the state *j* on *i* is an internal *time structure relation* ("rule") imposed upon the system as the centrally controlled *special biological route* of (necessarily, by space-mappings, being a *regressive* time evolution, i.e., on a *positive* time axis). We define this semantic information flow between micro-states *mediated* by the *symbolic states* as a *relaxation of the molecular ''self–excitationary''* process. As it follows from the above discussion, in other words, in that of *molecular disidentity*.

In this way, it seems evident that "molecular *disidentity*" (which expression is coined for the process of the special "material symbolic process" resulting in the *classical* information flow) reflects the time asymmetry and the *evolution of the system back to physical identity in a regressive way* to $t' = 0$. Thus, as has been noted above several times, *the primary*

biological process is , in fact, a special route of return to material (molecular) identity, inhibited in its direct route (i. e. physical disintegration) *exactly by space mapping* of the reverse time evolution, *which is a function of natural symbolic control.* This (molecular) disidentity (as a result of the original internal ''self–inhibition'' by natural *original* space mapping (Balázs, 2013,2014)), is which needs energy supply at every particular level of organization.

That this *self-maintenance* (the drive for structural stability), progressing according to its *own primordeal initial condition*, the controls of the ''abstract'' genetic codes (Balázs, 2013,2014), this energy–driven, so crucial energy-substraction from the environment, is *fundamentally present*, is clear already in "autopoiesis theory" (Pask, 1981), or in Bauer's early theory of Permanent Inaequilibrium (1935). We would add that "self-producing" in fact is a maintenance of internal/external global *excitation-substraction* from the environment, which is similar to the former theories, but it is *individual-dynamic* rather than statistical-thermodynamical like most current ''inaequilibrium'' models (see e.g. Nicolis and Prigogine (1977) or Haken (1977)).

It should be noted also that semantic (conditioned) information acts to narrow the quantum theoretical probabilities, hence arise the "second order uncertainty relations" in place of the ordinary uncertainty relations, eq. (7), (compare also Balázs, 2015b). The latter is also an expression of temporal relations, but the off-diagonal h_{ij} elements point to a relation intrinsic to the system: an *algorithmic relaxation of the molecular disidentity*, i.e. a lift of internal irreversibility *as being an additional constraint.*

The apparent irreversibility of the internal time evolution as symbol–constrained (Pattee, e.g. 2000) algorithmical coupling of the space mapped (so spatial) micro-states, corresponds to the *teleonomy* of the process, its goal being the regressive self-reproductional event as the ultimate relaxation of molecular disidentity (or the final ''damping'' of "self-excitation").

The essence of the primary symbolic life process, in phenomenological terms, is thus to offer the physical process (*of direct return to molecular identity*) *a substitute, alternative way* and this is the *indirect regressive time reversal return*. There are, in fact, a hierarchy of inhibitions and time–delays of the internal processes, with the evolutional emergence of nervous systems (Balázs, 2015a) (termed "*secondary processes*", as opposed to the here discussed *molecular* ''*primary*'' processes). The common property of the formers and the primary process(es) is that both are the results of internal inhibitions (constraints) offering a substitute *temporal effect* for material identity.

(''Internal measurement'') projective algorithmic internal behavior of the self-constrained dynamics, then, can be seen to correspond to both gradual ''damping'' of *evolutionally inherited* ''self–excitation'' of matter and, as its source, the (here phenomenologically discussed) classical semantic (conditioned) information flow in the system, materializing regressively the internal reverse time evolution progressing.

Quasiclassical Information-Driven Dynamics and Molecular Identity

Tentatively, then, we may conclude that a general Δ E excitation of the system is the result of an irreversible *internal/external (global)*, if *en gross regressive* (- τ imbedded) , real–time, partly reversible time evolution, emerging as an assimilation-dissimilation process in the system with the external + *t* dominating above – τ in the life cycle; i.e., an *active search*

("expectation", ''anticipation'') for the steps of its internal *algorithmical space-mapped behavior* (the generalized metabolic processes) may have arised.

It should again be stressed that the arisal of the h_{ij} off-diagonal action quantities are reducing the dispersion domains of the respective observables and are fundamental in the possibility of the inside process of "drive for unity" (i. e., the ceise of *any* ''exophysics'', returning to original *endophysical* ''self–identity''), that is to say, the *conditioned information* as *choice* of the subsequent off-diagonal projectors exert *control* in the system (Balázs, 2015b) towards internal/external *space replication (duplication)* (Balázs, 2013,2014), *through the actions of natural symbols.*

In this way, as was also pointed out by Freud (1920) in more detail and discussed above to some extent, it is essential that being cast out of the endophysical natural history is a natural ''driving force'' of life. In our frame, this is described as an *original endophysical ''self–measurement''* event of matter, with the splitting off a *measurement record (interface proto-enzyme*) and "*object-system*" (*RNA components at the boundary surface)* at the same mesoscopic quantal system with a primitive metabolism (Dyson, 1999), the ''drive'' ''aiming'' for the internalized reversed time process to complement fully the external ''forwards'' time evolution (thus reaching time inversion symmetry, adjointness). Thus one component (the retrocausal one) of the result of the original splitting off of the two directions of time may have become part of the system as *spatial* (self-) measurement record(s) as the *space-mapped* internalized inversed time process *after* the measurement, governing, as time-reversal process (-τ), the autonomous internal time evolution above ordinary quantum dynamics, subsequently.

It is our guiding principle, concerning phenomenologically the ''primary'' process.

Also, this is the reason that informational (or molecular "*disidentity*") relations are in fact *time-correlations*, as was discussed above.

In this way, the original split-off quantum dynamics and the symbolic *classical* space variable of the symbolic wavefunction (measurement record) results in a self-constrained, quasiclassical, semantic information-driven dynamics, which is the space-mapped manifestation of the internal time process, and is, in the same processes, probability and actuality; microscopicality and macroscopicality; statical (space) and dynamical (time) relations.

We have to quote here the appropriate expression of the ''second order'' uncertainty relation (Balázs, 2014,2015c):

$$(\Delta \mathbf{q}_i - \Delta \mathbf{Q}_j)\,(\Delta \mathbf{p}_i - \Delta \mathbf{P}_j) = h - 2h_{ij} \qquad (10)$$

with $\mathbf{Q}_j$, $\mathbf{P}_j$ referring to the (classical, controlling) symbolic observable of the *j*th subsystem (Balázs, 2014,2015b), while $\mathbf{q}_i$, $\mathbf{p}_i$ to the *corresponding quantum dynamical* observables of the *i*th unit (subsystem). There are three types of contribution: pure quantum dynamical (*h*), pure symbolic (interpretable only in relation with the pure quantum mechanical observables) (= 0), and *cross-terms* ($2h_{ij} < h$). The substractions refer to constrains on the quantum mechanical uncertainties: the symbolic observables narrow the quantum mechanical uncertainties. The smaller the ''sharpness'' of the symbolic observables, the more *relational* (contextual, controlling, coupled) they are (see the ''codon'' steric extended structure, for example, or the steric structure of enzymes, determined by quite an amount of crucial

structural units), so the proper internal/external formal/final cause aspects come into front, and the pure quantum mechanical space-mappings of the ''slave'' states *are the more exact (dispersion-free).* This relation appears to work *en gross* up to 98% precision (without by-products). In specific terms, the conditioned information may amount to ~10^4-10^5 bits e.g. in the encoded protein synthesis of individual poly– α-aminoacids by the DNA molecule.

Thus, as $2h_{ij} \rightarrow h$, the associated dynamics resembles more and more *classical behavior with informationally restricted micro-states.*

As it was referred to above, the stochastic ''freedom'' release by the constraints over the micro- (quantum-) dynamics, expressed by the ''second order'' uncertainty relations, is used up by the system to form these very constraints: the shrinkage of the diagonal phase space cells by the irreducible coupling of them is used for the *partial* (relative) external arbitrariness (teleonomy, external ''unprogrammability'', e.g. see Rosen and Kineman (2005)) of the *t*' (contractive semigroup-) evolution of the *total* (internal-external) regressive time process, being possible by the arisal of the internal $2h_{ij}$-s (and so the emergence of the symbolic states).

It is this *using up this freedom*, thus, which *underlies* the internal ''choice'' of the algorithmic behavior of the coupled quantum mechanical (microscopic) and symbolical (mesoscopic) states as a self-projecting time–series (Balázs, 2015b), at least in a phenomenological description.

The arbitrariness of the internal symbolic → quantum dynamic series along t' is more and more evident as the process evolutionarily moves away from the elementary "quantum-chreod" (Thom, 1969; Balázs, 2015b), to more distant ''algorithmic'' states. This corresponds to an accumulation of uncertainties in the $g^i{}_j \; g^j{}_k \; g^k{}_l \ldots$ time series. The semantic (conditioned-) information content (temporal correlations) increases with the number of steps involved, *also externally*.

We can, in this way, conclude that the *phenomenology of the primary biological symbolic process*, being the temporal, externally regressively observed time process, is first of all the ''drive'' for *structural stability* (self–maintenance, Pask, (1981)) being *subordinated to the most elementary ''drive'' for regressive self-replication as the "goal" of the internal process, as the substitute effect of molecular identity in face of direct physical disintegration*.

In fact, the drive for structural stability, i.e., the drive to follow a *special biological route of return to the unity of matter*, i. e., to restore time-reversal symmetry, is self-referential of the Varela type (1975,1979). Moreover, as noted above, in a sense, we can say that the primary biological symbolic process equals the cellular internal time relations turning into specially (closely matching) internal successive and spatial complementing space relations (e. g. see lock-and-key enzyme actions).

In general, during this ontogenetic autonomous, internal time process, space-structures are formed (mapped) and are successively transformed to spatial natural symbols as constraints, i.e., a symbol–constrained (automata-''metaphoric'') dynamics (Balázs, 2015b; Neumann, 1966) as a space mapped *time process*; and progresses along as internal reverse time complementation as producing *therefore* again *complementing* (''lock–and–key'') spatial structures, *reflecting the time complementation, which we know as global metabolism.*

The crucial step is the constraint on the quantal states of the "overlap" form $< Q^{j}(-\tau_{j}) \mid q_{k}(-\tau_{k}) > = g^{j}{}_{k}$, where $g^{j}{}_{k}$ is the metric tensor component by which the required *internal endogenous exophysical tensor product* in the basic (positive metric, affine) Hilbert space is developed. Thus, the *internal* tensor product is *partly arbitrary (free), partly law–like iconic* (Peirce, 1932).

We only note here that the biological holistic (''contextual'') ''secondary-level subject'' is, in this way, *may be also* the *function* of an evolved form of natural symbol; it is, to an extent, evolutionally emerged to the symbolised part-system as a *space structure-fixed expectation* (''anticipation'' of Rosen and Kineman (2005)) of $\Psi_i(\mathbf{Q}_i)$ for Ψ_k $(\mathbf{q}_k)$, only there we have synaptic connections, if globally it might follow (represent) the ''mechanisms'' and ''goal'' of the primary process, outlined above (compare Balázs, 2015a).

In this way, thus, the mechanism, involving the two sides of the *phenomenological primary symbolic life process* (structural stability and regressive self-replication) of the fundamental ''drive'' *might be itself the way of functioning of natural symbol as a global constraint*. It is time processes transforming into space structures (subsequency of a special off-diagonal spatial projector series, metabolism (Balázs, 2015b)), and so time structures (dynamics) transforming into stable special space structures gives rise to the resultant assimilation-dissimilation, growth and replication, phenomenology of the system.

Structural stability, as required by the above discussion, , can be maintained only through a special, active (informationally conditioned) matter, essentially *energetic*, interaction with the environment, where the constraints on the incoming material/energy components are ''*coded*'' as spatial structures (RNA/DNA), are transformed into complementing space structures, spatial projections, i.e., are constrained, selected, in an *internal* ''anticipatory'' dynamics of metabolism (first of all, by the above space fitting enzymes).

It is only not to be forgotten that the whole process is subordinated to the ''goal'' of time symmetry, the self-replicational *fundamental drive* (Balázs, 2015a). *Natural symbol is a symbol only through its function*, its control over the internal dynamics, manifesting in the autonomous internal/external time cycle along t', otherwise it is only a static inert physical (molecular-ensemble) entity, a pure static/dynamic spatial structure. It is precisely the dis-identity of its spatial structure, referring to a micro-state *of an other* subsystem, *other than itself*, which manifests itself in its control (constraint) on the dynamics (i.e., in essence, its regressive, gradually progressing internal time evolution).

CONCLUSIONS

It has been shown that ''self–excitation'' (''endophysical self–measurement'') of matter, as "*molecular dis-identity*" is at the very heart of the autonomic, teleonomic behavior of the fundamental (primary, molecular) biological process, presented in admittedly in a phenomenological way. Steric structures as space mapped ''symbols'' constantly transform into a dynamic process via a symbol-constrained quasiclassical dynamics (with $2 h_{ij} < h \rightarrow 0$).

That is, the basic symmetry-restoring process is *realized* through classical conditioned information in the algorithmic internal dynamic time evolution of the system. It is driving to relax spontaneous internal measurement ''excitation'' (molecular dis-identity), *evoluting*

towards restoring molecular identity by time-inversion symmetry, in a special biological, *indirect route.*

In our *description*, presented above, the *phenomenological biological primary symbolic process* arised concomitant with the origin of life, as the arisal of ''natural symbol'' of the primary endophysical quantum self-measurement *record* as its *space variable* (so of quasiclassical wavefunctions, termed above ''symbolic states''), of a primeval *Heisenberg- , actual event*.

The biological ''subject'', higher up on the evolutional ladder, quite up to the conscious human mind, is a spontaneous internal excitation (measurement transition) time series in our scheme, which is emphasizedly only a *model*, and so it conforms, in *very elementary and heavily restricted* (molecular) terms, to the Stapp-model of the subjective processes of the human *conscious* processes (compare the terms of Stapp, (1993)).

We are aware of the danger of introducing a kind of "*elan vital*" in our scheme, but this challenge should be met, as a conventional ordinary physical description (model) of the living state, relying *solely* upon quantum dynamics, is clearly insufficient.

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