A Unified Theory of Life

Bujatti, M.

VOL. II

A UNIFIED THEORY OF LIFE

CONSCIOUSNESS,

CREATIVITY AND INTELLIGENCE

IN BIOGENETIC, MORPHOGENETIC AND CULTURAL-EPIGENETIC

EVOLUTION

VOL. I AND VOL. II

A QUANTUM-MECHANICAL TRANSITION THEORY OF EVOLUTION

M. BUJATTI-NAFEESHUBER

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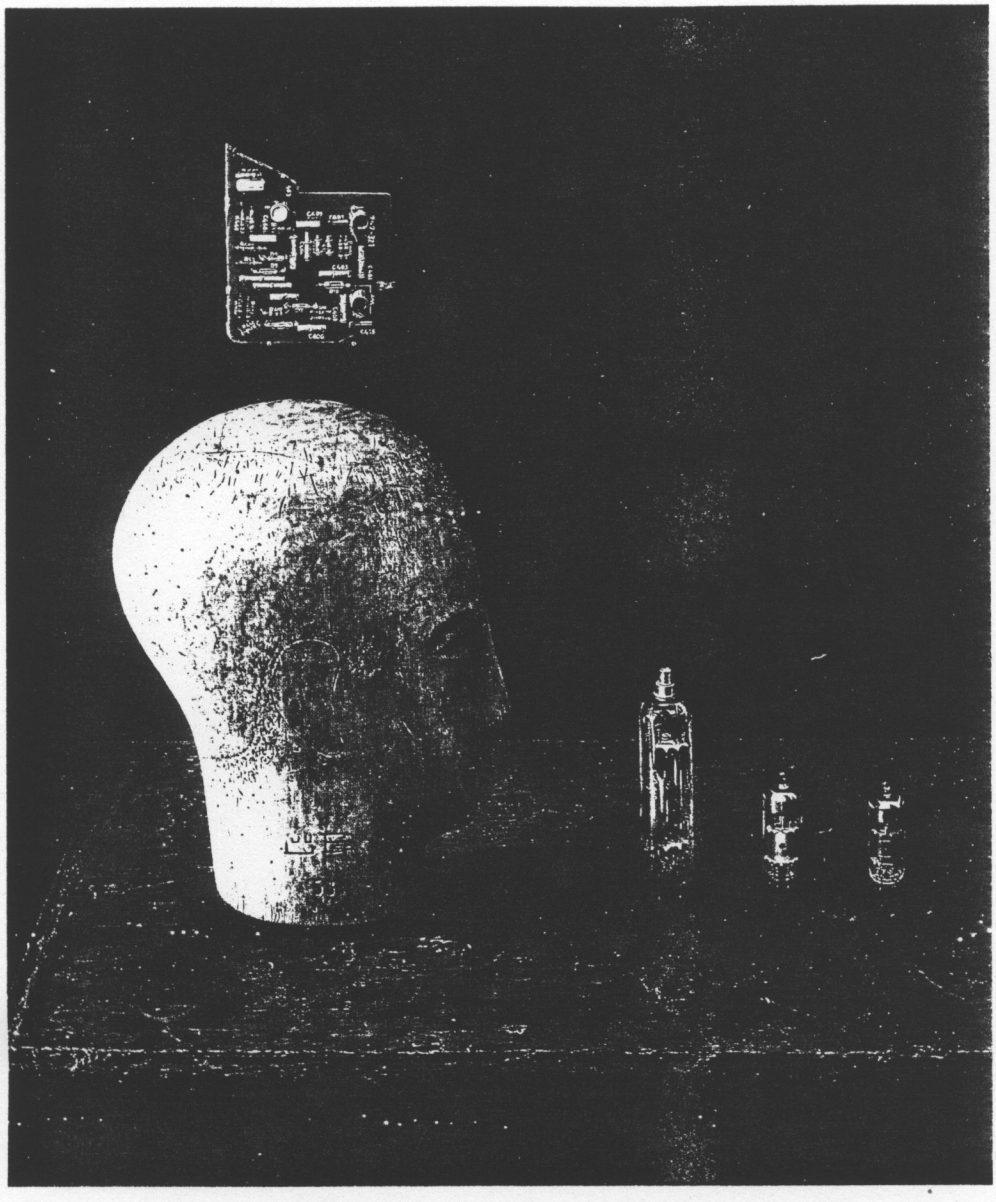

„Verengte Sicht" Öl und Tempera auf Holzfaserplatte, 90 x 50 cm, 1984

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Transition Theory of Evolution

Bujatti, M.

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SCHLÜSSELBEGRIFFE UND ZUSAMMENFASSUNG/

KEYWORDS AND SYNOPSIS

RUNNING HEADLINE:

Integrated Approach to Evolution Theory

KEY WORDS:

Epigenetic system - Darwinian evolution theory - Maxwell's demon - Isokinetic relationship - Morphogenesis - Creative intelligence - Consciousness - EEG

Ansatz zur phylogenetischen und ontogenetischen Kreativitäts-Evolution aus chemisch-physikalisch und humanbiologischer Sicht.

INHALT: Ausgehend von den quantenmechanischen Anfangsbedingungen des Lösungsmittels Wasser wurde die isokinetische Beziehung der Enthalpie-Entropie Kompensierten EYRING-Transition (EECT) im energetisch-entropisch fluktuierenden Milieu als entscheidender Faktor für die Evolution lebender Systeme eingeführt.

Diese theoretische Argumentation wird erhärtet durch eine Zusammenstellung experimenteller Befunde von Energie-Entropie Kompensation, die auf den relevanten Ebenen der biologischen Systemorganisation vom Lösungsmittel über die Makromoleküle bis zu den Funktionen der Neurotransmitter und in der elektrischen Aktivität des menschlichen Gehirns nachweisbar wurde.

Dieser letztere Befund wurde durch die isokinetische EEG-EECT--Analyse ermöglicht, die das menschliche Nervensystem auch in seinen speziellen Leistungen auf neue Weise statistisch physikalisch zu charakterisieren erlaubt. Es handelt sich dabei um das vorläufige Ergebniss einer computerisierten EEG-Darstellung im Versuchsstadium, die ein Studium der als Ruhe und Erfüllungs Reaktion beschriebenen Dynamik homeostatischer Selbstorganisation erlaubt.

Weiters weist in einem energetisch-entropisch fluktuierenden Milieu diese quantenchemische EECT alle Eigenschaften des Maxwellschen Dämons zur Negentropie-Selektion auf und ist damit zur chemisch-kinetischen Definition von epigenetischer Transition, Mutation und Selektion als biologischer Basis von Kreativität und Intelligenz geeignet.

Sie führt damit weiters anhand des Parameters der isokinetischen Temperatur zu einem im EEG, experimentell, statistisch thermodynamisch nunmehr falsifizierbaren, Modell des Bewußtseins und seiner verschiedenen Zustände, einschließlich der Entwicklung zu seinem gedankenfreien, rein transzendentalen Zustand.

Letzterer stellt sich in diesem Modell als der teleonom stabilisierte, isoenthalpische Spezialfall des makroskopischen Quantenzustands der Energie-Entropie kompensierten Transition dar.

Dieser makroskopische Quantenzustand hat als physikalischer Träger für Bewußtsein in dieser letztendlich quantenfeldbedingten Eigenschaft des Wassers seinen biologischen mikroskopischen Ursprung.

Als genereller morphogenetischer Faktor oder Invarianz-mechanismus, in seiner Bedeutung untrennbar vom Genom, als evolutionäre Bedingung für den Vorgang der Proteinkonformation erklärt Kompensation den experimentellen Befund der zumindest ebenbürtigen Möglichkeit zur phylogenetischen Stammbaumerstellung ausgehend von den Hydrophobizitätwerten der Proteinsequenzen, neben den üblichen genetischen Verfahren.

Weiters wird sie als homeostatischer Vorgang in der Compensation-Constraint Coevolution oder Verhalten-Gen-Koevolution dem bereits quantifizierten Effekt von Verhalten auf die Beschleunigung der morphologischen Evolutionsgeschwindigkeit zugrunde gelegt.

Schließlich wird EECT als biologisches Kriterium herangezogen für die stammesgeschichtlich, öko-morphologisch und öko-physiologisch begründete, auf der Ethologie des Appetenzverhaltens der symbolkonditionierten angeborenen Auslösemechanismen des Tauchvorganges beruhenden Physiologie der menschlichen Kreativität, der Gehirn- und Sprachentwicklung und der initiatorisch-metaphysischen und sozio-ökonomischen Kulturleistungen.

Als fundamentaler Mechanismus der Mikro-Organisation ermöglicht es EECT, die moderne synthetische Evolutionstheorie mit einer formalen, chemisch-kinetischen Grundlage für epigenetische Vorgänge zu vervollständigen. Dies schließt auch Ursprung und Ziel teleonomen Verhaltens ein, welches mit der Stabilisierung des isoenthalpischen Spezialfalles der Kompensation bei physiologischen Temperaturen, dem Tunneleffekt des Wassers entsprechend, begründet wird.

WISSENSCHAFTLICHE ZIELSETZUNG: Ausgehend von der makroskopischen Funktionsweise der Indolamin- Katecholamin Transmittersysteme des Menschen sollte der Ansatz für ein einheitliches, Kybernetik, Thermodynamik, Neurologie, Biochemie, Anatomie und Physiologie umfassendes Modell ihrer Funktionsweise unter besonderer Berücksichtigung der stammesgeschichtlichen Kreativitätsevolution entwickelt werden.

ERGEBNISSE: Dieses Modell wurde im Ansatz entworfen. Der dazu fundamentale Mechanismus der isokinetischen Transition des Lösungsmittels wurde den bisherigen notwendigen aber nicht hinreichenden Bedingungen der Populationsgenetik hinzugefügt, zu nunmehr Transition, Mutation, Selektion, Rekombination, Duplikation, etc. Daraus ergibt sich weiterführend im Ansatz eine integrierte Generelle Kreativitätstheorie selbstorganisierender lebender Systeme. Sie reicht isomorph vom isokinetischen Prinzip des Lösungsmittels, welches der mikroskopischen, epigenetischen Proteinfaltung und dem funktionellen dynamischen Verhalten der Proteine zugrunde liegt, über allgemeine zelluläre und interzelluläre Verhaltenssteuerung mittels der Neurotransmitter-Systeme zur Ethologie der Kreativen Intelligenz.

Sie bedient sich dabei der mehr auf stammesgeschichtliche Relevanz angelegten Theorie der Kompensation - Konstraint oder Verhalten - Gen Koevolution (Generelle Öko-Transitionstheorie) einschließlich der Ebene der funktionellen Öko-Morphologie des Menschen (Spezielle Öko-Transitionstheorie) die mit der Entwicklung der natürlichen und künstlichen kreativen Intelligenz und deren Symbolsprachen (Spezielle Kreativitätstheorie) einhergeht.

Für die Humanbiologie ergibt sich aus den erworbenen evolutionären Randbedingungen terraquatischer Öko-Transitionen zwangsläufig sowohl die typisch menschliche Morphologie einschließlich des als Transitionsorgan vergrößerten frontalen Neocortex analog zu den Cetacea als auch (Spezielle Kreativitätstheorie) die genetisch fixierte und auf Isokinetik Modifikation mittels selbstinduzierten Tauchtrieb-Etho-Physiologie beruhende symbolisch-sprachliche kreative Intelligenz.

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KURZFASSUNG/SUMMARY

Ausgehend von den quantenmechanischen Anfangsbedingungen des Lösungsmittels Wasser wurde die isokinetische Beziehung der Enthalpie-Entropie Kompensation - in einem energetisch-entropisch fluktuierenden Mikromilieu - als kritischer Faktor für die Evolution des Lebens eingeführt.

Diese Argumentation wird weiters erhärtet durch den experimentellen Befund von Energie-Entropie Kompensation auf allen relevanten Ebenen des biologischen Systems bis hinauf zur elektrischen Aktivität des menschlichen Cortex.

Dieser quantenchemische Mikro-Organisations-Mechanismus dient als Maxwellscher Dämon für Negentropie-Selektion, welcher die moderne Evolutionstheorie mit einer formalen, chemisch-kinetischen Grundlage für das Gesetz des epigenetischen, teleonomen Verhaltens vervollständigt.

Als genereller morphogenetischer Faktor oder Invarianz-mechanismus liegt er dem quantifizierbaren Effekt von Verhalten auf die morphologische Evolutionsgeschwindigkeit zugrunde. Ebenso erklärt er die ebenbürtige Möglichkeit der phylogenetischen Stammbaumerstellung ausgehend von Hydrophobizitätwerten der Proteinsequenzen, an Stelle der üblichen genetischen Verfahren. Er führt weiters zu einem experimentell, statistisch thermodynamisch nunmehr zugänglichen Verständnis des Phänomens des Bewußtseins als makroskopischem Quantenzustand, der in der mikroskopischen Energie-Entropie kompensierten Transition des Lösungsmittels seinen prägenetischen Ursprung hat.

Dieser fundamentale molekulare Mechanismus der Transition - zusätzlich zu den Prinzipien der Populationsgenetik wie Mutation, Selektion, Rekombination, Duplikation, etc. - sollte eine integrierte Verhalten-Gen-Koevolutionstheorie ermöglichen. Sie reicht isomorph vom isokinetischen Prinzip des Lösungsmittels, welches der mikroskopischen, epigenetischen Faltung und dem funktionellen dynamischen Verhalten der Proteine zugrunde liegt, bis zur makroskopischen Ebene der funktionellen Öko-Morphologie des Menschen mit aus erworbenen Randbedingungen terraquatischer Öko-Transitionen zwangsläufig sich ergebender Morphologie und funktioneller Etho-Physiologie der Isokinetik Modifikation bei symbolischer kreativer Intelligenz.

SUMMARY

Starting from the initial quantum mechanical conditions of the solvent, water, the isokinetic relationship of enthalpy-entropy compensated EYRING-transition of chemical kinetics in an energetically fluctuating micro-environment, was introduced as the critical factor for the evolution of life. This argumentation is based on and corroborated by experimental findings of compensation on all relevant biological system levels up to cerebral electromagnetic activity. Serving as MAXWELLIAN DEMON this quantum chemical, micro-organisational mechanism of negentropy selection provides evolutionary theory with a formal, kinetical basis for the epigenetic behavioural law.

As a general morphogenetic factor or invariance mechanism, it underlies the quantifiable behavioural acceleration of morphological evolution, the equal possibility for phylogenetic tree construction from hydrophobicity values of protein sequences, as well as from minimum mutation distance matrices and, finally, the phenomenon of consciousness. It is seen as biological macroscopic quantum state manifestation of the microscopic quantum mechanical enthalpy-entropy compensated transition property of the solvent.

This suggested fundamental molecular mechanism of transition, together with mutation, selection, etc., should account for an integrated behaviour-gene coevolution theory. It ranges from the quantum mechanical solvent principle underlying microscopic epigenetic protein folding and protein dynamical behaviour up to the macroscopic level of functional eco-morphology, ultimately expressed in human morphology and an etho-physiology based symbolic creative intelligence.

A U N I F I E D T H E O R Y O F L I F E IV

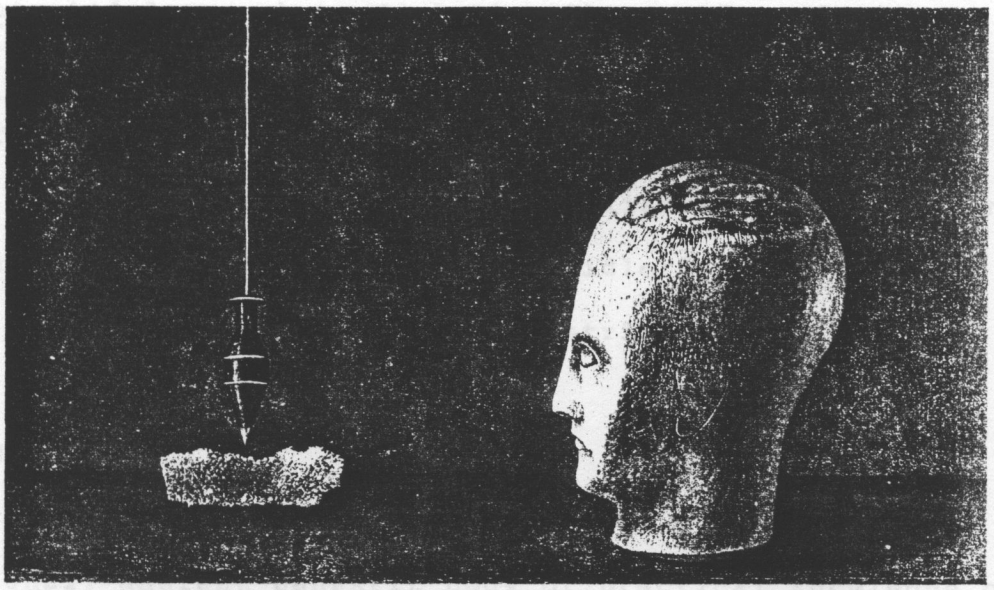
ANSATZ ZUR PHYLOGENETISCHEN UND ONTOGENETISCHEN KREATIVITÄTS-EVOLUTION AUS CHEMISCH-PHYSIKALISCH UND HUMANBIOLOGISCHER SICHT

I.TEIL

Human Morphology, General Eco-Transition Theory and Creative Intelligence.

An Integrated Approach to Evolution Theory. Part I.

M.BUJATTI-NARBESHUBER



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Human Morphology, General Eco-Transition Theory and Creative Intelligence.

An Integrated Approach to Evolution Theory: Part I. *)

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INTRODUCTION

Ayurveda (CARAKA, 1949; LECHNER-KNECHT, 1978), the traditional, ancient Sanskrit body of practical knowledge on life, having rich parallels in Greek culture where the corresponding term is biology, considers consciousness as the principal characteristic of living systems (ROSU, 1978).

This position seems quite antithetical to modern molecular theory of evolution, criticised also as Mendelianism and Darwinism by now four generations of scientists as seriously lacking an "inner principle" of evolution (for a list of earlier authors see RIEDL, 1975). While rightly indicating that, so far, no additional fundamental mechanism of evolution has been found - or even suggesting that it cannot be found - the exponents of the modern synthetic theory of evolution, DOBZHANSKY, MAYR, KOSSWIG even, have to attribute a fundamental ordering effect to a so-called "epigenetic system". Considered as gene-interactions it was analysed systematically on morphological grounds by RIEDL (1975).

*) Presented at the International Symposium on Vertebrate Morphology, August. 26. 1986, Univ. Vienna, Austria.

In another approach taken by MONOD (1970), the epigenetic process was seen differently. According to his calculation the three-dimensional, most specifically folded protein contains much more information relative to the information of the encoding DNA-strand. As evident source of the information contribution, the complex initial solution conditions were considered responsible for the epigenetic process underlying the manifestation of final protein conformations. The focus on the solute - amino acid sequences - led MONOD (1970), looking for the ultima ratio of epigenetic teleonomy, to chance.

A SOLVENT QUAYLITY UNIFYING MORPHOLOGY AND FUNCTION OF LIFE ?

Another slightly different, but very basic viewpoint is taken here. It looks at the epigenetic question from the pre-biotic or pre-genetic solvent angle by analysing the initial quantum mechanical conditions of the solvent water itself. Thereby a critical evolutionary principle of the living systhem underlying homeostatic, teleonomic self-organisation and defined as rest and fulfilment (RF-) response (BUJATTI-NARBESHUBER et al. 1976) is now provided with its corresponding quantum chemical, fundamental micro-organisational mechanism: Isokinetic EYRING Transition or Enthalpy-Entropy Compensated Transition (EECT). Stemming from the protic, highly self-associating solvent, it was suggested as critical for negentropy increase and evolution of life (BUJATTI-NARBESHUBER, 1985 b). Isokinetic transition dynamics according to quantum chemical kinetics means in short: "the lower the energy of the transition complex relative to the reacting species, the more the possibility for energy level separation and splitting. The entropy of the transition to

that state will tend to decrease" (CONNER, 1982, 1983).

EECT as fundamental molecular mechanism and general morphogenetic factor detailed later in its dynamics (part III), is added to evolutionary theory as formal, kinetical basis for the epigenetic behavioural law. It is necessary for the integrated evolution of form and function in phylogeny and ontogeny both and for behaviour-gene coevolution theory in the unified General Theory of Creative Intelligence (GTC).

This theory of the inherent creativity of life, envisioned by SINNOTT (1959), ranges from the microscopic quantum mechanical solvent principle determining the selection of form in protein folding and the selective functions in protein enzyme kinetics up to the macroscopic level of functional eco-morphology. It is used here to derive human eco-morphology and the origin of his creative intelligence.

SOME EXPERIMENTAL EVIDENCE

The theoretical argumentation is based on experimental findings of EECT on all levels of biological organisation:

1. EECT-dynamics on the quantum-mechanical level of selection rules. Together with energy level splitting they give rise to isokinetic transition (CONNER, 1982, 1983). Low transition energy is thereby selecting low entropy.

2. EECT-dynamics on the thermodynamical level of non-formal chemical kinetics (SCHMID et al. 1982). EECT is firmly established on statistical grounds (EXNER, 1973, LINERT, 1982, 1985). It is best described by the transition function

$$dH\# = T\,iso \cdot dS\#$$

relating transition enthalpy change (dH#) and transition entropy change (dS#) via isokinetic temperature (T-iso).

It is the characteristic constant factor as slope in this linear relationship. T-iso when put in relation to the actual system temperature, allows for a specification of chemical reaction series as predominantly energy or entropy controlled (SCHMID et al. 1981, 1982) relevant e.g. for a design of GTCI tests.

3. EECT-dynamics on the solvent level of biological systems consisting up to 90% of water. This anomalous solvent, with equally high donor and acceptor strength, is a highly self-interacting, hydrogen bonded, structured, low entropy or protic solvent (SCHMID et al. 1981, 1982, 1983). It is characteristically distinct from other solvents by the magnitude of the EECT compensation effect (FRANK et al. 1945; LUMRY et al. 1982). Of relevance for evolution is, that the solvent coordination chemical properties do not appear to be constant but rather are functions of the complementary solute properties. They are determined by the extent to which bonds between the solvent molecules are broken by certain solutes (SCHMID, 1983). EECT stability is sufficient for a selection.

Additionally in water at physiological temperature quantum chemical tunneling takes place (MOORE, 1972). Arrhenius diagram data on chemical tunneling of GOLDANSKI (1979, 1986) reveal in theoretical analysis such tunneling transition as isoenthalpic extremal case of again EECT-dynamics. Important for evolution since solely controlled by entropy changes (BUJATTI-NARBESHUBER et al. 1987), such EECT-tunneling has been found besides in the solvent, relevant for biology in negentropy storage in the interstellar evolution of later organic solute material (SAGAN, 1972, GOLDANSKI, 1979), in macromolecule (GOLDANSKI, 1986; FRAUENFELDER, 1979) and in

cell dynamics (COPE, 1971, 1974; AHMED et al. 1975) and was suggested for brain dynamics (WALKER, 1970; DOMASH, 1976).

4. EECT-dynamics on the level of macromolecule folding (BENIZINGER, 1971; 1981). The epigenetic principle of the folding process, found here to be EECT, guides higher level morphogenesis like self-assembly of multicomponent oligomere proteins, ribosomes, bacteriophages and cells (MONOD, 1970).

Relevant in hydrophobicity, manifesting relatively high energies (PASHLEY et al. 1985), EECT should be a principle involved in the effect of solvent structure modifications on protein configuration and aging (HÜTTENRAUCH et al., 1984).

5. EECT-dynamics on the metabolic level of both micro- and macro- molecular chemical reactions (LUMRY et al. 1970). EECT is underlying the selective "cognition" (MONOD, 1970) of stereospecificity in reactions, by allowing for the constant movement of proteins into conformational substates under the influence of interactions with coenzymes, ligands, substrate.

These movements represent an integral, teleonomic property of protein functional kinetics and not chance fluctuations (HARTMANN et al. 1982; FRAUENFELDER, 1983, 1985).

6. EECT-dynamics on the membrane level. EECT is found in membrane self-assembly and membrane functional dynamics, in the thermodynamics of aqueous micelle formation (EVANS, et al. 1982; 1983; 1984) and in lipid bilayer membrane penetration processes by amphiphiles (JAHNIG et al., 1982). EECT thus allows for functional flexibility in membrane processes, vesicle- or later cell-membrane fusion and fission, exocytosis and endocytosis, cell adhesion and recognition. It is an active principle in the self-assembly of membranes, as above in self-assembly of complex proteins.

7. EECT-dynamics on the neurotransmitter and hormone level for feedback regulation of membrane, cell and organ systems. Energy- Entropy Compensated Transition is evident in the "behavioural energy expenditure minimising" physiology of the indoleamine compounds like serotonin. As negentropy flow reporting transmitters, they compensate with deactivation executing homeostatic Rest and Fulfilment system kinetics. Likewise the "behavioral energy expenditure maximising" catecholamines as entropy flow reporting transmitters compensate with activation in homeostatic FF-Fight or Flight kinetics, as aspect of RF (BUJATTI-NARBESHUBER et al. 1976).

8. EECT-dynamics on the level of brain EEG-activity. Data of 6 EEG-leads (F3, F4, C3, C4, O1, O2) of 10 human subjects were taken. By computer analysis the statistical temperature and entropy of these EEG-signals, actually measuring the physical entropy of the process generating the EEG, had been determined (TOURENNE, 1981). Taking statistical temperature, known to represent linearly the energy of the thermal source that is sustaining the EEG-oscillations and plotting energy against entropy, again linear energy-entropy compensated transition appears from these preliminary data (Fig.1-3).

Through homeostatic, isokinetic self-organisation also on the hierarchically highest and most complex bio-system level of human brain activity again among neurons the epigenetic and evolutionary invariant mechanism of EECT manifests. This illustrates RF-dynamics of self-organisation also on the level of neurons. Any entropy change compensating with trends to diminish activation along with brain-state changes of T-iso can be physically measured. Equally, the height of self-organisation in regional nervous activity is measurable

by the closeness to the zero-entropy point (Fig.1). Self-organisation shows during the eyes open period (Fig.2) an expected lead of the functionally highly evolved optical region (O2, O1). A comparable if not better level of self-organisation is found interestingly during the eyes closed Transcendental Meditation - Diving Response (TM-DR) period (Fig.1). There it is found on a more complex level of integration, namely, in frontal-central regions (C3, F3; F4, C4) as predicted from RF-dynamics. It is a cortex area whose morphology has been strongly emphasised in the evolution of the human brain. This emphasis also happened in the monotreme and cetacean brain. This fact is heuristically most valuable to derive the origin of the morphology and creativity of man.

Multiple hypo-metabolic states are suggested as RF-diving drive to be the cause behind this expansion. The requirements of vegetative regulatory transition executions for multiple eco-transition is the evolutionary pressure behind the brain evolution of man, symbol elicitation and inborn TM-DR. It is associated with creativity and shows the lowest T-iso with the least possible activation dynamically characterising the self-organisation and evolutionary meaning of RF. The frontal left compared to frontal right hemisphere has a higher self-organisation showing the epigenetic evolutionary nature of the brain as mirrored in the local or hemispheric dominance.

CONCLUSIONS

1. A BIOLOGICAL MACROSCOPIC QUANTUMSTATE

Awaiting further confirmation, the above points are the preliminary evidence of natural selection having operated on

chemical systems subjected simultaneously, in principle, to ARRHENIUS-line and -plane generating variations in temperature and HAMMET-line and -plane generating genetic variations in amino acid substituents. It thereby selected systems with the coordination chemical ability to maintain

a) relatively temperature-change-insensitive kinetics and

b) relatively substituent-change-insensitive protein dynamics. This is achieved through self-organisation via spatio-temporally more and more stabilised EECT. This results in isokinetic EECT up to the electric activity of the brain and is interpreted as a biological macroscopic quantum state manifestation of the microscopic quantum mechanical EECT property of the solvent.

2. A BIOLOGICAL MARKER FOR CONSCIOUSNESS

For a first, and still preliminary, experimental proof of the statistical mechanical RF concept for a behaviour-gene coevolution theory (GTCI), formulated within the statistical theory of chemical kinetics (HARTMANN, 1974; LINERT et al., 1983, 1984), computerized EEG-data provided by a statistical physics approach from a brain model by TOURENNE (1981, 1985) were utilised. The discovery of EECT in the EEG is sofar supporting the suggestion of DOMASH (1976), with now EECT as the candidate, of a macroscopic quantum physical interface responsible for the experience of consciousness. Even the known physiology of pure consciousness (FARROW et al. 1982; BADAWI et al. 1984), seems to be experimentally identifiable through EECT-EEG, namely, by a T-iso of zero KELVIN. This is typical for the isoenthalpic extremal case of compensation found in chemical tunneling transitions (See part II).

Via monoaminergic EASE-activation, that is cholaminergic Energy Amplification by serotoninergically Synchronised catecholaminergic Exitation, considered as organised via the nucleus of the solitary tract by the diving response systems (BUJATTI-NARBESHUBER 1979, 1985) the pure consciousness experience or isoenthalpic EECT manifestation is permitted, held responsible for the observed sociological short and long distance field effects (ORME JOHNSON et al., 1982).

3. A BIOLOGICAL CRITERION FOR CREATIVITY AND INTELLIGENCE

The law of epigenetic ordering, drives, based on chemical kinetics (SCHMID et al., 1982), from the initial pregenetic solvent conditions, a process of behaviour-gene coevolution. In GET through passive and actively induced environmental or inner fluctuations EECT as macroscopic quantum state or consciousness allows algorithmic entropy-negentropy, chance-necessity distinction. Thereby hyper-energetic transition phases, with "epigenetic mutation" allow for a variety of reaction products defining "creativity". The following hypo-energetic transition phases, as "epigenetic selection", allow solely for low entropy reactants transition and autocatalytic replication advantage. This is selecting negentropy as the mechanism of "intelligence" (See also part III).

4. HUMAN CREATIVE INTELLIGENCE AND SPEECH ORIGINS

Above self-induced fluctuations of T-iso provide via hyper- and hypo-energetic activation changes or ergo-and trophotropy both creativity and intelligence as condition for epigenetic self-organisation up to ultimately the syntactic language elaboration. There the T-iso fluctuation as found and studied

in isokinetic EEG-analysis of human TM-DR, is self-initiated by sound symbol elicitation. This happens via the cortically symbol conditioned inborn release mechanism (IRM) of the vertebrate diving response (BUJATTI-NARBESHUBER, 1985 a,b). This human-ethological basis for creative intelligence has been discovered because EEG aspects of TM-DR physiology have been found to be directly correlated with creativity and intelligence in psycho-physiological research (See part IV).

For this the diving response is considered responsible. It is the phylogenetically most evolved expression of the RF-response. RF includes hypometabolic states as rest, sleep, dormancy, hibernation, estivation, and the diving ethology as adaptive responses to master various adverse environments. As sound symbol or thought elicited diving drive endowed with appetitive behaviour for transcendence, creative intelligence and "TM-DR" serving adaptive purposes, are added to the list.

Human syntactic creative intelligence and speech, as highly adaptive acquisition allowing for continued eco-transition, apparently evolved via this evolutionary diving response constraint and its later sound symbol elicitation stemming from coastal shifts of primate first and second terraquatic eco-transitions. The brain diving response centres, including the frontal brain as complex transition organ, are suggested to be pertinent for outer continuous etho-eco-transitions in the creative language, socio-economy and technology niche.

5. SPECIAL AND GENERAL ECO-TRANSITION THEORY

The Special Eco-transition Theory (SET) is reconsidering hominid primate morphology with additions slightly modifying by emphasisis the role of eco-transitions, the 1934 aquatic concepts of MAX WESTENHÖFER, HARDY (1960) and MORGAN (1984).

The Special Theory of Creative Intelligence (STC), concerning man and machine, is further allowing for the systematic integration of human creative intelligence under the general EECT principle of GTCI.

In the General Eco-transition Theory (GET) the teleonomic EECT mechanism (see also part II) of solvent-compensation and solute-constraint coevolution is introduced for a behaviour - gene coevolution theory. A role of behaviour driving DARWINIAN evolution has been suggested by HUXLEY (1942), SCHRÖDINGER (1958), HARDY, (1965), POPPER (1973). So solvent isokinetic TRANSITION is added to the necessary, but according to four generations of critics, not sufficient "solute" principles of MUTATION, SELECTION, RECOMBINATION, DUPLICATION offered by population genetics. It is an epigenetic mechanism for teleonomic self-organising behaviour, first described as RF-response (BUJATTI et al. 1976). Based on above quantum chemical isokinetics, it is acting as a MAXWELLIAN DEMON (see part III). This is a non-classical, quantum mechanical observer (BHANDARI, 1976; LAMPRECHT, 1986), being placed inside his own system and including his own experience in the statements on the systems physical behaviour (WALKER, 1976; KOSLOFF, 1981).

The accelerating effect of behaviour on the speed of morphological evolution has been determined quantitatively (WYLES et al. 1983; WILSON, 1986). Its relevance for evolutionary theory is further supported by the finding that phylogenetic trees can be constructed as well from solvent interaction derived conformationally relevant hydrophobicity values of protein sequences (LEUNISSEN et al. 1986) as from the genome derived minimum mutation distance matrices.

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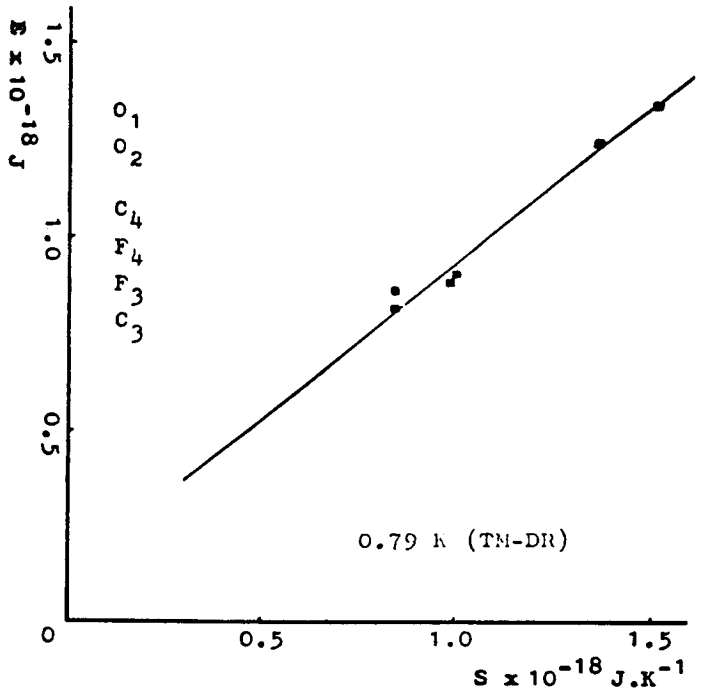
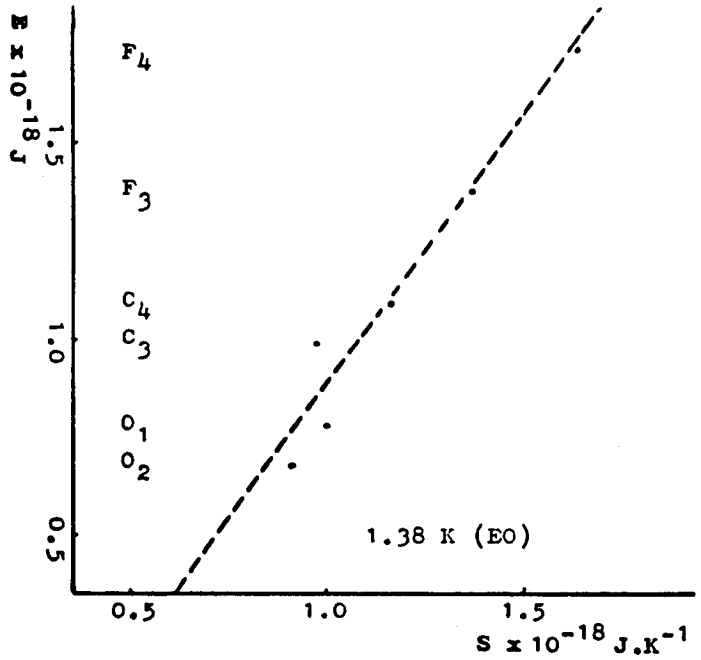

E x 10^-18 J
1.5
1.0
0.5
0
O1
O2
C4
F4
F3
C3
0.79 K (TM-DR)
0.5
1.0
1.5
S x 10^-18 J.K^-1


E x 10^-18 J
1.5
1.0
0.5
F4
F3
C4
C3
O1
O2
1.38 K (EO)
0.5
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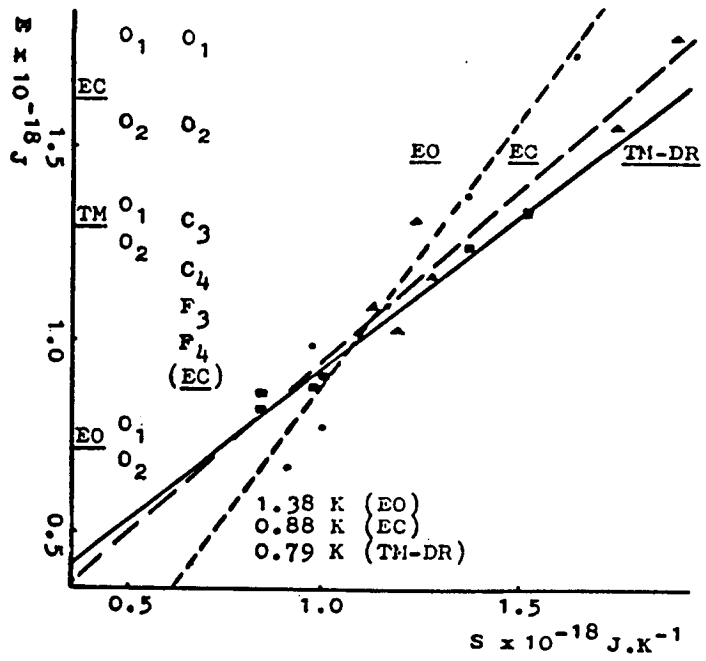
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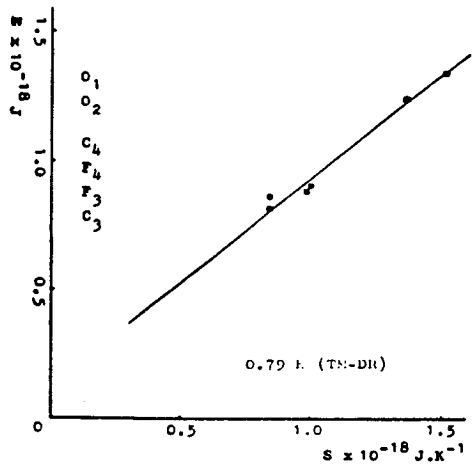
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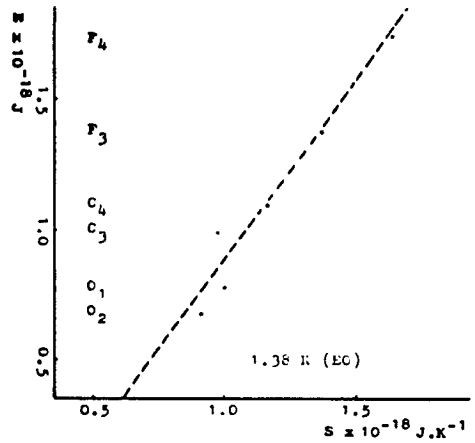
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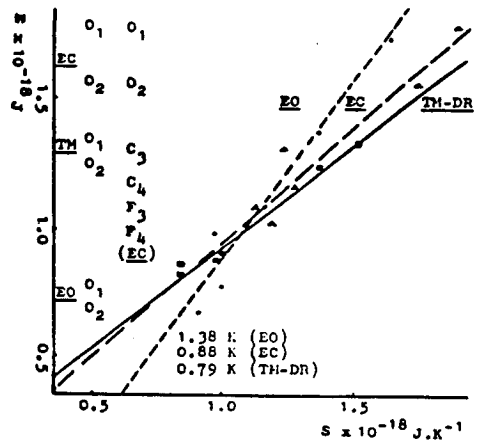
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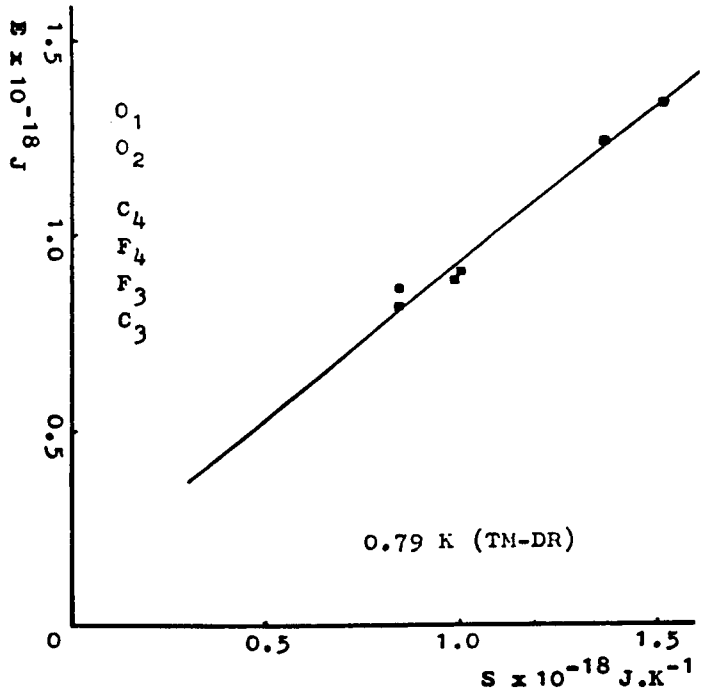
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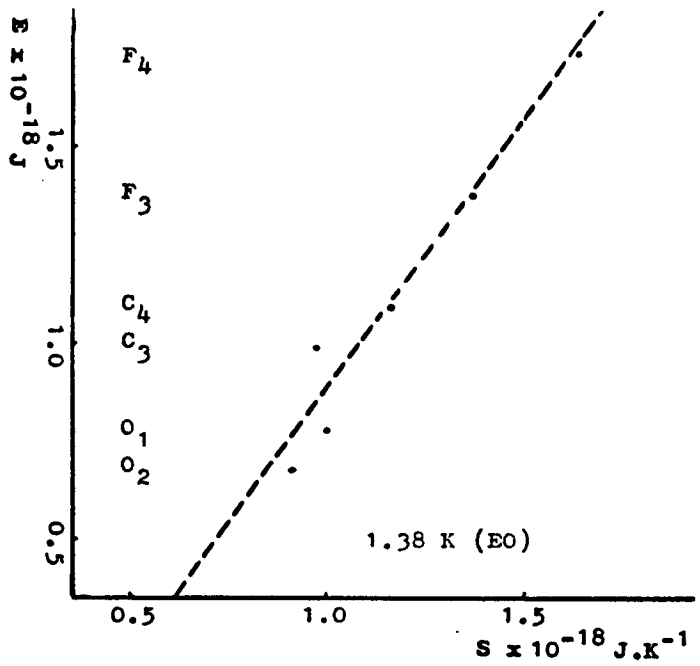
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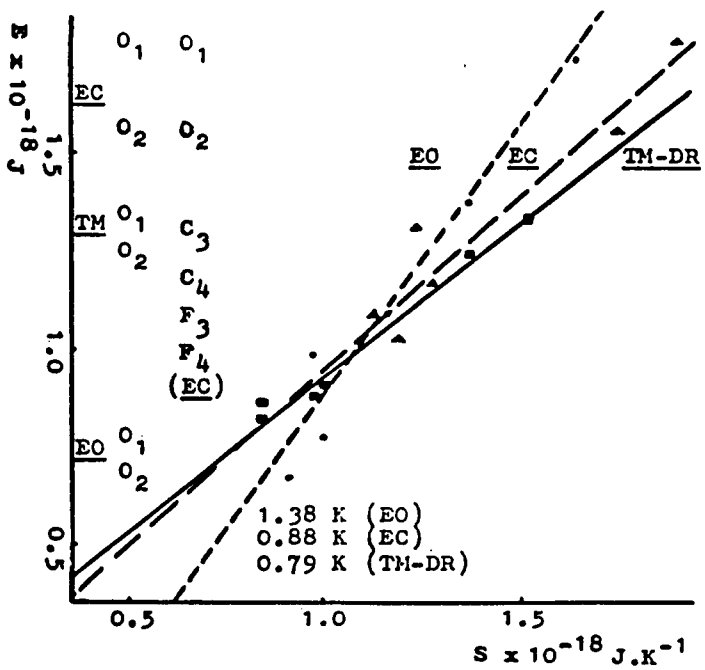
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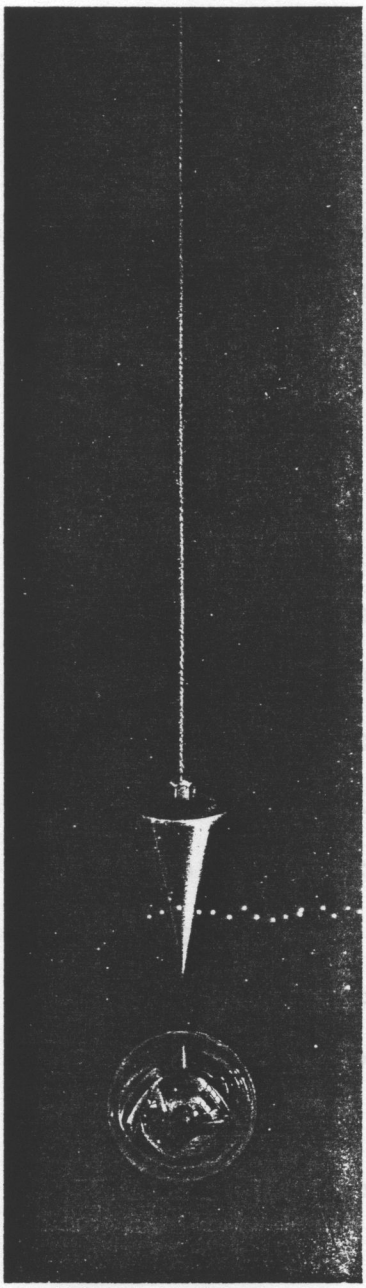
A U N I F I E D T H E O R Y O F L I F E V

ANSATZ ZUR PHYLOGENETISCHEN UND ONTOGENETISCHEN KREATIVITÄTS-EVOLUTION AUS CHEMISCH-PHYSIKALISCH UND HUMANBIOLOGISCHER SICHT

II.TEIL

Isokinetic Relation in Molecular Chemical Tunneling for Teleonomy in Bio-System Compensation - Constraint Co-Evolution. An Integrated Approach to Evolution Theory: Part II.

M.BUJATTI-NARBESHUBER



Isokinetic Relation in Molecular Chemical Tunneling for Teleonomy in Bio-System Compensation - Constraint Co-Evolution.

An Integrated Approach to Evolution Theory: Part II. *)

M. BUJATTI-NARBESHUBER

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INTRODUCTION

The criterion of a linear relationship between the chemical activation parameters of transition enthalpy and transition entropy in a series of similar chemical reactions is known in correlation chemistry as the "isokinetic relationship" or "compensation effect" of energy-entropy compensated transition (EECT). It has been suggested as an interesting tool for mechanistic research into the kinetic principles underlying pre-genetic and epigenetic bio-evolution (BUJATTI-NARBESHUBER, 1985, 1987 a).

In series of very similar chemical reactions - in the search for better catalysts, for instance - one observes as a rule that the intended acceleration of the chemical reaction via the enthalpy term - by changing the solvent, the catalyst or substituents - finds partial or even total compensation through an equally, that is, "homeostatically" changing entropy term.

*) Presented at the IVth World congress of Biological Psychiatry, September 8-13, 1985, Philadelphia, U.S.A.

Such EECT behaviour was suggested as being the basis for the homeostatic self-organising tendency of the living system and defined by the "rest and fulfilment response" (BUJATTI-NARBESHUBER et al. 1976, 1985, 1987 a, b).

The isokinetic relationship, firmly established on statistical grounds (EXNER, 1973; LINERT, 1982, 1985) is best described on the thermodynamic level (SCHMID et al. 1982) by the isokinetic transition function

$$dH\# = T\ iso\ .\ dS\#$$

relating transition enthalpy change (dH#) and transition entropy change (dS#) via the isokinetic temperature (T iso). It is the characteristic constant factor or slope in this linear relationship.

Via experimental determination of T iso and by putting it into relation to the actual experimental system or biological system temperature (T exp), a classification into entropy controlled (Tiso < T exp) and enthalpy controlled (T iso > T exp) reaction series becomes possible. This classification into more or less entropy controlled kinetics was developed by correlation chemistry. It seems useful for the more precise characterisation and an understanding of functional styles in biological systems chemical kinetics, sofar referred to only phenomenologically as ergotropy or trophotropy respectively (BUJATTI-NARBESHUBER, 1987 b).

As a limit case of the compensation effect, one of the two activation parameters dH# or dS# in the reaction series becomes zero, hence one speaks of an isoenthalpic or an isoentropic reaction. In the isoenthalpic case, T iso becomes nought, zero degree KELVIN (0 K) and is represented by a parallel line to the abscissa in the Arrhenius plot.

The relevance of this phenomenon for teleonomy in bio-systems is the central theme of this paper, contributing to an evolutionary understanding of human creative intelligence.

TUNNELING AS ISOKINETIC RELATIONSHIP

For a long time the nature of the EECT effects - not directly resulting from thermodynamics - remained uncertain. In fairly recent times the idea was expressed, developed and discussed that the compensation effect might be considered as a quantum chemical phenomenon (CONNER, 1982, 1983).

In this connection it is interesting to look at a theoretical finding gained from the analysis of experimental data and presented here for the first time. It supports the quantum mechanical interpretation of the compensation effect by demonstrating its general nature: the isoenthalpic case of the compensation effect-found in extremely low temperature quantum chemical reactions - is quantum chemical tunneling.

From the theoretical analysis of data (Fig. 1,2) provided by GOLDANSKI (1979, 1986), the finding of the isoenthalpic extremal case of isokinetic behaviour is made across a variety of quite different chemical reactions in the extremely low temperature range when tunneling effects in reactions become predominant.

In the Arrhenius plot (Fig.1), the quantum mechanical tunneling effect becomes apparent in the deviation of the Arrhenius lines of the most different chemical reactions, all becoming parallels to the abscissa. In a classical interpretation of this phenomenon at low temperature, the diverse reactions become <u>firstly</u>, isokinetic and <u>secondly</u>, are isoenthalpic as well, that is to say, solely governed by entropy.

Thirdly, parallel lines to the abscissa, characteristic for purely entropy controlled reaction series, allow the statement to be made: if tunneling effects become exclusively relevant, practically all chemical reactions enter into an isokinetic relationship.

ENERGY INFORMATION COMPENSATED SELECTION

Making it explicitly clear with the support from this extremal case, since entropic factors are solely responsible for the reactions, the above phenomenon means, that, entropically, some reactions will be favoured and some excluded. In this way an active isokinetic selection phenomenon takes place simply through entropy directly and precisely related to information.

According to COSTA DE BEAUREGARD (1960) it holds true (LAMPRECHT, 1985) that there is a reciprocal transition between entropy and information according to the formula that relates entropy S and information I through

$$dS = k \cdot \ln 2 \times dI$$

In the pre-cybernetic period of physics, the small entity of the BOLTZMAN konstant $k \cdot \ln 2$ was taken as zero and hence the transition from negative entropy toward information, the observation, the gathering of information was supposed to be gratis. The reciprocal transition back from information toward negentropy, the free action, the faculty of organisation, would then be impossible and just a psychological illusion.

In COSTA DE BEAUREGARD'S opinion the word information has, therefore, the above double meaning and, he continues, if the reciprocal transition between negentropy and information is

postulated, one accepts the above two meanings of information (gathering of information, observation and the faculty of organisation, free action). COSTA DE BEAUREGARD continues that this reciprocity reflects a real symmetry between the two processes of observing and acting,a symmetry which is normally masked by the small quantity of k . ln 2 and denied when put equal to zero in the equation.

This isoenthalpic transition state is permitting or excluding certain reactions with an economical minimum of energy solely via entropy or negentropy changes induced by information. In biological systems based on isoenthalpic relationships in certain specialised aspects of their functioning, flows of information alone in the delocalised quantum field aspect of the transition state can explain the EEG- and socialexperimental results of ORME JOHNSON et al. (1982), DILBECK et al. (1981, 1987) - necessary and sufficient to set the chemistry of the biological executive apparatus going. This leads to the long range mechanism underlying experimentally induced changes in social indicators of 48 cities reviewed by DILLBECK (1981) based on field effects.

TUNNELING TRANSITION AS SOURCE AND GOAL OF TELEONOMY

Both these aspects of chemical transition, compensation and tunneling, are found in the highly compensated biological solvent water (FRANK et al. 1945, LUMRY t al. 1982). As a decisive feature, water is demonstrating tunneling even at physiological temperatures (MOORE, 1972).

Water, this anomalous solvent, with equally high donor and acceptor strength, a highly self-interacting, hydrogen bonded, structured, low entropy or protic solvent (SCHMID et al. 1981, 1982, 1983), is characteristically distinct from

other solvents by the magnitude of the compensation effect (FRANK et al. 1945; LUMRY et al. 1982).

Of relevance is the fact, that quantum chemical tunneling has been found besides in extremely cold negentropy storage in interstellar evolution of later organic solute material (SAGAN, 1972, GOLDANSKI, 1979), around physiological temperature in the biological solvent water (MOORE, 1972), in macromolecules (GOLDANSKI, 1986; FRAUENFELDER, 1979) additionally to normal compensation in macromolecule folding (BENIZINGER, 1971; 1981), in cell dynamics (COPE, 1971, 1974; AHMED et al. 1975) and is suggested for the brain activities (WALKER, 1970; DOMASH, 1976).

Tunneling is finally suggested to be experimentally identifiable in neuronal activities, accounting for the experience and long range effects (ORME JOHNSON et al. 1982) of pure consciousness psycho-physiology (BADAWI et al. 1984). It is characterised by an T iso of O KELVIN in the statistical physics derived isokinetic EEG-analysis (BUJATTI-NARBESHUBER, 1985, 1987 a, b).

The general solvent quality of compensation, as invariance mechanism sofar experimentally identified on increasingly complex levels of bio-system organisation (BUJATTI-NARBESHUBER, 1985, 1987 b), is thereby shown to function - via the extreme case of isoenthalpic transition - as source and goal of teleonomy. As most economical form of transition it is guiding the self-organising tendency of the living system evolution.

COMPENSATION - CONSTRAINT CO-EVOLUTION

Mikroscopic, solvent originating, EECT is stabilised as a macroscopic quantum state via intercalated solute biomolecules. As evolutionary constraints they accomplish for compensation - as evolutionary invariance mechanism - and for their own molecular structure, propagation and multiplication. This manifests, according to the concept of solvent compensation - and solute constraint co-evolution of living systems, finally in behaviour - gene co-evolution (BUJATTI-NARBESHUBER, 1985, 1987 c).

The evolutionary framework of isokinetic transitions contains also inherent the mechanics - during low energy phases - for a gathering of molecular negentropy. It is a result of environmental energy fluctuations (day-night) with EECT selecting low entropy reactants. These allow the molecular negentropy and EECT invariance mechanism propagation as evolutionary constraints (see part III). Highly economical and advantageous is the teleonomical evolution principle maintaining and guiding isokinetic selection to low entropy reaction conditions. This leads, through information in its organising "JANUS" role, to the evolutionary stabilisation of the extremal case of isoenthalpic tunneling transitions.

Now emerging with above considerations on isokinetic tunneling as source and goal of teleonomy in living systems is a deeper concept of evolution as being driven by HAMILTON and LA GRANGE'S law of least action applied to isokinetic chemical transitions in a fluctuating environment. It was structured already into the definition of the "Rest and Fulfilment response". As the basic drive it is a condensed expression for the multitude of experimental results on the psychobiology of rest that lead to its formulation (BUJATTI-NARBESHUBER, 1976, 1987 c).

CONCLUSION

The analysis performed here of the data provided by V.I. GOLDANSKI on a phenomenon occurring in the extremely low temperature range, where solely quantum mechanical tunneling is responsible for the reaction, is summarised by listing the discoveries of:

a) the isokinetic relationship;

b) in a correlation chemical relationship across extremely different types of chemical reactions;

c) in the form of the isoenthalpic extremal case solely governed by entropy;

d) in the relevance for biological systems in connection with the solvent-solvent, solvent-solute, conformational and finally cellular interactions. There both enthalpy-entropy compensation and tunneling effects are found even around the high physiological temperature.

Compensated transition should be held to be both the most general and, in its abstractness being based on quantum field theory, the more relevant aspect when introducing the chemical tunneling effect as a factor in living systems evolution. It allow for a quantum theoretical definition of life: "The dynamical process of 0 KELVIN isokinetic temperature stabilisation". This definition seems applicable from first biopolymer synthesis in outer space interstellar tunneling chemistry at physical temperatures around 10 KELVIN with an isokinetic, statistical temperature of 0 KELVIN and leads upwards through evolutionary solvent compensation - solute constraint coevolution even to the highest conscious creative brain activities at 310 KELVIN with still the same statistical isokinetic temperature maintained of practically 0 KELVIN.

These falsifiable, therefore nonmetaphysical concepts will hopefully stimulate further experimental and theoretical research owing to their advantageous nature of lending themselves to rather simple experimentation and to many possibilities for falsification.

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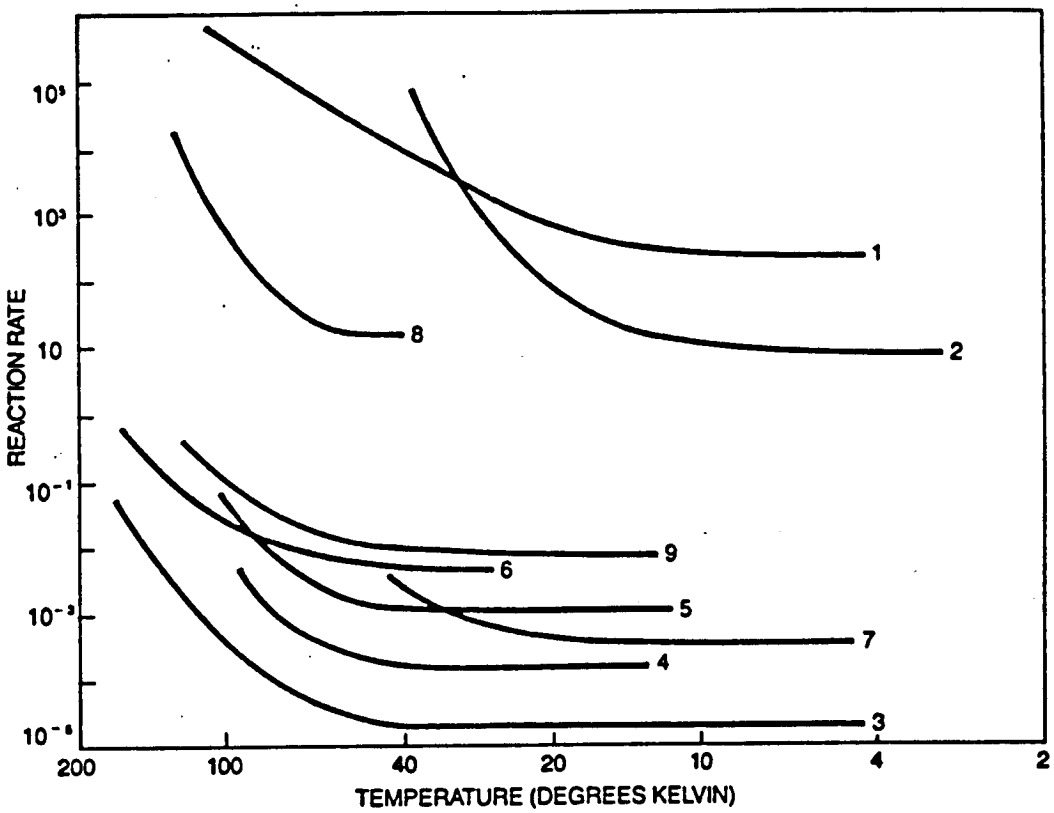
DIAGRAMME

Fig.1;2



LOW-TEMPERATURE REACTION-RATE LIMITS indicate that tunneling has occurred. Such limits have been observed for many chemical reactions: (*1*) the growth of formaldehyde polymer chains (1973); (*2*) the rebinding of carbon monoxide to hemoglobin (1975); (*3*) the isomerization, or structural rearrangement, of radical pairs in dimethylglyoxime after irradiation with gamma rays (1977); (*4, 5*) the abstraction of hydrogen atoms by methyl radicals from frozen methanol (*4*) and ethanol (*5*) (1977); (*6*) the transfer of hydrogen atoms during the isomerization of certain radicals (1978); (*7*) the formation of carbon-carbon bonds in certain radicals (1979); (*8*) the hydrobromination of (addition of hydrogen bromide to) ethylene (1978), and (*9*) the chlorination of butyl chloride by molecular chlorine (1980). The observations are from the U.S.S.R., the U.S.A., Japan and Canada.

Scient.Am. 254,2,(1986).

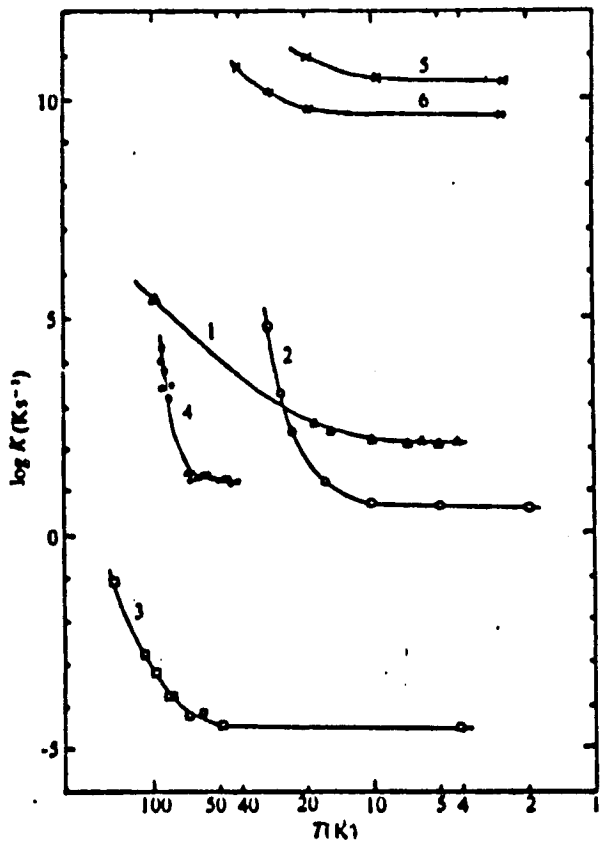


Fig. 4 Summary of data on the low-temperature limits of rate constants ($K\ s^{-1}$) of chemical reactions (log K–log T coordinates). Curve 1 (Δ), growth of chains of polymerisation of formaldehyde. Curve 2 (○), reconstitution of Fe–CO bonds in β-haemoglobin. Curve 3 (□), isomerisation of radical pairs in γ-irradiated dimethylglyoxime. Curve 4 (○), propagation of chains in the hydrobromination of ethene. Curve 5 (×), photoinduced conversion of rhodopsin into prelumirhodopsin. Curve 6 (×), photoinduced conversion of deuterated rhodopsin into prelumirhodopsin.

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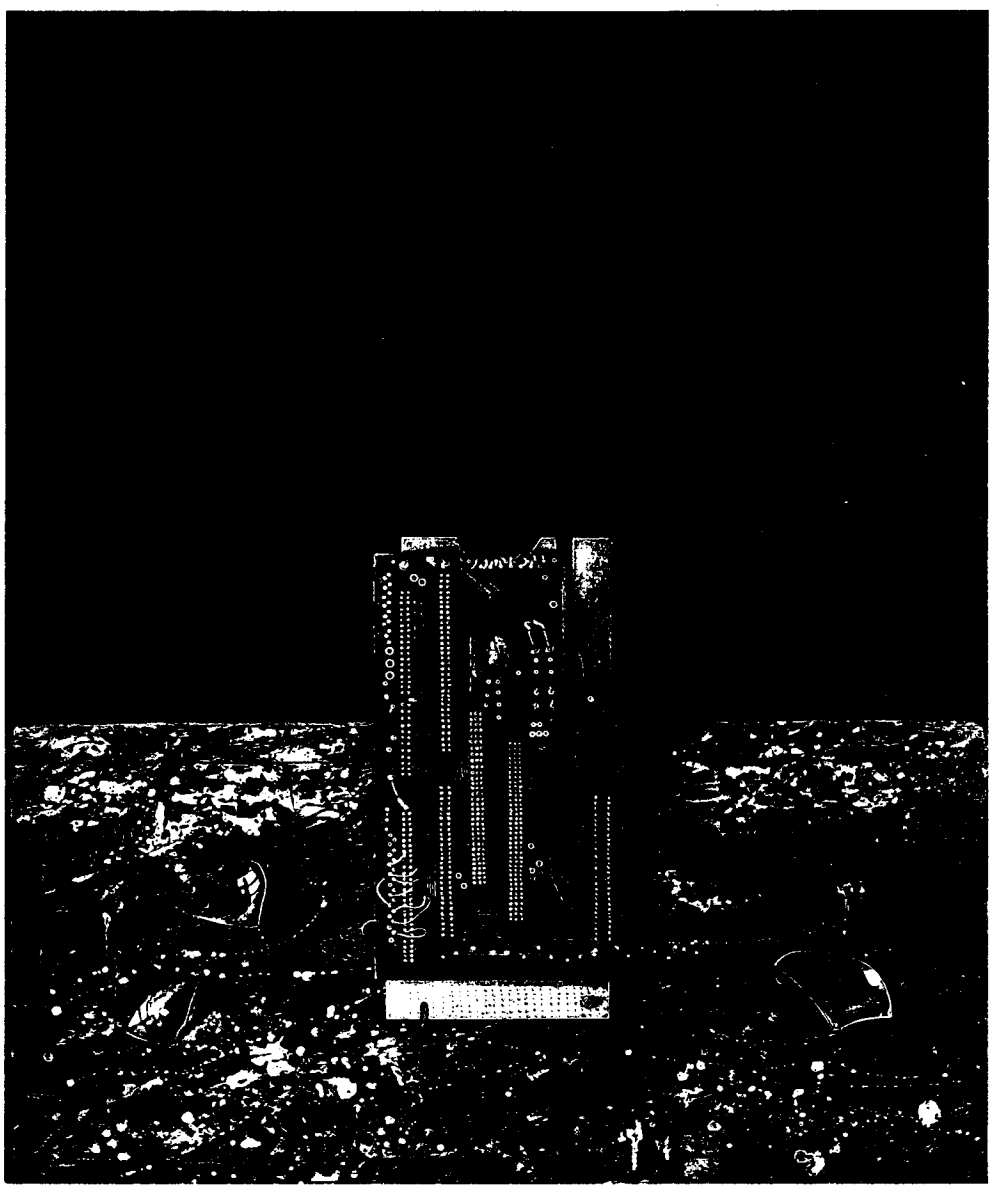

A U N I F I E D T H E O R Y O F L I F E VI

ANSATZ ZUR PHYLOGENETISCHEN UND ONTOGENETISCHEN

KREATIVITÄTS-EVOLUTION

AUS CHEMISCH-PHYSIKALISCH UND HUMANBIOLOGISCHER SICHT

III. TEIL

Maxwell's Demon in Compensation-Constraint Coevolution:
From Early Soda-Salt to Conscious Creative Intelligence

M. BUJATTI-NARBESHUBER

Maxwell's Demon in Compensation - Constraint Coevolution: From Early Soda-Salt Ocean to Conscious Creative Intelligence

An Integrated Approach to Evolution Theory: Part III. *)

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INTRODUCTION

The quantum mechanical transition-state properties of water self-interaction were taken as point of departure for an integrated evolution theory not excluding but explicitly including the phenomena of consciousness, teleonomy in epigenetic behaviour and the evolution of syntactic creative intelligence (BUJATTI-NARBESHUBER, 1985 a, b; 1987 a, b).

Water, this anomalous solvent - with equally high donor and acceptor strength - a highly self-interacting, hydrogen bonded, structured, low entropy or protic solvent (SCHMID et al. 1981, 1982, 1983), is characteristically distinct from other solvents by the magnitude of the enthalpy - entroy compensation effect (FRANK et al. 1945; LUMRY et al. 1982). Of relevance is that, additionally, at physiological temperature, quantum chemical tunneling takes place in water (MOORE, 1972), the isoenthalpic case (BUJATTI-NARBESHUBER, 1987 b) of Enthalpy-Entropy Compensated Transition (EECT).

*(Videotaped lecture, Chem.Dept., MIU, Fairfield, Iowa, USA. Sept. 16th, 1985. 2. Symp. on Vert. Morph. Vienna, Aug. 1986.

A biological role of tunneling - other than that of the solvent - has already been found during the extremely cold negentropy storage in the interstellar evolution of later organic solute material (SAGAN, 1972, GOLDANSKI, 1979), in macromolecules (GOLDANSKI, 1986; FRAUENFELDER, 1979) in addition to general EECT-dynamics of macromolecule folding (BENIZINGER, 1971; 1981) and in cell dynamics (COPE, 1971, 1974; AHMED et al. 1975). Finally, quantum tunneling at synaptic gaps has been suggested to account for consciousness in brain physiology (WALKER, 1970; DOMASH, 1976).

Preliminary experimental findings of energy-entropy compensation closely approaching the isoenthalpic case typical of tunneling transitions were detected from the new statistical physical EECT- EEG-analysis of the electric activity of the human brain. The model for consciousness as a macroscopic quantum phase coherent state (DOMASH, 1976) is therefore adapted to account as physical interface for consciousness - but now as a coherent macroscopic quantum state of microscopic isokinetic EECT. The extremal isoenthalpic case of EECT originating from solvent tunneling was added as the evolutionary source and goal of biological teleonomy and homeostasis control in man suggested to be associated with the experience and the effects of pure or transcendental consciousness (BUJATTI-NARBESHUBER, 1985 b, 1987 a, b).

Its experimental characterisation by the isokinetic temperature from the isokinetic plot of EEG-EECT-analysis, for man seems heuristically even more instructive if used with physiological characterisations (FARROW et al. 1982; BADAWI et al. 1984; allowing even to derive the biological evolutionary origin of his consciousness, creativity and intelligence.

A KINETICAL SELECTION PROCESS FOR LOW ENTROPY OF TRANSITION

Isokinetic transition-dynamics according to quantum chemical kinetics (CONNER 1982, 1983) most generally means:

"As a consequence of lowering the activation energy, a splitting or increased separation of the energy levels give rise to a decreasing entropy of transition".

"Within a level not all modes of energy are involved in the overlap (certain selection rules apply). Reaction (conversion between the states) is dictated by access tothe levels where crossover occurs (temperature dependence) and the probability that the energy is in the convertible (overlapping) distribution of energy modes". "In effect the lower the energy of the transition complex relative to the reacting species, the more the possibility for energy level separation and splitting. The entropy of the transition to that state will tend to decrease" (CONNER, 1982, 1983).

This EECT mechanism suggests itself for a study of the quantum mechanical source of low entropy selection resulting in so-called biological systems. In cases of EECT, low energy quantum level splitting and the selection rules give rise to low entropy of transition and, under specific conditions that will be further elaborated in the following, this should give rise to the "EECT-selection mechanism" of low entropy products.

EECT as microscopic essentially quantum mechanical property (CONNOR, 1982; 1983) originating from solvent isokinetic transition, has been long identified on increasingly complex levels of biological organisation. Already contained in the pre-genetic initial solvent conditions of the self-organisation process of evolution, it is further

contained in both amphiphile membrane and protein configuration and functions where it defines epigenetic ordering and is maintained as invariance mechanism up to ultimately human neuronal organisation. (For references see BUJATTI-NARBESHUBER, 1985 b, 1987 a).

The originally solvent-based epigenetc mechanism of isokinetic transition and its stabilisation as invariance mechanism was therefore introduced into evolution theory. The addition to the necessary but not sufficient conditions of the genetic exclusively solute-based MENDELIAN and DARWINIAN principles (BUJATTI-NARBESHUBER 1985 b, 1987 a) allows to integrate:

MAXWELLS DEMON OR THE PRE-GENETIC DIMENSION IN THE ORIGIN AND EPIGENETIC BEHAVIOUR OF EVOLVING BIO-SYSTEMS.

In the following we will take the sofar genetic basis for SCHRÖDINGER'S (1958) "order-from-order" principle to its pre-genetic quantum mechanical source. EECT is introduced as the quantum mechanical epi-genetic foundation of the sofar only genetic "order-from-order" principle. For characteristically open bio-systems (BERTALANFFY, 1932) EECT is further suggested as the actually utilised mechanism of negentropy selection relevant for: the necessity of entropy reduction in open bio- systems as discovered by SCHRÖDINGER (1958). This necessity has been studied further by PRIGOGINE and HAKEN with mechanisms not necessarily analogous to those utilised by bio-systems far from thermodynamic equilibrium.

In short EECT is suggested to be acting as MAXWELLS demon, conserved as an isomorphous invariance mechanism since pre-genetic evolution, allowing for teleonomical behavioural negentropy selection and for negentropy conservation.

I. ISOKINETIC TRANSITION OR CONSCIOUSNESS

MAXWELL'S Demon is firstly characterised, according to the reviews by LAMPRECHT (1985), as a non-classical, quantum mechanical observer (BHANDARI, 1976), placed inside his own system and including his own experience in the statements on the physical behaviour of the system (WALKER, 1976; KOSLOFF, 1981).

It is this very first quality of self-awareness that cannot be excluded on logical grounds (BHANDARI, 1976) and which we find realised as the self-awareness or consciousness phenomenon within biological systems of self-organisation. For both solvent isokinetic transition is suggested to be physically responsible becoming progressively spatio-temporally stabilised. Forming a macroscopic quantum state, experimentally accessible for biology through ultimately statistical physical isokinetic EEG-analysis. EECT is the intersubjective or objective interface of consciousness, basic for any cognition. With the help of intercalated suitable solutes, therefore called "biomolecules" and acting as evolutionary constraints this solvent quality stabilisation process progresses throughout phylogeny in compensation - constraint intercalary co-evolution.

This interface forms the biological conditio sine qua non for a less tautological (WADDINGTON) and less incomplete evolution theory (HEITLER, 1975; VOLLMER, 1985) not excluding evolutionary epistemology and consciousness (LOCKER, 1983). In a quantum chemical approach to consciousness and life ultimately based on unified quantum field theory (HAGELIN, 1987), consciousness is reinstated as indispensable basis for any scientific world picture (SCHRÖDINGER, 1958).

This macroscopic biological quantum state, starting - according to the water flickering cluster model - from the 10 to the 11th power of solvent-solvent transitions per second, arrives via biophysical phase correlation for spatio-temporal stabilisation at timescales of seconds, hours, days of more and more broadened awareness as ultimately pure and unbounded, stable consciousness.

This, eventually, also allows the special isoenthalpic case of EECT, the tunneling transition, objectively characterised by a T iso of 0 KELVIN to achieve the duration necessary for any conscious appreciation by the cognitive brain structures. It is perceived in this case as a distinct state of pure consciousness or self-awareness. This distinct experiential state of pure or transcendental consciousness has also been identified and characterised physiologically (WALLACE, 1971; BADAWI et al. 1984; FARROW et al. 1982).

As biophysical criterion of consciousness, this macroscopic quantum mechanical isokinetic TRANSITION stabilisation as objective interface defines the experiential and psychological dimension of CONSCIOUSNESS.

II. ISOKINETIC MUTATION OR CREATIVITY

As the second aspect of MAXWELL'S demon, EECT is suggested to be serving not only as a negentropy - entropy discerning, but also as a negentropy selecting device - given the following pre-genetically available conditions of:

a) a fluctuating e.g. solar day-night, energy field from earth rotation

b) a somewhat structured micro-environment or niche with solvent and with solutes as vesicles e.g. the carbonaceous ultra-microstructure fossils (PFLUG, 1984).

c) With chemical activation energies typically greater than the thermal energies of the environment.

According to GOLDANSKI (1986), activation energies are typically tenfold or greater than the thermal energies of molecules in our everyday world, where the temperature is roughly 300 KELVIN.

The solutes are supposedly those of an alkali ocean (KEMPE and DEGENS, 1986) with very low calcium and very enriched phosphate and anorganic carbon content - ideal for the structuring of phospholipid membranes, and all known as typical constituents of cells - with high solubility for the already complex organic carbon compounds of interstellar origin (SAGAN, 1972; GOLDANSKI, 1979) deposited in the present earth's shell calculated carbon content quantity by meteorites after interstellar tunneling evolution (PFLUG, 1984).

Given these minimal conditions, during the phase of high energy flow i.e. UV sunlight, etc. EECT allow with the high energy also high entropy of transition. The result is a greater variety of "mutations" in the synthesised chemical products as creativity:

As quantum chemical criterion, the inner, epigenetic, hyper-energetic or entropic, MUTATION aspect of the isokinetic interface defines the ultimately psychological dimension of CREATIVITY.

III. ISOKINETIC NEGENTROPY SELECTION OR INTELLIGENCE

During the following phase of low energy flow, i.e. during the solar night's "thermal bath", compensation with low availability of activation energy allows for low transition entropy a relatively higher reaction probability.

During low energy phases of night, lack of organic carbon,

this mechanism is selecting low entropy-transition reactants or micro environments from the variegated ensemble generated during the creative high energy phases, because they have the "kinetic advantage" of continuing their transitions. This is leading to the relatively greater reproduction of low entropy transition reaction-products, of low entropy autocatalytic-reactions, and of their products as intelligence:

As quantum chemical criterion, the inner, epigenetic, hypo-energetic or negentropic, SELECTION aspect of the isokinetic interface, defines the ultimately psychological dimension of INTELLIGENCE.

GENERAL THEORY OF CREATIVE INTELLIGENCE (GTC).

Isokinetic TRANSITION, MUTATION and SELECTION are three aspects of one energy-entropy compensated transition mechanism originating from quantum mechanical solvent properties in an environment of energy and entropy fluctuations. The same above logic applies namely to the effect of the latter entropy fluctuations upon EECT and need not be illustrated in equal detail here. It gives insight into the isokinetic origin of the phasic behavioural energetics of bio-systems termed "rest and activity".

The EECT-mechanism is open to experimental study as described in non formal chemical kinetics (SCHMID et al., 1982) and defines epi-genetic ordering from the initial pre-genetic solvent conditions through algorythmic entropy-negentropy (chance-necessity) distinction up to conscious creative intelligence. It constitutes the basis of a General Theory of Creative Intelligence (GTC), an integrated theory of evolution not excluding the epigenetic

phenomena. Therein, the solvent mechanism of isokinetic TRANSITION was added to the necessary but not sufficient solute conditions of population genetics to now TRANSITION, MUTATION, SELECTION, RECOMBINATION, DUPLICATION, etc. ... This is considered sufficient to allow for teleonomy, epigenetic homeostatic self-organisation, consciousness, creativity and intelligence in an integrated evolution theory (BUJATTI-NARBESHUBER, 1985 a, b; 1976, 197 a, b).

CONCLUSION

Driven by an energetically and entropically fluctuating environment, EECT should permit the formalised and both functionally and structurally more adequate, description of open living systems. This description reaches from pre-genetic MAXWELLIAN demon phenomena of conscious creative intelligence up to syntactic-motoric speech and technological culture.

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A U N I F I E D T H E O R Y O F L I F E VII

ANSATZ ZUR PHYLOGENETISCHEN UND ONTOGENETISCHEN

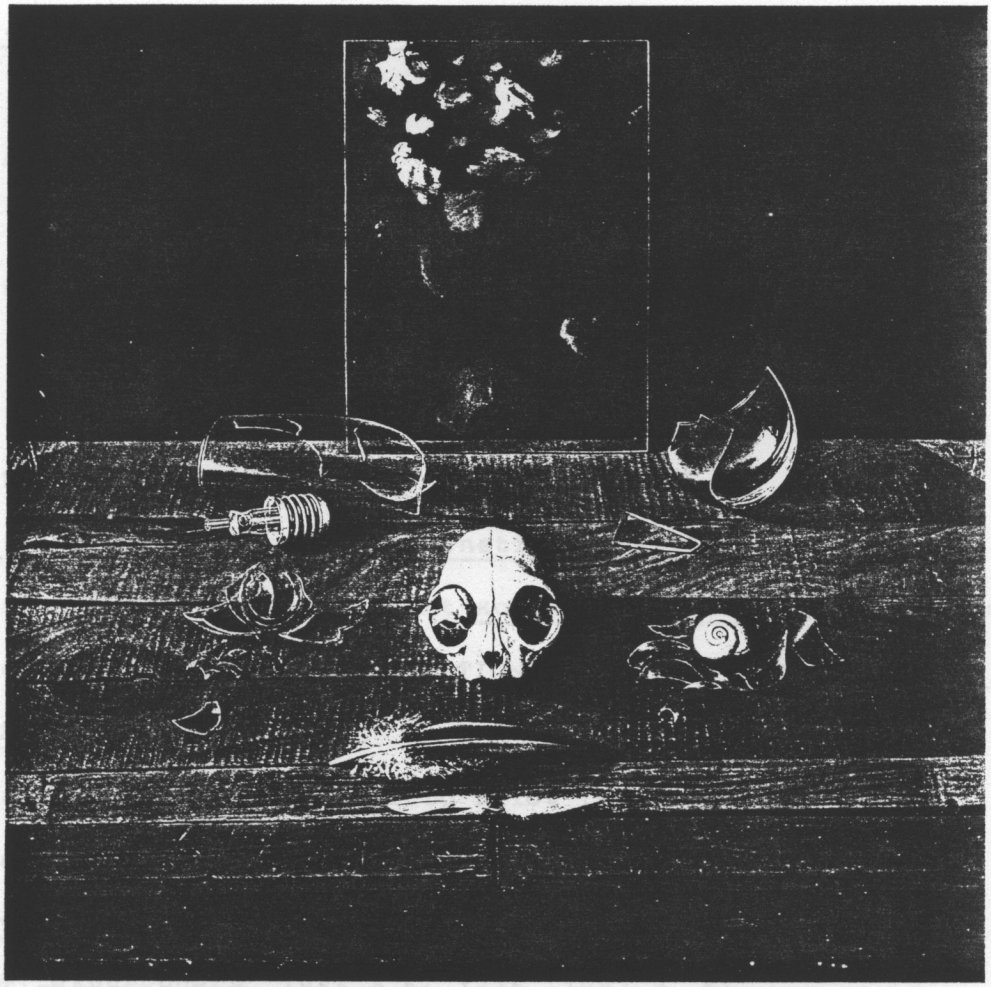
KREATIVITÄTS-EVOLUTION

AUS CHEMISCH-PHYSIKALISCH UND HUMANBIOLOGISCHER SICHT

System Unfoldment in the Transition Theory of Evolution

An Integrated Approach to Evolution Theory. Part IV.

M. BUJATTI-NARBESHUBER



„Synopsis III" Öl und Tempera auf Holzfaserplatte, 50 x 50 cm, 1983

System Unfoldment in the Transition Theory of Evolution

An Integrated Approach to Evolution Theory: Part IV.

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INTRODUCTION

The solvent mechanism of isokinetic TRANSITION was added to the necessary but not sufficient solute conditions of population genetics to now TRANSITION, MUTATION, SELECTION, RECOMBINATION, DUPLICATION, etc. ...

This is considered sufficient to allow for teleonomy, epigenetic homeostatic self-organisation, consciousness, creativity and intelligence in an integrated evolution theory (BUJATTI-NARBESHUBER, 1985 a,b; 1976, 1987 a, b).

Driven by an energetically and entropically fluctuating environment, EECT should permit the formalised and both functionally and structurally more adequate, description of open living systems from its pre-genetic MAXWELLIAN demon phenomena of consciousness creativity and intelligence up to epi-genetic syntactic-motoric speech and technological culture.

CONSEQUENCES OF MAXWELLS DEMON AND SOLVENT EECT-STABILISATION

The basic ability of negentropy selection, resulting from solvent EECT within an ensemble of appropriate solutes in a fluctuating environment, leads to conceptual consequences for biology and another sequence of steps in biotic evolution. This is

modifying the models by OPARIN, KOCH (1985), CORNFORTH (1984) with respect to the quantum-chemical solvent and solute property of:

1. ISOKINETIC TRANSITION OR CONSCIOUSNESS.

2. ISOKINETIC MUTATION OR CREATIVITY.

3. ISOKINETIC NEGENTROPY SELECTION OR INTELLIGENCE.

The negentropy selecting ability of MAXWELLS demon is ultimately utilising the dual nature of informaton deduced from the reciprocal negentropy to information conversion. (COSTA DE BEAUREGARD, 1960). This nature of information is allowing perception only against cost, but also symmetrically allowing action and organisation for free.

Working along these lines the MAXWELLIAN solvent mechanism is conserved and integrated since earliest bio-evolution by solvent compensation and solute constraint coevolution as invariance mechanism into the sequence of increasingly complex hierarchical biological features of:

4. SOLUTE NEGENTROPY ACCUMULATION AND PROPAGATION.

From first interstellar-negentropy conserving-tunneling evolution to solute negentropy accumulation in cooperative hierarchical evolutionary progression through quantum chemical kinetics, EECT is of evolutionary importance. EECT is further expressed in the process of amphiphile self-organisation (EVANS et al. 1986) selecting cooperativity in these hydrophobous homologous series of reactions allowing for information conservation and propagation through:

5. PHOSPHOLIPID MEMBRANE STRUCTURE AND FUNCTION.

EECT is involved in the building up, through self-organisation, of vesicles as niches. Gradient build-up in ions and in organic polymer materials synthesised from phosphates (CORNFORTH, 1984), amino acids, saccharoses and nucleotides allowed for information accumulation and through mechanical fusion and fission for information multiplication processes.

EECT is further taken into account in the mainly closely membrane associated next step of protein function utilising compensation for its expression through the:

6. PROTEIN AMINO ACID SEQUENCE CODE.

EECT is a protein structure determining functional principle behind this code. It is determining the expression of the code in the final configuration of the macromolecules and in the functional-dynamics of enzymes.

An evolutionary relevance of EECT as ultima ratio of the amino acid sequence code is supported by the finding that phylogenetic trees can be constructed at least as well from solvent interaction derived and conformationally relevant hydrophobicity values of protein amino acid sequences as from geneticminimum mutation distance matrices (LEUNISSEN et al., 1985).

Such, first membrane bound, functional dynamics of enzymes is indispensable for the next important evolutionary step of:

7. TELEONOMY GUIDED ACTION.

This step is constituted by a homeostatic, that is EECT or compensated transition controlled hydrolysis of energy-rich compounds. Energy conservation with controlled poly-

phosphate etc. utilisation (hydrolysis) allows energy and entropy fluctuations in the environment to be actively used or avoided. This first activity allows thereby for homeostatic, metabolic - synthetic and active transport system maintainance and later locomotion.

This activity leads through the homeostatic behavioural choice of environments to a concomitant choice of selective pressures and to behaviour-gene coevolution: the theme of General Eco-transition Theory (BUJATTI-NARBESHUBER, 1987 a).

As a model for EECT expressing in autonomous teleonomy guided behavioural activity may serve the cell membrane violation with entropy increase, due to the loss of ion gradient.

This entropy increase is associated with an increase of energy utilisation through ATP-hydrolysis. This is done by membrane ATP-synthase that restores the ion gradient. Correspondingly, such homeostatic teleonomic behaviour is causing that the negentropy increase through an ion gradient increase, dependent on the ordered, intact membrane, is again by EECT compensated with energy storage. This results from the a most central EECT finding of the "energy dependent conformation change" allowing ATP-synthase now only ATP-synthesis and no hydrolysis activity (MITCHELL, 1961; 1974; BOYER et al. 1977).

EVOLUTION OF GRADIENT (ENTROPY) DEPENDENT POLYPHOSPHATE UTILISATION

A sodium not proton gradient is found for transmembrane energy storage in some marine, alkalophile, halophile, chemotrophic and anaerobic bacteria. Since in PROPRIONIGENIUM MODESTUM (DIMROTH, 1985; 1987; SKULACHEV, 1985) even a structurally similar ATP-synthase activity is driven by it, probably first a sodium, and only much later

the proton gradient held first by KOCH (1985) is suggested for the sequential evolution of chemiosmotic-, chemotrophic-, then phototrophic- and finally oxidative phosphorilation.

Firstly, this finding in above bacteria is in full accord with the adopted hypothesis of an alkaline, that is proton poor, organic and anorganic carbon rich, early sodium carbonate ocean (KEMPE & DEGENS, 1986) with oxygen poor atmosphere.

Secondly, the two energy storing properties of central cellular importance namely cellular sodium gradient and polyphosphate hydrolysis and synthesis are from this hypothesis seen to have naturally a closely linked evolutionary origin. Violation of the membrane resulting in sodium gradient loss stops ATP synthesis and allows for ATP hydrolysis with associated sodium pumping restituting membrane potential.

Thirdly, the ion flux driven and actively ion pumping ATP-synthase proteins are suggesing themselves via nucleotide sequence changes as forerunners of the light energy driven, actively proton pumping bacteriorhodopsin, as well as of the diverse active and selective ion channels. These serve for neuronal and finally behavioural EECT through ultimately catecholamines and indolamines as entropy- or negentropy-flow reporting that is behavioural energy use or storage modulating transmitters (BUJATTI-NARBESHUBER & RIEDERER, 1976).

Such EECT teleonomic behavioural activity leads through homeostatically chosen selective pressures, to enhanced behaviour-gene coevolution. Therefore, further evolutionary advantage of EECT, finally the nucleic acid code becomes the main information carrier until the advent of culture, through:

8. THE INCREASE OF THE INFORMATIONAL SIZE OF THE GENOME.

On this level the useful explanatory principle of EECT is again suggesting itself as relevant evolutionary advantage. It is helping to overcome what should be called the "temperature crisis" in early genome size evolution.

According to REANNEY et al. (1984) the high daily and seasonal heat fluctuations result in genome mutation and deamination and pose a major barrier to genome functions in early evolution, reducing the maximum informational size of the genome approximately 30-fold. The maximum theoretical chain length in the small RNA viruses of 4,600, actually found in MS2 to be 4200, would thus have been reduced to about 150 bases (REANNEY et al. 1984).

EECT contributes to the explicit understanding of the physico-chemical functional aspects, sofar only implicit in theories of early genome evolution (SCHUSTER, 1986). It ranges from the EECT associated high specific heat of the solvent and the transport of heat out of the system through the solvent's liquid - quais cristalline phase changes along a temperature gradient (TRINCHER, 1981) to the conformational and functional, autocatalytic information stabilisation by the genome itself. Finally it is involved in a protection of the genome via isokinetic association processes of molecules like the acidophilic protective proteins and repair enzymes.

It is a so far neglected physico-chemical aspect with explanatory power and consequences for our deeper understanding when taken explicitely into account in an epigenetic - genetic integrated evolution theory.

On the next evolutionary level of metabolic kinetics EECT is a further evolutionary advantage concerning the temperature sensitivity of chemical reactions, in the:

9. TEMPERATURE SENSITIVITY ELIMINATION OF METABOLIC KINETICS.

In the early non-thermostatted living systems a coupling of compensated processes to chemical processes in rate-limiting reactions has the evolutionary advantage of greatly reducing the temperature sensitivity of the rate-limiting steps (LUMRY et al., 1970). This coupling in the mostly poikilothermic living systems renders the transition state dynamics almost temperature insensitive to the 10-40 °C day/night and seasonal temperature fluctuations keeping the reaction rates constant of rate limiting processes.

A further step in this direction on the next system level is the role of EECT in the evolutionary advantage of:

10. THE HOMEOTHERM TEMPERATURE RANGE OF 37,5 TO 42 CELSIUS.

In homeotherm temperature regulation this feature suggests again to have its origin in solvent EECT, considered the special property of liquid phase reactions (SCHMID & SAPUNOV, 1982; LINERT & KUDRJAWTSEV, 1984). In this solvent frame EECT would explain the biological fact that the later homeothermic mammals settle for a temperature around 37.5° CELSIUS since:

Firstly, this temperature is exactly at the solvent's point of the minimum in specific heat (TRINCHER, 1981).

Secondly, it is the EECT, isokinetic transition property that is physically directly related to specific heat (LINERT & KUDRJAWTSEV, 1984).

Thirldy, EECT at this temperature is providing through both solvent phase changes and the law of FOURIER

a) a fast means of disposing heat (TRINCHER, 1981) and

b) a fast means of disposing entropy (SCHRÖDINGER, 1958).

EECT is providing a deeper understanding of why the solvent and this unique temperature have aquired their central biological role. Lying at the solvent's point of balance among its liquid phase, its quasi-cristalline structured phase and its vacuum phase component, EECT is relevant in providing the understanding for TRINCHER'S (1981) finding that this temperature is providing a maximum of structural combinatorial possibilities with a minimal energy need.

Fourthly, homeotherm temperature should be dictated by the proposition that the associated minimum in specific heat and its above structural combinatorial and EECT properties are providing the (co-) evolutionary central advantage for the mammalian nervous system in creating the highest probability for a coherent macroscopic EECT quantum state stabilisation.

This happens through self-organisation of the temperature which allows an organisational EECT optimum in coherent solvent and solute isokinetic and isoenthalpic transition states. This is an expression of:

11. TELEONOMY IN IMPROVEMENTS OF NEGENTROPY-FLOW DETECTION.

On the level of large nervous systems, EECT finds in the more stable homeotherm body temperature an evolutionary prerequisite to fully unfold the organising power of the coherent isokinetic relationship acting as MAXWELLIAN demon. This evolution progresses with both a qualitative sensitivity and a quantitative range improvement in negentropy-flow detection through EECT as consciousness utilising the respective, increasingly complex levels of system organisation.

On the hierarchically high level of the sensitive mammalian

nervous organisation refined negentropy-flow detection in a thermically and entropically fluctuating environment is suggested to be facilitated by the stabilised temperature dependent part of chemical kinetics underlying the higher hierarchical system activity.

Defined by both the ARRHENIUS or EYRING equations the stabilised temperature dependent part (together with the temperature independent part) better represents the entropic fluctuations of the inner and outer environment in the EECT kinetics underlying the central nervous system information processing structures and consciousness regulation supporting:

12. TELEONOMY AND THE OF LAW OF LEAST ACTION TOWARD STABILISED TUNNELING TRANSITIONS.

The final effect of EECT concerns the evolutionary advantage of improvements of its stability, quality and range towards isoenthalpic tunneling transitions of pure consciousness. A necessary condition in order to allow a semantically increased range and an improved activity as MAXWELLS demon.

Consciousness, with its basis in quantum field theory (ORME-JOHNSON et al. 1982, DILLBECK, 1987; HAGELIN, 1987) and more specifically for biological systems in the quantum mechanics of EECT, finds for biology its purest and simplest expression in solvent isoenthalpic tunneling (BUJATTI-NARBESHUBER, 1987 a, b).

More and more complex bio-molecules serving as evolutionary constraints for information conservation and propagation lead from the passing microscopic initial states eventually to the macroscopic stabilisation of EECT. A continuous physiological

stabilisation of the isoenthalpic tunneling transition aspect of water on the level of the nervous system, apparently in man's reach, constitutes the source cource and goal of teleonomy.

This happens through that spontaneous natural tendency established since EULER, HAMILTON and LA GRANGE throughout physics as the law of least action. If this quantum mechanical law is applied to an energy-entropy compensating and information accumulating living system it leads to an appreciation of its behavioural and evolutionary relevance together with EECT in:

13. REST AND FULFILMENT RESPONSE, HYPOMETABOLISM, DIVING RESPONSE ASSOCIATED GENOME AND BRAIN SIZE EVOLUTION.

EECT provides the possibility to span periods of low energy availability via information as ultima ratio of life and as continuing evolutionary advantage. In other words an increase of information allows the system to lower its energy requirements. Also on the makroscopic level, HOFMANN (1984) found, while calculating the coevolution of brain size and species longevity, that in hominids the expansion of the brain is linked to metabolic rate reduction.

EECT should be understood as a prerequisite leading on the ethological level to its expression as the hypometabolic mechanism. Associated with information gain it is the adaptive, feature to situations of lowered energy availability (self-)induced e.g. by eco-transitions.

Through multiple hypometabolic eco-transitions plethodontid salamanders (SESSIONS & LARSON, 1987) were forced to extraordinarily increase their main regulatory information carrier (genome size). CETACEANS and HOMINIDS were

pressured by multiple hypometabolic eco-transitions involving the hypometabolic diving response also at the air-water-land interface to enormously increase their main regulatory information carrier-brain size.

As a side issue it should be considered that with mechanisms possibly resulting from multiple hypometabolic eco-transitions these salamanders have also adopted amphibian neoteny and reproductive K-strategy along with the large information carrier. They would be in these respects analogous to man, who, as a result of the same evolutionary pressure generated by multiple hypometaboliceco-transitions, is not only neotenic as stated by the neotenic hypothesis of human origins (GOULD, 1977) but is also endowed with reproductive K-strategy, slow development, small litters, intense parental care and exceptionally large information carrier or brain.

This brain size increase is a common feature with other homeotherms. It is found frontally and characteristically at the eco-morphological extremes of success of the mammalian lines of evolution: in the ancient most primitive monotremes (LENDE, 1969; GRIFFITHS, 1978)
and the most highly evolved cetaceans, not to speak of man. The formative hypometabolic eco-transitions leading to speciation took place for monotremes phylogenetically very early or for cetaceans later and man recently. For their brain increase both the fact that they have been once and still are performing these multiple hypometabolic eco-transitions is considered relevant. Furthermore it is considered relevant that they are all utilising for this the hypometabolic diving response (BUJATTI-NARBESHUBER, 1985 a, c, d) physiologically well understood (BLIX & FOLKOW, 1983).

The relative brain increase, ultimately EECT based, is seen causally linked to the vegetative Tiso-fluctuations caused by rapid and enormous hypometabolic regulatory requirements of the mammalian diving response elicited by multiple eco-transition selective pressure. The etho-physiology of this most advanced form of hypometabolism, namely of the diving response is therefore suggested, along with associated advantageous sensory-motor factors (MONOTREME electric field detection, CETACEAN SONAR detection, HOMINID speech sound detection to underlie the brain size increase of above mammals including that of the primate man.

In this connection at least for man an interesting linkage seems to exist between hypometabolism (WALLACE, 1971) and an increased serotonin metabolism (BUJATTI-NARBESHUBER et al. 1976). Furthermore for man physiologically (BUJATTI-NARBESHUBER, 1985 a, b, c, d), the multiple eco-transitions caused by his innovative syntactic creative intelligence, taking place now in a technological etho-eco-niche, are not only linked to human brain size explosion but also again to the vertebrate diving response, the human instinct basis of increased audio-vocal creative intelligence (BUJATTI-NARBESHUBER, 1985 a, TRAVIS, 1979).

One other factor for brain enlargement of course lies in the necessity that severe hypoxic restrictions for brain enlargement are completely overcome. This happens eather by full adaptation to the brain metabolic requirements during diving hypoxia, as it is the case for diving and burrowing monotremes and certainly the cetaceans. It is also the case for man through an aerobic idiolog-sound symbol conditioned elicitation of the diving response through its inborn release mechanism (IRM). This leads to the last factor concerning:

14. TERRAQUATIC ECO-TRANSITION DERIVED ORIGIN OF HOMINIDS AND SPEECH CODE.

According to the Special Eco-transition Theory (SET) (BUJATTI-NARBESHUBER, 1985 a, b, c, d; 1986), a three stage adaptation of hominoid primates to multiple terraquatic eco-transitions is the phylogenetic origin of early hominids. Leading to man it is an illustration of a general phenomenon of biotic evolution described in GET.

SET, by expanding and modifying the scope of the WESTENHÖFER (1942), HARDY (1960), LA LUMIERE (1981), VERHAEGEN (1985), CUNNANE (1980); MORGAN (1972, 1982, 1984, 1986), MORRIS (1967, 1977) aquatic ape theory, also provides the eco-morphological framework and the ethological basis for human creative intelligence and speech. (Special Theory of Creative Intelligence). It is based on the sound symbol conditioned elicitation of the hypometabolic diving response via the inborn release mechanism. It creates the fluctuations for EECT, a prerequisite for syntactic creativity and intelligence via T iso variations, for language elaboration (BUJATTI-NARBESHUBER, 1987 d).

This diving response has been trained in the initiatory cultural settings typical for mans society and his religious practices. It is evident in a neolithic postglacial cultural complex found since 7000 BC in Belutschistan and culminating in the Indus culture of 2500-1500 BC. Sofar there have been unearthed about 1000 sites of highly structured towns without palaces and temples but with large "ritual baths" serving the same purpose as those baths found in the Essene houses of Palestine leading to the later baptisteria of christianity.

In the initiatory and ritual washings the diving response is elicited in conjunction with the giving of the

name in order for its conditioning. This is still practically trained in the nonaquatic form in the TM-meditation techniques, as obvious since the disovery of the identity of the TM-hypometabolic physiology (WALLACE, 1971; ORME-JOHNSON et al., 1981) with the diving response physiology (BUJATTI-NARBESHUBER, 1985 a, b, c, d).

This form of symbol elicitation of the response is an evolutionary constraint of human brain phylogeny. Widely integrated into the human nervous system and a prerequisite for its regeneration, this response in turn is also most easily disturbed by it (BLIX & FOLKOW, 1983). This elicitation is considered to be the biological origin of the specifically human syntactic language, his mental health and creative intelligence (BUJATTI-NARBESHUBER, 1985 b, 1987 d) as evolutionary elaboration of the basic:

15. REST AND FULFILMENT RESPONSE.

Generally speaking the hypometabolic evolutionary advantage to master adverse environments is reflected on the etho-physiological level in the regulatory behavioural capacity to induce "hypometabolic states" of rest, sleep, hibernation, estivation and the diving response.

They are all evolutionary elaborations of the basic "rest and fulfilment (RF) response" whose teleonomic isokinetic nature was defined as: "the homeostatic self-organising tendency of the living system to meet all possible stressors in such a manner as to maintain, on increasingly complex levels, while fluctuating, a stable state of least possible activation (or entropy flow reporting) and of maximum possible deactivation (or negentropy flow reporting) an ultimately zero entropy state." "This RF-response is basic to

and also inclusive of the "fight or flight" or stress reactions that do appear as antagonists but ultimately are its own synergistic phenomenon" (BUJATTI-NARBESHUBER & RIEDERER, 1976). (RF provides with "fight or flight" for compensated protection from high entropy effects via high energy activity and such maintains homeostasis). RF was the first description of energy-entropy compensation dynamics as the mechanism allowing for life.

Besides in the neurotransmitter analysis of RF (BUJATTI-NARBESHUBER et al., 1976, 1979, 1987 c; SUBRAHMANYAM & PORKODI, 1980; LANGENSTRASSEN et al. 1980; WALTON et al., 1981, 1986), experimental evidence for RF-dynamics on the level of the nervous system was found in more dynamical detail in preliminary isokinetic EEG-EECT-analysis (BUJATTI-NARBESHUBER, 1987 a).

This EEG analysis provides evidence for the hypometabolic mechanism of RF, namely EECT and illustrates diving as the biological principle that lies behind human creative intelligence (CI). EECT as CI manifests syntactically through motoric-symbols in speech, culture and finally - as basis for the entropy law of economy (GEORGESCOU-ROEGEN, 1971) - in the socio-economical transactions and transitions expressing the full range of:

16. INTERCALARY EVOLUTION.

DARWINIAN evolution theory has been criticised by four generations of scientists as seriously lacking an inner principle of evolution. For a list of authors see RIEDL (1975).

Such an inner principle was found in the solvent quantum mechanical EECT property. The genetic solute mechanisms are

integrated into this basic process permitting its stabilisation as solvent-solute intercalary evolution.

Comparing living tissues in nucleomagnetic resonance (NMR-) spectra to dead, heat denaturated tissues or pure liquid water, the analysis shows the tissues not only dominated by the signal of water but additionally the living brain or muscle tissue shows a typical stronger broadening of the NMR-spectra of the solvent-solute complex then the dead one. This was taken to indicate for a living tissue a generally decreased amount of solvent transitions (HAZLEWOOD et al., 1969). This comparison could be potentially useful as additional experimental tool for the falsification of the just mentioned evolutionary viewpoint of coherently organised spatio-temporal bio-molecular EECT stabilisation process.

From the basic solvent level through the 16 above mentioned experimental levels, intercalary evolution or GTC finally can be experimentally tested also on the most complex level of the nervous system through EECT-EEG-analysis.

The pressure reversability of inhalation narcosis (MILLER et al. 1973) or the deep diving effects (BENNETT et al. 1984) on EECT-EEG or indolamine- catecholamine negentropy-entropy-flow reporting transmitters can be used to test predictions from the theory utilising a potentially direct effect of pressure on EYRING transiton state volume or EECT.

CONCLUSION

To summarise, the above points may contribute to the illumination of the advantage on the various levels of bio-systems that conserved since the beginnings of biological

evolution energy-entropy compensated transition through the genetic and later initiatory cultural evolution mechanisms.

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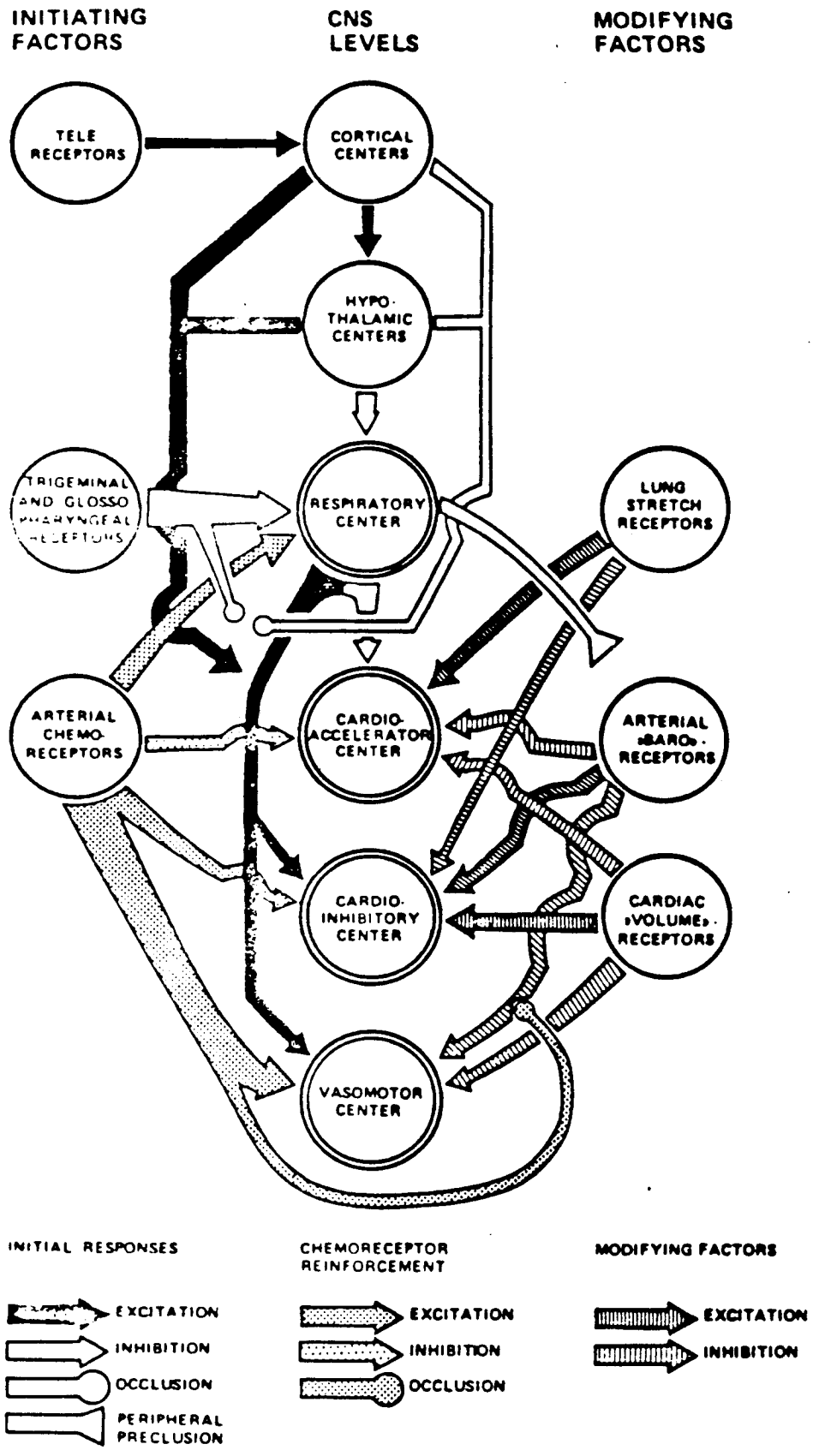

FIG. 1. Diagram illustrating integration of reflexes involved in initiation and development of diving responses in mammals and birds. Responses are evoked by stimulation of telereceptors and/or trigeminal and glossopharyngeal receptors. In some cases (notably in very short dives) initial cardiovascular responses can be occluded by corticohypothalamic influences. Normally, however, they are stimulated, albeit to a different extent in different species, immediately on cessation of breathing. In seals initial responses are usually profound, whereas in ducks they are more modest. In prolonged dives arterial chemoreceptors are activated and initiate secondary reinforcement of initial responses.

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A U N I F I E D T H E O R Y O F L I F E VIII

THE INTERDISCIPLINARY POSITION OF THE UNIFIED THEORY OF LIFE

M. BUJATTI-NARBESHUBER

THE INTERDISCIPLINARY POSITION OF THE UNIFIED THEORY OF LIFE: VIII

M. BUJATTI-NARBESHUBER

1. UTL as a measurement theory of evolution suggests first, concerning the quantum mechanical measurement theory (ZUREK, 1982, 1983) and the so far unfulfilled desire for a complete quantum mechanical description of the measurement process (OZAWA 1986, 1984), the start from the baseline description of the "dynamical process of self-coupling of the field that has gained the status of an operator which operates on itself. The quantum principle thereby discriminates the field as operator, dynamical relationship, and operand." This three in one principle is corresponding to consciousness as the observer, the process of observation and the observed. From here, this process leads to the five fundamental spin types and the further evolution towards matter and information and life.

In a hierarchical manner, the UTL as a measurement theory of evolution, through the symmetry breaking and information producing measurement process of observation, rises. It now unites, in principle objectively demonstrable, these conscious processes described by the General Theory of Creative Intelligence (GTCI) with natural science through this three in one principle or onto-epistemology paradigm stemming from ancient Vedic Science.

2. UTL as measurement theory of evolution starts from this commutation aspect of self-referential observation of the supersymmetric Unified Field Theories of quantum physics, in fact describing consciousness. Through quantum chemistry it unfolds into quantum biology with the Transition Theory of Evolution.

UTL attributes to the solvent or solute isokinetic transitions derived Eyring transition state stabilisation the status of the operator or

observer (RISHI). To the process of isokinetic transition it attributes the commutation (or the dynamical relationship) status as process of observation. It leads to symmetry breaking and new laws of nature (DEVATAS). Finally the reactants are attributed with the operand or the observed (CHHANDAS) status. Environmental energy and entropy fluctuations provide the prerequisite for living systems creative intelligence. They result in the measurement processes of: hyper-energetic isokinetic reactant mutations as creativity and hypo-energetic reactant selections as intelligence through Energy Entropy Compensated Transition (EECT) as the "Ultima Ratio" of life.

3. UTL as Integrated Evolution Theory complements the synthetic evolution theory of the Mendel, Darwin, Schrödinger and Eigen approach. It provides the above micro-organisational mechanism of pre- and epigenetic metabolic behaviour as life. It finds confirmation by Dyson's mathematical model so far.

4. Concerning epistemology, UTL with EECT as objective interface of the biological consciousness phenomenon provides also the experimental foundation for the Onto-Epistemology Paradigm. It allows for the integration of the evolutionary epistemology of Lorenz, Campbell, Vollmer, Öser and Riedl into the General and Special Theory of Creative Intelligence.

5. UTL provides the missing theory of developmental morphogenesis as the Intercalary Evolution Theory. This integrated theory of both phylogenetic and ontogenetic morphological evolution is conceived according to the hierarchical level as compensation-constraint, solvent-solute, epigenetic-genetic, behaviour-gene or teleonomy-culture coevolution theory. Complementing MONOD'S (1970) suggestion of an epigenetic approach to morphogenesis it provides with EECT-stabilisation the actual morphogenetic principle.

6. Moreover, UTL restricts in the General Eco-Transition Theory (GET) the generality of the Weismann doctrin or of the central dogma of molecular biology. The homeostatic epigenetic mechanism, determining the evolutionary role of molecular and biosystem behaviour, substantiates the expected powerful effect of behaviour on the genome, through behavioural ecology change. Such a role of behaviour by selecting evolutionary pressures has been suggested by Huxley, Schrödinger, Hardy, Popper, Cairns, Wyles and Wilson. It has been proven by the latter to accelerate morphological evolution.

7. Finally UTL identifies for paläoanthropology in the Special Eco-transition Theory (SET), the specific evolutionary pressure determining the process of anthropogenesis. In the ancient vertebrate, mammalian and primate "Diving Response" the mechanism is now at hand to account via multiple coastal, terraquatic eco-transitions for human neoteny, human eco-morphology, brain evolution and the human ethology of syntactic speech.

Speech and cultural meme (DAWKINS, 1976) generation and their conscious replication serve for creative information extraction by the cultural and scientific observation processes. SET critically complements the "Savannah" theory and the theory of Lovejoy by integrating them with the approach of Westenhöfer, Hardy, Morgan, Lumiere, Morris and Verhaegen.

GET emphasises the general role of eco-transitions for evolution. SET provides proof for their special role through the discovery of their diving palaeophysiology for the human evolution and their role in his permanent creative intelligence.

8. UTL, concerning human psychology, provides in the Special Theory of Creative Intelligence (STCI) a foundational theory of man's psychophysiology of consciousness and creative intelligence. Through the

special ethological basis found in the diving response ethology of symbol generation, STCI was added to the neccessary but insufficient ritualistic, human-psychological and human-ethological theories of Freud, Jung, Lorenz, Eibel-Eibelsfeldt. It is allowing for a new, evolutionary understanding of the ancient educational culture-ethological strategy of initiation into the transcendence experiences.

9. UTL concerning economical and ecological theory states that the market mechanism in order to be a regulative, is dependent on the intact teleonomical behaviour of its participants. In this way the Unified Theory of Life provides the basis for economical behaviour through its proper training. It is stating that hypometabolism of RF lies at the source of creativity and intelligence also for economical progress.

10. UTL concerning sociology results in the Creativity Deficit Theory (CDT) of psychosomatic and psychosocial disease and cultural decline. It explains by phylogeny why sleep is a necessary but insufficient condition for human brain regeneration. It provides for preventive medicine, sociology and political science a foundational theory of the characteristic "Initiatory Society" typical of man. It considers typical and essential the cultural addition of the human ethology of aerobic (initatory) diving response self-elicitation. This regenerating instinct process-elicitation by conditioned idiolog-symbols (MANTRAS, baptising and Name) is the phylogenetic necessity for full brain regeneration and creative problem solving. The loss of this process leads, also if only deficient, to enormous socio-economical costs & cultural decline as "epigenetical error catastrophes".

11. In this way the interdisciplinary Unified Theory of Live, if found consistent, provides the necessary and sufficient condition for the full use of the creative brain potential. It fulfills the since 1976 intended "design for a system theory of man." Epistemic authority (BOCHENSKY,

1974), concerning the knowledge of UTL, is derived from the testability only, that comes from both the ancient Vedic Sciences experiential, experimental approach, systematised in Maharishis Technology of the Unified Field, as well as from the modern natural sciences, utilising the measuring, experimental approach, systematised since Galileo Galilei.

12. Deontic authority (BOCHENSKY, 1974) serving for the implementation of goal oriented actions, from UTL can be based on solidarity, due to common, namely teleonomical, transcendental experience stabilising goal of socio-economic evolution, rather than sanctions.

This should help to further the integrated socio-economical progress of human society.

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NACHWORT/CONCLUDING REMARKS

Dieser, von den sechs Abstract-publikationen, nun, in konzentrisch sich immer mehr erweiternden Teilen vorliegende Ansatz für eine integrierte Evolutionstheorie, ist hiemit zu einem vorläufigen Abschluss gebracht.

Abgesehen von den enormen interdisziplinär fachlichen und sprachlichen Hürden, die mir, weiter denn je, von einer Lösung entfernt erscheinen, aber in Kauf genommen wurden um eine eventuelle spätere Diskussion mit einer englischsprachigen Fachwelt nicht von vorneherein zu erschweren, so ist doch auch ein erster Erfolg dieses nunmehr vorliegenden Konzeptes gegeben. Es schuf die ganzheitlichen Voraussetzung dafür, um gegebenenfalls nun in einzelnen Sektoren, zum Beispiel derzeit für einen Kongressband in deutscher Sprache, eine Darstellung über die hier überblicksmäßig gewonnene Einsicht in die ethologische Natur der menschlichen Kreativität zu geben. Die weitere Beurteilung, Förderung und Ablehnung obliegt jedenfalls der dafür institutionalisierten Fachwelt.

ANHANG/APPENDIX

Design for a Systemtheory of Man

Bujatti, M.

AN INCENTIVE FOR FURTHER RESEARCH

A SHORT GLIMPSE OF THE PHYSIOLOGY OF TRANSCENDENCE (TM-DR) FOUND IDENTICAL TO THE AEROBIC PHYSIOLOGY OF THE DIVING RESPONSE WITH LACTATE PRODUCTION REDUCTION AND LACTATE UTILISATION AND THE RELEVANT CORRELATION WITH CREATIVITY.

Journal of Neural Transmission 39, 257—267 (1976)

Short Communication

Serotonin, Noradrenaline, Dopamine Metabolites in Transcendental Meditation-Technique*

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With 1 Figure

Received March 25, 1976

Summary

The highly significant increase of 5-HIAA (5-hydroxyindole-3-acetic acid) in Transcendental Meditation technique suggests systemic serotonin as "rest and fulfillment hormone" of deactivation-relaxation.

Furthermore 5-HT (5-hydroxytryptamine, serotonin) is considered to to be the EC-cell (enterochromaffine-cell) hormone requested by *Fujita* and *Kobayashi* and its role for EEG synchronisation via area postrema chemoreceptor as anti arousal agent is being discussed.

The significant decrease of the catecholamine metabolite VMA (vanillic-mandelic acid) in meditators, that is associated with a reciprocal increase of 5-HIAA supports as a feedback necessity the "rest and fulfillment response" versus "fight and flight".

As the adreno medullary tissue serves for hormonal reinforcement of orthosympathetic activity, the Enterochromaffine Cell System (having taken the form of distinct organs in some species as octopus and discoglossus) is suggested to serve via serotonin for humoral reinforcement of parasympathetic activity in deep relaxation.

Introduction

Transcendental Meditation (TM-technique) by *Maharishi Mahesh Yogi* (1966) is a mental relaxation and maturation technique as compared to physical relaxation techniques (Hatha-Yoga, Progressive

* The results of this work have been partly contributed to the neuroscience meeting Sept. 4, 1975 at Courchevel and the MERU-Symposium Hamburg May 22, 1976.

Relaxation by *Jacobson*, Autogenic Training by *Schultz*). TM-technique improves and normalizes the emotional state, improves field independence, the ability to focus attention, reaction time and mind-body coordination without drugs.

Presently TM is practiced by over one million people according to SIMS organization statistics. This number and the spreading use in sports, government support in education and social rehabilitation (*Shafii et al.*, 1974; *Benson*, 1972) justify the investigation into the clinical effect.

The present study is an initial investigation of the effects of TM-technique on biogenic amines metabolites.

Material and Methods

A. TM-Program Participants and Clinical Staff

This investigation was carried out with 11 healthy practitioners (4 female, 7 male) of TM-technique, and the data compared to those obtained from the controls, 13 healthy subjects of the clinical staff, chosen to approximate the age and sex distribution of the experimental group and to account for ultradian rhythm. TM-experimental subjects were regular Meditators obtained through the Students International Meditation Society, Austria. The selection of the meditators was essentially random. The age distribution of the TM-practitioners ranged from 19 to 61 years, the average length of regular TM-practice was 29 months ± 11 ranging from 14 to 54 months. As a routine the technique is practiced twice daily for 20 min, morning and evening.

B. Sample Taking

Of the 11 meditators samples of 2 hour urine were taken 2 hours before and 2 hours after the start of the 30 min TM-practice in the group (3 p.m. to 5 p.m. and 5 p.m.—7 p.m.).

The controls practicing no form of relaxation and the TM-practitioners except for their 30 min of meditation were subjected on separate days to the same condition of light activity (conversation and occasional walks) during the 4 hours of the experiment. After collection the pH-value of the urine was immediately adjusted to 2—2.5 with the aid of 6 n hydrochloric acid. The urine was examined for indoleacetic acid, 5-hydroxyindole-3-acetic acid, homovanillic acid, and vanillic-mandelic acid. Urine that could not be analyzed immediately was frozen at —32 °C and analyzed at the latest 3 days after.

C. Influence of Circadian Rhythm and Diet

The circadian rhythm of 5-hydroxyindole-3-acetic acid, homovanillic acid, vanillic acid, and vanillic-mandelic acid was examined by *Riederer et al.* (1974) in urine from a healthy group of subjects divided into four fractions according to time of day. The fractions for the intervals from 8 a.m. to

2 p.m.; 2 p.m. to 8 p.m.; 8 p.m. to 2 a.m.; 2 a.m. to 8 a.m. showed a maximum of vanillic-mandelic acid and homovanillic acid during the waking state (8 a.m.—2 p.m.; 2 p.m.—8 p.m.), and a significant decrease during the sleep state (8 a.m.—2 p.m.; 2 p.m.—8 p.m.). During the day, there was no significant alteration shown in the concentration of 5-hydroxy-indole-3-acetic acid. From these investigations, the conclusions could be made that significant alterations of the metabolite concentration in the urine do not take place during a period of 2 to 4 hours.

To test this hypothesis, urine from 7 healthy subjects was collected at the same time of day, under the same time conditions previously described. The result showed, that in fact, no circadian rhythmic influence on the concentration of homovanillic acid, vanillic-mandelic acid, indoleacetic acid, and 5-hydroxyindole-3-acetic acid, was evident during 3 hours (*Riederer et al.*, 1975). Dietary influence on the substances mentioned have been described (see *Riederer et al.*, 1974, 1975). It was seen to that no interfering foods were consumed by any of the persons studied.

D. Biochemical Methods

In principle thinlayer- and gas chromatography methods have been applied.

In brief, aliquot amounts of the urine samples were centrifuged, and then shaken out several times with the same amount of peroxide-free diethyl ether each time (E. Merck AG., Darmstadt, FRG, p.a.). The diethyl ether fractions were collected and dried over waterfree sodium sulfate (E. Merck AG., Darmstadt, FRG, p.a.). The ether fractions dried in this manner were then distilled completely dry at 40 °C on a Rotavapor. The device was ventilated with pre-dried pure nitrogen (AGA-Vienna, p.a.) and the sediment was put into flasks as fast as possible in 2 ml of a mixture of ethyl acetate-methanol (8 : 2). The thin-layer chromatography, the demonstration, and the quantitative establishment of the individual metabolites were performed in the manner described by *Riederer et al.* (1974).

The results were scrutinized in a random test with the aid of gas chromatography. The method from *Sandler* (1973) was employed to establish homovanillic acid and vanillic-mandelic acid. Homovanillic acid and vanillic-mandelic acid were isolated from human urine by ethylacetate extraction. Two-hour urine collections were made. The urines were titrated to a pH-value of 2 during collection and stored at —32 °C. After evaporation to dryness the residue was diluted with 5 ml ethylacetate. 0.1 ml were evaporated by freeze drying in a 1 ml Reacti-Vial (Pierce Chemical Co., Rockford, Ill., U.S.A.). Derivatization of HVA and VMA were carried out adding 0.5 ml ethanolic HCl. After 30 min at room temperature 1.4 ml abs. ethanol (E. Merck AG., Darmstadt, FRG, p.a.) were added. A 50 μl aliquot was freeze-dried; 20 μl acetonitrile and 100 pentafluoropropionic anhydride were added. Reaction was carried out at 65 °C for 40 min in sealed Reacti-Vials. The derivatives of HVA and VMA were reconstituted in dry ethyl-acetate.

GLC analysis was carried out on a Perkin Elmer model 3920 instrument using electron capture detection. Separation was achieved on a 12 ft. glass column packed with 10 % SE-54 on Chromosorb W-HP (80—100 mesh). The column oven temperature was 200 °C. The injection block was maintained at 200 °C and the EC-dedector at 280 °C.

Results

The data in figure 1 demonstrate for the controls, that the urine concentration of VMA (main noradrenaline metabolite), HVA (main dopamine metabolite). 5-HIAA (main serotonin metabolite) and IAA (tryptamine metabolite) of the 2 hours periods 3 p.m.—5 p.m. (A) and 5 p.m.—7 p.m. (B) are not significantly different.

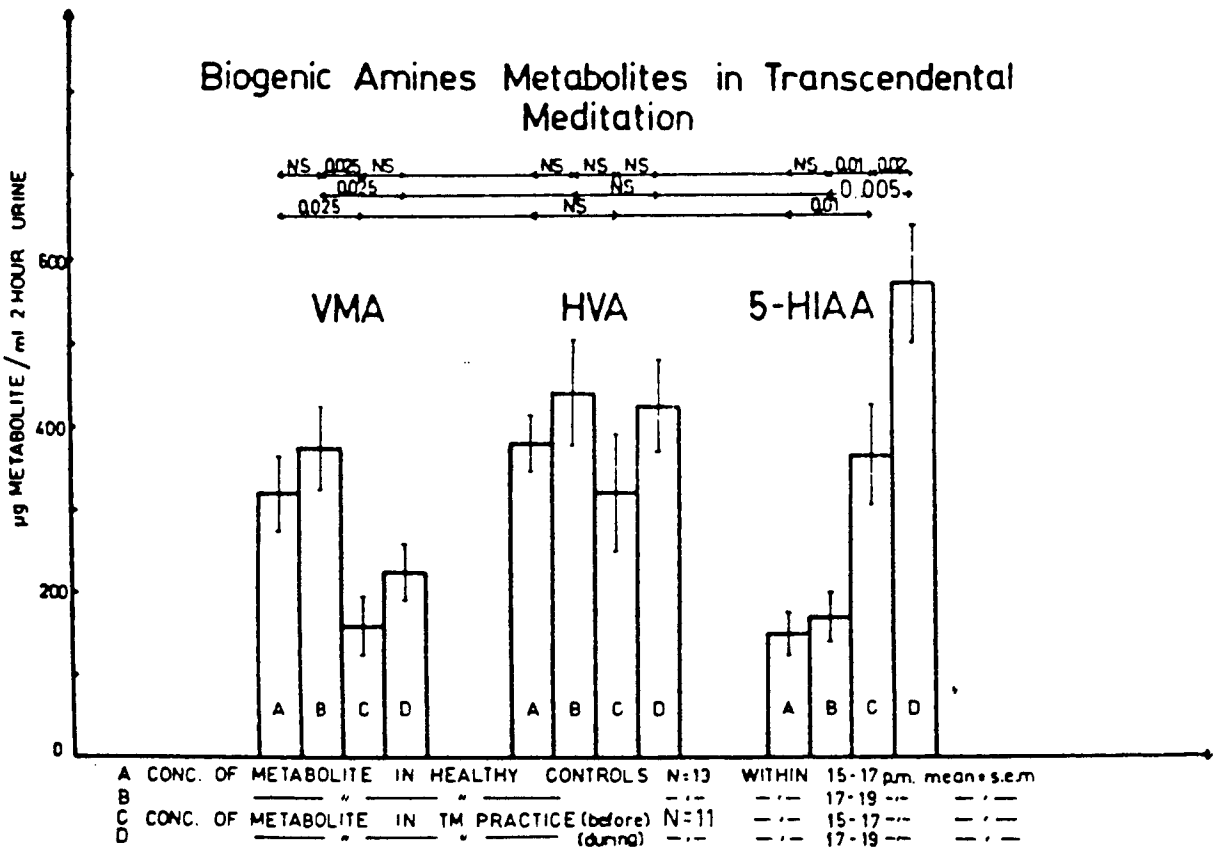

Fig. 1. t-Test for paired values between C/D for 5-HIAA were significant at the $p < 0.05$ level, those for VMA between A/D were significant at the $p < 0.02$ level

In TM-practice (comparing the 3 p.m.—5 p.m. premeditation period (C) to the 5 p.m.—7 p.m. TM and postmeditation period (D), that includes 30 min of TM-practice), the meditators, serving as their own controls, showed a significant increase of 5-HIAA ($p < 0.02$).

This allows for the conclusion that TM-technique has an effect of increasing serotonin metabolism. The increase of the other neurotransmitter metabolites does not become significant.

TM-practitioners 7—9 hours after their regular morning meditation, showed in their 2 hour urine metabolite sample (C) taken before the 5 p.m.—7 p.m. afternoon meditation period (D), a significantly lower VMA concentration (as compared to the controls) and a higher 5-HIAA concentration significant at the $p < 0.01$ level, rising to $p < 0.005$ after TM. These data allow for the conclusion that the meditators exhibit a lower level of activation (*Frankenhaeuser*, 1969), less stress and strain and have a lower adrenal hormonal level out of TM-practice periods also than our controls.

The elevated 5-HIAA conc. (C) indicates a sustained serotonin level well above control values in regular meditators during the day, rising with TM-practice (D).

It should be stated that in meditators compared to non-meditators a significant decrease in concentration of a main metabolite of the catecholamines noradrenaline and adrenaline, namely VMA, is associated with a reciprocal increase of the main metabolite of serotonin. This effect can be associated with the known effects of TM: synchronisation of EEG, decrease of muscle tone, decrease in anxiety etc. (*Banquet*, 1973; *Orme-Johnson* and *Farrow*, 1976).

The observed trend during daytime can be interpreted as lowered "basal activation". In meditators the ratio of the metabolites before and after TM followed a general logic and tended to a certain ratio (*Bujatti*, 1976).

Discussion

Referring to the data on the physiology of TM by *Wallace*, *Benson* and *Wilson* (1971), *Selye* (1975) writes: "TM's physiologic effects on metabolism, breathing, skin resistance, blood lactate, brain waves and the cardiovascular system are exactly opposite to those identified by medicine as being characteristic of the efforts to meet demands of stress."

The reduction of plasma cortisol during and after TM (*Jevning et al.*, 1975) and the significant reduction of VMA in this study on TM is further evidence for the above description and is connected with an increase in 5-HIAA in TM-practitioners.

The increase of the serotonin metabolite 5-HIAA while IAA (indole-3-acetic acid) remains more constant suggests the following conclusion:

A: Since 5-hydroxylation of L-tryptophan is the rate limiting step in 5-HT biosynthesis (see for review *Hamon et al.*, 1974) the long term increase in 5-HIAA production should be due to the stimulation of L-tryptophan turnover to 5-HTP in TM-practitioners.

L-tryptophan-5-hydroxylase which as capable of metabolizing

L-tryptophan into 5-HTP (5-hydroxytryptophan) has been localized in mammalian intestinal mucosa (*Porter et al.*, 1961).

The occurrence of serotonin in the enterochromaffine (EC) cells has been evidenced by *Ersparmer* and *Azero* (1952). Furthermore, the EC-cells of the enterochromaffine cell system in the gastrointestinal mucosa are the main site of production and storage of 5-HT in mammals (*Ersparmer*, 1963).

B: After EC-cell stimulation by administration of hypertonic glucose in the gut lumen:

a) EC-cells responded by emiocytotic release of the basal granules (*Kobayashi* and *Fujita*, 1974).

b) Formaldehyde induced fluorescence (Falck-Hillarp Method) in the EC-cells of the human duodenal mucosa disappeared (*Tobe*, *Kimura* and *Fujiwara*, 1967),

c) an elevated blood serotonin level in the portal vein followed (*Johnson* and *Jesseph*, 1961; *Johnson*, *Sloop* and *Jesseph*, 1962),

d) leading to the conclusion: The EC or enterochromaffine cell, which represents the predominant element in the gut endocrine system can now be called a "safely endocrine cell", *Fujita* and *Kobayashi* (1974), *Osaka*, *Sasagawa* and *Fujita* (1974).

Feyrter (1938, 1953) established the morphological concept of the "diffuse endocrine epithelial organs". The work of the Japanese research-groups on the "gastro-entero-pancreatic endocrine system" provide evidence for its value. *Feyrter* concluded among many others since *Ciacco* (1906) an endocrine activity of the EC-cells, yet the question after the hormone, its function and the endocrine targets remained.

By lowering orthosympathetic vegetative tone in TM-technique, the observed increase in serotonin metabolism and consecutive urine 5-HIAA excretion are infered to be caused by basal granulated EC-cell stimulation plus secretion of 5-HT.

Such mechanism is well established for the basal granulated G-cell (*Uvnas*, 1942; *Pe Thein* and *Shofield*, 1959; *Hunski et al.*, 1971; *Matsuo*, *Seki* and *Kitamura*, 1974) that belongs to the same Gastro-Entero-Pancreatic endocrine system (GEP-system) as the EC-cell and the Amine Precursor Uptake and Decarboxylation series (APUD-series) as well, producing in this case the intestinal hormone gastrin (*Solcia* and *Sampietro*, 1965; *Busolati* and *Pearse*, 1970; *Mitschke*, 1971).

"It is an important fact that the amines in the APUD-cells are present in addition to polypeptide hormones and there seems to be no reason for the EC-cell being an exception to this point." (*Fujita* and *Kobayashi*, 1974)

So far the increase of 5-HIAA in the TM-practice is the first physiological-functional evidence for serotonin itself to be the presumptive main EC-cell hormone requested by *Fujita* and *Kobayashi*.

As the adreno medullary tissue serves for hormonal reinforcement of orthosympathetic activity (*von Euler*, 1963) the Enterochromaffine Cell System (having taken the form of distinct organs in some species as octopus and discoglossus) is suggested to serve via serotonin for humoral reinforcement of parasympathetic activity in "rest and fulfillment" of deep relaxation.

The classification of 5-HT activity:

1. Locally upon smooth muscle (*Sleisenger et al.*, 1959) as "tissue hormone" and

2. its powerful stimulant action on intestinal peristalsis (*Bülbring* and *Lin*, 1958; *Bülbring* and *Crema*, 1959; *Lee*, 1960) bloodflow in the gut wall and mucous secretion (*Menguy*, 1969; *Thorson*, 1958) as "intestinal hormone" can be suggested now. 5-HT according to *Ersparmer* (1963) acts further on

3. dilatation of the coronary vessels in the heart, the tone of venous, arterial and capillaric bloodvessels (*Oates et al.*, 1966, suggested bradykinin involvement); its effect on the pulmonary arterial tree, the placenta and possibly the kidney, the suggested metabolic activity concerning glycogenolysis (*Kursky*, 1974) as well as the effects on uterine muscle, all could be considered along this line, as "systemic RF-hormone" activity, of practical clinical and explicatory value.

4. The systemic "rest and fulfillment hormone" (RF-hormone) finally should act via area postrema chemoreceptor through the reticulo-solitario-reticular feedback system (*Koella* and *Czicman*, 1965; *Koella*, 1974) on, last not least, the "neurotransmitter serotonin" with its supporting role for EEG-synchronisation (*Gaillard* and *Bartholini*, 1974), the common finding of EEG research done on TM (*Wallace, Benson* and *Wilson*, 1971; *Banquet*, 1973; *Banquet et al.*, 1974; *Kobal*, 1975; *Krahne*, 1975).

5. 5-HT, that is held responsible for a bewildering multitude of central regulatory effects is suggested to account as "negentropyflow transmitter" (*Bujatti*, 1976) for them and the deactivation of the "rest and fulfillment response" observed in TM-technique centrally and peripherally antagonistic to the activation of the "entropyflow transmitter" noradrenaline (DA?) in "fight and flight".

The term "rest and fulfillment response" is defined (*Bujatti*, 1976) as "the homeostatic, self-organizing tendency of the living system, that is to meet all possible stressors in such a manner, as to maintain on increasingly complex levels of integration, while fluctuating, a

stable state of least possible activation and of maximum possible deactivation, an ultimately zerocntropy-state". This "rest and fulfillment response" (RF-response) is basic to and inclusive of the activation of "fight and flight" and "stress" reactions that do appear as antagonists but ultimately are its own synergistic phenomenon.

It should also be mentioned that in acupuncture an increase of 5-HIAA in the urine was demonstrated (*Riederer et al.*, 1975). Simultaneously an increase of slow alpha-activity is observable in acupuncture (*Birkmayer et al.*, 1976).

The increase of 5-HIAA concentration in a mental relaxation technique (TM) and in acupuncture of a peripheral point indicates a more general validity of the above mechanisms mediated by central and peripheral serotonin.

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Faculty and student members of MIU's Substance M research team (from left): Dr. Kenneth Walton, Phil Tomlinson, Shiyao Wu, Todd Hauser, Nirmal Pugh, Bonnie Neimann, Michael Lerom, and Tom McCorkle. *Photo by Gabrielle Dewan*

Students Contribute to Recent Breakthroughs in Substance M Research

Bob McIlvride

MIU chemistry students contributed to important breakthroughs in Substance M research last month, determining what appears to be a structural component of the substance, and pinpointing a major contaminant marring the near-pure samples of Substance M.

Samples were sent out last week for high-resolution mass spectroscopy tests which could reveal the structure of Substance M.

In addition, Dr. Ripu Malhotra, a physical organic chemist at Stanford Research Institute International in Palo Alto, California, has been running mass spectrometer tests on the most purified samples of Substance M to date, and has found the molecular weight for the

Continued on page 3

Breakthroughs in Substance M Research

Continued from page 1

predominant substance in the samples to be 514. This is now thought to represent the major contaminant.

"These findings mark the culmination of several years of researching the substance, and the beginning of a new understanding of its chemical structure," said Dr. Ken Walton, Associate Professor of Chemistry at MIU, Director of the Neurochemistry Laboratory, and director of the Substance M research.

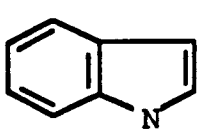
Undergraduate chemistry student Bonnie Neimann and Assistant Professor of Chemistry Michael Lerom have purified ten times more Substance M at a higher level of purity than ever before.

Last week they discovered what could be the final obstacle to completely purifying Substance M — a single contaminant originating from steps of the purification procedure itself. With this knowledge, they are working to isolate a completely pure sample.

"It is exciting to be on the forefront of this new research," said Bonnie. "The faculty and staff working on Substance M are experts in their fields, which makes my time and work here especially rewarding."

Another student researcher, Ph.D. physiology student Phil Tomlinson, recently made another major contribution in determining the structure of Substance M.

By introducing a different staining technique into his thin layer chromatography research, Phil has shown that a basic structural component of Substance M is probably an "indole ring," represented diagrammatically as:



Discovered Indirectly

The Substance M research grew out of studies done on serotonin, a neurotransmitter associated with feelings of well-being and positive moods.

In 1976 Michael Bujatti conducted a study on TM and serotonin in Austria, concluding that serotonin may act as a hormone helping to produce deep rest. Psychiatrists currently associate low levels of serotonin in the brain with aggressive behavior, depression, suicidal tendencies, and other mental problems.

MIU researchers think the effects of TM may be correlated with high serotonin levels. How much serotonin is in the body can be inferred from measuring the level of 5-HIAA, its major break-down product, found in samples of cerebrospinal fluid, urine, and blood.

Substance M was discovered accidentally by Dr. Ken Walton when he was studying 5-HIAA content in urine samples of meditators. A discrepancy appeared between two different methods of estimating the amount of 5-HIAA in the samples.

In samples taken at different times of day, Dr. Walton noticed that one test indicated a certain level of 5-HIAA, while a second, more specific test showed far less 5-HIAA in the same samples. The greatest difference between levels occurred right after the meditation.

"This difference might only have caused us to switch to the more specific method if we had not noticed that the biggest difference coincided with program times," said Dr. Walton. "This was what suggested that another compound might be involved."

There was indeed another compound involved, a substance which was soon dubbed "Substance M."

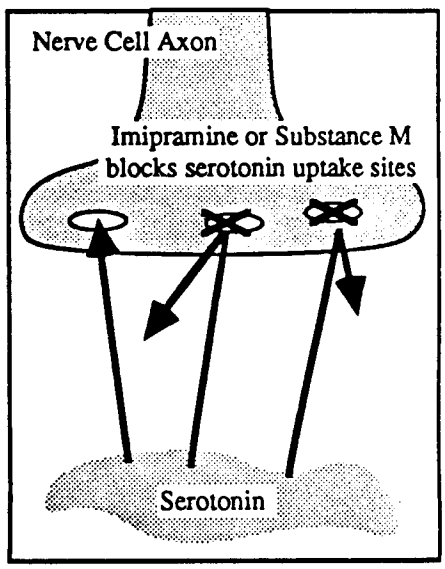
This discovery was made late in 1982, and for several years MIU biochemists have been working to purify Substance M, in order to determine its chemical structure.

Substance M at Work

Since 1984, research in collaboration with chemists at other institutions has pointed to one possible function of Substance M — to inhibit serotonin uptake and thereby sustain a feeling of well-being in the body and mind.

The effects of serotonin in the nervous system occur when it is released from a nerve cell into the synapse between cells. There it can affect receptors on the cell walls of adjacent nerve cells. Chemists hypothesize that when the nerve cell that released the serotonin reabsorbs it, the associated good feelings dissipate.

Chemists have developed a number of synthetic drugs to inhibit serotonin uptake by nerve cells. One of these is called imipramine, a drug used clinically to treat symptoms of depression, but which also causes several undesirable



side effects. Imipramine blocks the serotonin uptake sites in the nerve cell, leaving more serotonin available in the synapse, where it might continue to create feelings of well-being.

According to initial studies carried out in collaboration with Drs. Larry Meyerson and John Ieni in the Medical Research Division of American Cyanamid, a pharmaceutical firm in New Jersey, Substance M acts in the same way as imipramine — inhibiting the process of serotonin uptake by the nerve cells.

But while it might perform the same function as imipramine, Substance M would not be expected to create harmful side effects, because it is a natural substance made in the body.

"We are among the pioneers of research in positive levels of consciousness," said Chris MacLean, laboratory technician, who, along with Todd Hauser and Dr. Tom McCorkle, has been working on the Substance M

Continued on page 5

Breakthroughs in Substance M Research

Continued from page 3

project for over a year. "Very little is understood about normal states of being. This discovery of an anti-depressant substance is an exciting reversal of this trend."

Future Research

The immediate goal of the Substance M research is to determine the entire structure of the substance. The indole ring — apparently present in Substance M — also forms the basic structure of serotonin, 5-HIAA, and tryptophan, the metabolic precursor of serotonin. This suggests that Substance M could be a "metabolic relative" of these compounds.

In addition to its structure, MIU researchers will be studying how Substance M functions, what factors may change its levels in blood and urine, and what states of mind may be associated with high and low levels.

The research will address the relationship between Substance M, serotonin, and the experience of pure consciousness during TM. And much of it will be carried out by MIU students.

Recently, Dr. Orme-Johnson's psychophysiology students found evidence that the increased feelings of well-being after the TM-Sidhi program are associated with increased 5-HIAA.

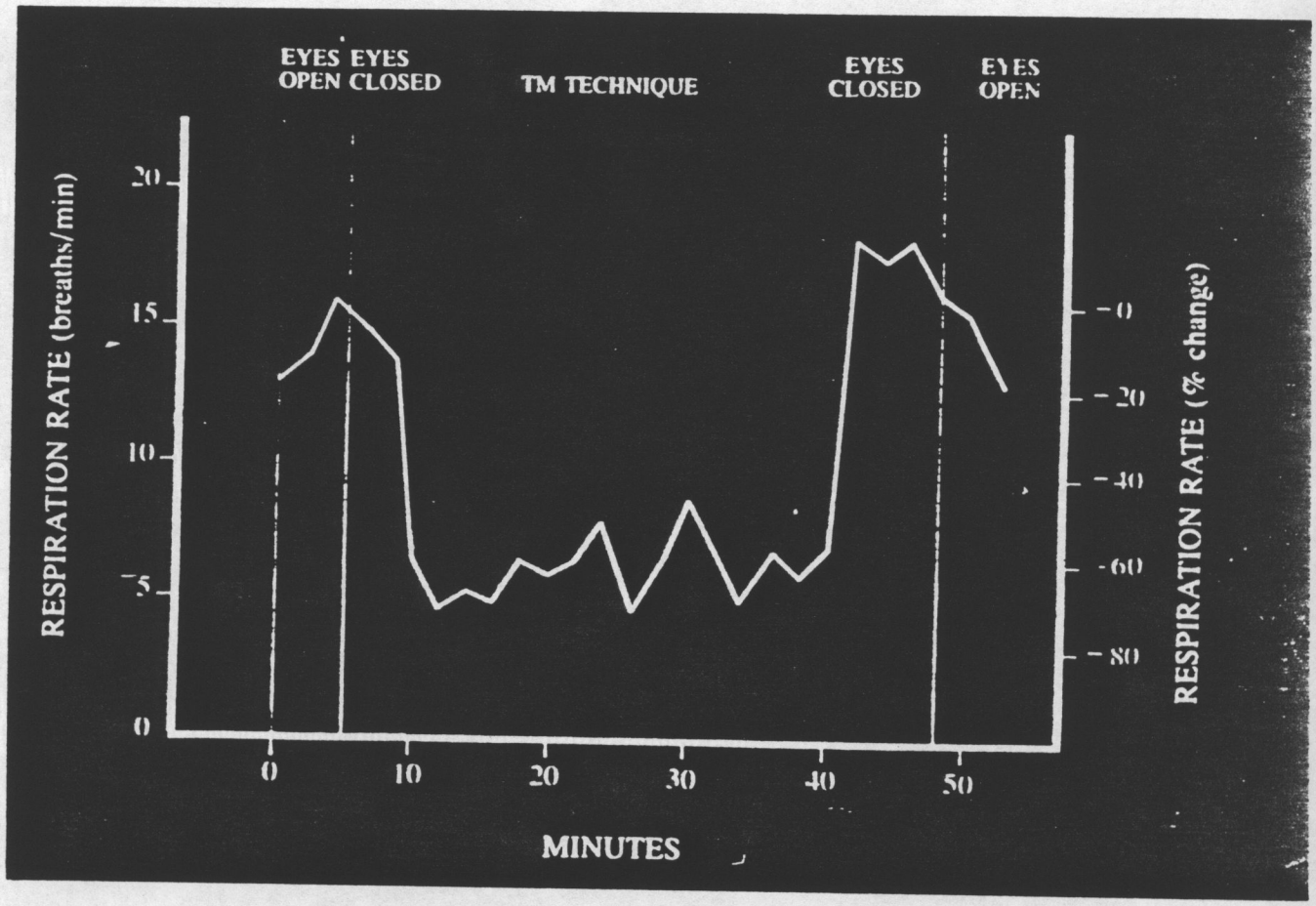
"Perhaps most interesting of all," says Dr. Walton, "is the indication that 5-HIAA and serotonin may correlate with numbers in the Super Radiance program. This important study is being carried out in our laboratory by Nirmal Pugh, a student at Maharishi School of the Age of Enlightenment."

Substance M and Bliss

Much of the excitement over Substance M arises from suggestions that it could mediate the experience of bliss. Dr. Walton thinks it is much too early to reach any conclusion about this, but he is intrigued by evidence of serotonin's importance in the experience of pure consciousness, and by evidence that Substance M may be interacting with serotonin.

"I, too, began lab research as an undergraduate in college, enjoying it right from the start," said Dr. Walton. "But this is the most exciting and challenging project I have ever encountered. I want to extend a special thanks to Keith [Dr. Keith Wallace, Co-Director of the Doctoral Programs in Neuroscience and Physiology] for his encouragement and collaborative support, and to the generous donors from the Fairfield community who have made this work possible."

Bob McIlvride recently became the first student to complete the degree requirements for a master's degree in Professional Writing at MIU.



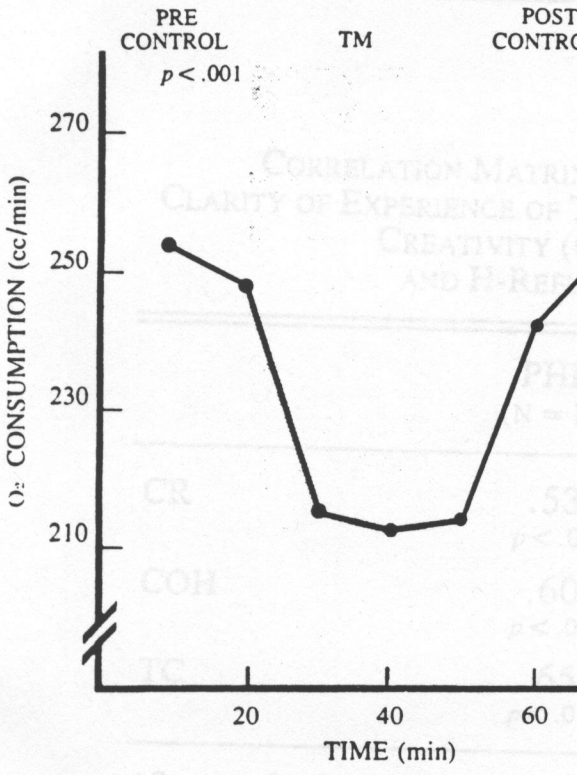


FIG. 1. OXYGEN CONSUMPTION

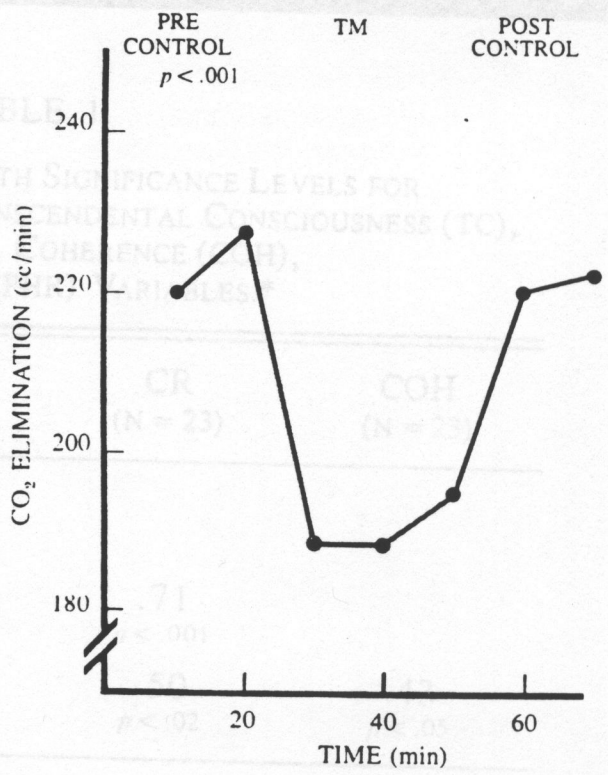


FIG. 2. CARBON DIOXIDE ELIMINATION.

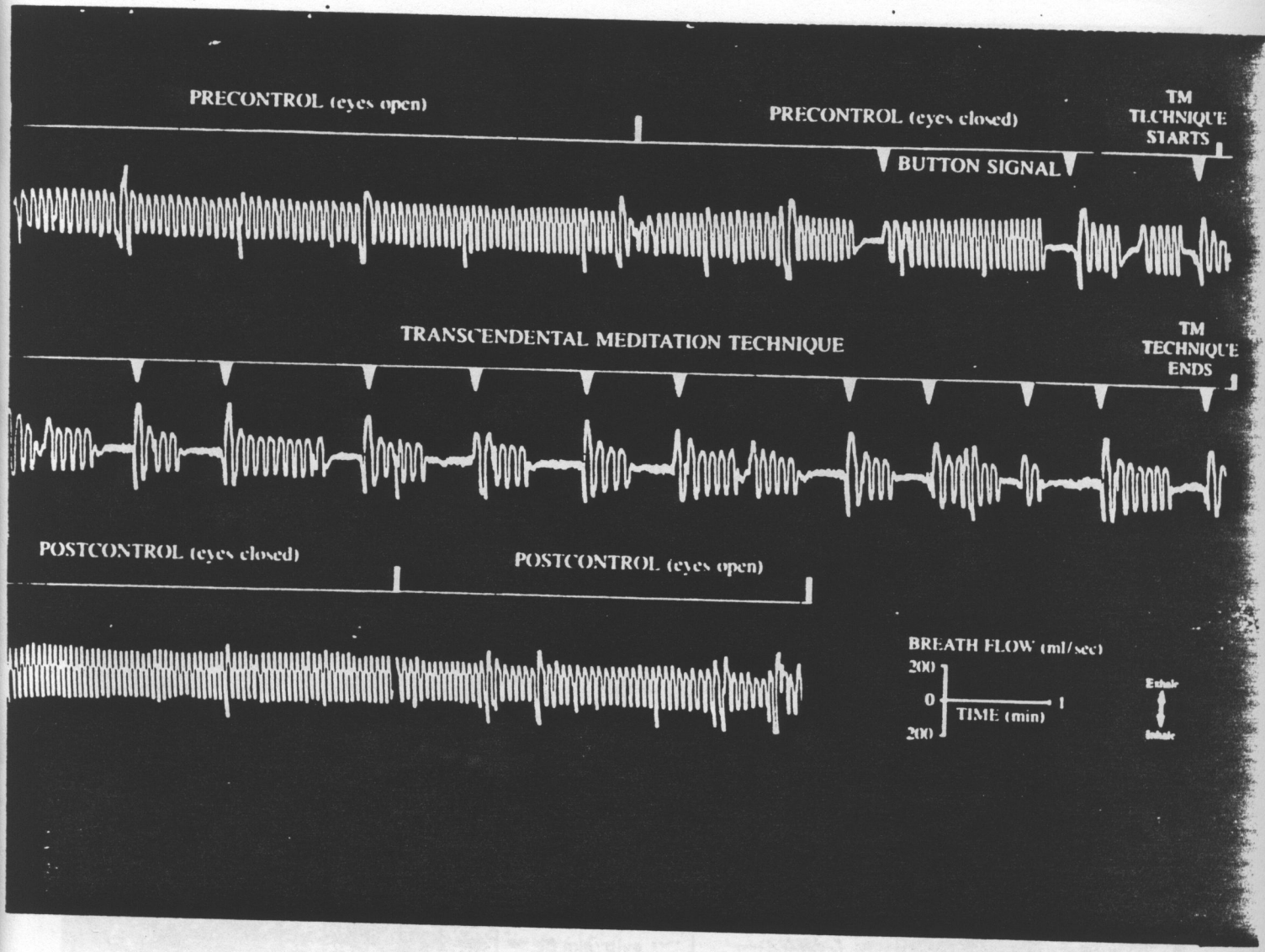
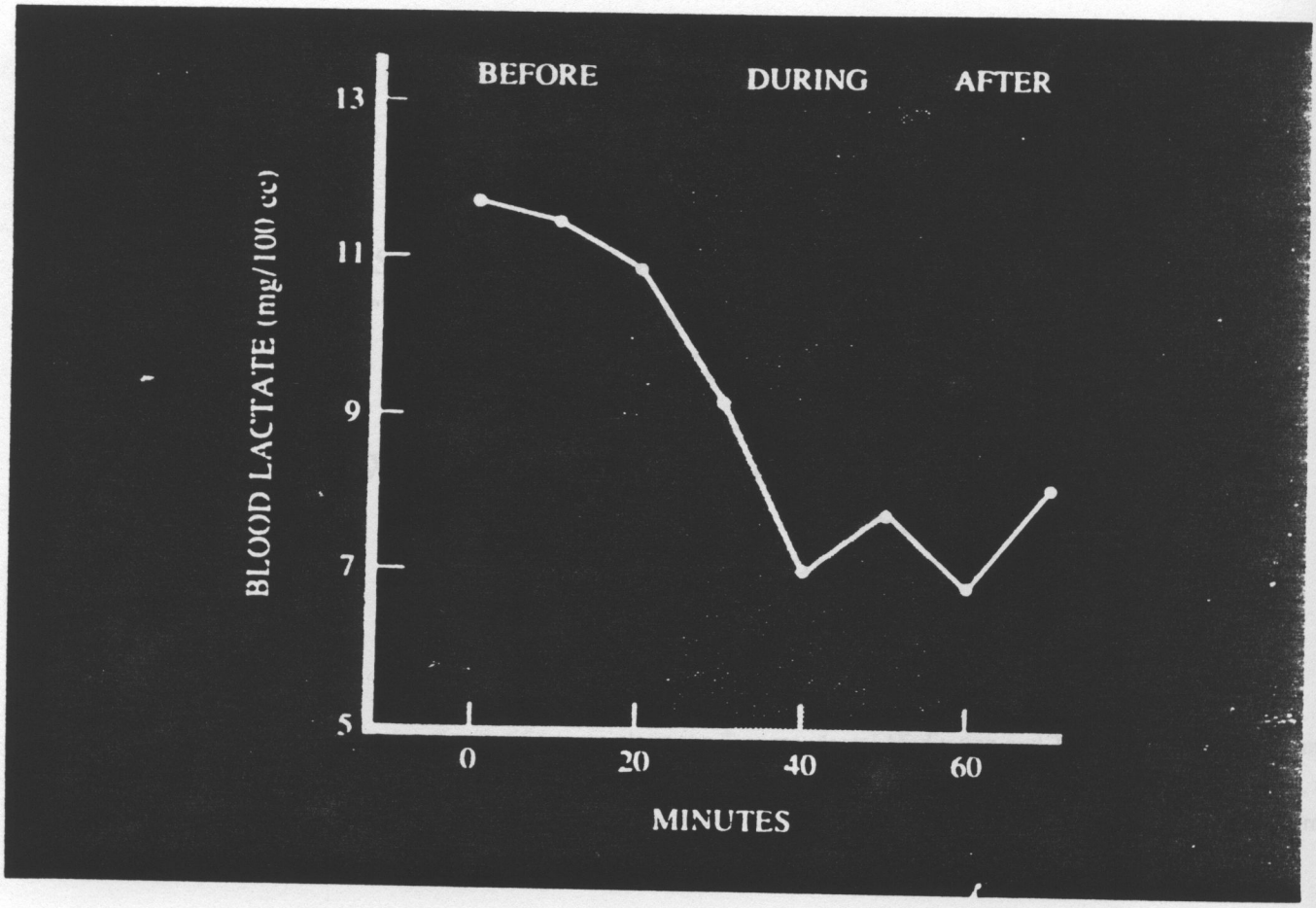


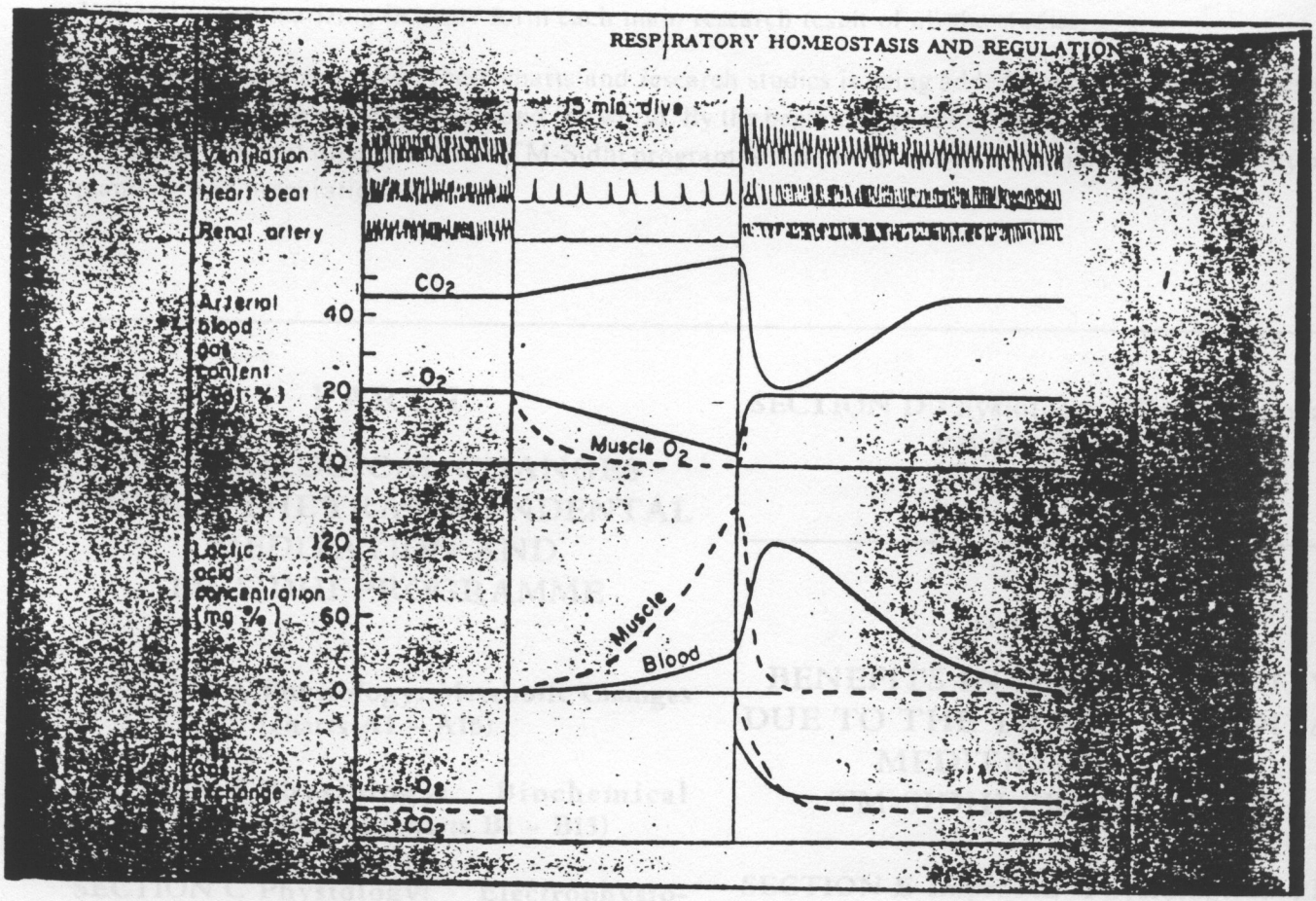
TABLE 1

CORRELATION MATRIX WITH SIGNIFICANCE LEVELS FOR CLARITY OF EXPERIENCE OF TRANSCENDENTAL CONSCIOUSNESS (TC), CREATIVITY (CR), COHERENCE (COH), AND H-REFLEX (PHR) VARIABLES.*

	PHR (N = 15)	CR (N = 23)	COH (N = 23)
CR	.53 $p < .05$		
COH	.60 $p < .02$	.71 $p < .001$	
TC	.65 $p < .01$	.50 $p < .02$	.43 $p < .05$

*See text for further description of these variables.


BEFORE
DURING
AFTER
BLOOD LACTATE (mg/100 cc)
13
11
9
7
5
0
20
40
60
MINUTES


RESPIRATORY HOMEOSTASIS AND REGULATION
15 min. dive
Ventilation
Heart beat
Renal artery
Arterial blood gas content (vol. %)
CO2
O2
40
20
Muscle O2
Lactic acid concentration (mg %)
120
60
0
Muscle
Blood
Gas exchange
O2
CO2

REFERENCES

SCIENTIFIC RESEARCH ON THE TRANSCENDENTAL MEDITATION AND TM-SIDHI PROGRAMME

TWO VOLUMES CONTAINING OVER 200 STUDIES AND COVERING FIFTEEN DISCIPLINES

An account of the results of scientific research on the Transcendental Meditation and TM-Sidhi programme can be found in *Scientific Research on the Transcendental Meditation Programme: Collected Papers*, Vol. I, 1976, and Vol. II, (in press), two 700-page volumes each containing over 100 research studies and published by MERU Press. The areas of research are listed below.

The chart numbers in each section refer to illustrated abstracts compiled by Maharishi European Research University, summarizing in chart form each main research result of all the studies.

The research summarized in these charts and research studies is being added to daily by intensive research activity in over 150 universities around the world. By the beginning of 1981, research projects undertaken on the Transcendental Meditation and TM-Sidhi programme totalled over 800, with many more currently in the planning and preparation stages.

PART I

PHYSIOLOGICAL CHANGES DURING THE TRANSCENDENTAL MEDITATION AND TM-SIDHI PROGRAMME

SECTION A Physiology: Metabolic Changes (charts A1 – A16)

SECTION B Physiology: Biochemical Changes (charts B1 – B13)

SECTION C Physiology: Electrophysiological Changes (charts C1 – C7)

SECTION D Physiology: Electroencephalographic (EEG) Changes (charts D1 – D21)

PART II

BENEFITS IN DAILY ACTIVITY DUE TO THE TRANSCENDENTAL MEDITATION AND TM-SIDHI PROGRAMME

SECTION E Improved Physiological Efficiency (charts E1 – E9)

PART I

PHYSIOLOGICAL CHANGES DURING THE TRANSCENDENTAL MEDITATION AND TM-SIDHI PROGRAMME

SECTION A

Physiology: Metabolic changes

CHART A1 **LEVELS OF REST**

FIRST REFERENCE: Robert Keith Wallace and Herbert Benson, 'The Physiology of Meditation', *Scientific American* 226, no. 2 (U.S.A.:1972): 84-90.
SECOND REFERENCE: Robert Keith Wallace, Herbert Benson, and Archie F. Wilson, 'A Wakeful Hypometabolic Physiologic State', *American Journal of Physiology* 221, no. 3 (U.S.A.: 1971): 795-799.

CHART A2 **LEVELS OF REST: A REPLICATION**

REFERENCE: Paul W. Corey, 'Airway Conductance and Oxygen Consumption Changes Associated with Practice of the Transcendental Meditation Technique' (University of Colorado Medical Center, Denver, Colorado, U.S.A., 1974). Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A3 **LEVELS OF REST: COMPARED TO CONTROL GROUP**

REFERENCE: V. Hubert Dhanaraj and Mohan Singh, 'Reduction in Metabolic Rate during the Practice of the Transcendental Meditation Technique', Paper presented at first Canadian Congress for Multidisciplinary Study of Sport and Physical Activity, Montreal, Quebec, Canada, October 1973. Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A4 **NATURAL CHANGE IN BREATH RATE**

REFERENCE: Robert Keith Wallace, 'The Physiological Effects of Transcendental Meditation: A Proposed Fourth Major State of Consciousness', Ph.D. Thesis, Department of Physiology, University of California, Los Angeles, California, U.S.A., 1970. Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A5 **NATURAL CHANGE IN BREATH RATE: A REPLICATION**

REFERENCE: Robert Bakker, 'Decreased Respiratory Rate during the Transcendental Meditation Technique: A Replication' (California State College, Sonoma, California, U.S.A., 1974). Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A6 **NATURAL CHANGE IN BREATH VOLUME**

REFERENCE: Paul W. Corey, 'Airway Conductance and Oxygen Consumption Changes Associated with Practice of the Transcendental Meditation Technique' (University of Colorado Medical Center, Denver, Colorado, U.S.A., 1974). Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A7 **REDUCED HEART RATE**

REFERENCE: Robert Keith Wallace, 'The Physiological Effects of Transcendental Meditation: A Proposed Fourth Major State of Consciousness', Ph.D. Thesis, Department of Physiology, University of California, Los Angeles, California, U.S.A., 1970. Published

in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A8 REDUCED HEART RATE: A REPLICATION

REFERENCE: V. Hubert Dhanaraj and Mohan Singh, 'Reduction in Metabolic Rate during the Practice of the Transcendental Meditation Technique'. Paper presented at first Canadian Congress for Multidisciplinary Study of Sport and Physical Activity, Montreal, Quebec, Canada, October 1973. Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A9 REDUCED HEART RATE: COMPARED TO CONTROL GROUP

REFERENCE: Paul W. Corey, 'Airway Conductance and Oxygen Consumption Changes Associated with Practice of the Transcendental Meditation Technique' (University of Colorado Medical Center, Denver, Colorado, U.S.A., 1974). Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*

CHART A10 INCREASED AUTONOMIC BALANCE

REFERENCE: V. L. Levander, Herbert Benson, R. C. Wheeler, and Robert Keith Wallace, 'Increased Forearm Blood Flow during a Wakeful Hypometabolic State', Federation Proceedings 31 (U.S.A.: 1972): 405.

CHART A11 SUSPENSION OF RESPIRATION: PERFECT REST IN THE STATE OF TRANSCENDENTAL CONSCIOUSNESS

FIRST REFERENCE: John T. Farrow, 'Physiological Changes Associated with Transcendental Consciousness: The State of Least Excitation of Consciousness'. Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers.*
SECOND REFERENCE: J. Russell Hebert, 'The Psychophysiology of Advanced Participants in the Transcendental Meditation Programme: Suspension of Respiration - A Replication', MERU Report 7605, Psychophysiology Laboratory, Maharishi European Research University, Weggis, Switzerland, 1976. *Additional reference –see appendix*

CHART A12 IMPROVED BRAIN BLOOD CIRCULATION: THE BASIS OF OPTIMIZING BRAIN FUNCTIONING

REFERENCE: Ronald Jevning and Archie F. Wilson, 'Behavioral Increase of Cerebral Blood Flow', *The Physiologist* 21 (1978): 60. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Colleted Papers* (in preparation).

CHART A13 INCREASED BIOCHEMICAL STABILITY AND EFFICIENCY

REFERENCE: Ronald Jevning and Archie F. Wilson, 'Altered Red Cell Metabolism in TM', *Psychophysiology* 14 (1977): 94. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART A14 PHYSIOLOGICAL INDICATIONS OF TRANSCENDENTAL CONSCIOUSNESS: DECREASED RESPIRATION AND HEART RATE

REFERENCE: Carl J. Severeide, 'Physiological and Phenomenological Aspects of Transcendental Meditation' (University of Trondheim, Norway, 1978). Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART A15 INCREASED EFFICIENCY OF THE HEART

FIRST REFERENCE: Debra Warshal and Joe W. Peterson, 'Change in Cardiac Output during Transcendental Meditation as Measured by Noninvasive Impedance Plethysmography' (University of Texas, Austin, Texas, U.S.A., 1980). Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).
SECOND REFERENCE: Ronald Jevning, Archie F. Wilson, William R. Smith, and Mortimer E. Morton, 'Redistribution of Blood Flow in Acute Hypometabolic Behavior', *American Journal of Physiology* 235 (U.S.A.: 1978): R89-R92. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART A16 INCREASED CARDIOVASCULAR EFFICIENCY: INDICATION OF GREATER LONGEVITY

REFERENCE: Ulrich Bauhofer, 'Cardiovascular Effects of the Transcendental Meditation Technique' (Julius-Maximilian University, Wuerzburg, West Germany, 1978). Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

SECTION B
Physiology: Biochemical Changes

CHART B1 BIOCHEMISTRY OF DEEP REST

FIRST REFERENCE: Robert Keith Wallace and Herbert Benson, 'The Physiology of Meditation', *Scientific American* 226, no. 2 (U.S.A.: 1972): 84-90.
SECOND REFERENCE: Robert Keith Wallace, Herbert Benson, and Archie F. Wilson, 'A Wakeful Hypometabolic Physiologic State', *American Journal of Physiology* 221, no. 3 (U.S.A.: 1971): 795-799.

CHART B2 BIOCHEMISTRY OF REDUCED STRESS

REFERENCE: R. Jevning, A. F. Wilson, J. VanderLaan, and S. Levine, 'Plasma Prolactin and Cortisol during Transcendental Meditation', *The Endocrine Society Program 57th Annual Meeting*, New York City, 18-20 June 1975, p. 257.

CHART B3 BIOCHEMICAL CORRELATES OF STATES OF CONSCIOUSNESS

REFERENCE: R. Jevning, A. F. Wilson, J. VanderLaan, and S. Levine, 'Plasma Prolactin and Cortisol during Transcendental Meditation', *The Endocrine Society Program 57th*

Annual Meeting. New York City, 18–20 June 1975, p. 257.

CHART B4 LONG-TERM NEUROCHEMICAL EFFECTS

REFERENCE: R. Jevning, A. F. Wilson, and W. R. Smith, 'Plasma Amino Acids during the Transcendental Meditation Technique: Comparison to Sleep', paper presented at a symposium of the International Association for the Psychophysiological Study of Sleep, Edinburgh, Scotland, July 1975 (University of California, Irvine, California, U.S.A.). Published in Volume I, *Scientific Research on the Transcendental Meditation Program: Collected Papers*.

CHART B5 INCREASED BIOCHEMICAL EFFICIENCY: REDUCED CORTISOL LEVEL

FIRST REFERENCE: Anthony J. W. Bevan, Peter M. Young, Maurice L. Wellby, Peter Nenadovic, and John A. Dickins, 'Endocrine Changes in Relaxation Procedures', paper presented at the August 1976 meeting of the Endocrine Society of Australia. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).
SECOND REFERENCE: Anthony J. W. Bevan, 'Endocrine Changes in Transcendental Meditation', paper presented at the 1978 Annual Scientific Meeting of the Australian Society for Medical Research. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).
THIRD REFERENCE: Anthony J. W. Bevan, Richard G. Symons, Clive G. Beng, and Maurice L. Wellby, 'Short-Term Endocrine Changes in Transcendental Meditation', paper presented at the 1979 Annual Meeting of the Endocrine Society of Australia. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART B6 INCREASED BIOCHEMICAL EFFICIENCY: REDUCTION IN SERUM GROWTH HORMONE

FIRST REFERENCE: Anthony J. W. Bevan, 'Endocrine Changes in Transcendental Meditation', paper presented at the 1978 Annual Scientific Meeting of the Australian Society for Medical Research. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).
SECOND REFERENCE: Anthony J. W. Bevan, Richard G. Symons, Clive G. Beng, and Maurice L. Wellby, 'Short-Term Endocrine Changes in Transcendental Meditation', paper presented at the 1979 Annual Meeting of the Endocrine Society of Australia. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART B7 INCREASED BIOCHEMICAL EFFICIENCY CHANGES IN THYROXINE (T4) AND TRI-IODOTHYRONINE (T3)

FIRST REFERENCE: Anthony J. W. Bevan, Peter M. Young, Maurice L. Wellby, Peter Nenadovic, and John A. Dickins, 'Endocrine Changes in Relaxation Procedures', paper presented at the August 1976 meeting of the Endocrine Society of Australia. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).
SECOND REFERENCE: Anthony J. W. Bevan, 'Endocrine Changes in Transcendental Meditation', paper presented at the 1978 Annual Scientific Meeting of the Australian Society for Medical Research. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART B8 BIOCHEMICAL INDICATIONS OF GREATER BALANCE, RELAXATION, AND FULFILMENT

REFERENCE: Michael Bujatti and Peter Riederer, 'Serotonin, Noradrenaline, and Dopamine Metabolites in the Transcendental Meditation Technique', *Journal of Neural Transmission* 39 (1976): 257–267. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART B9 BIOCHEMICAL INDICATIONS OF REDUCED STRESS AND IMPROVED RESISTANCE TO DISEASE: A REPLICATION

REFERENCE: Ronald Jevning, Archie F. Wilson, and Julian M. Davidson, 'Adrenocortical Activity during Meditation', *Hormones and Behavior* 10 (1978): 54–60. Published in Volume II, *Scientific Research on the Transcendental Meditation Program: Collected Papers* (in preparation).

CHART B10 INDICATIONS OF INCREASED PHYSIOLOGICAL FLEXIBILITY

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PART II

BENEFITS IN DAILY ACTIVITY DUE TO THE TRANSCENDENTAL MEDITATION AND TM-SIDHI PROGRAMME

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CHART G12 **EASIER, MORE NATURAL CHILD BIRTH—BETTER HEALTH FOR MOTHER AND CHILD**

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SECTION H

Improved Athletic Performance

CHART H1 **IMPROVED ATHLETIC PERFORMANCE: RUNNING SPEED**

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CHART N3 REHABILITATION OF PRISONERS: IMPROVED SOCIAL BEHAVIOUR

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CHART N7 REDUCTION IN MARIJUANA USE

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SECTION O

Sociology: Improved Quality of Life Through the Maharishi Effect

CHART O1 **INDICATIONS OF THE AGE OF ENLIGHTENMENT: THE MAHARISHI EFFECT**

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CHART O4 **THE MAHARISHI PRINCIPLE OF RECIPROCITY: EXTENSION OF THE MAHARISHI EFFECT**

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CHART O9 **INCREASED COHERENCE OF COLLECTIVE CONSCIOUSNESS AS INDICATED BY INCREASED EEG COHERENCE: SUPER RADIANCE EFFECT**

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CHART O12 **INDICATIONS OF THE AGE OF ENLIGHTENMENT—GROWTH OF AN IDEAL SOCIETY THROUGH THE MAHARISHI EFFECT: REDUCTION IN CRIME RATE IN MAJOR U.S. CITIES**

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CHART O13 **INDICATIONS OF THE AGE OF ENLIGHTENMENT: IMPROVED QUALITY OF LIFE AND INCREASED BALANCE IN NATURE THROUGH THE GROUP DYNAMICS OF CONSCIOUSNESS**

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CHART O14 **THE DAWN OF WORLD PEACE—DECREASE IN VIOLENCE AND SOCIAL DISORDER DUE TO GROUP PRACTICE OF THE TM-SIDHI PROGRAMME**

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CHARTS O15–O18 *see appendix*

SECTION P

Psychological and Physiological: Changes and Benefits in Daily Activity due to the TM-Sidhi Programme

CHART P1 **BRAIN WAVE COHERENCE IN COSMIC CONSCIOUSNESS**

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CHART P2 **EXPERIENCES OF THE TM-SIDHIS AND INCREASED BRAIN WAVE COHERENCE**

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CHART P3 **HIGH BRAIN WAVE COHERENCE, STABILIZED PURE AWARENESS, INCREASED CREATIVITY, AND EXPERIENCES OF THE TM-SIDHIS**

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CHART P4 **INCREASED EEG COHERENCE DURING THE PRACTICE OF THE FLYING TM-SIDHI**

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CHART P5 **HIGH EEG COHERENCE AND HEART RATE DURING AN EXPERIENCE OF LEVITATION**

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CHART P6 **COHERENCE CYCLES OF THE BRAIN DURING THE PRACTICE OF THE TM-SIDHIS**

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CHART P7 **ENHANCED HEARING ABILITY FROM PRACTICE OF THE TM-SIDHIS RESULTING FROM THE AGE OF ENLIGHTENMENT GOVERNOR TRAINING COURSE**

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CHART P8 **BROAD COMPREHENSION AND IMPROVED ABILITY TO FOCUS ATTENTION RESULTING FROM THE AGE OF ENLIGHTENMENT GOVERNOR TRAINING COURSE**

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CHART P9 **INCREASED VISUO-SPATIAL CREATIVITY RESULTING FROM THE AGE OF ENLIGHTENMENT GOVERNOR TRAINING COURSE**

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CHART P10 INCREASED INTELLIGENCE RESULTING FROM THE AGE OF ENLIGHTENMENT GOVERNOR TRAINING COURSE

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CHART P15 *see appendix*

APPENDIX

Additional Scientific Charts

CHART B14 BIOCHEMISTRY OF INCREASED INNER WAKEFULNESS DURING REST AND GROWTH OF INNER SILENCE DURING ACTIVITY

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CHART D22 CORRELATIONS AMONG FRONTAL EEG COHERENCE, H-REFLEX RECOVERY, AND CONCEPT LEARNING: HOLISTIC NEUROLOGICAL IMPROVEMENT

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