

TRANSDISCIPLINARITY IN BIO-MEDICINE, NEUROSCIENCE AND PSYCHIATRY: THE BIO-PSYCHO-SOCIAL MODEL

Sorin RIGA¹, Dan RIGA¹, Simona GEACĂR² and Aurel ARDELEAN³

¹ Department of Stress Research & Prophylaxis, "Al. Obregia" Clinical Hospital of Psychiatry, Bucharest, Romania

² Faculty of Psychology and Educational Sciences, University of Bucharest, Romania

³ "V. Goldis" Western University, Arad, Romania

Corresponding author: DAN RIGA, E-mail: D_S_Riga@yahoo.com

Accepted December 10, 2014

The concept is an universal manner of representation, and as idea it is the "witness" of reality. Treated according to a theory of definition, concepts are formal/as ideas, objective/in the sense of objects, hybrid/as structures and migratory/as dynamics. The concepts "substantiate" disciplinarity, and their nature "rebuilds" ① Disciplinarity/unity into → ② MultiDisciplinarity/diversity → ③ Inter-Disciplinarity/dynamics → until reaching ④ TransDisciplinarity/transcendence. The integrator of "spaces" among the four levels of evolution-restructuring is information. The purpose of transdisciplinarity is gnoseological/epistemological, heuristic and wholistic/integrative. Translational research → medicine → science ensures the dynamics of progress and civilization (translational continuum). The four TRANSCEND, USA programs of transdisciplinarity in medicine and neurosciences have included as reference in their database two advanced studies of the Drs. Riga team, published in 1994 and 2006. The human being and health/illness are "built into" transdisciplinarity: the bio-psycho-social model/structure which works in intra-multi-inter-trans-disciplinarity/causation. Chronologically and iatro-historically, the elaboration of the bio-psycho-social transdisciplinary model was conducted in medicine and science by three outstanding figures: Acad. Dr. Vladimir M. BEKHTEREV (1852–1927), Russia - precursor, Prof. Dr. Doc. Petre BRÂNZEI (1916–1985), Romania - founder and Prof. Dr. George L. ENGEL (1913–1999), USA - developer. The work objectively informs of the Romanian priority in the area through P. Brânzei, who chronologically holds international priority with 7 (seven) and 3 (three) years before G. L. Engel, USA, who only published his works beginning from 1977.

Key words: intra-multi-inter-trans-disciplinarity/causation, translational research → medicine → science, bio-psycho-social concept - model - constructiveness - psychiatry, V. M. Bekhterev-precursor, P. Brânzei-founder, G. L. Engel-developer.

THE DYNAMICS OF PROGRESS, SCIENCE AND CIVILIZATION

Concept – general **idea** which justly reflects reality; definition (DEX, ed. II, 1998) – is of Latin origin – absent in Greek. Starting from Plato's *Idea*, the *concept* is systematically and functionally "built" into *Idea* for Kant. The *concept* is an universal, mediated and inferential manner of representation of the rapport with the object of knowledge. Specific to knowledge (philosophical – scientific), the *concept* is different than the *idea*,

being the result of the *act of conception* or an *objective entity referring to something else* (other than itself – as the *idea*)²⁴.

In contemporary epistemology, the matter of *concepts* is treated according to a *theory of definition*, and currently has a genealogy of a *product of conception (design)*. Through semantic mobility, the concept opens up philosophy to culture, nature and technology⁸. There are **formal concepts** (on ideas side), **objective concepts** (in the sense of object), **hybrid concepts** (as structure) and **migratory concepts** (as dynamics)⁷.

Disciplines-disciplinarity-areas, namely the process of knowledge (as dynamics) and knowledge (as finality) are “built-grounded” on characteristics-properties, ideas-concepts, hypotheses-demonstrations, processes-phenomena, thought-logic, abstractization-generalization, rules-laws. The **nature of concepts** (formal, objective, hybrid and migratory) “rebuilds” **disciplinarity** into **multi→inter→trans→disciplinarity**.

The **evolution of the binomial** structure/substance ↔ function/energy from *Disciplinarity* (unity) → *MultiDisciplinarity* (diversity) → *Inter-Disciplinarity* (dynamics) → to *Trans-Disciplinarity* (transcendence) is the dynamics of progress, science and civilization. The relation integrator of/and the “spaces” of the four evolution levels (of complexity) is *information* (Fig. 1).

The **purpose of transdisciplinarity** is *gnoseological/epistemological* (theory of knowledge), *heuristic* (discovery of new knowledge) and *holistic/integrative* (the synthesis and unity of knowledge).

Transdisciplinarity defining results from three simultaneous postulates (fundamentals truths): levels of reality, the logic of the included third and complexity, which also determines the transdisciplinary research⁶.

The brain, man and life are **transdisciplinarity**, biomedicine, neurosciences, anthropology and ecology are **transdisciplinarity**, the general systems theory, the GAIA concept and the **bio-psycho-social** model are **transdisciplinarity**³.

Translational research → *medicine* (disciplinarity) → *science* ensures an accelerated and multiple progress in bio-medicine, neurosciences and psychology (health) – psychiatry (disorder).

Translating progress is achieved by *translational continuum*: basic science discovery → early translation → late translation → dissemination (*American Journal of Translational Research, Journal of Transnational Medicine, The Open Translational Medicine Journal, Science Translational Medicine, Clinical and Translational Science, Duke Translational Medicine Institute, Society for Clinical and Translational Science*).

In the current and global stages of sciences, the progress of knowledge enforces and is achieved through **transdisciplinarity**. New proof of this fact is the **TRANSCEND** Research Program - Institute: **Treatment Research And NeuroSCience Evaluation of Neurodevelopmental Disorders** (TRANSCEND is an acronym and highlights the transdisciplinary research in neurosciences).

© S.&D. Riga, 2014

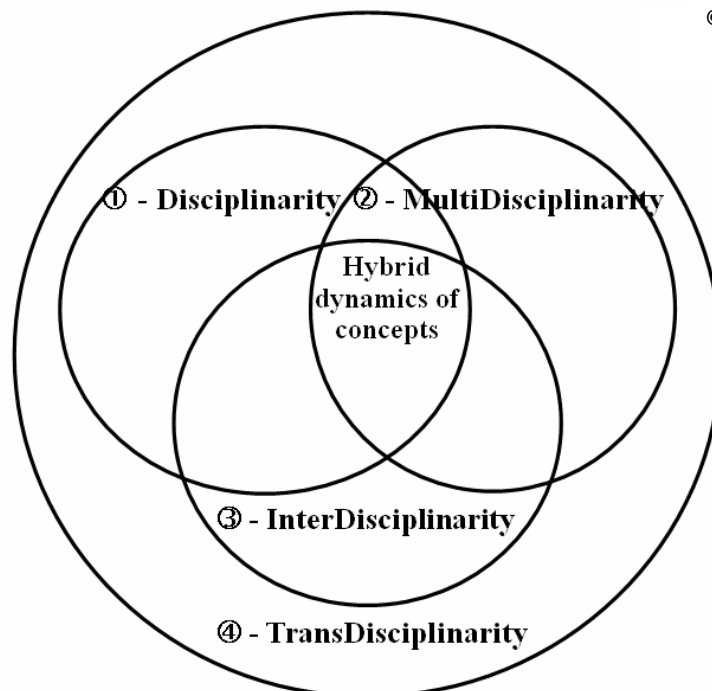


Figure 1. From hybrid dynamics of concepts to transdisciplinarity.

The TRANSCEND scientific resources (www.TranscendResearch.org, USA) are ensured by a consortium comprised of:

- Harvard Medical School, Boston, MA, USA;
- Massachusetts General Hospital;
- Center for Morphometric Analysis;
- Martions Center for Biomedical Imaging.

TRANSCEND - a multimodal multisystem brain research program (2009-2015) comprises:

- ① *A Whole Body Approach to Brain Health;*
- ② *Glial Cells - "The Other Brain" that the Neurons can't live without;*
- ③ *Autism Research;*
- ④ *Autism Revolution.*

The four American programs of integrated research into neurosciences and translational medicine have included as basic references in their research database two advanced studies from Romania – the Drs. Riga team, published in 1994 in *Archives of Gerontology and Geriatrics*¹⁰ and in 2006 in *Annals of the New York Academy of Science*¹².

HEALTH AND ILLNESS IN TRANSDISCIPLINARITY

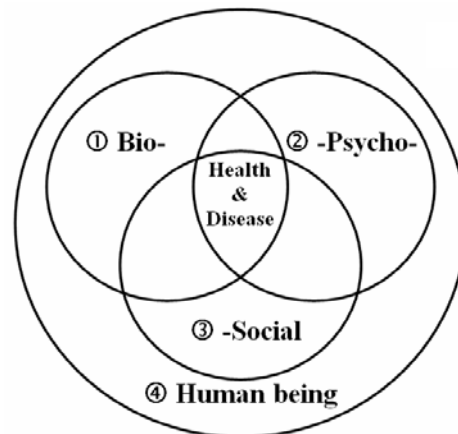
In Antiquity, oriental (Chinese, Indian, Persian) and European (Greek, Roman) medicine were built in a binomial manner of thinking (*mind-body*), which acts in society via the *mind-body-society* trinomial. The *mind ↔ body* interrelation is revealed in a sanogenetic synergy through the ancient adage: *Mens sana in corpore sano, Satyrae X (Book IV, Satyrae X, Line 356 - 10.356)*, Decimus Iunius Iuvenalis (c60 A.D. - c135 A.D.), Roman poet.

In contemporary times, on the other hand, the 1946 WHO definition of *health* (UK) / *Gesundheit* (DE) / *santé* (FR) / *salud* (ES) / *saúde* (PT) / *salute* (IT) / *sănătate* (RO) is a *state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity*. **Sanogenesis** (cause/dynamics/process) resulting in **health** (effect-consequence-finality/state) must become trivalent, in a positive direction (+): *physical, somatic, biological health + mental, psychic health + behavioral, social health*¹⁴. In the same fashion, **pathogenesis** (cause/ process) → illness, pathology, morbidity (effect/result) is also trivalent but in a negative direction (-)¹³.

The *transdisciplinary* perspective in defining, characterizing, analysis and elaboration of solutions in the antagonistic **health ↔ illness binomial** is the dynamic essence of scientific progress in bio-medicine⁹.

The progress made by global medicine in the past 150 years have brought about the need to approach health and illness in **transdisciplinarity**, as two antagonistic, opposed, polarized systems of the human being. Bearing in mind the practical, palpable, applicative needs, the **trivalent bio-psycho-social model** has been created and enforced: in diagnostic and therapy, as preventative⁴ and curative² medicine, for public health strategies¹⁵ and programs^{20, 21} (Fig. 2).

The bio-psycho-social model reveals its *structural* (space, static) and *functional* (time, dynamics) dimensions through *intra-/ multi-/ inter-/ and trans-causality* and determinism (Fig. 3).



© S.&D. Riga, 2014

Figure 2. The human being and health/illness “built” into a bio-psycho-social trivalent system.

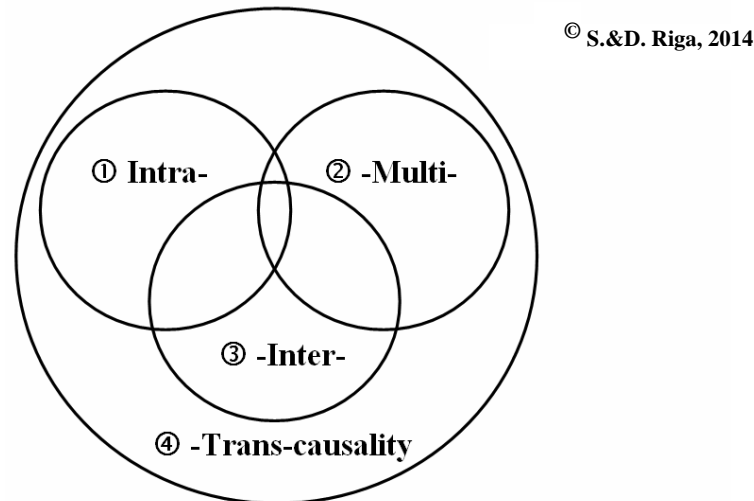


Figure 3. The construction of intra-, multi-, inter- and trans-causality in transdisciplinary phenomenology (logic).

The knowledge registered by transdisciplinarity on a scientific, cultural and philosophical level can be eloquently exemplified by the **bio-psycho-social transdisciplinary model**:

- it offers an integrative-systemic-holistic investigation and description of the human being in bio-medicine, in phylogenesis-ontogenesis-life cycles²²;
- it accomplishes a structural-spatial analysis of the functionality of man¹⁸;
- it allows a dynamic-temporal approach of both person, as well as the medical act¹¹;
- it pragmatically fulfills the purpose of personalized medicine (the medicine of the person, not of the disease)¹⁹;
- it reveals the transcendence in the anti-entropic (ectropic) organization-functioning, by modelling new properties in space and time¹⁷.

HISTORICAL SUBSTANTIATION OF THE BIO-PSYCHO-SOCIAL TRANSDISCIPLINARY MODEL

The historical truth objectively demonstrates in succession the contribution of 3 (three) valuable scientists in the substantiation (19th–20th century) of the *bio-psycho-social* model/concept of human being²³ (Fig. 4):

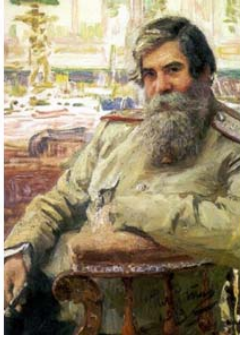
- Vladimir M. BEKHTEREV (1857–1927), Russia - precursor;
- Petre BRÂNZEI (1916–1985), Romania – founder;
- George L. ENGEL (1913–1999), USA – developer.

Acad. Dr. Vladimir Mikhailovich BEKHTEREV

Russian scientists (2005–2007) consider that the author/finder of the bio-psycho-social model is their compatriot V. M. BEKHTEREV – the founder of the *Psycho-Neurological Institute*, in St. Petersburg, Russia, 70 years before American G. L. Engel.

A scientist and visionary, an encyclopedist and pioneer in bio-medicine, V. M. Bekhterev is judged to be one of the founders of neuroscience: ... was an outstanding Russian neurologist, psychiatrist, psychologist, morphologist, physiologist, and public figure, who authored over 1000 scientific publications and speeches. At the beginning of the twentieth century, he created a new multidimensional multidisciplinary scientific branch - psychoneurology, which included the objective knowledge of the anatomy and physiology of the nervous system, psychology, psychiatry, neurology, philosophy, sociology, pedagogy, and other disciplines¹.

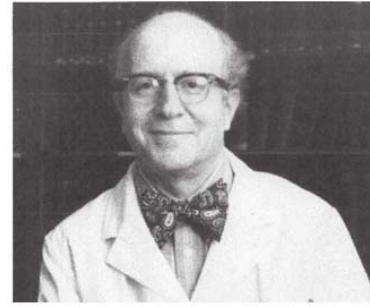
With his training, way of thinking, innovation and multidimensional excellence in the logic of hybrid concepts, through multi- and inter-disciplinarity he created in trans-disciplinarity the bio-psycho-social model: *Psychoneurology in V. M. Bekhterev's understanding has furthered the introduction into the idea of a "biosocial" essence of man of a third - psychological - component, thus having created a "biopsychosocial" model in the interpretation of human diseases*¹.



Vladimir
M. BEKHTEREV



Petre BRÂNZEI



George L. ENGEL

Figure 4. Founders of the bio-psycho-social model.

The paternity of the bio-psycho-social model is attributed to the Russian scientist by another study, published two years before, in 2005: *However, by the beginning of the twentieth century V. M. Bekhterev (1857–1927) had already created a concept of the study of an ill person and a well person, which Bekhterev called the “study of human nature”. The objective psychology and, subsequently, reflexology developed by Bekhterev provided the basis of the concept - and promoted the forming - of a biopsychosocial model of understanding of humans*⁵.

Prof. Dr. Doc. Petre BRÂNZEI

An eminent scientist and man of culture, teacher, doctor and public health organizer, a prominent figure in bio-medicine, a WHO/OMS expert on mental health, Petre BRÂNZEI established the *Modern School of Psychiatry* in Socola - Iași, thus attaining a broad European openness. He registered Romanian scientific firsts in world psychiatry: the *bio-psycho-social model* and the *ASFA neurometabolic nootrope*²³.

A paver of ways in neuroscience, he elaborates **as of 1968** an original, integrative-dynamic concept of human personality and etiopathogeny for psychic disorders, of the biological interference with the psychological and social, in a triple determinism – the **bio-psycho-social concept**¹⁶.

He is the first to publish the concept in European international journals written in *French*:

- **1970** – Brânzei, P., L'actualité nosologique dans la psychiatrie contemporaine. Critères pour une classification dynamique **bio-psycho-sociale** en psychiatrie, *Annales Médico-Psychologiques (Paris)*, vol. 1(4) din 1970, pp. 504–520, **1970**;

- **1974** – Brânzei, P., Quelques considérations sur la signification d'un **concept tridimensionnel** dans le développement de la psychiatrie contemporaine, *Annales Médico-Psychologiques (Paris)*, vol. 1(3) din 1974, pp. 341–355, **1974**;
- **1981** – Brânzei, P., Natansohn, I., Le constructivisme **tridimensionnel bio-psycho-sociale** de l'école de Socola dans la perspective de la psychiatrie contemporaine, *Acta Psychiatrica Belgica*, vol. 81, pp. 425–436, **1981**; and
- **1985** – Brânzei, P., Chiriță, V., Boișteanu, P., Le constructivisme **tridimensionnel bio-psycho-sociale** dans l'abord des conduites aberrantes, *Archives de l'Union Médicale Balkanique*, vol. 23, pp. 88–89, **1985**.

Also, the concept is defined in Romanian monographs and journals:

- **1975** – Brânzei, P., *Itinerar psihiatric [Psychiatric Itinerary]*, 372 pp., Ed. Junimea, Iași, RO, **1975**, published in Romanian, but with an ample abstract in 6 (six) languages: *Romanian, French, English, German, Russian, Italian*, three of these languages being international ones.

The book *Itinerar psihiatric* defines and develops the concept in the third part: *Relația bio-psiho-socială în terapia psihiatrică [The bio-psycho-social relation in psychiatric therapy]* (pp. 277–354) and in the sub-chapter: *Semnificația unui concept tridimensional în terapeutica psihiatrică [The meaning of a tridimensional concept in psychiatric therapeutics]* (pp. 346–354):
– *Through the tridimensional concept we can thus deduce in a vectorial manner the perspectives of an ecological-epidemiological psychiatric outlook structured on criteria which are nosologic,*

psychological and sociological at the same time, necessarily attuned to the programmatic politics of WHO regarding the safeguard of physical, mental and social health (p. 351);

– In conclusion, although mental health is not only a psychiatric reflection, it nonetheless primarily refers to the tendencies and the actions characteristic of the social side of a clinical tridimensional psychiatry, the contents of which constitute the key stone of the public health policy, psychic disorders expressing the focused concentration on the morbidity factors in general (p. 354);

– The psychiatric itinerary holds as a managing plan an original bio-psycho-social concept, dynamic and unitary at the same time, on psychic processes in normal and pathological conditions (p. 355).

- **1982** – Brânzei, P., Natansohn, I. N., Constructivismul **tridimensional bio-psiho-social** al școlii de la „Socola” în perspectiva psihiatriei contemporane [Tridimensional bio-psycho-social constructiveness of “Socola” school in the perspective of contemporary psychiatry], *Neurologia, Psihiatria, Neuro-chirurgia*, vol. 27, nr. 2, pp. 137–144, **1982** – with an abstract in 4 (four) languages: English, French, German, Russian.

The work chronologically and gnoseologically show the theoretic and practical priority of the bio-psycho-social concept-model-constructivism-psychiatry achieved by Petre BRÂNZEI (1968–1985):

– Many times, constructivism is associated with structuralism, bearing in mind that structuralism is also familiar with various orientations and trends. In reality, this belief is false, owing to the fact that both constructivism and structuralism have grown as a result of the triumph of the systemic approach in the development of science. In this respect, George L. Engel is right when claiming that the enforcement of the bio-psycho-social model instead of the bio-medical one is based on the systemic approach, its origins appearing in the works of Paul Weis and Ludwig von Bertalanffy, without however achieving identity with our simultaneously tridimensional, dynamic, constructivist and in the same time unitary concept (p. 140);

– As of this new qualitative moment in the interpretation of psychiatry, we moreover estimate on a sociological level “the double concomitant opening” between psychiatric services and society,

in view of protecting and promoting the mental health of the population through its own educational elevation regarding the medicine of the healthy man, a theory which from our constructivist perspective is not identical to the lagging option on preventative medicine of the bio-medical system (p. 141);

– With this interdisciplinary aim in mind, between 1968 and 1970, a special space which was named as such “The bio-psycho-social complex” was built within the “Socola” Hospital, a space which – in fact – conferred new dimensions to the complex activity of the “Socola” School. Also, under the aegis of the “Socola” school, the “Psycho-Social Service” was established in 1969, a psychiatric extra-hospital institution hiring specialists from various scientific areas and which elaborated, as a team, ample studies among the adult and young populations, activities recognized by specialists and scientific bodies in Europe and America (pp. 141–142).

The bio-psycho-social psychiatry – created, developed and applied by the “Socola” School of Psychiatry – Iași, including as a pilot EURO-WHO-Romania Base – was appreciated over time by reputed European specialists (from the UK, Belgium, Denmark, France, Germany, Italy, Norway, the Netherlands) and by Americans (from the US).

Prof. Dr. George Libman ENGEL

For the first time, American psychiatrist G. L. ENGEL published his bio-psycho-social model in journals such as *Science*, **1977** and *General Hospital Psychiatry*, **1979**, (23):

- **1977** – Engel, G. L., The need for a new medical model: a challenge for biomedicine, *Science*, vol. 196, no. 4286, pp. 129–136, **1977**;
- **1979** – Engel, G. L., The **biopsychosocial model** and the education of health professionals, *General Hospital Psychiatry*, vol. 1, pp. 156–165, **1979**;
- **1980** – Engel, G. L., The clinical application of the **biopsychosocial model**, *American Journal of Psychiatry*, vol. 137, no. 5, pp. 535–544, **1980**;
- **1981** – Engel, G. L., The clinical application of the **biopsychosocial model**, *Journal of Medicine and Philosophy*, vol. 6, no. 2, pp. 101–123, **1981**;

- **1983** – Engel, G. L., The **biopsychosocial model** and family medicine, *Journal of Family Practice*, vol. 16, no. 2, pp. 409, 412–413, **1983**;
- **1992** – Engel, G. L., Anniversaries – the **biopsychosocial** complementarity of keeping count and not keeping count, *Psychosomatic Medicine*, vol. 54, pp. 543–545, **1992**;
– Engel, G. L., How much longer must medicine’s science be bound by a seventeenth century world view?, *Psychotherapy and Psychosomatics*, vol. 57, nos. 1–2, pp. 3–16, **1992**;
- **1997** – Engel, G. L., From biomedical to **biopsychosocial**. 1. Being scientific in the human domain, *Psychotherapy and Psychosomatics*, vol. 66, no. 2, pp. 57–62, **1997**;
- **1997** – Engel, G. L., From biomedical to **biopsychosocial**. Being scientific in the human domain, *Psychosomatics*, vol. 38, no. 6, pp. 521–528, **1997**.

The chronological iatro-historical evidence unequivocally demonstrates the paternity of P. Brânzei as founder of the bio-psycho-social model (and psychiatry-medicine): he published in 1970 (which is 7 years before) and in 1974 (which is 3 years before) the 2 (two) works on the bio-psycho-social concept-constructivism-psychiatry in *Annales Médico-Psychologiques (Paris)*¹⁶.

However, *NationMaster - Encyclopedia* (Online Encyclopedia) presents the *biopsychosocial model* in the section of the term *Biopsychosocial*:

– with the following note – *The model was proposed by psychiatrist George Engel in a 1977 article in Science*,

– and at *References* it writes – *Engel, George L., The need for a new medical model, Science, 196: 129–136, 1977. PMID 847460.*

The international promotion¹⁶ of the Engel model and the establishment of American priority in the specialty literature was conducted through a massive citation of the *Engel – biopsychosocial model binomial*:

– the work published in *Science*, 196(4286): 129–136, 1977, cited almost 1900 times over the years; and

– the article published in *American Journal of Psychiatry*, 137: 535–544, 1980 was cited dozens of times in international journals.

The American system-procedure of multiple promotion of the work of *Prof. Dr. George L. Engel* is impressive:

- during his lifetime (1977–1999) –
 - individual (G. L. Engel), as well as collective (students, collaborators, disciples and foreign authors) promotion of his biopsychosocial model through new scientific works, through associations, developments, reports on new perspectives of this model, published in English in a multitude of American/international medical journals;
- after his death (1999 – continuously, including at this time) – the promotion of his figure and works is achieved through various ways:
 - his descendants (the son – dr. Peter A. Engel, together with his wife dr. Anna G. Engel) in works published in international journals;
 - colleagues, collaborators, students and other researchers and doctors: for example T. N. Wise – 2001, A. S. Dowling – 2005, G. A. Fava – 2008 etc.;
 - the institution where he conducted his scientific activity – University of Rochester Medical Center, Rochester, NY, USA;
 - annual conferences/lectures under the eponym of “George L. Engel”, of the same university, for instance Cohen, J., John Romano and George Engel: two lives, one vision for medical education, *7th Annual George L. Engel Memorial Lecture, Alumni Weekend 2008*, University of Rochester, School of Medicine and Dentistry, Rochester, NY, Sept. 25–27, 2008.
 - Dowling, A. S., Images in psychiatry: George Engel, M. D. (1913–1999), *American Journal of Psychiatry*, vol. 162, no. 11, p. 2039, 2005.
 - Engel, P. A., George L. Engel, M. D., 1913–1999: remembering his life and work; rediscovering his soul, *Psychosomatics*, vol. 42, no. 2, pp. 94–99, 2001.
 - Engel, P. A., Engel, A.G., George L. Engel 1913–1999: remembering his life and work; strengthening a father-son bond in a new time of grief, *Australian and New Zealand Journal of Psychiatry*, vol. 36, no. 4, pp. 443–448, 2002.
 - University of Rochester Medical Center, Papers of George Libman Engel,

http://www.urmc.rochester.edu/hslt/miner/historical_services/archives/Faculty/PapersofGeorgeLibmanEngel.cfm. Retrieved on 03.07.2008.

The formal, but *de facto* loss by P. Brânzei, Romania of the paternity of his work was favored by the advantages of G. L. Engel, USA:

– he published in American English written journals (a different impact);

– Engel lived for 86 years/as opposed to the 69 years of Brânzei, and died 14 years later/compared to Brânzei;

– Engel benefited and is still benefiting from a multiple and permanent cultural marketing system for promoting his medical and scientific work, while Brânzei has almost been forgotten by his own country.

REFERENCES

1. Akimenko M. A., Vladimir Mikhailovich Bekhterev, *Journal of the History of the Neuro- sciences*, 16(1–2): 100–109, 2007.
2. Fahy G. M., West M. D., Coles L. S., Harris S. B. (Eds.), *The Future of Aging. Pathways to Human Life Extension*, Springer, Dordrecht, NL, 2010.
3. Hirsch Hadoorn G., Hoffmann-Riem H., Biber-Klemm S., Grossenbacher-Mansuy W., Joye D., Pohl C., Wiesmann U., Zemp E. (Eds.), *Handbook of Transdisciplinarity Research*, Springer, 2008.
4. Mateescu R., *Bazele fiziologice ale gerontoprofilaxiei*, Ed. Helicon, Timișoara, RO, 1996.
5. Neznanov N. G., Akimenko, M. A., Development of a biopsychosocial concept of disease at the V. M. Bekhterev Institute in the twentieth century, *International Journal of Mental Health*, 34(4): 4-10, 2005.
6. Nicolescu B. (Ed.), *Transdisciplinarity - Theory and Practice*, Hampton Press, Cresskill, NJ, 2008.
7. Northoff G., *Philosophy of the Brain*, J. Benjamins Publ., Amsterdam, NL, 2004.
8. Riga S., Riga D., The methodology of time research in biology, 5th International Congress of Logic, Methodology and Philosophy of Science, London (Ontario), Canada, Aug. 27 - Sep. 2, 1975, Volume of Proceedings, Section VIII: Foundations of Biology, pp. 31-32, 1975.
9. Riga D., Riga S., Mărirea vitalității creierului, factor în promovarea stării de sănătate mintală. *Buletinul Academiei de Științe Medicale*, 3: 421-431, 1979.
10. Riga D., Riga S., Antagonic-Stress®: a therapeutic composition for deceleration of aging. II. Brain lipofuscinolytic activity demonstrated by electron microscopy, *Archives of Gerontology and Geriatrics*, 19(S 1): 227-234, 1994.
11. Riga D., Riga S., Hălălău F., Schneider F., Neuro-glial mechanisms in brain protection, aging deceleration and neuro-psycho-longevity, pp. 223-236. In R. Klatz, R. Goldman (Eds.), *Anti-Aging Therapeutics*, Vol. 8, American Academy of Anti-Aging Medicine, Chicago, IL, 2006.
12. Riga S., Riga D., Schneider F., Hălălău F., Processing, lysis and elimination of brain lipopigments in rejuvenation therapies, pp. 383-387. In: S. Rattan, P. Kristensen, B. F. C. Clark (Eds.), *Understanding and Modulating Aging*, (Annals of the New York Academy of Sciences, Vol. 1067), New York Academy of Sciences, New York, NY, 2006.
13. Riga D., Riga S., *Anti-Aging Medicine and Longevity Sciences (Romanian lang.)*, Cartea Universitara Publ., Bucharest, RO., 2007.
14. Riga S., Riga D., *Stressology, Adaptology and Mental Health (Romanian lang.)*, Cartea Universitara Publ., Bucharest, RO., 2008.
15. Riga D., Riga S., Moș L., Motoc D., Schneider F., Prolongevity life styles. Importance of physical activity and sport, *Palestrica of the 3rd Millennium - Civilization and Sport*, 10: 138-144, 2009.
16. Riga D., Riga S., Restituția Petre Brânzei - fondatorul conceptului bio-psiho-social, pp. 123-154. In: G. Cornuțiu (Ed.), *Orientări și perspective în gândirea psihiatrică românească actuală*, Ed. Universității din Oradea, Oradea, RO, 2009.
17. Riga S., Riga D., Mihăilescu A., Motoc D., Moș L., Schneider F., Longevity health sciences and mental health as future medicine, pp. 184-187. In: R. M. Tanguay (Ed.), *Aging, Cancer, and Age-Related Diseases. Common Mechanisms?* (Ann. New York Acad. Sci., vol. 1197), Wiley-Blackwell-New York Academy of Sciences, Boston, MA, 2010.
18. Riga D., Riga S., Construcția sănătății și medicina omului sănătos, *Revista Medicală Română*, 57(4): 223-229, 2010.
19. Riga D., Riga S., Medicina stresului - necesitate a prezentului, Cap. 6, pp. 141-174. In: J. Vincze (Ed.), *Biofizica Medicală (Biofizica, Vol. 38)*, Editura NDP, Budapesta, HU, 2011.
20. Riga D., Riga S., The Science of Ageing - Global Progress, *Rejuvenation Research*, 14(5): 573-577, 2011.
21. Riga D., Riga S., Motoc D., Geacăr S., Ionescu T., Health-longevity medicine in the global world, Ch. 17, pp. 347-366. In: J. Maddock (Ed.), *Public Health - Methodology, Environ-mental and System Issues*, InTech - Open Access Publ., Rijeka, Croația and Shanghai, China, 2012.
22. Riga S., Riga D., Motoc D., Geacăr S., Ionescu T., Medicina sănătății-longevității - fundament în sănătatea mintală, pp. 7-24, 25-75. In: G. Cornuțiu, D. Marinescu (Eds.), *Orientări și perspective în gândirea psihiatrică românească actuală*, Ed. Universității din Oradea, Oradea, RO, 2013.
23. Riga S., Riga D., Repere în cercetarea științifică psihiatrică românească, pp. 356-427. In: G. Cornuțiu (Ed.), *Capitole de istorie a psihiatriei românești*, Ed. Universității din Oradea, Oradea, RO, 2013.
24. Weitz M., *Theories of Concepts: A History of the Major Philosophical Tradition*, Routledge, London, UK, 1988.