THE POLISH
CHRISTIAN PHILOSOPHY
IN THE 20TH CENTURY

Piotr Lenartowicz

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Piotr Lenartowicz

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THE POLISH CHRISTIAN PHILOSOPHY IN THE 20TH CENTURY

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Piotr Lenartowicz

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1.

Biography

The beginnings of the research

Piotr Lenartowicz, the son of Wiesław and Krystyna née Schneider, was born on the 25th of August 1934 in Warsaw. He passed his school leaving certificate examinations in 1951, completing his education at the Jan Sobieski Secondary School in Krakow. A year later he started medical studies at the Medical Faculty of the Medical Academy of Warsaw, which he completed in 1958 and was awarded with a diploma in medicine.

In conversation with Prof. Zbigniew Wróblewski he would honestly admit that his choice of medical degree was one taken through a process of elimination. For he was neither taken by humanistic nor technical fields of study, and given that there were so many doctors in his family he decided to pursue a career in medicine.[1]

Even though his decision to take up medicine as a degree was not particularly motivated by any calling in this direction or an affiliation for medicine as a career—as we shall become convinced—that this decision was to have a huge impact on his academic-philosophical undertakings. While in his second year, Lenartowicz signed up for the "physiologists circle." And it was there he was to be noticed by Prof. Franciszek Czubalski, the eminent doctor and physiologist, who

[1] Cf. Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," in *Vivere & Intelligere. Wybrane prace Piotra Lenartowicza SJ wydane z okazji 75-lecia Jego urodzin*, ed. J. Koszteyn (Kraków: Wyższa Szkoła Filozoficzno-Pedagogiczna "Ignatianum", Wydawnictwo WAM, 2009), p. 26.

having perceived in Lenartowicz the makings of a good experimenter and scientist employed him in 1956 at the Department of Human Physiology, which he headed at the Medical Academy of Warsaw. The post was that of assistant lecturer and later, upon completing his medical degree, he proposed he do a PhD at the Department of Human Physiology, Polish Academy of Sciences in Warsaw and that he also applied for a scholarship grant. There also, under the guidance of Prof. Czubalski, Lenartowicz was to prepare his thesis entitled *The influence of ammonium salts on electrocorticogram and the cortical potentials indirectly evoked*,[2] on the basis of which he was to be awarded in 1961 the degree of PhD at the Medical Faculty of the Medical Academy of Warsaw.[3]

The almost ten-year contact with both Departments of Physiology allowed Lenartowicz to become acquainted with the methods and methodology of natural research. He quickly became aware, however, of how the extremely important precision and technical perfection for experimental research was bought at the price of a fragmentary and partial look at a living organism, while the results of research obtained recalled the "pieces of some jigsaw puzzle or other," which someone had forgotten about or had simply been unable to complete into a coherent and finished image.[4]

His entrance into the Society of Jesus

While studying at the Medical Academy of Warsaw, the idea of entering the Society of Jesus started to take shape in Lenartowicz's mind. After his fourth year he approached the then Provincial Superior Stanisław Wawryn SJ, who was of the view that he first should complete his medical degree. And so Lenartowicz finished his medical

[2] The work was published as: P. Lenartowicz, "Wpływ soli amonowych na elektrokortiogram i korowe potencjały bezpośrednio wywołane," *Acta Physiologica Polonica* no. 7 (1961), pp. 365–380.

[3] About Piotr Lenartowicz, as one of Professor Czubalski's post-war students, information may be found in the extensive work: A. Trzebski and E. Szczepańska-Sadowska, "Katedra i Zakład Fizjologii Doświadczalnej i Klinicznej," in *Dzieje I Wydziału Lekarskiego Akademii Medycznej w Warszawie (1809–2006)*, vol. 3, ed. M. Krawczyk (Lublin: Wydawnictwo Czelej, 2009), p. 896.

[4] Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," pp. 26–28.

degree and with his medical diploma once again met with the Provincial Superior. Yet on learning that this "freshly graduated" young man had been offered the chance of doing a PhD and had been awarded special grant by the Polish Academy of Sciences he was of the view that such an opportunity could not be passed by. "As a result of that—as Lenartowicz was to recall—I remained and within the course of two years, having murdered about ninety cats, I did my PhD."[5]

After having submitted his PhD thesis to the dean's office of the Medical Faculty of the Medical Academy of Warsaw (yet prior to the actual defence), he, on the 1st of November, entered the Society of Jesus and commenced a two-year novitiate in Kalisz.[6]

So why did he choose to enter the Society of Jesus? Well, Lenartowicz had listened with great interest to his father's (Wiesław's) accounts of an almost 5-year stay in Stalag XVII B in Krems an der Donau in north-eastern Austria. From 1940 onwards the camp had started to receive French and Belgian prisoners-of-war, amongst whom were many Jesuits. Their knowledge, culture and piety were to make a great impression on Wiesław Lenartowicz. He became friendly with one of the Belgian Jesuits—Richard de Smet, who was a seminarian at the time. This friendship was to last the years of captivity and Father de Smet, who was to become after the war an eminent Indologian of world standing, was to visit the Lenartowicz family several times either while on his way to or returning from India.[7]

These wartime reminiscences of his father together with the talks he had had with Father de Smet during his short visits to Warsaw were to arouse in Lenartowicz an immense interest in the Society of Jesus, in which not only was knowledge valued but rather the constant and relentless requirement to deepen it and to submit oneself to constant philosophical and theological reflection. So when there arose in him a calling to take the cloth, the choice of order was an obvious one.

In entering the Society of Jesus, Lenartowicz already had a definite outline of how he would function in the order. For he was well

[5] Ibidem, p. 27.

[6] When news came to Kalisz about the date of his doctorial thesis defence, Lenartowicz obtained a two-day pass to travel to Warsaw.

[7] Cf. W. Lenartowicz, *Wspomnienia szwoleżera*, ed. P. Lenartowicz (Kraków: Wydawnictwo WAM, 2005), pp. 92–93 as well as the caption for photo XXIV.

aware that the achievements of the biological sciences had a fundamental influence on moral-ethical attitudes, the hierarchy of values and man's outlook on the world in general. That they reflected themselves more or less audibly not only in the concepts broached by philosophers of living nature, sociologists and psychologists, but also in the decisions taken by legislators and constitutionalists. And this finds its reflection in the lives of individuals and society as a whole. Lenartowicz was conscious of how important it was to have a correct understanding of biological research and their correct interpretation. He wanted to deepen this understanding within the order and this understanding he wished to share with others.

Philosophical studies: PhD, postdoctoral degree, professorship

After completing his two-year novitiate in Kalisz, Lenartowicz began to study at the Society of Jesus' Faculty of Philosophy in Krakow (1962–1965) obtaining the canonical degree of BPhil, equivalent to the Polish tertiary education degree level of *magisterium*.

At this time the hard core of the three-year degree program were six subjects, two subjects a year: epistemology and ontology (1st year), the philosophy of life (known as rational psychology) as well as the philosophy of inanimate nature (2nd year), and finally ethics and theodicy (3rd year). During this degree program Lenartowicz came to the conclusion that the philosopher of nature should first and foremost involve themselves in the search for, and testing of natural wholes. With total clarity he perceived that what he had been doing once in the Department of Physiology "had been playing with parts, completely beyond the whole, not considering or evaluating that very whole, or considering the whole to only a small degree."[8]

From 1965 to 1969 Lenartowicz studied at the Bobolanum Theological Faculty in Warsaw where he was also awarded a degree. After three years of theological studies he was ordained priest by Cardinal Stefan Wyszyński on the 17th of June 1968 in Warsaw.

In 1971 Lenartowicz started his PhD degree program at the Gregorian University in Rome. Much suggests that in travelling to Rome

[8] Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," p. 31.

he had not yet decided on the subject of his PhD. What he did know was that he had to write an article on the subject of man's origins, an article promised Father Roman Darowski SJ. He started therefore "to wade into the subject literature of human evolution and instead of writing a PhD thesis, for a year and half or so" he wrote that article.[9] And so the interest in paleoanthropology was to germinate within Lenartowicz that was to accompany him to the end of his professional life.

His stay in Rome was to be interrupted by a trip to London, where Lenartowicz was delegated as a chaplain at Westminster Cathedral (1972–1973). He also found time to participate in the seminars run at the time at Oxford University by Prof. Horace Romano (Rom) Harré, the eminent British philosopher. In addition he was to spend every available minute in the library of the Natural History Museum, making notes and microfilms of thousands of pages of literature connected mainly with the biology of development and animal adaptation to environment. These questions considered within the context of genotypes and phenotypes were to not only become the background for his PhD but were to constitute the foundation for the philosophy of animate nature he conducted.

Following his return to Rome, Lenartowicz wrote–under the tutorage of Prof. Jerzy Szaszkiewicz SJ—a doctoral thesis entitled *Phenotype-genotype dichotomy*[10] and on the basis of this he was to obtain the degree of PhD at the Gregorian University in 1975.

The reflections contained in *Phenotype-genotype dichotomy* concerning the concept of genome, phenotype, adaptation, the cycle of life were developed by Lenartowicz and fine tuned in *Elements of the philosophy of the biological phenomenon*.[11] He was to awarded the postdoctoral academic degree in 1985 at the Faculty of Philosophy of the Pontifical Academy of Theology in Krakow.

In 1991 the Great Chancellor of the Faculty, the Superior General Peter Hans Kolvenbach SJ nominated Lenartowicz to the position of

[9] Ibidem, p. 34. The article mentioned by Lenartowicz was published in 1972. Cf. P. Lenartowicz, "O wczesnych stadiach ewolucji człowiekowatych," in *Człowiek i świat. Szkice filozoficzne*, ed. R. Darowski (Kraków: Wydawnictwo WAM, 1972), pp. 160–213.

[10] P. Lenartowicz, *Phenotype-genotype dichotomy: An essay in theoretical biology* (Roma: Pontificia Università Gregoriana, 1975).

[11] P. Lenartowicz, *Elementy filozofii zjawiska biologicznego* (Kraków: Wydawnictwo WAM, 1986).

professor at the Faculty of Philosophy of the Society of Jesus in Krakow, and in 1999 at Belweder, the presidential palace in Warsaw, he was made a full professor.

An extremely busy man

The time between return from Rome and the acquiring of subsequent academic degrees was spent on not only intensive academic work but also teaching. As a lecturer he was first connected with the Society of Jesus' Faculty of Philosophy in Krakow (now the Jesuit University Ignatianum in Krakow). From 1976 he lectured there on the philosophy of animate nature, and from 1990 equally on the theory of cognition. From 1995 to 2010 he headed the Ignatianum's Department of the Philosophy of Animate Nature, and from 2002 to 2004 he was vice-rector of the Higher School of Philosophy and Education "Ignatianum" in Krakow.

He also lectured at the Higher Seminary of the Order of Friars Minor Capuchin in Krakow (1991–2008), at the Faculty of Philosophy of the Pontifical Academy of Theology in Krakow (1993–2003) and at the Philosophy Faculty of Colorado State University at Fort Collins (1986–1987).

Additionally, he headed the Academic Association of Jesuit Priests in Krakow from 1995 to 2001. From 1982 to 1990 he participated in seminars organised by John Paul II at Castel Gandolfo entitled "Science—Religion—History" (together with Prof. Jerzy A. Janik he edited four volumes of materials from these seminars). He participated in European congresses of Jesuits dealing with research into the field of the natural sciences (Aix-en-Provence 1989, Barcelona 1991, Gdynia 1993) as well as in similar meetings of Jesuits lecturing in philosophy (Zagreb 1995, Krakow 1998). He took part in numerous conferences on matters philosophical and was invited to lecture by an array of academic institutions both in Poland and abroad (Austria, Slovakia, USA).

Father Piotr Lenartowicz SJ worked almost to the very end. Despite having cancer he continued to teach at Ignatianum to the end of the 2011/2012 academic year. He was still active as a tutor at the PhD defense of one of his students in July 2012. He died on the 10th of October 2012.

Academic interests

Lenartowicz's academic interests were concentrated around the philosophy of animate nature, paleoanthropology, as well as the theory of cognition; areas that found their reflection in the numerous academic articles he produced as well as in the three extensive monographs he wrote: *Elementy filozofii zjawiska biologicznego* [Elements of the philosophy of biological phenomenon],[12] *Ludy czy małpoludy. Problem genealogii człowieka* [People or manapes: Problem of human genealogy][13] and *Elementy teorii poznania* [Elements of epistemology].[14]

Undoubtedly it was the philosophy of animate nature that was the main area of his interests. In his opinion philosophers' research and inquiry should be conducted within the context of ontogenetic life cycles linked together in a generational line. The foundation of a life cycle which in an non-arbitrary way concerns the said "border" of the "minimal biological whole," is immanent developmental dynamics, that is the integrated construct of different correlated body structures which condition the overlapping of varied biochemical, physiological and behavioural processes.

Lenartowicz's second area of interest—equally important and *de facto* contained within the philosophy of animate nature—was paleoanthropology and the investigation into the origin of man connected with it. He attempted in the works written to identify those elements of our notions on early hominids that are well documented and to separate them from elements based on *a priori* assumptions. In analysing the results of paleoanthropological research as well as following discussions on the taxonomic status of prehistoric hominids, he came to the conclusion that there is a high possibility that various forms of hominids were not separate species but rather ancient ecotypes of *Homo sapiens*.

The experience obtained as a result of his empirical-philosophical works was to significantly affect his epistemological views. He was

[12] Ibidem.

[13] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka* (Kraków: Wyższa Szkoła Filozoficzno-Pedagogiczna "Ignatianum", 2010).

[14] P. Lenartowicz, *Elementy teorii poznania* (Kraków: Wydawnictwo WAM, Akademia Ignatianum, 2014).

an opponent of all forms of Representationalism (Epistemological Dualism) and a clear adherent of Presentationalism that is the conviction that we truly can know phenomena and objects situated within our surroundings. Sensual-intellectual understanding—particularly of man alone—lies at the basis of our aspirations to search for and reveal truths, to understand the deepest reasons for the phenomena and things with which the human consciousness comes into contact. He characterised it as "cognitive optimism," that is the conviction that we are able—as equally in our daily lives as in the natural sciences—to gradually acquire reliable knowledge on the subject of reality. Admittedly we commit mistakes, become misled. But we are able to discover these errors and eradicate them. The revealing of a mistake is no "coffin nail" for human cognition—quite the opposite, in fact, for it constitutes man's cognitive triumph.

2.

The character of the epoch

The main features of philosophy of the second half of the 20th century

Piotr Lenartowicz's philosophical work was to fall within the second half of the 20th century, a period which may be characterized by the use of several general formulations. Firstly, this is a period in which the center of philosophical thought moves from Europe to the United States. In as far as in the first half of the 20th century new currents and philosophical trends—such as Phenomenology, Neo-positivism, Existentialism or Structuralism, were to arise on the Old Continent and from there were to radiate out to the world, then the second half of the century equally significant or even more significant turned out to be concepts devised on the other side of the Atlantic—particularly Pragmatism and Neo-pragmatism combined with the philosophy of Ludwig Wittgenstein and Neo-positivism.

Secondly, the second half of the 20th century is the period of the strongest naturalization of philosophy. By naturalization it follows to understand the metaphilosophical trend involving the subordination of philosophical research—both in terms of content as method, to research from the natural sciences broadly understood. This results in a situation in which philosophy becomes to a certain degree the servant of science. One needs to look for the sources of progressive naturalization in the successes within the natural sciences themselves (particularly biology), in the disappointments with the great philosophical projects (e.g., transcendental philosophy), in the changes

within the system of teaching as well as in movement towards what Daniel Bell has termed post-industrial society.

Thirdly, the philosophy of the second half of the 20th century started to be dominated by the philosophy of language (hermeneutics inspired by neo-positivist logical analysis, linguistic philosophy, and the philosophy of colloquial language). This was to mold philosophical questions in such a way that often reference is made to a "linguistic turn," the effect of which—as has been suggested by Michael Dummett after Gottlob Frege—was the understanding that the deliberation of every philosophical problem should lead to a question about a problem from the field of language.

Fourthly, in the second half of the 20th century and particularly at its end there increasingly appeared ideas as to the limit of philosophy. In opposition to the beginning of the century when new currents such as Phenomenology, Neo-positivism, and analytical philosophy arose, the second half of the century was characterized by its own type of ideological satiety, fatigue, and philosophical mannerism. This is the most clearly visible in Post-Modernism, both in its continental version (represented by Jean-François Lyotard, Jacques Derrida, Gilles Deleuze or Jean Baudrillard), as equally the American, the best known representative of which being Richard Rorty. Postmodernism is sometimes defined as the philosophy of the period of exhaustion or—using the terminology of Nietzsche—as the relativistic eclecticism of the epoch of "the last people." Fundamental philosophical, theological and existential questions were replaced within it by a free discussion on style, form and private pleasures. In this respect Postmodernism declared itself to be an anti-Enlightenment or post-Enlightenment philosophy: however, from the present-day perspective it can be seen that contrary to declarations it was just a subsequent typical Enlightenment project in which philosophy and ideology were to have become the instrument for social change. It was the subsequent mutation of Enlightenment eschatology created this time not by revolutionaries but by sybarites.

Epistemological questions

Despite the domination on the part of questions relating to the philosophy of language, the 20th century was a century of epistemology

conducted in different variants, while the philosophy of language served often as an instrument for solving the classical problems emanating from the field of cognition, and sometimes metaphysics as well. Both naturalization and postmodernism were connected at their bases with questions and resolutions concerning cognitive matters. Discerned was the insufficiency of hitherto philosophical projects which needed to be made scientific (as the naturalist optimists saw it), or given up on (as was the view of the postmodernist sceptics). Therefore in many respects the thought of the 20th century was a continuation of the modern philosophical paradigm in which from the days of Descartes the metaphysical problem matter had become secondary in relation to that of epistemology. However, 20th century philosophy owes a lot more to Immanuel Kant than it does to Descartes together with the naturalized versions of Kant's views that were developed in the 19th century.

Kantianism and neo-Kantianism impacted on the most important philosophical currents of the 20th century and to a certain degree established the set of problems as well as solutions which were to appear during this epoch. One of the fundamental questions was connected with questions over the nature of cognitive relations, the status of the object of cognition as well as the role of subjective cognitive structures in the shaping of our cognition, and through this of the image of the world itself. Towards the end of the 19th century and beginning of the 20th, such currents as the Marburg School of Neo-Kantianism, French Conventionalism, Neo-Positivism, the analytical philosophy of Bertrand Russell, George E. Moore and Charlie D. Broad, and also phenomenology and hermeneutics were involved first and foremost in the problem of subjective access to the world as well as the factors shaping and molding the said access. Consequently the fundamental question was the matter of epistemological realism, in which the overriding majority of positions rejected this said realism in its direct form, adopting some form of representationalism or phenomenalism. For these exited in effect a general agreement that the subject does not have any direct cognitive access to objects, and only to the sensory (phenomena, impressions), from the existence of which one may conclude about the existence of a real world as the cause of sensory impressions (the causal theory of perception), but also such a conclusion is unauthorized which leads to various naturalistic and transcendental versions of subjective idealism. In the first

case the fundamental questions concerned the relations of representations to the original, sensory data to the objects, that is—generally speaking—the relations of the subjective image of the world to the world *an sich*. In the second case this question is not relevant and consideration here was over the way in which the world is formed in the consciousness as its correlate.

Another important matter present in principle in all the main concepts of the main current of twentieth-century philosophy, was the question of the super-subjective factors determining cognition, and thus about the conditions shaping subjective cognitive subjects. Traditionally considered here are the influence of biological factors (particularly in the area of naturalized Kantianism) as well as of cultural factors whose significance in philosophy has been perceived for a long time although their systematic study was only to commence with the end of the 19th century along with the development of ethnological and anthropological sciences, and also the history of science (key here being the works of Pierre Duhem, Alexandre Koyré as well as Thomas Kuhn and Paul K. Feyerabend). This problem area was to be supplemented by the rapidly developing philosophy of language, which drew attention to the linguistic conditionings of cognition. A classic example of this type of research being Ludwig Wittgenstein's *Tractatus logico-philosophicus*, whose philosophy Eric Stenius called "linguistic Kantianism." These matters were equally researched within other philosophical currents, including within Hermeneutics.

The philosophy of biology

The philosophy of biology was an area that especially intensively developed in the 20th century, chiefly as a result of the progress connected with the development of Darwinist evolutionism as well as genetics. In as far as the beginning of the 20th century, as equally the twenty first century, were times of physicalism and attempts to reduce philosophy to the physical sciences, the second half of the twentieth century belonged to the biological and psychological sciences. William W. Bartley III draws attention to the fact that for many years the theory of cognition, and together with it the philosophy of science, were concentrated on the cognitive methods and results of the physical

sciences, which served as a certain model for academic proceedings, as equally a source of problems and questions.[15] The fundamental role played in the physical paradigm was by: phenomenalism, operationalism, reductionism, instrumentalism, determinism, inductionism, positivism, as well as justificationalism.[16] One may add here a fairly significant although more general characteristic, namely mechanicism, which—even in a more refined version—was to exert sizeable influence on the physicalistic way of thinking about the world.[17] For the problem nevertheless lay in the fact that the deductions derived from analysis of the achievements of the physical sciences collided with those deductions that analysis of the biological sciences had resulted in. For besides the philosophy of physics there appeared after the matter of Konrad Lorenz, Karl R. Popper and Donald T. Campbell—a philosophy based on biology, characterized by realism, indeterminism, deductionism, anti-instrumentalism, anti-positivism and anti-justificationalism.

The philosophy of biology may be understood in three ways. Firstly, if we take it that philosophy is a certain meta-objective reflection, while biology an objective reflection on living organisms, then the philosophy of biology should be understood as a meta-objective reflection on the procedures used in the science of living organisms.[18] The philosophy of biology would be in such a case a philosophically understood methodology of a certain science or simply the philosophy of science. It would consequently involve itself in such detailed questions as the ways of formulating and verifying hypotheses, the rules of correct inference, generalizations etc., as well as general matters concerning the status of biology itself as a science (what it is that makes it a science, what differs it from other sciences, how its history looks etc.). Alexander Rosenberg in his classic work on this subject has written "Whether and how biology differs from the other natural

[15] Cf. W.W. Bartley III, "Filozofia biologii a filozofia fizyki," transl. T. Szubka, *Poznańskie Studia z Filozofii Humanistyki* 14 (1994): *Kategorie filozoficzne a poznawczy status nauki*, pp. 81–146.

[16] Cf. ibidem, p. 94.

[17] Cf. E. Mayr, *What makes biology unique? Considerations on the autonomy of a scientific discipline* (Cambridge: Cambridge University Press, 2004), p. 2.

[18] Cf. M. Ruse, ed., *Philosophy of biology* (Amherst, N.Y.: Prometheus Books, 1998), pp. 1–2.

sciences ... is the most prominent, obvious, frequently posed, and controversial issue the philosophy of biology faces."[19]

The second understanding of the philosophy of biology would be broader and would cover those aspects of the relations between philosophy and biology that would connect with the settling of questions such as dealing with the nature of cognition in general. Biology would constitute a starting point for broader philosophical reflection—here not merely in the area of epistemology but also ontology and ethics—providing examples of cognitive behavior, as also—and here more importantly—pointing out philosophical problems together with suggestions as to their solution. *Stricte* biological solutions could not be directly the solutions to problems *stricte* philosophical, however they could point out certain directions for their conceptualization (an example could be, for instance, an attempt to replace in concepts of the being the living mechanistic paradigm with an organismic approach).

The third understanding of the philosophy of biology could be termed reductionistic, although here reduction does not concern the methodology but rather the philosophy itself and it is an expression of the said extreme naturalistic program, towards which, for example, Willard Van Orman Quine found himself inclined. It would involve an attempt to solve—or eliminate—all the traditional philosophical problems with the aid of solutions based on the discoveries of the biological sciences. The matter therefore involves postulation by means of a certain version of naturalism, the taking of meta-objective solutions to the objective level, and therefore the transformation of philosophy into a science through the elimination of "philosophization."

Evolutionary epistemology

The twentieth-century philosophy of biology was shaped under the decisive influence of the Darwinian theory of evolution. Hence equally the basic philosophical current which combined philosophical and biological research was so called evolutionary epistemology

[19] A. Rosenberg, *The structure of biological science* (Cambridge: Cambridge University Press, 1985), p. 13.

(or also the evolutionary theory of cognition), that was to intensively develop more or less from the mid-twentieth century.

Evolutionary epistemology is an interdisciplinary and internally varied research program that makes recourse to Darwinian or neo-Darwinian concepts in the evolution of species.[20] On the one hand it is conducted in the spirit of naturalized epistemology (although it does not have to see the realization of all of its postulates, particularly the reductionist), while on the other it fits—at least in certain concepts—within the framework of the philosophy of biology, particularly in the second (as mentioned above) understanding.[21] As Michael Bradie writes, those from naturalistic epistemologies "which are directly motivated by evolutionary considerations and which argue that the growth of knowledge follows the pattern of evolution in biology are called 'evolutionary epistemologies'."[22] A supplementation to this definition might be the words of Konrad Lorenz, who characterized the approach of an evolutionary theory of cognition as such: "I consider human understanding in the same way as any other phylogenetically evolved function which serves the purpose of survival, that is, as a function of a natural physical interaction with a physical external world."[23]

The cited quotes signalize the basic elements in the program of evolutionary epistemology, that is: the existence of cognitive structures

[20] The starting point for evolutionary epistemology is at present the synthetic theory of evolution accepting three fundamental principles: (1) a gene is the unit of hereditariness, (2) the unit of selection is the individual, (3) the object of evolution is the population having a joint (common) gene pool. Cf. B.-O. Küppers, *Geneza informacji biologicznej. Filozoficzne problemy powstania życia*, transl. W. Ługowski (Warszawa: PWN, 1991), p. 21.

[21] Henry Plotkin considers evolutionary epistemology to be a field broader than philosophy, based on evolutionary biology (for example "of universal Darwinism"). Cf. H. Plotkin, *Darwin machines and the nature of knowledge* (Cambridge, MA: Harvard University Press, 1997), p. 179. Franz M. Wuketits looks similarly on evolutionary epistemology, treating it as an interdisciplinary, supraphilosophical science, alluding to the programme of naturalised epistemology in the spirit of Quine, the sources of which may be seen already in Hume and Spencer. Cf. F.M. Wuketits, *Evolutionary epistemology and its implications for humankind* (Albany, NY: State University of New York Press, 1990), pp. 4–5, 47–52.

[22] M. Bradie, "Evolutionary epistemology and naturalized epistemology," in *Issues in evolutionary epistemology*, ed. K. Hahlweg and C.A. Hooker (Albany, NY: State University of New York Press, 1989), p. 394.

[23] K. Lorenz, *Behind the mirror: A search for a natural history of human knowledge*, transl. R. Taylor (London: Methuen and Co., 1977), p. 4.

acquired in the course of the phylogenetic development of structures, the compliance of the "logic" of the development of science (or knowledge as such) with the "logic" of evolution in its Darwinian version, the defined relation between the image of the world as the creation of human structures and the world itself. The varied conceptions developed within the frameworks of the broad research program of evolutionary epistemology adopt as a result all these elements, they differ however with regard to the direction their deeper research is directed. The most popular typology in approach is advanced by Michael Bradie, who differentiates two fundamental programs:[24]

(1) The Evolution of Epistemological Mechanisms (EEM), directed towards the shaping (molding) of biological or psychological cognitive mechanisms, and hence human means for the acquisition of knowledge. The most significant characteristic of this approach is the strong biological orientation leading in some cases to biological reductionism. For this reason, EEM is sometimes known as "bioepistemology."[25]

(2) The Evolutionary Epistemology of Theories (EET). This approach may be taken as a supplementation to EEM and it is often conducted simultaneously with the first. In as far as bioepistemology is involved in the evolution of mechanisms or cognitive structures then EET strives to research the evolution of human knowledge. Here the matter concerns an attempt at transferring the model of Darwinian natural selection as well as the mechanism of trials and errors on the development of human knowledge realized in the development of scientific (academic) theories. Within the framework of this approach recourse to the model of evolution often has a more metaphoric character than the literal and is based on pictorial though often exploited analogues which at a deeper level of analysis may quite easily become the subject of criticism.

[24] Cf. M. Bradie, "Assessing evolutionary epistemology," *Biology and Philosophy* 1, no. 4 (1986), pp. 401–459.

[25] Cf. K. Hahlweg, "Popper versus Lorenz: An exploration into the nature of evolutionary epistemology," PSA: *Proceedings of the Biennial Meeting of the Philosophy of Science Association* 1 (1986), pp. 172–182.

The discussed division is in principle widely accepted by researchers involved in evolutionary epistemology, although they do not always apply the names proposed by Bradie, contenting themselves with the more general characteristic of the two approaches: one directed towards showing the biological sources of our cognition (cognitive structures) and the second attempting to describe the development of science by means of schemes and analogies drawn from the theory of evolution.

In summing up, one may state that Lenartowicz's philosophy arose at a time that was not particularly sympathetic towards his way of thinking. On the one hand, post-modernist relativism and skepticism dominated, challenging the possibility of obtaining any kind of objective knowledge whatsoever and leading science into one of numerous "narratives." On the other hand, there was in the ascendency a specific type of modern naturalism based upon a mechanistic-materialist paradigm. And although in the 20th century physicalism was to a certain degree to give way to philosophy connected with biology, these connections were ones that were made in accordance with the principles elaborated on in Darwinian evolutionism, in which there was no room for, say, notions such as purpose. Within such an intellectual environment Lenartowicz's philosophical project, with its referencing to Aristotelianism-Thomism, appeared as original as it did alien. However, the weight of his propositions appear beyond discussion, particularly if we are to take into consideration all the weaknesses and difficulties encountered by mainstream current philosophy, both within post-modernist tendencies, as in those shaped by materialist naturalism. Taking into consideration the theoretical closing of both currents, which increasingly fall into dogmatism, then the open and fresh philosophical thought of Lenartowicz appears today to be an attractive proposition.

3.

Lenartowicz's Understanding of Philosophy

General comprehension of philosophy

Philosophy—in the way Lenartowicz understood and practiced it—reaches with its roots to those intellectual currents of thought that concentrate their attention on what exists *sensu stricto*, and so is "independent of the conscious act [of man], which may become the object in the cognition of many consciousnesses."[26] Systematic philosophy was most certainly closer to him that is the philosophical research (enquiry) into reality, than the study of philosophical views of reality which were in his view auxiliary and secondary in their role.[27]

Lenartowicz, in referencing the traditions of Aristotelianism and Thomism (A-T), defined philosophy as "(a) the cognition (b) of all forms of reality (c) fundamental (d) methodological (e) with the natural consciousness of man."[28] He was to understand by the notion of "cognition" the immanent dynamic of the subject, which in the case of man is a form of sensual-intellectual contact with reality, as a result of which our concept about varied objects and phenomena

[26] P. Lenartowicz, *Elementy teorii poznania*, p. 295.

[27] Cf. ibidem, p. 15.

[28] Ibidem, p. 38.

becomes all the richer and fuller.[29] Philosophy was for Lenartowicz the expression of a natural for man "tendency to become acquainted with everything that exists,"[30] which accompanies the search for truth—and first and foremost ontological truth, that is "the causes, conditions, the regularities constituting the 'being' (existence) of a given thing in the form that it actually is."[31] This means that philosophy is "fundamental" cognition, one not avoiding equally investigation into the question of the ultimate reason for the existence of reality, one ontologically independent of our cognitive effort. In this process of acquaintance the philosopher is bound to, among other things: regularity (methodicalness) in research progress, the revealing of the elements for the starting points of solutions (axioms, obviousnesses), the revealing of criteria, that is the regulations for deeming the results of investigations to be true and flawless, the presentation of the route along which the philosopher has travelled to reach his conclusions, critical reflection of what constitutes the appropriate research "method."[32] In a philosophy thus understood the acquaintance and cognitive understanding of reality is exclusively based on "that data which are available to the consciousness without the participation of a supernatural factor"[33] and mystical experiences.

The Aristotelian and Thomistic concepts of philosophy as becoming acquainted (the cognition) with "all forms of reality," may generate certain misconceptions. In being aware of exactly this Lenartowicz explained that—firstly—A-T had not attempted to "appropriate for itself the right to exclusivity in the description and explanation of reality,"[34] but merely to show that its research program

[29] Cf. P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, third expanded edition (Kraków: Wyższa Szkoła Filozoficzno-Pedagogiczna "Ignatianum", Wydawnictwo WAM, 2000), p. 175; P. Lenartowicz and J. Koszteyn, "Substancja i poznanie a filozofia nauki," *Edukacja Filozoficzna* no. 24 (1997), p. 84. More on Lenartowicz's epistemological views in the present book in the chapter "Epistemological realism."

[30] P. Lenartowicz and J. Koszteyn, "Substancja i poznanie a filozofia nauki," p. 83.

[31] P. Lenartowicz, *Elementy teorii poznania*, p. 160.

[32] Cf. ibidem, pp. 30–33; 40–41.

[33] P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, p. 20.

[34] P. Lenartowicz, *Elementy teorii poznania*, p. 39.

did not exclude *a priori* any forms or aspects of reality from its sphere of interests.

Secondly—something that Lenartowicz paid particular attention to—in the definition of philosophy given, the matter concerns an acquaintance and knowledge of "all forms of reality," which means that A-T does suppose *a priori* neither does it give an opinion at the start of these investigations as to whether the reality known by us constitutes some form of whole (entirety) or not.

> If instead of the term "all forms of reality" one were to use the term "the entirety of reality," there could have arisen the dangerous illusion that a philosopher should somehow in advance treat reality as its own form of unity … "Everythingness" does not have to … mean "the whole/entirety" …, but only the conviction that a philosopher should not pass over within his considerations any form, any element, any aspect of reality.[35]

In Lenartowicz's conviction reality appears to be rather a collection or assemblage of "varied and different objects, and sometimes ones unconnected to, and independent of each other."[36] Therefore the question as to whether reality is an entirety (or not) or what is the entirety in it, requires investigation, careful deliberation.[37]

Thirdly—as Lenartowicz noted—the statement that within the sphere of interests for the philosophy of A-T there remains "everything that exists" does not mean that individual philosophers (in a similar way to academics) investigate "everything." *Ars longa, vita brevis*—nobody "is able to comprehend through their consciousness and memory all details, all aspects of reality, and … is not able to comprehend them in the course of their single short life."[38] Academics have their specific fields, individually chosen by them, to which they devote their attention, attempting to know and understand them.

[35] Ibidem, pp. 39–40.
[36] Ibidem, pp. 39–40.
[37] Cf. ibidem, p. 23.
[38] Ibidem, p. 27.

The philosophy of biological phenomena

Lenartowicz's philosophical interests were first and foremost concentrated on living organisms (on their structure, dynamics, mutual relations as well as connections with the abiotic environment).[39] Key within his philosophy was the concept of a living organism understood as a *life cycle*.[40] At the basis of this cycle is the developmental dynamism, namely the building/construction (biosynthesis, embryogenesis), rebuilding/reconstruction (constant metabolic change) and repair (regeneration) of the body structure. This fundamental dynamism delineates in a nonarbitrary way the "boundaries" of the basic object for the investigations of biologists and philosophers that is the individual (an individual living organism) constituting the "minimal" context of sensible solutions on the subject of the characteristic features of a biological whole, its causes and genesis. One may differentiate in this research—according to Lenartowicz—several rudimentary cognitive stages:

— observation of the processes of biosynthesis, morphogenesis, embryogenesis, adaptation and regeneration;
— observation of the repetition of the processes of epigenesis in subsequent generations of individuals of a concrete natural species;
— discernment of precise and integrated limitations to the dynamic of mineral matter in relation to the dynamic of the final effect;
— search for a rational and holistic explanation for these limitations;
— postulating of the "integrating factor" proportional to the dynamics of the individuals of a concrete natural species;

[39] More about Lenartowicz's philosophy of animate nature is provided in the present book in the chapter "The philosophy of biological phenomenon" as well as in the "Paleoanthropological evidence of the unity of the human race."

[40] Cf. among others: P. Lenartowicz, *Phenotype-genotype dichotomy: An essay in theoretical biology*, pp. 38–42; P. Lenartowicz, "Pojęcie całości i przyczyny w dziejach embriologii," in *Studia z historii filozofii. Księga pamiątkowa z okazji 50-lecia pracy naukowej ks. Profesora Pawła Siwka SJ*, ed. R. Darowski (Kraków: Wydział Filozoficzny Towarzystwa Jezusowego, 1980), pp. 209–214; P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 45–52, 423.

— search for the reason for the existence of living forms (of living organisms).[41]

The stages enumerated display Lenartowicz's method of philosophical investigation. Starting from an exact description of the researched object (substituting the definition ostensive/deictic), he set about introducing those concepts most corresponding to the obvious features of this object. Then he considered the questions that arose for a description of the said features which led him to reflection on the conditions that would have to have been fulfilled by correct and satisfying answers. Significant here was, among other things, the requirement that answers did not refer to concepts generating the same questions as the initial phenomenon.

Lenartowicz made recourse in his deliberations to concepts, notions and terminology derived from the rich tradition of Aristotelianism-Thomism broadly understood, but in his belief this philosophical current had supplied many valuable "intellectual tools" for research and investigation into living dynamics, the nature of living organisms. Hence of importance in his philosophy were, among other things, such concepts as being (*sensu stricto*),[42] substance[43] and the substantial form of a living being.[44] However, this does not mean that Lenartowicz hung

[41] Cf. among others P. Lenartowicz, "Trzy koncepcje dynamiki biologicznej: arystotelesowska, neo-darwinowska, inteligentnego projektu," in *Philosophia vitam alere. Prace dedykowane księdzu Profesorowi Romanowi Darowskiemu SJ z okazji 70-lecia urodzin*, ed. S. Ziemiański (Kraków: Wyższa Szkoła Filozoficzno-Pedagogiczna "Ignatianum", Wydawnictwo WAM, 2005), p. 381.

[42] That is what "actually exists—and not is a creation of consciousness; exists in itself—and not in something else; … is a whole—and not a part of the whole, is unity and not a collective of unity" (P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, p. 157).

[43] "The notion of substance is … key to understanding the essence of philosophy and scientific research. … The term substance represents such a reality that … preserves its fundamental identity despite the changes taking place within it—in other words its 'substantive existence' manifests itself in varied forms of chance, accidental existence" (P. Lenartowicz and J. Koszteyn, "Substancja i poznanie a filozofia nauki," p. 83).

[44] "This is an internal, integrated, immanently active and indivisible factor, which in orientating itself in its surroundings and modifying them according to needs, constructs from the raw mineral matter an integrated system of organs of a biological body, acts through these organs and communicates with other living forms" (P. Lenartowicz, "Dusza," in *Encyklopedia Filozofii Przyrody*, ed. Z.E. Roskal (Lublin: Wydawnictwo KUL, 2016), p. 113).

on "tightly" to textbook definitions of concepts of this type. Despite the broadly held opinion that Aristotelianism-Thomism is already an outdated and fossilized current of thinking, he considered A-T to be a philosophy that always had and still has a chance of being a philosophy *in statu nascendi*.[45] Therefore he carried out the necessary—in the light of the newest biological achievements as well as those in the other natural sciences—reinterpretations, modifications, honed and brought up to date the traditional concepts of A-T. He also did not hesitate to introduce new, most often equivalent terms in relation to these concepts in order to connect in this way with the terminology of contemporary sciences or to highlight an important aspect of the referent.[46]

The philosophy of nature and the natural sciences

Lenartowicz's research fits into the long standing debate between existence monism (first and foremost the material monism) and existential (ontological) pluralism.[47] The controversies concern chiefly the question as to whether the reality that is accessible to our cognition is a whole, or not; whether only a physical-chemical causality is in effect within this reality or if there are other types of causality at play; whether this reality requires the postulation of some reasons for its existence or not, and if it requires the said what sort of cause might this be.

The only chance to reconcile this debate in his view was the careful study of the results of natural science research as well as their thorough and critical analysis. A philosopher of nature has to know the object of his investigations, while the fundamental (often the only) source of knowledge on this subject is what the natural sciences say about it.

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[45] Cf. P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, p. 153.

[46] E.g., a "living substantial form" (ψυχή) is called—depending on the context of deliberations—"a dynamic genome," "an integrating factor," "active information."

[47] Cf. P. Lenartowicz, "O empirycznych przesłankach pluralizmu bytowego," *Forum Philosophicum* 11 (2006), pp. 37–53; J. Koszteyn, P. Lenartowicz, "Scjentyzm – pozytywy i negatywy," *Zagadnienia Naukoznawstwa* no. 2–3(144–145), (2000), pp. 275–283.

Obviously the closest to Lenartowicz were the biological sciences, which originating in his research from some concrete biological wholes (organisms of some species or another) aspire (*explicite* or *implicite*) to knowing these wholes, although—as a result of the complexity and variety of the objects investigated—this is achieved through acquainting oneself with specific aspects or fragments of the said wholes. Consequently science—at least one like biology—was for him "the expression of a tendency for philosophizing," that is "a tendency to become acquainted with the whole"[48] (the substance). In turn the results of the philosophical cognition of the whole, yet one rooted in natural empiricism (e.g., biological), could—according to Lenartowicz—satisfy what in science is deemed "theory."[49]

Practically speaking, Lenartowicz did not refer to those research results from those fields of the natural sciences (empirical-mathematic), the methods of which Michał Heller labelled with the term "extremely ascetic" (that is "investigated reality should be excessively simplified to the point of its complete deformation"[50]), for whom mathematics was "not merely the language of the sciences, but also its content."[51] Such an approach to natural reality and the methods of its investigation could lead—and indeed *de facto* did lead certain academics—to the conviction that "in reality there is nothing that does not succumb to the mathematical-empirical method,"[52] and that mathematics is the "material of the world."[53]

Lenartowicz's position in relation to research methods of this type—which had settled amongst the natural sciences because of Descartes among other reasons—is well illustrated by a fragment of his conversation (interview) with Zdzisław Kijas:

> I shall present now its [i.e., the Cartesian method] caricature, but I am convinced that the applying of this method led to conclusions far more caricatural.

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[48] P. Lenartowicz and J. Koszteyn, "Substancja i poznanie a filozofia nauki," p. 83.

[49] Cf. ibidem, p. 85.

[50] M. Heller, *Nowa fizyka i nowa teologia* (Kraków: Copernicus Center Press, 2014), p. 73.

[51] Ibidem, p. 74.

[52] Ibidem.

[53] Ibidem, p. 57.

> Hence, if we were to take the study of a bird we would immediately observe that a bird is highly complicated—so let us take merely the wing of a bird for the purpose of our research. However, even here with a wing things are highly complicated, so let's focus instead on investigating a feather. Admittedly a feather is equally no simple matter—so let us draw ourselves a feather on a piece of paper. In drawing a feather on a piece of paper it becomes easier for us to create notions "clear and distinct." So we have drawn the shape of a feather but this is even too complicated. Let us draw ourselves the outline of this feather, merely the contours. Having the outline we can think up some mathematical formula—with the aid of a computer—to draw this contour. So what we have is a feather in the form of a mathematical formula. So what is a bird in relation to this? It is quite simply just a series of mathematical formulae. In this way we "have found out" that a bird is a certain exceptionally complex mathematical form.[54]

The method and description of reality in mathematicised disciplines of the natural sciences is, as Michał Heller has noted,

> Not … only epistemological problems but also a question of a certain ontology. Therefore the matter concerns and is answer to the question: how should the real world be for the science of this world to be a "mathematical science."[55]

Hence Lenartowicz considered that both in science as in philosophy research methods should be subordinated to the objects and phenomena of nature (in all the wealth of its manifestations), and not the "pictures" of reality that we have constructed in our mind in accordance with our expectations or *a priori* assumptions that the world should be such and not otherwise (methods assigned to "images" will more than likely confirm this "image," but will it be in accordance with reality?).[56]

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[54] P. Lenartowicz, J. Koszteyn, "Czy współczesna nauka mówi o Bogu?," in *Mówić o Bogu…*, ed. Z. Kijas (Kraków: Stowarzyszenie Civitas Christiana, Wydawnictwo OO. Franciszkanów „Bratni Zew", 1997), p. 111. This utterance of Lenartowicz's corresponds with the claim by Heller that in certain "areas of physics involved in the 'essence of matter,' material has become completely dismantled into mathematical functions" (M. Heller, *Nowa fizyka i nowa teologia*, p. 74).

[55] Ibidem, p. 57.

[56] Cf. P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 23–24.

The philosophy of nature as practiced by Lenartowicz, undeniably places itself—in accordance with the division of understanding (the definition) of this area of knowledge as proposed by Anna Lemańska[57]—within the category of "traditional perspectives," in which the object of interest is nature acquainted directly or indirectly through the natural sciences. However, an "analysis of the concepts, theorems and research methods of the natural sciences, the means of arriving at theorems and their justification, of verification, falsification"[58]—that the philosophy of the natural sciences involves itself in—was not the main object of his interests though it did represent for him a certain essential element of philosophical discussion into the research "layer" of naturalists. He valued therefore the role that the philosophy of science plays or could play in nature studies:

> The philosophy of science may constitute an attempt at investigating the credibility of the fundamental options and limitations adopted by the contemporary natural sciences. … the philosophy of science should … investigate the credibility of the intra- and extrapolation estimated by the sciences in the description of reality, the correctness of the methods ascending certain abstractions to the ranking of significant traits of reality while deeming others as insignificant features. In other words, the philosophy of science could research the level of cognitive contact limitations resulting from an academic's decisions.[59]

Consequently, Lenartowicz was interested to a certain degree in what the philosophy of nature understood as "philosophy in nature, in which it searches for philosophical premises mixed up in scientific issues."[60]

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[57] Cf. A. Lemańska, "Filozofia przyrody a wyniki nauk przyrodniczych," *Studia Philosophiae Christianae* 43, no. 1 (2007), pp. 115–123; A. Lemańska, *Filozofia przyrody a nauki przyrodnicze. Wybrane zagadnienia w teorii filozofii przyrody* (Warszawa: Akademia Teologii Katolickiej, 1998), pp. 31–74. Cf. also A. Latawiec, "W poszukiwaniu obrazu współczesnej filozofii przyrody," in *Filozofia przyrody współcześnie*, ed. M. Kuszyk-Bytniewska and A. Łukasik (Kraków: Towarzystwo Autorów i Wydawców Prac Naukowych "Universitas", 2010), pp. 29–41.

[58] A Lemańska, "Filozofia przyrody a wyniki nauk przyrodniczych," p. 117.

[59] P. Lenartowicz and J. Koszteyn, "Substancja i poznanie a filozofia nauki," p. 87.

[60] A Lemańska, "Filozofia przyrody a wyniki nauk przyrodniczych," p. 117.

Most definitely he did not pursue the philosophy of nature "leading to a synthesis or a generalizing of the conclusions of the natural sciences, the task [of which] is the creation of a certain image of reality on the basis of the results (outcomes) of the natural sciences which are fragmentary/partial and aspectual."[61]

In summing up: according to Lenartowicz one could distinguish two highly different approaches to the philosophical cognition of reality. One approach is an attempt to present reality in a single cohesive whole, with the main task of the philosopher being the search for such phenomena and the application of such methods of behavior that will enable the notional synthesis of the maximum quantity of empirical data. The notion of entirety thus obtained does not guarantee however its objectivity for it is the result of the application of a method clearly subjected to the initial conviction that everything which exists constitutes a single whole. In the second approach the philosopher examines reality and searches for those objects for investigation which create a chance to perceive the comprehensibility and define the non-arbitrary criteria deciding on the existence or absence of the entirety/whole.[62]

[61] Ibidem, p. 118. Cf. also J. Koszteyn, P. Lenartowicz, "Scjentyzm – pozytywy i negatywy," p. 283.

[62] Cf. P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, p. 23.

4.

Detailed theoretical problems

4.1. Epistemological realism

Does the reality that surrounds us exist independently of our cognition and thought, or is it the case that what we experience as an objective reality is in fact merely the creation of our senses? What is the origin of our notions on varied objects and phenomena? Is our knowledge about reality objective and credible? Questions of this sort have been some of the most important objects of philosophical deliberation and discussion since ancient times.

Lenartowicz—as opposed to various forms of anti-realism, idealism, constructivism—spoke out for both an objective existence of the reality that surrounds us as equally for the possibility of a credible cognition of this reality. His epistemological views were derived not only from "textbook" knowledge acquired when studying philosophy but first and foremost from experiences gained in experimental work (in the field of animal physiology) as well as from reflections on the methods, methodology and interpretation of the result of biological research.

The problem of universals

Aristotle, in a supplement to his list of categories, enumerated five forms of predicate (*praedicabilia*), among which are types and species. The Neoplatonic Porphyry comments on the said *praedicabilia* in his *Introduction to Aristotle's Categories (Isagoge)* and asks three questions, not providing answers to them:

> I shall omit to speak about genera and species, as to whether they subsist (in the nature of things) or in mere conceptions only; whether also if subsistent, they are bodies or incorporeal, and whether they are separate from, or in, sensibles, and subsist about these, for such a treatise is most profound, and requires another more extensive investigation.[63]

The question of the problem of universals was brought to Mediaeval philosophy by Boethius in translating the *Isagoge* into Latin. His commentary to Porphyry's text was an attempt to grasp the relations between man's cognition of reality and the concrete objects and phenomena existing independently of his cognitive effort.[64] Boethius rejected both the view that universals are substances (living wholes), as equally the view that universals are substances (living wholes), as equally the view that universals did not have any connection with reality and admitted that they are expressions, wherein he did not separate expressions and concepts.

Lenartowicz in *Elementy teorii poznania* [Elements of epistemology] cited a fragment *In Isagogen Porphyrii commenta* by Boethius.[65] He did not analyze the entire commentary, he did not discuss it in detail within the historical and contemporary context of the debate over universals, as a historian of philosophical thought would have done. The Boethius quote was for him a pretext to show that what gives the impression of contradiction, what appears to be a philosophical Gordian knot, may to a significant degree be a solution when we, for instance, in deepening such concepts as existence, being, entirety, unity, when we contemplate the genesis and types concepts and the ways of contemplating the origin and types of concepts as well as the means for establishing the genesis and types of concepts as well as the means to classify objects and phenomena.[66]

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[63] Porphyry, "Introduction of Porphyry, Chapter 1: Object of the writer, in the present Introduction," in Aristotle, *The Organon, or logical treatises of Aristotle, with the introduction of Porphyry*, vol. 2, transl. Octavius Freire Owen (London: [published by] Henry G. Bohn, 1853), pp. 609–610, accessed September 29, 2018, https://archive.org/details/bub_gb_cm4TmBSZEn8C.

[64] Cf. T. Tiuryn, *Boecjusz i problem uniwersaliów* (Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego, 2009), pp. 14–28.

[65] Cf. P. Lenartowicz, *Elementy teorii poznania*, p. 293.

[66] Cf. ibidem, p. 294.

Lenartowicz shared the Aristotelian-Thomistic position that "existence" in the strictest meaning of the term (*sensu strictissimo*) refers to substances, to intrinsic beings, that is to those that "exist within themselves—and not in something else, … they are the entirety—and not a part of the whole [or] a collection [of the whole]."[67]

"Existence" is also understood in the strict sense (*sensu stricto*) and then relates to everything "that exists independently of the act of consciousness, which may become the object of the cognition of many consciousnesses."[68] Such an object may be, for example, a man's head, the shell of a tortoise or an ash leaf.

While in the broad meaning of the term (*sensu lato*) "there exist not only material and spiritual beings, but there exists as well the content of consciousness, my thoughts, notions, aspirations, dreams, recollections, fantasies."[69] These are thought up existences which—in turn—can be understood in the (a) genetic, (b) accidental, (c) objective sense and (d) as existences purely contrived (*ens rationis obiective tantum*).[70]

According to Lenartowicz the debate over universals concerns one of the most important—from the point of view of the credibility of natural knowledge—questions, and namely: whether the concepts of "category" and "species" are:

— thought up/contrived existences of the (c) type that is objective—"that which was known through the mind but which exists also in itself (as a substance), independently of the act of cognition,"[71] or if
— thought up/contrived existences of the (d) type, that is purely contrived—"that which the mind makes itself aware of, but that beyond it (the mind) there is no other relations to existence."[72]

Lenartowicz considered that within the natural sciences we are dealing first and foremost with objective concepts (c), which constitute

[67] P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, p. 157. Cf. also P. Lenartowicz, *Elementy teorii poznania*, p. 294.

[68] Ibidem, p. 295.

[69] Ibidem, p. 294.

[70] Cf. ibidem, pp. 296–297.

[71] Ibidem, p. 297.

[72] Ibidem.

the foundation of natural knowledge.[73] These notions are usually divided into the general (transcendentals, universals) and the particular (particulars). In his opinion on the ground of biology (and quite possibly other natural sciences) this division is worth enriching with synthetic and analytical concepts.[74] Synthetic concepts are as if the "data bases" of individual existences/beings (e.g., the concrete dog specimen),[75] or a collection of beings/existences of a given category (e.g., many varied/different dogs).[76] In turn analytical concepts refer to the various structural and dynamic abstracted features from existence wholes (e.g., the leaves of an oak, a dog's head, man's two-legged locomotion).[77] And this relation to existence wholes results in synthetic and analytical concepts becoming for Lenartowicz a separate "class" of general or specific notions.

The objectivity and credibility of theoretical knowledge

The debate over universals is in effect debate about the objectivity and credibility of concepts and scientific theories, and with the same about the value of our knowledge of reality.[78] According to Lenartowicz the crux of this debate best illustrates the five philosophical attitudes advancing various solutions to this problem, that is positions: (a) nominalist, (b) Kantian (conceptualism), (c) conventionalism, (d) extremely realistic as well as (e) Aristotelian-Thomistic.

[73] Obviously Lenartowicz was aware that within scientific classification there occurs a certain specific type of purely mental notions. These are the notions of the II intention (*secundae intentionis*), fulfilling an important role in the systemization, ordering of objective notions. Cf. P. Lenartowicz, *Elementy teorii poznania*, pp. 77–78.

[74] Cf. P. Lenartowicz, "Trzy koncepcje dynamiki biologicznej: arystotelesowska, neo-darwinowska, inteligentnego projektu," p. 377; P. Lenartowicz, *Elementy teorii poznania*, pp. 75–77.

[75] These are concrete synthetic notions. Cf. P. Lenartowicz, *Elementy teorii poznania*, p. 76.

[76] These are abstract synthetic notions, for as a rule they consider these features abstracted from individual objects that are characteristic for a given type of existential wholeness (entirety)—for example all dogs or all people. Cf. ibidem, p. 76.

[77] Equally, Lenartowicz divided analytical notions in the concrete or the abstract. Cf. ibidem, p. 77.

[78] Cf. ibidem, p. 289.

(a) For nominalists the reality with which our consciousness comes into contact is a collection of unrepeatable objects and phenomena. We do not perceive any objectively existing regularities, principles, individuals or wholes. Existing wholes (substances), natural categories, relations of causality, rules etc., are merely linguistic categories, something that appears only in the sphere of linguistic expressions.[79] Science does not so much deal with things and phenomena as "claims and statements about them, expressions creating specialized languages."[80]

(b) For conceptionalists like Kant, the Aristotelian categories (e.g., of substance or relation) were the *a priori* categories of the mind "built into" our consciousness before it was connected with reality. Categories in the understanding of A-T were the result of the gradual uncovering of the real and objective state of things and as such became the "intellectual tools" of the scientific (theoretical) encompassing of reality. However, for conceptualists the categories—not having within their genesis anything in common with extramental reality—were merely "ordering instruments" a mass of content of varied sensual experiences flooding into our consciousness. Scientific theories—in the light of such a position—are the result of incorporating into the description of reality those regularities which "dictate" to us *a priori* intellectual categories.[81]

(c) Conventionalists are of the view that scientific theories (first and foremost so-called great natural theories) are, to a significant degree, arbitrary forms of putting in order the content of experience.[82] However, what "puts in order" and gives "shape" to theories are not the *a priori* categories of the mind but conventional categories, that is conventions introduced by science for the easier comprehension of phenomena and objects.

(d) For the representatives of extreme conceptual realism—the creator of which was Plato—there is no doubt that our notions refer

[79] Cf. ibidem, pp. 290, 298.

[80] A. Podsiad, "Nominalizm," in *Słownik terminów i pojęć filozoficznych* (Warszawa: Instytut Wydawniczy Pax, 2000), p. 567.

[81] Cf. I. Kant, *Krytyka czystego rozumu*, transl. R. Ingarden (Warszawa: PWN, 1957), B 16, A 240.

[82] Cf. P. Lenartowicz, *Elementy teorii poznania*, p. 299.

to some actual (real) objects. As our notions and concepts are characterized by permanence and unity then equally the subjects of these concepts have to possess such features. Meanwhile things that we know as a result of experience are variable and complex, and consequently cannot become the object of notions. Plato admitted therefore that the object of notions are invariable ideas understood as actually existing beings. Only ideas really existing are beings *sensu stricto*. Things at best "appear" and are connected to ideas in the way that, for example, the reflection of a birch on the surface of a sheet of water is to a birch growing on the bank of a pond. Ideas are consequently models (but not the causes) of things, carrying within themselves some "stamp" of an idea. We do not have direct access to the world of ideas. We can at most perceive things, yet these are not the objects of our notions. So where do notions relating to ideas come from? Plato claimed that notions are innate. We come into the world with ready-formed notions which initially are as if the "effaced" recollections of ideas that our mind saw in the previous life. Sensual contact with things means that we spontaneously recall these ideas (which were the models of things).[83]

Science for Plato—in the strict meaning—concerns what exists eternally and invariably, and consequently ideas. Empirical knowledge deriving from the sensual cognition of variable things was uncertain and for this reason not only did he show it contempt he even deemed it not to be a science at all.

According to Lenartowicz, certain elements of the positions held by extreme cognitive realism may be perceived within the concept of *Harmonia praestabilita*, which played an important role in Leibniz's deliberations, as equally in the position of certain mathematics who saw the foundations for the entirety of reality in "mathematical beings."[84]

(e) Aristotelian-Thomistic (moderate) realism is, according to Lenartowicz, the position that attempts to show the possibility of correct scientific cognition and the conceptual comprehension of

[83] Cf. ibidem.

[84] Cf. ibidem. On the Platonic provenance of the mathematicians' views cf. e.g., M. Heller, *Bóg i nauka: moje dwie drogi do jednego celu* (Kraków: Copernicus Center Press, 2014), pp. 65–66.

objectively existing reality without reference to the "world of eternal ideas" or to *a priori* categories of the mind. It does not limit the task of science to merely putting in order notions of reality "on the strength of" conventional agreements or also research into the links between the expressions of scientific language. Moderate realism does not underestimate either the significance of certain regulations of research conduct, nor the significance of linguistic signs (expressions) in the conveying of the results of cognitive effort/exertion. And first of all it does not underestimate either the sensual or intellectual cognition lying at the basis of the objectivity of the scientific, theoretical views of natural reality.[85] According to this position people's cognitive powers act thus that in the cognitive process they transfer from what is variable to that which is invariable; from causes to reasons; from what is secondary to what is primary; from the part to the whole.[86]

The unity of sensual and rational cognition

Within the dynamics of human cognition, the intellectual orientation in the object is as important as the sensual. Thanks to observation by means of the senses (if needed "armed" with the technical instruments of observation) the human intellect is able to perceive various necessities, significant correlations revealing "nature," the "logic" of the given object or phenomenon. Among others such concepts like correlation, cause or a natural whole are not in Lenartowicz's conviction either *a priori* intellectual categories imposed onto a biological reality, or speculative notions resulting from formal concluding.[87] They are notions derived from the intellectual examination of the object which in the A-T tradition is called *epagogé* (intellectual induction).[88] *Epagogé* he understood as the "intellectual, yet direct

[85] Cf. P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, pp. 69–70.

[86] Cf. P. Lenartowicz, *Elementy teorii poznania*, p. 300.

[87] Cf. P. Lenartowicz, "Cel (celowość, teleologia)," in *Encyklopedia Filozofii Przyrody*, ed. Z.E. Roskal (Lublin: Wydawnictwo KUL, 2016), pp. 34–35.

[88] Intellectual induction cannot be identified with either enumerative or eliminative induction. Cf. J. Dębowski, "Idea bezzałożeniowości w filozofii Arystotelesa," *Studia Filozoficzne* no. 1(218), (1984), pp. 3–18; T. Kwiatkowski, *Epagogé*, in *Powszechna Encyklopedia Filozofii*, vol. 3, ed. M.A. Krąpiec (Lublin: Polskie Towarzystwo Tomasza z Akwinu, 2002), pp. 178–180.

seeing of the object in the material of an orientation obtained through sensual cognition."[89] "*Epagogé* is consequently the process of the cognition of 'the nature' of being, that is of the very fundaments of the sources of its properties."[90] According to Lenartowicz the characteristic object of intellectual cognition—at least in biology—are first and foremost existence wholes/entireties, substantive beings, in the context of which it is possible to comprehend collections or their parts.[91]

The question of *intellectual obviousness* was important for Lenartowicz, because it is connected with the question of the sources and bases for the credibility of our knowledge about natural reality. In his opinion the objectivity of natural knowledge, the credibility of scientific theories appears unattainable for either conceptualism, conventionalism, nominalism or extreme conceptual realism. According to Lenartowicz the guarantor of the objectivity and credibility for our cognitive efforts is the "presentationalism—though a better possibly would be to say 'observationism,' of Aristotelianism-Thomism, which takes the position that the senses enable us to enjoy direct contact with the object."[92] In the case of man sensual cognition is the viewing of the object through the intellect by means of the senses,[93] albeit within the dynamics of human cognition the sensual element and the intellectual element are not integrated with each other.[94]

The question of truth

The discovery or intellectual reconstruction of the essential conditions and reasons for the wholeness of a given existence or—in the case of a collection of existences—the sources of their mutual

[89] P. Lenartowicz, "Trzy koncepcje dynamiki biologicznej: arystotelesowska, neo-darwinowska, inteligentnego projektu," p. 379.

[90] P. Lenartowicz, J. Koszteyn, "On Paley, epagogé, technical mind and a fortiori argumentation," *Forum Philosophicum* 7 (2002), p. 81.

[91] Constantly discussed in philosophy is the problem of whether science has as its task the discovery of the nature of things (which Lenartowicz was in favour of), and also the description of the significant differences between one object and another (Popper). Cf. A. Kolb, *Realismus als Lösung von Widersprüchen in Philosophie und Naturwissenschaften. Wider den Materialismus und den Determinismus* (Berlin: LIT Verlag, 2006), pp. 231–233.

[92] P. Lenartowicz, *Elementy teorii poznania*, p. 306.

[93] Cf. ibidem, p. 304.

[94] Cf. ibidem, p. 195.

relations and correctness is an expression of understanding[95] the subject of the research. This type of comprehension may be called the current theory of a given subject, cohesively joining the elements of empirical knowledge (sensual and intellectual) as well as purely speculative elements.[96]

Here the question arises as to whether what we are able to understand, to comprehend in theory, is in accordance with the truth. What do we have in mind when we talk about "truth" or "truthfulness"? We use these terms either in relation to things (objects or phenomena), or to the results of their cognition. In the case of this second reference the most well known is the classic definition of truth, that is the truthfulness of cognition, which we find in St. Thomas of Aquinas: *veritas est adaequatio rei et intellectus*.[97]

According to Lenartowicz the term "truth" has at least six different meanings, ones derived from the A-T tradition:[98]

— Ontological truth: is everything "that structurally and dynamically constitutes a given thing ...; it is the group of reasons, conditions, regularities deciding on the 'being' (existence) of a given

[95] Certain methodologists of science (as equally scientists) write that the result of academic research is "explanation." The meaning of the term "explanation"—depending on the author—either overlaps with the meaning of the term "understanding." Cf. A. Podsiad, "Rozumienie," in *Słownik terminów i pojęć filozoficznych* (Warszawa: Instytut Wydawniczy Pax, 2000), p. 771; T. Greenwood, "Explanation," in *The Dictionary of Philosophy*, ed. D.G. Runes (New York: Philosophical Library Inc., 1942), s. 104, or it differs from it. E.g., Heller writes: "We state that we understand a phenomenon if it is possible for us to include empirical datum—or more frequently: a group of empirical data—in a sequence of arguments and results described through the course of formal implications" (M. Heller, *Nowa fizyka i nowa teologia*, p. 98). Ludwig von Bertalanffy writes similarly: "explanation means the fitting of these phenomena into a theoretical system." L. von Bertalanffy, *Problems of life* (New York: Harper and Brothers, 1952), p. 171.

[96] Cf. P. Lenartowicz, *Elementy teorii poznania*, p. 305; P. Lenartowicz and J. Koszteyn, "Substancja i poznanie a filozofia nauki," pp. 83–87.

[97] Sancti Thomae de Aquino, *Quaestiones disputatae de veritate*, q. 1 a. 1 ad 1, Fundación Tomás de Aquino quoad hanc editionem Iura omnia asservantur OCLC, nr 49644264 (2011), accessed September 29, 2018, http://www.corpusthomisticum.org/qdv01.html.

[98] Cf. P. Lenartowicz, *Elementy teorii poznania*, pp. 160–168; P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, pp. 177–178.

thing in the way that it is; it is internal cohesion, harmony, integration, the perfection of a given thing."[99]

— Logical truth: "this is the conformity between the object of cognition and the comprehension (notion) of this object in the consciousness."[100] The definition given by Lenartowicz is in keeping with the classical definition of truth,[101] but is broader for it takes into consideration not only people possessing intellect but also animals that in having the ability of sensual cognition are aware of the various features of their surroundings.[102]
— Ontological truth: "is the correct recognition of an earlier known object."[103]
— The truth of an utterance: "is the conformity of a man's utterance with his own current orientation in reality (external or one's own) or knowledge about it."[104]
— Semantic truth: "is the correct, in accordance with the linguistic convention in force, linking of a graphic sign (or sound, or of some other material object) with its meaning (designatum)."[105]
— Formal-symbolic truth: "this is the correct, in accordance with definite regulations of transformation, change of the linguistic marks of one language into the marks of another. Only and exclusively taken into account during this change is the figure of the symbol, with the omission of semantics."[106]

Of interest to naturalists is first and foremost ontological truth. This is the subject of scientific cognition. In the sphere of "cognitive contact" with the object, in the process of concluding, in the interpretation of the results of cognition there could creep in an error, an

99 P. Lenartowicz, *Elementy teorii poznania*, p. 160.

100 Ibidem, p. 162.

101 "Veritas logica recte definitur: conformitas seu adaequatio intentionalis intellectus cum re." L. Salcedo, *Philosophiae scholasticae summa*, vol. 1: *Introductio in philosophiam. Logica. Critica. Metaphysica generalis* (Biblioteca de autores cristianos, vol. 98), (Matriti: La Editoria Catolica, 1953), p. 335.

102 Cf. P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, p. 177.

103 P. Lenartowicz, *Elementy teorii poznania*, p. 165.

104 Ibidem, p. 166.

105 Ibidem, p. 167.

106 Ibidem.

oversight, an illusion. It could also lead to deception, the conscious tricking through the "manipulation" of the object of research[107] or the recounting of the results of research at variance with the truth. Therefore naturalists attempt in their cognitive undertakings to strive equally for logical, ontological truth as well as the truth of utterance, for these truths decide on the credibility and worth/value of our knowledge about nature. In the case of ambiguity or doubt (with regard to the correctness of cognition, diagnosis, description, conclusion, conception etc.) the final, deciding criterion of the truthfulness of their knowledge is the given thing and its repeated testing.[108] This for Lenartowicz is the fundamental and final criterion, that is that:

> (a) from which there is no reference to another criterion, (b) which is not based on another criterion, (c) to which everyone who wishes to show the credibility of some positive results of their cognition has to refer.[109]

The critical act: two types of error

The cognitive powers of a mature person are able to uncover an error, to discern false from truth, something that is confirmation of the effectiveness of cognition and the basis for the cognitive optimism of Aristotelianism-Thomism.[110]

Lenartowicz—in accordance with Aristotle—accepts that not only the cognition of ontological truth but equally the discovery of errors and their causes is key to deliberations over the dynamics of our

[107] An example can be the "Piltdown forgery," which was revealed thanks to the discovery of ontological non-truth. Cf. J.S. Weiner, *The Piltdown forgery* (New York: Dover Publications, Inc., 1980); E. Trinkaus and P. Shipman, *The Neandertals: Changing the image of mankind* (New York: A.A. Knopf Inc., 1993), pp. 199–208.

[108] Cf. P. Lenartowicz, *Elementy teorii poznania*, pp. 161–162.

[109] Ibidem, p. 170. In the scholastic tradition such a criterion was so-called "Evidentia vero formalis: [est] cognitio clara obiecti, per quam obiectum manifestatur menti sive per se ipsum, sive per connexionem necessariam cum eo quod est praesens per se ipsum intra intellectum. Haec, ut patet, subiectivam et obiectivam amplectitur" (L. Salcedo, *Philosophiae scholasticae summa*, vol. 1: *Introductio in philosophiam. Logica. Critica. Metaphysica generalis*, p. 330). In Lenartowicz the thesis has: "Ultimum et universale criterium et motivum veritatis et certitudinis naturalis non est auctoritas sive humana sive divina, neque instinctus animi caecus, aut sentimentum veri, aut conscientiae testimonium, aut idea subiectiva clara et distincta" (ibidem, p. 321).

[110] Cf. P. Lenartowicz, *Elementy teorii poznania*, p. 38.

cognition and the credibility of its results.[111] In the critical part of his theory of cognition Lenartowicz introduces the concept of error in negation and affirmation.[112] For in his conviction:

> strictly speaking, there exist two forms of the *critical act*. One involves the uncovering of the *error of negation*, while the other revealing the error of affirmation. The first error—that is the error of negation—involves the refuting of the recognition as real of that which is obvious. The second error—that is the *error of affirmation*—involves the recognition as real of that which is absurd, impossible.[113]

Lenartowicz adopts as the criterion for recognizing the error of affirmation the Aristotle's principle of non-contradiction, which—in opposition to the Thomist tradition—is here treated not as a principle of being, but as the maximally pared-down definition of the absurd.[114] In referring to Łukasiewicz,[115] he considers that "there is no point in talking about this principle as about … *a principle of being, existence, reality*."[116]

The principle of non-contradiction is therefore the fundamental and final criterion in the uncovering of the error of affirmation, but it is not either a fundamental nor the final criterion of the cognition of reality.[117] It has no application in the case of the error of negation. Here

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[111] "We ought however not only to state the true view, but also to account for the false one, since to do so helps to confirm the true; for when we have found a probable explanation why something appears to be true though it is not true, this increases our belief in the truth." Aristotle, *Nicomachean Ethics*, transl. H. Rackham, in *Aristotle in 23 volumes*, vol 19, ed. H. Rackham (Cambridge, MA, London: Harvard University Press, William Heinemann Ltd., 1934), 1154a, accessed September 29, 2018, http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.01.0054%3Abekker+page%3D1154a.

[112] Cf. Chapter 4 "O akcie krytycznym" in P. Lenartowicz, *Elementy teorii poznania*, pp. 133–158.

[113] Ibidem, p. 137.

[114] Cf. ibidem, pp. 141–142.

[115] J. Łukasiewicz, *O zasadzie sprzeczności u Arystotelesa* (Warszawa: PWN, 1987), p. 88. In the newest works talk is of the "principle of non-contradiction."

[116] P. Lenartowicz, *Elementy teorii poznania*, p. 142.

[117] Cf. ibidem, p. 175. The law of contradiction "say nothing about reality, one cannot draw any positive content from it" (ibidem, p. 142). "Contradiction is the signal of error, but the discovery of contradiction is not a guarantee of the cognition of truth [but at most] eliminates a certain path in the search for truth (like 'a dead end')" (ibidem, p. 174).

we have to make recourse to the act of cognition, its positive result that is the experience of the evidence of an object or phenomenon. Lenartowicz calls *evidence* "the consciousness that I can clearly see, hear something, I feel, experience."[118] Evidence of this kind he calls *direct* evidence. But thanks to memory, logical thinking, the ability to link facts we are also able to "see" things which are invisible to our senses, but they are "visible," that is obvious for/to our intellect.[119]

Evidence is the immanent experience of consciousness. So can it be a measure of the correct cognition of underlying contents in external objects? Lenartowicz was aware of the numerous difficulties and doubts connected with evidence.[120] He knew that within our consciousness there is underlying what we have become acquainted with through total evidence as well as that we have imbibed as a guess, an *a priori* assumption or premise or as a "religious wish." The separation of these various contents is often extremely difficult but thanks to thorough reflection it is possible.[121]

Summing up: Lenartowicz did not identify himself with any concrete "school" or "current" of Aristotelianism and Thomism, but he reached out to the thinking of various philosophers making reference to the A-T tradition. In his opinion Aristotelianism-Thomism broadly understood still constituted a good fundament for the description and shaping of notions about natural reality (in particular about living nature).

The philosophical problem which moderate realism places us before, concerns the question—which Lenartowicz called "the paradox of cognition"—of the way "man's consciousness finds out, that is 'sees' objects not being of this consciousness, ones 'external' in relation to this consciousness."[122] He considered that at the bases of our cognition (whether this be colloquial or academic) lies a sensual orientation in the features, traits, and properties of objects, which is the first cognitive phenomenon: the substantialist act.[123] In Lenartowicz's

118 Ibidem, p. 168.

119 Cf. ibidem.

120 Cf. ibidem, pp. 174–176.

121 Cf. ibidem, p. 175.

122 Ibidem, p. 196.

123 Cf. P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, pp. 170–172.

conviction moderate cognitive realism, which does not disregard sensual cognition and treats it as an integral element of an undivided sensual-intellectual dynamics for the acquisition of knowledge about reality, is able to defend the credibility of scientific cognition from the accusations directed at it by various forms of anti-realism and skepticism.

4.2. The philosophy of biological phenomena

Piotr Lenartowicz was fascinated with life in its various manifestations, while he approached human life—on all of its levels: the physical, the psychic, the spiritual—with enormous respect and love. No doubt this came from his medical and pharmacist family background. This was evident in his care for the sick and his complete opposition to contraception and first and foremost abortion.[124]

This holistic view of life—whether that of man or animal, or even of a bacterium—in confrontation with what he encountered during his research work at the Department of Physiology of the Medical Academy of Warsaw as well as the Polish Academy of Sciences was to become a cause of increasing frustration for him. Even though he was highly interested and involved in academic research it was to leave him with a certain dissatisfaction and even distaste. His philosophical studies made him fully aware that "biological knowledge has to be interpreted"[125] within the context of the biological whole which undoubtedly is the living organism.

It is no coincidence that the definition of philosophy that Lenartowicz formulated for himself and here for his own use was: philosophy is "the research of the whole as a whole,"[126] which is after all merely a paraphrase of Aristotle's definition that philosophy is "the science that studies being qua being."[127] This is a fully justified

[124] P. Lenartowicz, "Aborcja – sprawiedliwość czy dyskryminacja?," *Pismo Okólne. Biuletyn Informacyjny Biura Prasowego Episkopatu Polski* no. 8 (1991), pp. 16–20; P. Lenartowicz, "Indywidualne i społeczne zło aborcji," *Horyzonty Wiary* 8, no. 1(31), (1997), pp. 51–64.

[125] Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," p. 30.

[126] Cf. ibidem.

[127] Arystoteles, *Metafizyka*, transl. K. Leśniak, in Arystoteles, *Dzieła wszystkie*, t. 2 (Warszawa: Wydawnictwo Naukowe PWN, 1990), IV 1, 1003 a 21.

interpretation of Aristotle's thinking, for Aristotle himself understood being as the compound of matter and form, something he termed *sýn-olon*, and which may be translated as "whole," "entirety."

The whole

The notion of the whole in Lenartowicz has a fundamental ontological meaning. For it is identical with biological existence or being. A living being is a whole in an understanding far deeper and broader than simply being an ordinary compound of matter and form. For if for Aristotle *sýn-olon* had a fundamentally static character, then for Lenartowicz whole in the understanding of living being has a character that is overwhelmingly dynamic.

In attempting to define life and a living being, Lenartowicz initially approached matters from the pre-learning cognition unmediated and bestowed on everyone. He writes:

> From childhood each of us spontaneously assemble and gather other experiences on the subject of living entities (people, animals, plants). With the passage of time this data base instinctively grows within man, creating an increasingly richer and more accurate, complex, but synthetic, conception of life. This concept or notion does not have to be totally verbalized, but it is fundamentally correct and extremely similar amongst completely different races, tribes and social classes of *Homo sapiens*.[128]

Such a synthetic notion constitutes the basis for the thinking and functioning of man since the dawn of time. Science and philosophy with their logical and methodological approach to the object of research have a tendency to divide the whole and here equally in the spatial sense as in the temporal as well as to concentrate on some part or other or the properties of a living organism, or on one of the processes occurring within it, or on one of its stages of development—most often on its mature state.[129] In this way the spatial-temporal, dynamic whole of a living being is lost from view.

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[128] P. Lenartowicz and J. Koszteyn, "Wyjściowe przesłanki teorii życia biologicznego," in *W poszukiwaniu istoty życia. Pamięci ks. prof. Szczepana Ślagi*, ed. G. Bugajak and A. Latawiec (Warszawa: Wydawnictwo UKSW, 2005), p. 26.

[129] Cf. P. Lenartowicz, "Pojęcie całości i przyczyny w dziejach embriologii," p. 208.

What life is not

Lenartowicz criticised the reductionistic conceptions of a living organism that put emphasis on the structures of the body as the fundament and reason for its dynamics (life).[130] He considered that for a correct description of life necessary is a clear "differentiation between the structures arising as a result of biological dynamics and the dynamics themselves."[131] He emphasized that life is not a physical structure but a dynamism which is expressed

> through integrated changes of structure … What is alive does not have a constant mass (it grows, becomes fatter or thinner), it does not have a constant shape, a constant chemical structure, or even a constant organ structure. The structural notion of a living organism is a caricature of life.[132]

An indivisible unit of life is also not any of the cognitively isolated development stages of an organism. Neither is it either the reproductive cell or the mature form (adult), nor any of the intermediate stages, but it is the dynamic tendency to realise the entire developmental cycle, in which one stage harmoniously transfers into another. This innumerable quantity of integrated processes of biosynthesis, cytogenesis, organogenesis, which are accompanied by the endless monitoring of as equally the surroundings as the state of the body's structures allowing for their correct regeneration and adaptive modification. And this takes place at all levels of the organism beginning with the molecular and ending with the anatomical. Which is why—according to Lenartowicz—the philosophy of nature, which tries to get to know and understand the dynamics of life has to take account of both the indivisibility of the development dynamic as equally with its complexity.

Lenartowicz emphasized strongly that "life manifests itself as a construct of material structures but it is not a material structure itself."[133] Simultaneously it is a perfect, materially and energetically

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130 Cf. P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," in *Antropologia* (Dydaktyka Filozofii, vol. 1), ed. S. Janeczek (Lublin: Wydawnictwo KUL, 2010), pp. 238–254.

131 P. Lenartowicz and J. Koszteyn, "Wyjściowe przesłanki teorii życia biologicznego," p. 32.

132 Ibidem, p. 28.

133 Ibidem.

unsurpassable type of "constructing." Man with all his knowledge and technology, at the price of enormous amounts of work, is able admittedly to imitate certain structures similar to those which arise as a result of the development dynamic yet does so in an ineffective and imperfect manner when a, as if relatively simple, bacterium cell constructs it incomparably faster and more effectively.[134] At the same time, one cannot draw the conclusion on the basis of the fact that man is able to imitate some of the particle processes occurring within living organisms, that he is able to create life. Even the process of reproduction cannot be termed the creation of life rather simply its continuation.[135]

Life according to Lenartowicz is not a physical-chemical process (nor does it have its origins in processes of this kind[136]), but merely appears in the processes of building selective, correlated and integrated material structures, in which—obviously—physical-chemical processes occur.[137]

> All structures of the body without exception are constructed out of mineral matter elements. All forms of biological dynamics makes use of the structural-energy potential of mineral matter. What makes the living body different from mineral matter is its unusual selectivity. A living dynamic does not create a mineral dynamic. A mineral dynamic—that is various physical-chemical processes—is the result of the properties of matter. The living dynamic only selectively limits ("narrows") the mineral dynamic.[138]

Selectiveness and correlation in biological processes mean that the living organism selects from the huge reserve of raw materials surrounding it, those which are necessary in the construction of the

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134 Ibidem, p. 29.

135 Cf. ibidem.

136 Cf. P. Lenartowicz, "Czy istnieją 'dusze' roślin i zwierząt, a jeśli tak, to skąd się one biorą?," in *Philosophiae et Musicae. Księga Pamiątkowa z okazji Jubileuszu 75-lecia urodzin Prof. Stanisława Ziemiańskiego SJ*, ed. R. Darowski (Kraków: Wyższa Szkoła Filozoficzno-Pedagogiczna "Ignatianum", Wydawnictwo WAM, 2006), pp. 467–488.

137 Cf. P. Lenartowicz, J. Koszteyn, "Wyjściowe przesłanki teorii życia biologicznego," p. 31.

138 P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," p. 248. Cf. also P. Lenartowicz, "Dusza," pp. 102–104.

body's structures and to guarantee their correct functioning. Complicated structures arise in a synchronic (time correlation), syntopic (spatial correlation), symmorphic (structural correlation), synhexic (correlation of internal properties) and synergic (energy correlation) way.[139] The development processes occur in an integrated way at all levels of an organism's structural complexity. Hence there appears the postulate of the integrating factor. "which should be identified with the effects of its action."[140] As Lenartowicz conjectured at the moment of an organism's death, when this factor ceases to act, the internal structure of its cells undergo disintegration, the syntopy, synchrony symmorphy, synhexy and synergy disappear.[141]

The life cycle

Lenartowicz had already claimed in his PhD thesis *Phenotype-genotype dichotomy* that the fundamental unit of life phenomena and with it the entirety of a concrete living being is the life cycle.[142] This is the entire cycle of changes from the reproductive cell to the mature form capable of reproduction, and therefore to commence again the subsequent life cycle of an already new organism.[143] He draws attention here to the fact that the life cycle is not what we colloquially understand by the word "cycle." It is not

> any series of changes or activities conducted within the framework of some system, which is a series that leads it with a return to the starting point …, for the initial changes in the moment of the separation from the parent organism do not lead to the starting point but—the reverse—they lead it to the obtainment of new features and properties, ones that earlier were not in it.[144]

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[139] Cf. P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 240–242; P. Lenartowicz, "Cel (celowość, teleologia)," pp. 39–41.

[140] P. Lenartowicz and J. Koszteyn, "Wyjściowe przesłanki teorii życia biologicznego," p. 31. Cf. also P. Lenartowicz, "Dusza," pp. 102–103; P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," pp. 248–250.

[141] Cf. P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, p. 298.

[142] Cf. P. Lenartowicz, *Phenotype-genotype dichotomy: An essay in theoretical biology*, pp. 38–44.

[143] Cf. P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 45–52.

[144] Ibidem, p. 51.

In the life cycle together with the appearance of subsequent structures there occurs a gradual increase in the complexity and internal differentiation of the organism (the growth of objective information). This process is called epigenesis. Lenartowicz in his works and particularly in his main work *Elementy filozofii zjawiska biologicznego* [Elements of a philosophy of biological phenomenon], was to devote a lot of space to this process, analyzing its various aspects and types.[145] For epigenesis presents itself differently in eumetazoa and differently again in unicellular organisms. In each, however, we are dealing with a life cycle and with an increase in complexity as well as objective information.[146] At the same time subsequent life cycles are not a simple reproduction of the cycles that preceded them. True each life cycle of a given species contains an identical set of basic features but also each of them possesses its own adapted features (correlated with the conditions of the environment in which they are to be found) as well as an ontogenetically unique set of identifying features.[147] So every life cycle is not simply a whole but every time a specific, one could say, unique whole. One gains the impression that as if the directing factor through this dynamic had managed an individualization of every living being.

From the times of Descartes and his mechanical philosophy, the living organism started to be understood as a specific type of machine, and so a functional system. It is a fact, claimed Lenartowicz, that "there occur in living organisms sets of various structures, fibers, cells, particles organized such that their joint action leads to a single relatively simple (descriptively) mechanical, chemical or electrical effect."[148] But he clearly emphasized that "the activity of these structures called biological machines (for example proton ATPases), is not

[145] It is enough to look at the headword "epigenesis" in the subject indexes in P. Lenartowicz, *Elementy filozofii zjawiska biologicznego* as well as J. Koszteyn, ed., *Vivere & Intelligere. Wybrane prace Piotra Lenartowicza SJ wydane z okazji 75-lecia Jego urodzin* (Kraków: Wyższa Szkoła Filozoficzno-Pedagogiczna "Ignatianum", Wydawnictwo WAM, 2009).

[146] Cf. P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 91–92.

[147] On the subject of organism traits cf. ibidem, pp. 94–106; P. Lenartowicz, *Phenotype-genotype dichotomy: An essay in theoretical biology*, pp. 44–51; J. Koszteyn and P. Lenartowicz, "Integracja dynamiki biologicznej a drzewa rodowe istot żywych," *Filozofia Nauki* 9, no. 2(34), (2001), pp. 61–63.

[148] P. Lenartowicz, "Pojęcie całości i przyczyny w dziejach embriologii," p. 212.

a biological dynamic yet these machines are the products and tools of the biological dynamic. Their functionality is dependent on the nonreductive team of closely defined (selective) physical-chemical features,"[149] being the result of the living dynamic integrating and narrowing (limiting) the mineral dynamic. As a result of this

> ... the conceptual scheme of the functional system does not lend itself ... to a description of the events constituting the essence of the phenomenon of the life cycle. If one were to discern in the internals of an organism certain objective analogies with machines constructed by man, then they could obscure the fact that an organism treated as a whole is not a machine. The functional system has the character of an automatic phenomenon. This means that it is a system whose dynamic explains itself wholly, without recourse to beings, forces, hypothetical fields, without the postulation of demons material or non-material. ... The only puzzling element is the process by which such a system comes into being. There may also be raised the question as to whether the process of constructing the functional system is characterized by some wholeness or other as well as on what such an entirety depends.[150]

In analyzing—as examples of development systems—the stages of the biosynthesis of the chlorophyll-protein complex collecting light energy (LHC: *light harvesting complex*),[151] which plays a significant role in the process of photosynthesis, or also the stages in the building of the locomotor system of the bacterium *Escherichia coli*,[152] Lenartowicz pointed to a range of discernible regularities in the creation of each functional system. Biological developmental processes are characterized by:

(a) repetitiveness;
(b) growth in complexity (epigenesis);

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[149] P. Lenartowicz and J. Koszteyn, "Wyjściowe przesłanki teorii życia biologicznego," p. 33.

[150] P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 247–248.

[151] Cf. ibidem, pp. 248–254 as well as P. Lenartowicz, "Fundamental patterns of biochemical integration. Part 1: The functional dynamism," *Rocznik Wydziału Filozoficznego Towarzystwa Jezusowego w Krakowie 1991–1992* 4 (1993), pp. 203–217.

[152] P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 257–262 as well as P. Lenartowicz, "Rozwój i postęp w świetle empirii biologicznej," in *Humanizm ekologiczny*, vol. 2: Materiały z sympozjum nt. "Kryzys idei postępu – wymiar ekologiczny," Lublin 7–8 grudnia 1992, ed. S. Kyć (Lublin: Wydawnictwa Uczelniane Politechniki Lubelskiej, 1993), pp. 177–180.

(c) the construction of new tiers in the hierarchy of structures (hierarchization);
(d) the transfer from the outline of structures to details (concretization);
(e) the maintaining of the process of development at a certain limit.[153]

The developmental system is a system of developmental paths clearly subordinated to the creation of particular parts of the functional system.[154]

On the intracellular level of organization (and it is at this level that the building of body structures commences) one can clearly see that the significant stages in the development process are: (1) the production of a whole range of strictly defined simple forms of organic compounds (such as carbohydrates, heterocyclic compounds etc.), (2) the production of complex organic compounds (such as coenzymes, nucleotides etc.), (3) the production of heteropolymers (such as polypeptides, mRNA, tRNA, rRNA) as well as (4) the assembly of complexes and multimolecular structures into the form of completed enzymes, ribosomes etc.

> Each of the enumerated stages can be divided into many elementary chemical reactions which occur in a strict order so that the products of the entire syndrome reaction are strictly determined with regard to their chemical structure. ... The above mentioned stages are strictly linked to each other and this is a double-sided relationship. On the one hand, selective production on the lower stage constitutes the physicochemical condition and basis for the later stages, on the other hand, the end product ... constitutes the physicochemical condition for the precise selectivity of all subsequent stages.[155]

It is best to comprehend the internal logic of the developmental dynamic in the context of functional integration. If we perceive the dynamic integration of functional structures in which:

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153 Cf. ibidem, p. 180.

154 Cf. *Elementy filozofii zjawiska biologicznego*, pp. 277–278.

155 P. Lenartowicz, "Całościowość procesu życiowego na poziomie molekularnym," in *Nauka – Religia – Dzieje. II Sympozjum Interdyscyplinarne w Castel Gandolfo, 6–9 września 1982*, ed. J.A. Janik and P. Lenartowicz (Kraków: Wydział Filozoficzny Towarzystwa Jezusowego, 1984), p. 61.

— suitably formed parts (*symmorphy*),
— at a suitable spatial scale and number (*stoichiometry*),
— produced from suitable materials (*synhexy*),
— suitably distributed in space (*syntopy*),
— activated at a suitable time (*synchrony*),

they cause:

— a strictly determined direction of flow,
— a strictly determined form of energy,
— a strictly determined portion of this energy,
— with maximum energy efficiency (*synergy*),[156]

then "we have to—as a consequence—discern the integration of the phenomenon of development."[157]

At the highest level of the developmental system are visible syntopy, synchrony, symmorphy, synhexy and synergy, with the addition to these of epigenesis and hierarchization, and so the creation of subsequent tiers of structural complexity of the organism body. It follows to here note that an enormous number of individual "developmental paths" make up the development cycle of an organism, which in the process of the whole dynamism of the life cycle are perfectly integrated with each other. This obviously provokes the question as to the factor integrating this unimaginably rich development dynamic. According to Lenartowicz, this factor—judging by results—has to characterize:

(1) the capability for the selective search and choice of suitable, varied raw materials (e.g., the appropriate foodstuffs ...),
(2) the capability to make from these raw materials appropriate building materials (e.g., ... appropriate proteins ...),
(3) the capability to shape (from these materials) various appropriately fitting parts ...,
(4) the capability to place these varied parts within appropriate spatial relations ...,
(5) the capability to build this structure in the appropriate part of the body ...,
(6) the capability to skillfully use the built structure,

156 Cf. P. Lenartowicz, "Cel (celowość, teleologia)," p. 39.
157 P. Lenartowicz, "Rozwój i postęp w świetle empirii biologicznej," p. 181.

> (7) the capability to realize when the structure has worn out and a subsequent one needs to be built or that an element needs to be changed.[158]

Totipotency and development potential

The next exceedingly important concept within Lenartowicz's deliberations over the nature of living beings was totipotency. In a lecture that he gave before Pope John Paul II as part of the 6th Seminar Session "Science—Religion—History" at Castel Gandolfo in 1990 he categorically claimed:

> Totipotency, that is wholeness and potentiality—is the same nucleus of the philosophical debate between monism and ontic pluralism. In biology this debate has a different name—for here it is the debate between mechanism and vitalism … While there certainly does not exist under the sun a better illustration of the notions of wholeness and potency than biological dynamism.[159]

And so in entering into an analysis of this we are entering into the very centre of Lenartowicz's philosophy of living dynamism. We shall start, however, with a definition of totipotency. Lenartowicz himself in introducing the question wrote:

> In the biology of development the term totipotent (from the Latin *totum* = whole and *potentia* = potency, power) has been adopted to refer to those cells which have the potential to transform themselves—obviously through many subsequent cell divisions—into a complete, mature form of the organism.[160]

Totipotency relies therefore on the capability of a given cell or group of cells to initiate and realize the full life cycle. Totipotency appears in the reproductive cell in the clearest possible way. However, in the world of living beings there are many other examples of totipotency. It had already been discerned by Aristotle, who wrote:

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158 P. Lenartowicz, "Cel (celowość, teleologia)," p. 40.

159 P. Lenartowicz, "Totipotencjalność – kluczowe pojęcie biologii rozwoju," in *Nauka – Religia – Dzieje. VI Seminarium Interdyscyplinarne w Castel Gandolfo, 6–9 sierpnia 1990*, ed. J.A. Janik (Kraków: Uniwersytet Jagielloński, 1992), p. 87.

160 P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 134–135.

> many animals ... can, though divided, continue to live by means of the part connected with nutrition. While this member is indeed in actuality single, yet potentially it is multiple, for these animals have a constitution similar to that of plants; plants when cut into sections continue to live, and a number of trees can be derived from one single source. ... while others can be propagated by the taking of slips.[161]

However, Aristotle's insight was not to find instant understanding in biology or the philosophy of nature. Totipotency and the epigenesis connected with it was to be replaced for many centuries by the theory of preformation, which proclaimed that in a seed (or egg) there is already a whole, though miniaturized and as if an enveloped organism, and that development depends on its evolvement (unfurling) and enlargement. We should note that the words which till this day are used in the biology of development come from this period of time. Take simply the word *development* for instance. Only that which is enveloped can develop.[162] Only with the perfection of the microscope (the 18th century) was a breakthrough to occur and the exposure of the theory of preformation as false. Victorious was to be epigenesis and the totipotency connected with it. However, there arose an extremely difficult question: how does it occur that from a single relatively simple cell or a small number of cells a whole complicated organism arises one of incomparably greater complexity? A similar question arises in the case of the phenomenon of regeneration: how is it possible that an organism rebuilds lost or damaged organs, and even is able to rebuild itself entirely from a small part?

There is also another aspect to the dynamism of an organism where totipotency is visible—these are phenotypic adaptations. Observations (often connected to carefully planned experiments) reveal that living organisms respond to changes in environment (abiotic and biotic) not only through an appropriate change in behavior but

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[161] Aristotle, *Parva Naturalia: De iuventute et senectute, de vita et morte, de respirationon*, transl. G.R.T. Ross, in Aristotle, *The works of Aristotle*, vol. 3, ed. W.D. Ross (Oxford: Clarendon Press, 1931), 468a-468b, accessed August 23, 2006, https://archive.org/stream/worksofaristotle03arisuoft#page/n3/mode/2up/search/parva.

[162] Similar it is in other European languages: *développer—envelopper* (Fr.), *sviluppare—avviluppare* (It.), *entwickeln—einwickeln* (Ger.), *развивать(ся)—свивать(ся)* (Rus.).

also through the perfect rebuilding of the structures of their body as well as through the selective adjustment of biochemical-physiological processes.[163] Lenartowicz differentiated quantitative and qualitative (functional) adaptations.[164] The former concerned changes in the size of the body or in organ proportions given an unchanged functioning. While qualitative adaptations were connected with changes in the principles of organ functioning or of their systems, and here as he wrote:

> The transformation from one to another functional form within the framework of a single species may be achieved with various speed: sometimes extremely fast, within the course of several dozen minutes or so, even multiple times within the framework of the same life cycle, sometimes very slowly, gradually, over the course of many generations. In both cases these changes are reversible and repeatable.[165]

Phenotype—genotype—genome

Deliberations on totipotency and developmental-adaptive potential led to the key matter for Lenartowicz of the problem of the reason or reasons for the dynamic wholeness (entirety) of living organisms. This problem matter was to accompany Lenartowicz from the moment he started his interest in philosophy. And here there is nothing strange, for the first question that philosophers asked themselves was the question over *arché*, that is the reason, principle of being. Lenartowicz asks this question within the context of biological phenomena and life as such. The notions of phenotype and genotype play a significant role in answers to this question, which due to Wilhelm Johannsen have permanently entered into the vocabulary of the biological sciences.

The concept of phenotype (from the Greek *phaínomai* meaning "to show," and *týpos*: meaning "type") is widely understood as the "entirety of features of an individual"—the anatomical, the physiological,

[163] Numerous examples of adaptation are discussed in P. Lenartowicz, *Phenotype-genotype dichotomy: An essay in theoretical biology*, pp. 48–51; P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 101–107; P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, pp. 291–294.

[164] Cf. ibidem, p. 304; J. Koszteyn and P. Lenartowicz, "Integracja dynamiki biologicznej a drzewa rodowe istot żywych," p. 62.

[165] P. Lenartowicz, "Totipotencjalność – kluczowe pojęcie biologii rozwoju," pp. 90–91.

the biochemical and the behavioral, which arise as a result of "the joint action of the genotype of a given organism and environmental factors."[166] For Lenartowicz

> Phenotype in the broadest meaning of the word means everything that may be observed in the life cycle, at whatever level of its complexity, at whatever stage of its development. The most significant feature of the notion of phenotype is that it appears *de novo* in the course of an organism's life cycle. In other words a phenotype is in the description of the life cycle clearly a changeable element, and its changeability is characterized by epigenesis, that is the gradual increase in complexity.[167]

In as far as the concept of phenotype was merely somewhat modified and honed, the notion of genotype and genome were to undergo a fairly fundamental redefinition. Genotype is usually understood as "the sum of genes contained in an organism's cell. Genotype demarks a certain range of development possibilities whose realization dependent on environment factors leads to the formation of a phenotype."[168] A genome in turn—in the case of eukaryotes—is defined as "the sum of all the chromosome genes contained in the basic, haploid chromosome set; and in prokaryotes—the sum of the genes contained in the genophore. The term genome is also used as a synonym for genotype."[169]

For Lenartowicz—who most frequently used the term "genome"—the most important question was to look for an answer to the question as to whether genes did in fact possess a "development program" for the organism and constitute "the source of information about all the features and properties of particular living forms."[170] In other words he asked whether it was true that

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166 H. Krzanowska, "Fenotyp," in *Leksykon biologiczny,* ed. C. Jura and H. Krzanowska (Warszawa: Wiedza Powszechna, 1992), p. 189. Cf. also J.C. Stevenson, *Dictionary of concepts in physical anthropology* (New York: Greenwood Publishing Group, 1991), p. 291.

167 P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, p. 200.

168 H. Krzanowska, "Genotyp," in *Leksykon biologiczny*, ed. C. Jura and H. Krzanowska (Warszawa: Wiedza Powszechna, 1992), p. 215.

169 H. Krzanowska, "Genom," in *Leksykon biologiczny*, ed. C. Jura and H. Krzanowska (Warszawa: Wiedza Powszechna, 1992), p. 215.

170 P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 375.

> The collection of chromosomes in the fertilized egg constitutes the complete set of instructions for development, determining and details of the formation of the heart, the central nervous system, the immune system, and every other organ and tissue required for life.[171]

Lenartowicz proposed, in his considerations on the subject of genomes, to differentiate a structural genome (static, passive) from a dynamic one. A structural genome are the coded—in the form of a definite sequence of codons (of three nucleotides)—sections of DNA (so called genes) essential in the biosynthesis of protein as well as tRNA. It follows here to note that:

> (1) The sequence of DNA codes does not completely decide on the final functional shape of the enzymes, about their secondary, tertiary and quaternary structure. ...
>
> (2) The sequence of DNA codons more than once have not decided on the complete structure of the messenger RNA (mRNA), and consequently about the correct primary structure of functional proteins. ...
>
> (3) The sequence of DNA nitrogen-containing nucleobases does not completely determine the functional structure of the transfer RNA (tRNA).[172]

In addition—as Lenartowicz pointed out—the majority of genes appear in the form of fragments (exons) scattered amongst the non-coding sequences. The sequences of nucleotides of a single gene cannot appear on one but on both complementary strands of DNA, they can be "read" in various ways, that is they possess two or more starting points as well as points ending the process of transcription (ORF[173]). In the course of somatic recombination there occurs a regrouping of the definite sequences of nucleotides leading to the creation of the

[171] Quoted from: H.F. Nijhout, "Metaphors and the role of genes in development," *BioEssays* no. 12 (1990), p. 441.

[172] P. Lenartowicz, "Sens i zakres pojęcia informacji genetycznej," in *Rozprawy i szkice z filozofii i metodologii nauk. Księga Pamiątkowa ku uczczeniu siedemdziesięciolecia urodzin Profesora Władysława Krajewskiego*, ed. J. Such, E. Pakszys and I. Czerwonogóra (Warszawa: Wydawnictwo Naukowe PWN, 1992), pp. 313–314.

[173] Open Reading Frame.

appropriate genes coding immunoglobulins, surface receptors of lymphocytes T etc. But much points, however, to the fact that

> the information stored in DNA molecules requires interpretation by the highly dynamic cellular systems that control DNA packaging, imprinting, replication, transcription, translation, splicing, signal transduction, morphogenesis and so forth.[174]

Homeobox genes—which were to finally have solved the puzzle of the development of an organism—contain only codes for the protein signals switching on and switching off the transcription of the relevant genes in the course of embryogenesis. What is more "it turned out that in insects, mice and in man—despite the huge differences in the structures of the mature form—the DNA codes for the signals regulating development are very similar."[175]

In the biology of development—as Lenartowicz wrote—"the central problem is (a) the stock of information, (b) the utilization, 'activation' of information and (c) the coordination of this activation."[176] The DNA molecule fulfils only the first of the enumerated roles and then to a degree insufficient to even explain the genesis of a single protein (or tRNA), not mentioning the whole organism.

> The DNA of living cells amazingly recalling a "crib sheet." … this is an encrypted record … This is a record which like in every crib sheet is incomplete and most totally passive. Finally this is a record that quite frequently makes use of abbreviations, ones requiring supplementation … The DNA of eumetazoans also contains in its structure the codes of developmental signals (so-called homeoboxes) … Their physicochemical structure has nothing in common with the changes that they signalize. A telling illustration of this is the fact

[174] J.A. Shapiro, "A 21st century view of evolution," *Journal of Biological Physics* 28, no. 4 (2002), p. 748.

[175] P. Lenartowicz, "Totipotencjalność – kluczowe pojęcie biologii rozwoju," p. 106. Cf. also: E.M. De Robertis, G. Oliver and C.V.E. Wright, "Homeobox genes and the vertebrate body plan," *Scientific American* no. 6 (1990), pp. 46–52; Fernald R.D., "Evolution of eyes," *Current Opinion in Neurobiology* 10 (2000), pp. 444–450; J.S. Robert, "Interpreting the homeobox: metaphors of gene action and activation in development and evolution," *Evolution and Development* no. 3(4), (2001), pp. 287–295.

[176] P. Lenartowicz, "Racjonalność ducha czy życia?," *Kwartalnik Filozoficzny* 23, no. 2 (1995), p. 92.

> that the signal representing a certain stage in the development of a fly's body is almost identical with the signal showing the stage of development of a mouse embryo.[177]

Many facts known at present contradict—according to Lenartowicz—the widely spread opinion "as if DNA was a store of complete information and at the same time the greatest dispatcher of this information."[178] Therefore "needed is a notion of a dynamic genome expressing the wholeness (entirety) of the development of a concrete living form."[179]

> A materialistic genome is precisely a structural genome, and not a dynamic genome. From observation of the development, adaptation, regeneration of living forms there does not emerge a vision of structure (chemical or anatomical), but of a *factor*:
>
> > which is a *unity* and not a set of factors,
> >
> > which possesses a certain orientation in the surroundings and in itself,
> >
> > which possesses the capability to manipulate itself and the surroundings,
> >
> > which operates within the borders of not any *norm of reaction* whatsoever (a tortoise's, stork's., monkey's or bee's),
> >
> > which displays a certain potential/potency for the construction of structures, and they in their functionality (energy efficiency) literally *cannot be bettered*.[180]

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[177] Ibidem, pp. 92–93. Cf. also P. Lenartowicz, "Are we fully shaped and determined by our genes?," in *Genethik (41. Internationales Karwochenseminar 9.–14. April 1997 St. Virgil, Salzburg); Medizin und Tod. Vom Umgang mit Sterbenden (40. Internationales Karwochenseminar 1996, 31. März–4. April 1996 St. Virgil, Salzburg)*, ed. F. Haslinger (Wien: Internationale Mediziner Arbeitsgemeinschaft, 1997), pp. 67–80; P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 330–334.

[178] P. Lenartowicz, "Racjonalność ducha czy życia?," p. 93. A similar opinion has been expressed by many biologists. Cf.: R.C. Stroham, "The coming Kuhnian revolution in biology," *Nature Biotechnology* 15 (1997), pp. 194–200; J.A. Shapiro, "A 21st century view of evolution," pp. 745–764; C. van der Weele, "Images of the genome," in *Current themes in theoretical biology: A Dutch perspective*, ed. T.A.C. Reydon and L. Hemerik (Dordrecht: Springer, 2005), pp. 9–31; M. Chorąży, "Geny i genetyka – nowe dylematy," *Onkologia w praktyce klinicznej* 1, no. 1 (2005), pp. 1–6.

[179] Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," p. 44.

[180] Ibidem, p. 48.

The dynamic genome—in Lenartowicz's conception—acts simultaneously on all the levels of the hierarchical complexity of the living organism—from the molecular to the anatomical.

> A genome has that very trait: "the whole is in the whole, and the whole is in every part." The whole of what? Not the whole of atomic or molecular structures. Here the matter concerns the whole of the dynamic arousing a concrete phenotype.[181]

It has consequently a property that is traditionally ascribed to the substantial form, Aristotelian soul (*psyché*): *totum est in toto, et totum est in qualibet parte*.

4.3. Paleoanthropological premises of the unity of mankind

The knowledge acquired while studying medicine on the subject of man's anatomy and physiology without doubt had a huge influence on Lenartowicz's inquiries into man's evolution and the taxonomic status of prehistorical hominid forms.[182] This knowledge helped him penetrate the thought process of paleoanthropologists and reflections over the methods and results of the reconstruction of the anatomy and behavior of early hominids based on the analysis of bone remains as well as other traces of their presence (footprints, tools, the remains of fires etc.). In turn, his philosophical studies and research into biological phenomena, the nature of living being, made him aware with total clarity that the significance of what has been preserved from our prehistoric ancestors takes on true meaning in the context of the dynamism of individual anatomical systems, and first and foremost that of the entire organism.

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[181] Ibidem, p. 50. Cf. also: P. Lenartowicz, *Elementy filozofii zjawiska biologicznego*, pp. 363–389; P. Lenartowicz, "Trzy koncepcje dynamiki biologicznej: arystotelesowska, neo-darwinowska, inteligentnego projektu," pp. 368–376; P. Lenartowicz and J. Koszteyn, "Wyjściowe przesłanki teorii życia biologicznego," pp. 25–40.

[182] The term "hominids" refer in Lenartowicz's works to all Pliocene, Pleistocene and Holocene biological forms whose remains show anatomical and behavioural features (e.g., dentition, bipedalism, the production of tools etc.) characteristic for modern people.

Reconstruction of the structures and dynamism—the "double empiricism" of fossil remains

It is important to be aware—wrote Lenartowicz—that "the direct objects of observation for paleoanthropologists are the dead,the more or less fragmentary remains of individuals alive once."[183] These remains constitute almost 90% of the empirical material that allows one to reconstruct chiefly the biology of hominids. The traces of the so-called material culture of earlier hominids is less than 10% of the excavated material and only later better preserved artefacts have allowed for a fuller probe into the intellectual potential of our ancestors.[184]

Is it possible to discover the biological aspect of humanity by possessing the damaged, fragmentary and scattered remains of body structures? Lenartowicz drew attention to the fact that fossil remains have a "double significance"—"as if a double empiricism."[185]

> The research effort of paleoanthropologists is connected with not only the reconstruction of the *structure* but first and foremost the *dynamism* of a concrete life form. In this paleoanthropologists make constant recourse to … biological knowledge that is the result of research into beings living "here and now." Without this type of knowledge, the fragmentary, mineralized "object of research" could not be recognized as remains coming from some definite living form.[186]

The remains of the skeletal structures available to paleoanthropologists enable for the reconstruction of a dynamism basically to only two biological systems: of locomotion and mastication (that is the chewing and crushing of food). And it was on these that Lenartowicz was to concentrate showing in his works that the remains of hominids—even those several million years old—carry within themselves traces of a dynamism typical for man and clearly differ from those that we observe in apes.

In his descriptions and analyses he was to remain true to the conviction that in reconstructing the past one should refer to the present,

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183 P. Lenartowicz, "Rekonstrukcja biologii i psychologii hominidów," *Rocznik Wydziału Filozoficznego Akademii Ignatianum w Krakowie* 18 (2012), p. 215.

184 Cf. P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 141.

185 Cf. ibidem, p. 321.

186 P. Lenartowicz, "Rekonstrukcja biologii i psychologii hominidów," pp. 215–216.

that is to the results of research into contemporary people and apes. For research of this sort enables the best insight into the structure and principle of action of any dynamic system whatsoever, and in addition—which was according to Lenartowicz exceedingly important—displays with total clarity the structural-dynamic integration of such a system deciding on its maximum biological efficiency. It also makes us aware that "a fragment of bone or tooth is a trace of the process of embryogenesis … No one is going to claim that the correct shaping of the thigh bone may arise without the simultaneous development of the shank bone, or those of the hips. … Reconstruction requires the notion of the entirety of the dynamic system."[187]

The locomotor system. A holistic dynamic approach in research into the prehistoric remains of hominids is significant in any reconstruction of the locomotion system of prehistoric hominids. Such an approach lay at the basis of the reconstruction of the length and positioning of the thigh bone in *Australopithecus afarensis*, which was carried out by Kingsbury G. Lovejoy and C. Owen Heiple.[188] The discovered remains enabled them to measure the width and height of the bones of the pelvis, the diameter of the head of the thigh bone (the femur), the length of the neck as well as the angle between the axis of the neck of the thigh bone and the bone's diaphysis, the width of the thigh bone from the side of the knee joint as well as the angle of axis deviation of the thigh bone diaphysis from the perpendicular. However, it was not possible to measure the length of the thigh bone of this *Australopithecus* because the bone shaft had disintegrated.

The reconstruction carried out by Lovejoy and Heiple, was based equally on an analysis of the remains as on certain anatomical-physiological regularities such as: the mirror symmetry of the left and

[187] P. Lenartowicz and J. Koszteyn, "Fossil hominids: an empirical premise of the descriptive definition of *Homo sapiens*," *Forum Philosophicum* 5 (2000), p. 171.

[188] Cf. C.O. Lovejoy and K.G. Heiple, "A reconstruction of the femur of *Australopithecus africanus*," *American Journal of Physical Anthropology* no. 32 (1970), pp. 33–40. Lenartowicz presented a thorough analysis of the results of research and the course of Lovejoy's and Heiple's reasoning at a conference organised by the Poznań branch of the Polish Academy of Sciences and the Theology Faculty of the Adam Mickiewicz University in Poznań and entitled „Człowiek – istota nieznana?" [Man – an unknown being?] (Poznań, 25th November 2011). Cf. also P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, pp. 95–96.

right halves of the body, the knees meet in the sagittal plane and the flexion in the knee joints on a horizontal axis. Taking this into consideration, these academics estimated the length of the thigh bone of this *Australopithecus* to be a mere 28 cm. They rejected in this a whole series of faulty reconstructions. For if—for example—the thigh bone had been longer then the knees would have crossed. In turn, if the missing diaphysis fragment had been too short then the *Australopithecus* would have had legs disproportionately short and wide apart. In both cases correct locomotion would have been impeded or rather impossible.

One may therefore say that there exist numerous ways for the incorrect reconstruction of the length and positioning of the thigh bone, but there exists but a single correct reconstruction that is the one that takes into consideration the empirical and biological (functional) logic of the locomotor system of hominids.

The positioning of the thigh bones in man nowadays recalls the letter V, which means that we move "fluidly/smoothly." One can observe a similar positioning in *Australopithecus* and other ancestors of man. However, in chimpanzees the diaphysis of the thigh bones runs almost parallel, something that is connected with its natural physiological quadrupedalism.[189] Which is why a chimpanzee during the bipedal walk, characteristically waddles from side to side.

If one were to go back, say, 3 or 4 million years we would not observe any similarity in the locomotor system of hominids and that of apes. One may again repeat the words of Lenartowicz: when a paleoanthropologist examines bone remains e.g., of the form called *Australopithecus*, then

> he notes not only the coloration, hardness, weight and shape of the bone fragments … He equally "sees" that these two fragments must be—as results from the "logic" of these structures—placed in relation to each other in a strictly determined way, at a strictly

[189] A chimpanzee "moves … on all fours … Sometimes he adopts a bipedal pose, which is for the chimpanzee … unnatural to such a degree as to move on all-fours for man." A. Rajski, *Zoologia*, vol. 2 (Warszawa: Wydawnictwo Naukowe PWN, 1995), p. 495. "The placing of a chimpanzee skeleton in an upright position (which in Paleoanthropology is a widespread phenomenon) has as much sense as placing the human skeleton in an all-fours position." P. Lenartowicz, "Rekonstrukcja biologii i psychologii hominidów," p. 218. Cf. also P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 104.

> determined distance. He "sees" also with total obviousness that remains thus placed were bone fragments involved in the dynamic of locomotion ... as we observe today only in man.[190]

The footprints of *Australopithecus* discovered close to Laetoli (northern Tanzania) illustrate the masterly control of body balance while moving in an upright position. Even though they were produced over 3.5 million years ago they practically differ in no way from the footprints that would be left by modern man barefoot (e.g., by the "uncivilized" tribes of South American Indian).[191]

The mastication system. Lenartowicz was to devote as much attention, as he did to the locomotor system, to the mastication system of hominids. He presented within his richly illustrated works the mastication system of Pliocene and Pleistocene hominids, showing certain characteristics of this system such as the parabolic arch of the mandible, the small size of the canine teeth, which do not stick out beyond the edge of the remaining teeth, and the absence of diastema; features equally typical for modern man. He did not avoid either certain characteristics of this system in prehistoric hominid's forms, those that arouse the greatest doubts and controversy. Early forms of hominids had relatively large teeth, particularly the molars and premolars; something which was connected with their massive jaws and pronounced prognathism. However, as Lenartowicz noted, these were not qualitative differences but the only quantitative differences being connected, on the one hand, with the food eaten by hominids, while on the other with the dimensions of their bodies.

> One may distinguish in the history of hominids—wrote Lenartowicz—at least two phases. The first, during which together with the gradual increase in body dimensions, the organism developed an increasing massive jaw, increasingly bigger molars and respectively more powerful muscles. ... In the second phase—between 2 and 1.5 million years ago—there continued the trend for an increase in body dimensions, but the mastication structures did not experience any further growth, with there even occurring a tendency for their gradual reduction in size. This would be paradoxical

[190] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 321.

[191] Cf. ibidem, pp. 127–132.

> if we did not take into consideration the possibility that the reduction in teeth proves the application of techniques for the grinding of food by means of hammer stones, blunting or by its roasting in fires.[192]

In a word "early man (hominid) had dentition and a whole mastication system developed in accordance with [his] biological needs."[193]

Allometry. The changes in the shape, dimensions and proportions of particular structures and parts of the hominids body observed in the fossil material Lenartowicz connected with allometry which—in his deepest conviction—constituted an important element in the reconstruction and description of the dynamics of living forms.

> The biological notion of allometry is clearly connected with functionality, energy efficiency, the saving of material, and first and foremost with the realization of certain tasks that only have meaning in relation to the whole life cycle of an individual and simultaneously in relation to features of the environment in which this cycle takes place. … the elements of a definite biological structure are clearly subordinated to optimal biological functioning.[194]

Brain size and the problem of hominids' rationality

Intelligence and intellect. Lenartowicz drew attention to the fact that in many academic works as well as in the overwhelming number of texts popularizing the achievements of paleoanthropology it is suggested that a large brain with numerous neurons decided about the high level of intelligence, while a low level of intelligence was the result of the small sizes of the brain. In a word fairly common is the conviction,

> that the greater the brain, the higher the intelligence. While hominids with a brain volume in the order of 400–500 cm^3 are treated

[192] Ibidem, p. 158.

[193] P. Lenartowicz and J. Koszteyn, "Fossil hominids: an empirical premise of the descriptive definition of *Homo sapiens*," p. 175.

[194] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 167. Cf. also P. Lenartowicz, "Allometria – zasada i narzędzie rekonstrukcji paleontologicznych," in *W poszukiwaniu swoistości człowieka*, ed. G. Bugajak and J. Tomczyk (Warszawa: Wydawnictwo UKSW, 2008), pp. 25–40.

> as "pre-sapient" beings who in the course of evolution (with the increase in brain size) became rational beings—*Homo sapiens*.[195]

Suggestions of this type arise, according to Lenartowicz, for at least two reasons:

- the lack of differentiation between *sensual intelligence* (bees, beavers, swallows), and the *intellectual intelligence* of man, one equipped as equally with sensual intelligence as with intellectual power,
- the disregard of facts showing an absence of a significant correlation between intelligence and brain dimensions.[196]

Lenartowicz was of the position that "rationality" and "intelligence" are terms signifying various, selective, correlated and purposeful actions. Actions of this type were for a long time ascribed almost exclusively to man and were treated as a distinguishing attribute of mankind. However, increasing numbers of biologists have recently begun to realize that it is not only man and not only animals but all forms of life that act teleologically. We can discern this activity in, for example, the dynamics involved in the building of a nest, in taking care of offspring, or in the course of obtaining food. For much indicates that all living entities are able to find their orientation within the properties of the surroundings in which they live, and that many of these are able to gain experience, to remember individual contents and to recognize certain general regularities in the phenomena that repeat themselves. This—according Lenartowicz—speaks of the existence of "sensual intelligence," that is of "biological rationalism."[197]

While man—as the only living being—possesses also "intellectual intelligence." In talking about intellect, Lenartowicz referred to the Aristotelian-Thomistic tradition according to which

> intellect … is a cognitive power, which in organizing sensual cognition as well as reflecting on its results allows man to obtain

[195] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 206. Cf. also P. Lenartowicz, "Rekonstrukcja biologii i psychologii hominidów," p. 223.

[196] P. Lenartowicz, "Rekonstrukcja biologii i psychologii hominidów," p. 224.

[197] Cf. among others: P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," pp. 252–256; P. Lenartowicz, "Rekonstrukcja biologii i psychologii hominidów," pp. 224–225.

> orientation in the deeper, more significant layers of reality. Thanks to the power of intellect man may gradually, increasingly better become acquainted with the regularities, the laws and principles fundamental for the existence of the mineral world, biological, psychological and spiritual life. … Intellectual cognition equally broadens the range of man's effective forms of manipulation … of the elements in his surroundings.[198]

Brain size and hominids' rationality (intellectuality). Lenartowicz considered that a human brain capacity of the order of 1250–1350 cm^3 given by textbooks did not express the scope of its size, merely the average volume of this organ calculated for a limited—most frequently European—population of modern man. Known and documented are cases of intellectually fully fit individuals with a brain volume of less than 700 cm^3. The brain volume of Anatol France was estimated to have been 1017 cm^3, while that of Ivan S. Turgenev 2021 cm^3. While fully intellectually developed individuals can have decidedly different brain sizes, which in no way determines for any differences in intellectual intelligence. In the light of these differences the contrast between the size of the brain of australopithecines (around 400–500 cm^3) and some people living today appears to diminish.

In describing the traces of the material culture of earlier hominids, Lenartowicz emphasized that they were able, among other things, to produce sharp tools from rounded pebbles, effectively treat the carcasses of the animals they had hunted, build shelters that differed little from the shelters built by tribes of peoples contemporary to us, had control of the use of fire.

> There do not exist therefore convincing evidence of their "pre-rational" intelligence. One should apply in relation to them the very same criteria that an anthropologist applies to numerous and varied tribes (even those so-called "primitive" or "wild").[199]

According to Lenartowicz a paleoanthropologist should be most cautious with attempts to "measure" intellectual intelligence on the

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198 P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 169.

199 P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," p. 259.

basis of brain size. Tools found next to the late Pleistocene remains of *Homo floresiensis* (with a brain volume of around 380–430 cm^3) as well as those from the Holocene found with the remains of "dwarfs" on the island of Palau (the brain size being around twice that of *Homo floresiensis*) force one to greater caution in establishing the level of intelligence on the basis of brain dimensions.[200]

Biological species and the problem of the unity of mankind

Lenartowicz was puzzled by the fact that the Pliocene and Pleistocene remains of hominids are split into over 15 different genera and over 50 different species, when the population of contemporary man (Holocene)—despite the lack of uniformity either morphologically or culturally—is classified into a single species: *Homo sapiens*.

Natural species and taxonomic species. The results of paleoanthropological research show that the bodies of hominids over the course of millions of years underwent gradual changes. There remains, however, the question as to whether these were intraspecific intraspecific changeability or species changes. According to Lenartowicz the answer to this question to a great degree depends on the concept of biological species.

The concept of species was for Lenartowicz closely bound with his understanding of a living organism as a life cycle, within the framework of which there appear subsequent forms sometimes drastically differing from each other like, for example, the larva and adult of a butterfly. However, in investigations into a biological species one cannot limit oneself to a single life cycle. "The dynamic notion of a life form … would not be complete without discussion … of the adaptive potential expressing itself through ecological polymorphism."[201]

Changes of an adaptive nature may occur very quickly, within the course of a single life cycle, but most often occur gradually within the framework of many generations of individuals.[202] The scope for the changeability (polymorphism) of a given living form is called *the*

[200] Cf. ibidem, pp. 259–260; P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, pp. 365–369.

[201] Ibidem, p. 290.

[202] Cf. ibidem, pp. 291–294 as well as J. Koszteyn J. "Plio-Pleistocene hominids: epistemological and taxonomic problems," *Forum Philosophicum* 9 (2004), pp. 174–176.

norm of the reaction of a given life form. The term "reaction norm"—as Lenartowicz wrote—may refer either to the "whole range of realized adaptive phenotypes (ecotypes)," or "to the admittedly non-actualized, but actually existing, rich *development potential* of a given life form."[203] It is here obvious that "a particular individual … at one and the same time, in one and the same environment displays only one of its rich repertoire of ecotypes."[204] However, the multiple development potential is present in each individual of a given biological form and is present at any moment.[205]

Taking into consideration this rich developmental-adaptive potential, Lenartowicz asked whether, for instance, various forms of "wild" dogs—coyotes, jackals, wolves, foxes, bat-eared foxes etc., are ecotypes or in fact separate species.[206] And he answered "the fact that … there occurs the crossing of individuals of 'wild breeds' or the individuals of 'wild breeds' and kennel breeds seems to clearly point to the [species] unity of a given living form."[207]

In his investigations into species Lenartowicz made recourse to, among other things, the concept proposed by Erich Wasmann SJ of a gradually evolving natural species and taxonomic species.[208] The natural species, according to this particular Austrian zoologist, is derived from some relatively monomorphic ecotype, the individuals of which, with the measure of the flow of time, have created—dependent on the environmental conditions—new adaptive forms. Ecotypes—both those observed at present as equally those reconstructed on the basis of fossil remains—became, according to Wasmann, the basis for the taxonomic species distinguished by systematists.

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[203] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 294.

[204] Ibidem, p. 293.

[205] Cf. J. Koszteyn and P. Lenartowicz, "Integracja dynamiki biologicznej a drzewa rodowe istot żywych," p. 66.

[206] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 294.

[207] Ibidem, p. 299. Lenartowicz understood that individuals of particular ecotypes as a rule create characteristic features, ones identifying in the form of definite smell, sound signals, colour patterns, instinctive forms of dynamism (e.g., mating rituals) etc. He considered them to be elements of anti-hybridisation mechanisms which, on the one hand, prevent the cross-breeding of individuals of almost the same natural species but of another ecotype, and on the other hand make the finding of an appropriate partner for mating easier (cf. ibidem, p. 298).

[208] Cf. E. Wasmann, *Modern biology and the theory of evolution* (London: Kegan Paul, Trench, Trübner & Co, 1910), pp. 298–299.

Polymorphism and the species unity of hominids. Paleoanthropological research according to Lenartowicz clearly shows that at least from the australopithecines there had taken place an ecotypic differentiation in hominids. Possibly there were as many ecotypes as there have been taxa of the range of genus and species distinguished by paleoanthropologists. However, certain basic features (e.g., an erect body form, bipedalism, typical human dentition) are unchanged starting from *Australopithecus* onwards, and ending with *Homo sapiens*. This, in Lenartowicz's opinion, "is evidence of the clear unity of the living form, called man. Fossil remains as well as other traces of prehistoric hominids do not suggest that the entities to which these remains belonged were separate living forms, that is separate natural species."[209]

Amongst paleoanthropologists one can encounter extremely different views on the subject of the taxonomic status of prehistoric hominids. Some speak of the magnitude of separate species, others to various degrees reduce their number. For example, Milford H. Wolpoff, Alan G. Thorne, Jan Jelínek and Yinyun Zhang are for the inclusion of the taxon *Homo erectus* to *Homo sapiens*.[210] Maciej Henneberg, John F. Thackeray and Carmen de Miguel go even further, suggesting that beginning from the earliest Pliocene australopithecines we are dealing with one species of man, one gradually evolving, and displaying the polymorphism typical for vertebrates.[211] Lenartowicz shares this position, being for the unity of the human species.[212] It is obviously difficult to expect complete confirmation of this position on the basis of the criterion of the interbreeding of prehistorical hominid's forms.

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[209] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 322.

[210] Cf. M.H. Wolpoff, A.G. Thorne, J. Jelínek and Y. Zhang, "The case for sinking *Homo erectus*: 100 years of *Pithecanthropus* is enough," in *100 Years of Pithecanthropus: The Homo erectus problem*, ed. J.L. Franzen (Frankfurt am Main: Courier Forschungsinstitut Senckenberg, 1994), pp. 341–361.

[211] Cf. M. Henneberg and J.F. Thackeray, "A single-lineage hypothesis of hominid evolution," *Evolutionary Theory* no. 11 (1995), pp. 31–38; M. Henneberg and C. de Miguel, "Hominins are a single lineage: brain and body size variability does not reflect postulated taxonomic diversity of hominins," *HOMO. Journal of Comparative Human Biology* no. 55(1–2), (2004), pp. 21–37.

[212] Cf. P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 288; J. Koszteyn and P. Lenartowicz, "Integracja dynamiki biologicznej a drzewa rodowe istot żywych," p. 70; P. Lenartowicz and J. Koszteyn, "Fossil hominids: an empirical premise of the descriptive definition of *Homo sapiens*," pp. 162–163.

However, the genetic testing by Svante Pääbo's team shows that this occurred at least between Neanderthals (and, more than likely, Denisovans) and so-called contemporary people.[213]

[213] Cf. among others: S. Sankararaman, N. Patterson, H. Li, S. Pääbo and D. Reich, "The date of interbreeding between Neandertals and modern humans," *PLoS Genetics* 8, no. 10 (2012): e1002947. https://doi.org/10.1371/journal.pgen.1002947; D. Reich et al., "Genetic history of an archaic hominin group from Denisova Cave in Siberia," *Nature* 468 (2010), pp. 1053–1060.

5.

Discourse and polemics

Lenartowicz's philosophy constituted a complex and coherent thought system, in which the positive, constructive element outbalanced the critical and polemical. However, as with every rich conception, there were to appear with it discussions with other approaches, ones allowing for him to better present his own position, and often to perceive its further theoretical consequences. Discussions of this type, in which we are dealing with a reliable reconstruction of the views of his adversary—something that Lenartowicz makes use of in every case—were to bring the additional benefit of allowing the reader to present their own evaluation of the position presented and the difficulties therein connected.

Lenartowicz conducts philosophical discussion on several levels, which often merge. The most general polemical arguments appear at the metaphilosophical level, on which Lenartowicz discusses the fundamental conjectures and suppositions of his philosophical vision, its methods and aims, confronting it with other contemporarily existing solutions. The next seemingly key level is the discussion with cognitive skepticism (in its various forms), which is to permeate throughout the entirety of Lenartowicz's work. This is of fundamental meaning for its rejection of skepticism and pessimism or even cognitive nihilism, strongly affecting thinking at the turn of the 21st century, is a condition for the conducting of positive philosophical and academic (scientific) work. The displaying of weaknesses and the internal contradiction of skeptical claims allows one to subsequently define the nature of science, its aims and tasks, and also the relations of academic research and philosophical reflection. On this level one

may also place epistemological discussions (connected with, among other things, the question of epistemological realism) as well as the philosophy of science (for example the problem of the incommensurability of scientific theories). The next level on which Lenartowicz engages in discussion with existing concepts is the level of metaphysics, within the framework of which he defends his own, specific, pluralist and multi-layered concept of being/existence. These questions are elementary yet their positive perspective is possible only after the overcoming of epistemological skepticism as well as thanks to the adoption of a definite metaphilosophical program.

We may find besides this polemics and discussions in Lenartowicz's works that concern detailed problem areas ones both philosophical as academic (scientific). Here it is important to point out his remarks on the Darwinian theory of evolution and the materialistic programme that lay at its bases. This question was equally connected with his—ones not devoid of criticism—comments on the subject of the concept of intelligent design.

A subsequent level for the polemics are the discussions from the field of philosophical anthropology and the philosophy of man, during the course of which Lenartowicz presents his own views on the subject of nature and the genesis of man along with the differences between man and animals.

As far as the metaphilosophical level is concerned, in projecting the entirety of Lenartowicz's work, one may classify him as an unnaturalistic naturalist, and so a naturalist in the traditional, Aristotelian and not scientistic sense. Often within contemporary philosophy adopted is the opposition between philosophy conducted in a naturalist spirit and philosophy conducted within the transcendental paradigm,[214] ignoring the fact that, firstly, this division is not exhaustive for there exist non-naturalistic philosophies which are not simultaneously transcendental philosophies, secondly, it is not separate: for a large amount of contemporary philosophical thought is of the ilk of naturalized transcendentalism.[215] Thirdly,

[214] Cf., for example, J. Woleński, "Status epistemologii: pomiędzy naturalizmem a transcendentalizmem," in *Epistemologia współcześnie*, ed. M. Hetmański (Kraków: Towarzystwo Autorów i Wydawców Prac Naukowych "Universitas", 2007), pp. 139–157.

[215] Cf., for example, S. Pihlström, *Naturalizing the transcendental: A pragmatic view* (Amherst, NY: Humanity Books, 2003).

the term "naturalism" is applied today extremely freely (loosely), sometimes without deeper reflection (it occurs, for example, for naturalism to be defined as a view which accepts only "natural" explanations in science and philosophy, which obviously is an explanation *idem per idem*). It follows to say in this final case that the most significant role within the contemporary naturalist orientation is played by the declaration of non-recognition in scientific investigations and concepts of God (of any intelligent "higher power") as a causative factor.

Lenartowicz refutes such a solution, writing: "the word naturalness, or nature, was monopolized and locked in a cage. They made out of God the Creator, who is the most natural for creation, a supernatural entity."[216] In his opinion, contemporary naturalism as a metaphilosophical program in point of fact smuggles in an extremely significant, though at the same time limited, metaphysical concept, namely materialistic monism.

In accordance with the contemporary naturalistic paradigm, philosophy is as if the servant science in terms of methods and researched content which means that a philosopher has to accept from the start both the actual achievements of particular sciences as well as the methods employed by them and only on the basis of this is he able to create his own interpretations. It is not difficult to see that within such a perspective philosophy loses its autonomy and in point of fact stops existing as an independent reflection on the world.

In opposition to this reductionistic vision of philosophy, Lenartowicz proposed an understanding of philosophy closer to the classical approach. Philosophy was for him first and foremost

> The search for natural wholes (entireties)—not sets, not parts, but wholes … The description of a whole as a whole appeared to him to be the correct interpretation of philosophizing in opposition to the natural sciences. In such an approach I would not decide in advance, *a priori*, that everything is a whole. I would reject the "everythingism" *a priori* and would agree that maybe reality is comprised of certain packets, or of certain elements which are completely incompatible with each other.[217]

[216] Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," p. 41.

[217] Ibidem, pp. 30–31.

The next important theme that penetrates the entirety of Lenartowicz's work is the polemic with cognitive scepticism (present in, among others, postmodernism), which is often connected with cognitive and axiological relativism. Lenartowicz's debate with scepticism and relativism is clearly visible in his critique of the epistemological anarchism of Paul K. Feyerabend.[218] In referring to the theses and arguments of the author of *Against method*, based as equally on the history of science (chiefly the history of scientific mistakes) as also on an analysis of the psychology of perception (with the aim of showing the fallibility of sensual experience), Lenartowicz does not question either that science makes mistakes, or that our sensual perception can be fallible. However, he does show that the very fact of the possibility of formulating such arguments addresses itself against the thesis by the means of which Feyerabend constructed his defense, and hence the thesis of relativism and cognitive skepticism. The key question concerns here cognitive mistakes (errors) and the possibilities to reveal these. Lenartowicz's main critical argument is that in order to speak of an error one needs to have *a priori* theories of correct cognition, instruments to distinguish an error from what is not. A sceptic, such as Feyerabend, conjures up arguments for the unreliability of cognition which nevertheless he treats in advance as reliable, and so *implicite* supposes the possibility for the existence of certain knowledge, or at least likely knowledge. From this viewpoint skepticism is—to a degree—an attitude so faulty and flawed that it is rather impossible to maintain it in a theoretical defense (if only because such a defense would suppose a certain cognitive positivism).[219]

It seems that the basic problem of philosophical discussion concerning the worth/value of cognition, including scientific cognition, lies in its radicalism and disjunctive placing of the matter this derived from, among other things, Cartesianism: or we have at our disposal absolutely certain cognition but—if all can be doubted—no knowledge is valuable, everything is equally uncertain. In reality the matter is different—neither do we possess absolute certainty nor are we stuck in absolute error, but our knowledge finds itself somewhere

[218] Cf. P. Lenartowicz, "Wiarygodność twierdzeń przyrodniczych (Arystoteles contra Feyerabend)," in *Nauka – Religia – Dzieje. III Interdyscyplinarne Seminarium w Castel Gandolfo, 6–9 sierpnia 1984*, ed. J.A. Janik and P. Lenartowicz (Kraków: Wydział Filozoficzny Towarzystwa Jezusowego, 1986), pp. 73–100.

[219] Cf. ibidem, pp. 94–95.

between these extremes. In such a case it would be best to follow Aristotle's methodology and equally in epistemology to adopt the principle of the golden mean.

Lenartowicz's metaphilosophy alluding to the ideals of classical philosophy, opposing skepticism and being characterized by moderate cognitive optimism, affects his views of epistemology broadly understood and the philosophy of science. Interesting given this context appears his discussion with a certain way of philosophy's impact on science or rather with the utilization in science of certain philosophical concepts and philosophical metaphors which could fulfil an inspiring role, though equally could block the development of scientific cognition. As a rule philosophers, and particularly philosophers of science, take on in relation to science a certain sense of superiority, showing scientists their philosophical ignorance and demanding from them deeper reflection into the bases of their research work and investigations. Obviously a knowledge of philosophy should in no way hinder, however despite the positive aspects of this pervasion of the disciplines it follows equally to point out the negative. These are linked to the treatment on the part of certain scientists of the purely speculative, theoretical propositions of philosophers as introductory cognitive schemes, ones defining the framework for scientific research. A scientist—as is known from, among others, the theory of science advanced by Henri Poincaré and Pierre Duhem—does not approach reality nonassumptive (as naïve scientists of the 19th century imagined it), but they enclose it within the framework of a certain categorical scheme defining the most important metaphysical and epistemological questions. This scheme is not based on experience/experiment although it constitutes a prism through which the interpretation of experience is conducted. This could fulfil a heuristically fertile role, but also may block scientific research or lead it onto the wrong track.

Lenartowicz in several places showed the dependence of this sort of scientific research on philosophical outlook, criticizing the philosophical paradigm which is today the most popular and the most often adopted and which, in his opinion, is a type of flawed philosophy standing in the way of the advance of sciences (and particularly life sciences). The source of these philosophical errors are modern philosophical concepts, which appeared post Descartes as reaction to the problems presented by him—including the psychophysical problem and the question of mechanical philosophy.

> The quirky notions of certain modern era philosophers—writes Lenartowicz—was to so deeply penetrate the consciousness of naturalists that in a significant way it was to cripple the way they viewed reality. Two main philosophical derivative deviations are the fascination with the dynamics of chaos and the recognition of fragmentary concepts of reality as the sole genuine object of research.[220]

The first philosophical "deviation"—as Lenartowicz writes—leads to "the idolatry of chaos."[221] Its manifestation is the conviction present as equally in cosmology as in evolutionary biology that nature in some way forms itself, that chaos is creative, and the effect of this creativity is a certain order perceived as equally in the Cosmos as in living organisms. While the second philosophical "deviation" is for Lenartowicz "fragmentarism," that is the "tendency to homogenization and the simplification *per fas et nefas* in the description of data. This involves the irresponsible use of extrapolation on the one hand, and the risky utilization of the sophist procedure *pars pro toto* on the other."[222]

Views of this type, derived from modern mechanical philosophy and materialism,[223] lie at the basis of the certain metaphysics which contemporary academics have adopted more or less consciously. In a nutshell the said metaphysics is a form of monism and this is materialistic monism assuming that the only existing substance is matter (material). The consequence of this monism on the level of metaphysics is reductionism, which demands that the whole complexity of the phenomena is reduced to the simplest elements and to elements of the same type in this case, material.

Lenartowicz in the whole of his output fiercely polemicized with such an approach, showing, that materialist monism (and no other) is not an appropriate philosophical presentation of reality, with which we are in contact both on the basis of the specific sciences, as equally

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220 P. Lenartowicz, "O zgubnym wpływie filozofii na nauki biologiczne," *Znak* 47, no. 481(6), (1995), p. 44.

221 Cf. ibidem, p. 45.

222 Ibidem, p. 51.

223 The sources of such views it follows to emphasise need to be looked for not in the thinking of Descartes but rather in the works of his opponents Pierre Hobbes and Thomas Gassendi, to whom the thinkers of the French Enlightenment were later to refer, Julien Offray de La Mettrie, Paul-Henri T. Holbach, Jean Antoine N. Condorcet and Helvétius.

colloquial cognition. In writing about the beginnings of his philosophical route he claimed that his "introductory intuition was existential or substantive pluralism,"[224] being such a vision of reality that is "easy to document, easier to defend than the vision of monism."[225] The metaphysical pluralism proposed by Lenartowicz is tiered in nature, which in certain respects brings his conception close to the philosophy of Nicolai Hartmann and his layered ontology. However, in Lenartowicz the levels are treated as disparate, which results, say, from the fact that for him the starting point is a living substance. A conception of this type requires the application of a much richer conceptual system that the one suggested by philosophy of mechanistic monism that lies at the bases of the contemporary ideal of science. If existence is layered in character then matter, as equally the spirit, are separate tiers of existence, unlimited to each other and connected with each other through varied relations that are not reductionist in character. In addition, there exist besides these two layers others which have not been considered by the conceptual system of contemporary materialistic metaphysics, but which one may described by means of language based on Aristotle's metaphysics—something that Lenartowicz also does.[226]

The discussions conducted by Lenartowicz also concerned questions of philosophical anthropology. In conducting these he was able to specify his own views on nature and the genesis of man as well as on the character of the human mind. He also presented the consequences that discoveries in the field of the natural sciences, and particularly the life sciences, have for our reflection upon the essence of man. He attempted equally to reveal within this context the suppositions smuggled in by certain scientific, philosophical and methodological concepts, ones not based in empirical knowledge, but determining the manner of its interpretation.[227]

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[224] Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," p. 31.

[225] Ibidem, p. 42.

[226] Cf., for example, ibidem, pp. 43–44. See also on this subject P. Lenartowicz, "Wiedza przyrodnicza – nauka – religia a spór pomiędzy monizmem i pluralizmem bytowym," *Filozofia Nauki* 14, no. 1(53), (2006), pp. 69–84.

[227] Cf. P. Lenartowicz, "'Stawanie się człowiekiem' – Polemika z artykułem Jerzego Strojnowskiego," Znak 45, no. 452(1), (1993), pp. 55–64; P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," pp. 237–272.

6.

Influence on philosophical circles

As far as the impact exerted by Lenartowicz's thought, then undoubtedly the greatest influence was impacted by his book *Elementy filozofii zjawiska biologicznego* [Elements of the philosophy of biological phenomenon], which immediately on publication drew note within philosophical circles. As an example, the review of the book by Anna Dyduch-Falniowska may serve.[228] She draws attention to the innovative nature of the work within Polish philosophical circles, writing that "it constitutes the first attempt at a consistent referencing of the lowest levels of biological organization to a concrete philosophical school"[229] adding that this book may be treated as the start of a research route connected with the philosophical presentation of the phenomenon of life. Dyduch-Falniowska detects the originality of Lenartowicz's approach, although she does not agree with all of his views. She criticises, among other things, his critical stance towards the Darwinist theory of evolution (the view as to the nonexistence of any noncontroversial examples of the transformation of one species into another she considers to be "outrageous," though without providing any such noncontroversial example).

[228] A. Dyduch-Falniowska, "Początek drogi [review of: Piotr Lenartowicz, *Elementy filozofii zjawiska biologicznego*, Wydawnictwo Apostolstwa Modlitwy, Kraków 1987, pp. 477]," *Zagadnienia Filozoficzne w Nauce* no. 10 (1988), pp. 57–62.

[229] Ibidem, p. 62.

A similar tone is taken in the extensive review by Władysław J.H. Kunicki-Goldfinger.[230] Despite critical comments the reviewer claims that "the book is a valuable example of an examination of biological problems" raising an array "of new questions which biologists themselves maybe would not have quickly formulated."[231]

Highly praiseworthy, although not devoid of critical elements, was the evaluation of the book by Szczepan W. Ślaga, who wrote among other things: "in the work in question together with its solid preparation and extensive knowledge hand-in-hand goes the ability for an analytical and at the same time independent understanding of the problems examined with constant care for their exact and precise presentation."[232]

With the passing of time *Elementy filozofii zjawiska biologicznego* was to become a classic, and to this day is treated as a sort of textbook providing invaluable definitions and reconstructing the most important concepts from the field of the philosophy of biology, as well as constituting a reference point for the presentation of Lenartowicz's own line on matters. We may find reference being made to Lenartowicz's book in the 1990s' works by Marian Wnuk[233] as well as in the extensive monograph that constituted the author's postdoctoral thesis,[234] in which Lenartowicz's work is cited almost forty times. Wnuk is in agreement with Lenartowicz's position of viewing the cycle of life to be the fundamental biological unit.[235] Wnuk also discusses in detail Lenartowicz's main theses on epigenesis and interaction on the molecular level of organisation as well as their consequences for an understanding of evolutionary processes.[236]

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230 W.J.H. Kunicki-Goldfinger, "Nowe spojrzenie na biologię (review of: Piotr Lenartowicz, *Elementy filozofii zjawisko biologicznego*, Wydawnictwo Apostolstwa Modlitwy, Kraków 1986)," *Przegląd Powszechny* no. 1(797), (1988), pp. 125–129.

231 Ibidem, p. 129.

232 S.W. Ślaga, "Wokół filozofii zjawiska biologicznego," *Studia Philosophiae Christianae* 24, no. 1 (1988), p. 210.

233 M. Wnuk, "Enzymy jako nanoprocesory. Perspektywa bioelektroniczna," *Roczniki Filozoficzne* 43, no. 3 (1995), pp. 127–154; M. Wnuk, "Filozoficzne aspekty katalizy enzymatycznej," *Roczniki Filozoficzne* 44, no. 3 (1996), pp. 117–144.

234 M. Wnuk, *Istota procesów życiowych w świetle koncepcji elektromagnetycznej natury życia: bioelektromagnetyczny model katalizy enzymatycznej wobec problematyki biosystemogenezy* (Lublin: Redakcja Wydawnictw KUL, 1996).

235 Cf. ibidem, p. 148.

236 Cf. ibidem, pp. 148–154.

From amongst other references to *Elementy filozofii zjawiska biologicznego* it follows to mention Dariusz Sagan's book,[237] and that of Witold Wilczyński,[238] the article by the prematurely deceased philosopher of biology Krzysztof Chodasewicz[239] as well as the articles by Mariola Flis[240] and Dariusz A. Szkutnik.[241]

Lenartowicz's first work *Phenotype-genotype dichotomy*, published in 1975,[242] was to enjoy a similar level of interest though in somewhat different circles. Reference was made to it by the British biologist Rupert Sheldrake, who developed the morphogenetic field and morphic resonance hypotheses, and who for years has been known as a critic of the quite common mechanistic-materialistic paradigm. A reference to Lenartowicz's monograph we may find in one of Sheldrake's newer books entitled *A new science of life*, where we read: "In a detailed analysis in *Phenotype-genotype dichotomy*, Lenartowicz has shown that if the genotype is simply identified with the

[237] D. Sagan, *Metodologiczno-filozoficzne aspekty teorii inteligentnego projektu* (Biblioteka filozoficznych aspektów genezy, t. 6), (Zielona Góra: Instytut Filozofii Uniwersytetu Zielonogórskiego, 2015). There is reference here also to other works by Lenartowicz, e.g., P. Lenartowicz, *Phenotype-genotype dichotomy. An essay in theoretical biology*; P. Lenartowicz, , "Trzy koncepcje dynamiki biologicznej: arystotelesowska, neo-darwinowska, inteligentnego projektu," pp. 367–388; J. Koszteyn and P. Lenartowicz, "Struktura ontyczna bytu żywego w arystotelizmie," in *Ewolucjonizm czy kreacjonizm*, ed. P. Jaroszyński, P. Tarasiewicz, I. Chłodna and M. Smoleń-Wawrzusiszyn (Lublin: Fundacja "Lubelska Szkoła Filozofii Chrześcijańskiej," 2008), pp. 303–340.

[238] W. Wilczyński, *Idea przyrody w historii myśli geograficznej* (Kielce: Wydawnictwo Jedność, 1996). The author also makes recourse to the article: P. Lenartowicz, "Rozwój i postęp w świetle empirii biologicznej," pp. 173–187.

[239] K. Chodasewicz, "Emergencja w biologii: redukcjonizm vs. organicyzm," *Filozofia i Nauka. Studia filozoficzne i interdyscyplinarne* 2 (2014), pp. 381–401.

[240] M. Flis, "Etyka personalistyczna i poczwórny argument a etyka dyskursu," *Diametros* no. 24 (2010), pp. 58–70; M. Flis, "Czy psychologia potrzebuje koncepcji natury ludzkiej?," *Psychologia Rozwojowa* no. 1 (2012), pp. 31–38; M. Flis, "Pokrewieństwo i kulturowe zróżnicowanie instytucji małżeństwa," *Estetyka i Krytyka* no. 4(23), (2011): *Przez kultury i cywilizacje. Pamięci Profesora Andrzeja Flisa*, pp. 19–30.

[241] D.A. Szkutnik, "Hansa Driescha filozofia świata organicznego. Od eksperymentu biologicznego do metafizycznej teorii witalizmu," *Zeszyty Naukowe Towarzystwa Doktorantów UJ – Nauki Humanistyczne* no. 2 (2011), pp. 143–155.

[242] P. Lenartowicz, *Phenotype-genotype dichotomy. An essay in theoretical biology*, op. cit.

DNA, its apparent explanatory value disappears."[243] Lenartowicz's is mentioned also in the well-known work by Martin Mahner and Mario Bunge from the field of biophilosophy,[244] where Lenartowicz is defined as a "vitalist," something with which he himself would have agreed.[245] Recourse to *Phenotype-genotype dichotomy* is also made by Georg Toepfer in the second volume of *Historisches Wörterbuch der Biologie* where discussed is the relation between a genotype and a phenotype.[246] Mention of the work may also be found in pieces produced by Amartija Koers,[247] Daniël van Draanen[248] and Elena Ciani.[249]

As far as other works by Piotr Lenartowicz are concerned, it is also worth mentioning: *Fundamental patterns of biochemical integration*,[250] quoted in Sagan's monograph[251] as well as in the article by Krzysztof Kassolik, Waldemar Andrzejewski and Ewa Trzęsicka,[252] *The body-mind dichotomy*[253] and *Racjonalność ducha czy życia?* [Rationality

[243] R. Sheldrake, *A new science of life: The hypothesis of formative causation* (London: Icon Books, 2009) [endnote 8 to Chapter 1: "The unsolved problems of biology"], p. 319.

[244] M. Mahner and M. Bunge, *Foundations of biophilosophy* (Berlin, New York: Springer, 1997).

[245] He spoke about this in conversation with Zbigniew Wróblewski. Cf. Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," p. 36.

[246] Cf. s.v. "Genotyp/Phänotyp," in G. Toepfer, *Historisches Wörterbuch der Biologie. Geschichte und Theorie der biologischen Grundbegriffe*, vol. 2: *Gefühl – Organismus* (Stuttgart: J.B. Metzler, 2011), pp. 59–71.

[247] A. Koers, "Which meaning do students, with knowledge of genetics on upper secondary school biology level, attribute to the concept 'hereditary trait'?" (M.A. thesis, Utrecht University, 2016).

[248] D. van Draanen, "The status of the concepts 'hereditary trait' and 'phenotype' in secondary school textbooks" (M.A. thesis, Utrecht University, 2015).

[249] E. Ciani, "Bridging the gap between the genotype and the phenotype: the role of omics technologies," Conference paper, The ICAR Satellite Meeting on Camelid Reproduction in Tours (France) 2016, accessed May 17, 2016, https://www.researchgate.net/publication/303279800_Bridging_the_gap_between_the_genotype_and_the_phenotype_the_role_of_omics_technologies.

[250] P. Lenartowicz, "Fundamental patterns of biochemical integration. Part 1: The functional dynamism," pp. 203–217.

[251] D. Sagan, *Metodologiczno-filozoficzne aspekty teorii inteligentnego projektu*, op. cit.

[252] K. Kassolik, W. Andrzejewski and E. Trzęsicka, "Role of the tensegrity rule in theoretical basis of massage therapy," *Journal of Back and Musculoskeletal Rehabilitation* 20, no. 1 (2007), pp. 15–20.

[253] P. Lenartowicz, "The body-mind dichotomy. A problem or artifact?," *Forum Philosophicum* 1 (1996), pp. 9–42.

of mind or rationality of life?],[254] cited by Remigiusz Kalski,[255] as well as the extensive book *Ludy czy małpoludy* [People or manapes],[256] referenced by Rafał Kupczak in his PhD thesis[257] and other publications.[258] In turn, Tomasz Niemirowski in an article on the subject of the role of genetic information in man's development,[259] quotes two of Lenartowicz's works: *Sens i zakres pojęcia informacji genetycznej* [Meaning and the scope of the notion of genetic information][260] and *Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?* [Does biological sciences have any meaning for the philosophy of man?].[261]

Mirosław Twardowski[262] has written an article on Lenartowicz's philosophy, in which he reconstructs Lenartowicz's position played out against the broad backcloth of the discussion between the mechanical and vitalist approach in philosophy researching the nature of life. In summing up his article Twardowski emphasizes the significance of Lenartowicz's approach, even if it appears controversial from the perspective of contemporary scientific paradigms. He also laments the ignorance about this Polish philosopher amongst researchers in the

254 P. Lenartowicz, "Racjonalność ducha czy życia?," pp. 87–98.

255 R. Kalski, "Co się dzieje ze zwierzętami po śmierci? Refleksje na bazie teorii tomistycznej," *Otwarte Referarium Filozoficzne* no. 3 (2010), pp. 131–142, accessed May 17, 2016, http://wujzboj.com/orf/ORF-03-131-2010.pdf.

256 P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, op. cit.

257 R. Kupczak, "'Przedrozumność' i 'rozumność' człowieka a narzędzia paleolityczne" (PhD thesis, Akademia Ignatianum w Krakowie, 2012).

258 R. Kupczak, "Działalność narzędziowa a 'rozumność' i 'przedrozumność'," *Zeszyty Naukowe Towarzystwa Doktorantów UJ: Nauki humanistyczne* no. 2(1), (2011), pp. 156–166; R. Kupczak, "Interpretacja działań narzędziowych plioplejstoceńskich hominidów a współczesny obraz człowieka prehistorycznego," in *Logos i etos cywilizacji Zachodu*, ed. R. Kupczak and M. Jabłoński (Bielsko-Biała: Wydawnictwo Prasa Beskidzka, 2014), pp. 160–200; D.A. Szkutnik and R. Kupczak, "Holistyczno-teologiczne spojrzenie na zjawiska morfogenetyczno-regulacyjne i behawioralne: ogólne refleksje nad znaczeniem pojęć teleologicznych," *Humanistyka i Przyrodoznawstwo* no. 21 (2015), pp. 313–330.

259 T. Niemirowski, "Rola informacji genetycznej w rozwoju człowieka," *Czasopismo Psychologiczne/Psychological Journal* 22, no. 1 (2016), pp. 47–53.

260 P. Lenartowicz, "Sens i zakres pojęcia informacji genetycznej," pp. 307–319.

261 P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," pp. 237–272.

262 M. Twardowski M., "Neowitalistyczna koncepcja życia Piotra Lenartowicza," *Studia z Historii Filozofii* 6, no. 2 (2015), pp. 83–100.

philosophy of biology, which is certainly the result of the general approach to Vitalism, one somewhat dismissive in attitude.

A separate current with regard to the influence of Lenartowicz's views on philosophical and scientific circles, was his cooperation with Jolanta Koszteyn, the biologists and ecologist, dating back to 1996. This productive mutually influencing and inspiring partnership, was recalled by Lenartowicz in conversation with Wróblewski.[263] Lenartowicz and Koszteyn wrote many articles together as well as editing the third extensive edition of *Wprowadzenie do zagadnień filozoficznych* [Introduction to philosophical questions].[264] Koszteyn was also the editor of the volume devoted to Piotr Lenartowicz entitled *Vivere & Intelligere*.[265] This tome of over 800 pages contains the academic output of Lenartowicz as written about by Roman Darowski as well as a representative selection of texts divided into three thematic block: 1. The philosophical problems of the dynamics of living forms, 2. The philosophical problems of paleobiological reconstruction, 3. The philosophical problems of cognition, that is orientation within reality.

Lenartowicz's epistemological views are best illustrated in the posthumous edition of *Elementy teorii poznania* [Elements of epistemology],[266] a synthetic discussion of which is contained in Rafał Kupczak's review.[267]

In summing up, it follows to sadly state that Lenartowicz's concepts aroused and arouse the interest of only a few philosophical and scientific circles; something that does not so much arise from the content of his views formulated on the basis of an analysis of biological empiricism, but rather from the nature of the main current within the philosophy of science, which marginalizes solutions not in accordance with the canon of those scientific truths and methods currently in force.

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263 Cf. Z. Wróblewski, "Rozmowa z Piotrem Lenartowiczem SJ," pp. 37–38.

264 P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, op. cit.

265 J. Koszteyn, ed., *Vivere & Intelligere. Wybrane prace Piotra Lenartowicza SJ wydane z okazji 75-lecia Jego urodzin*, op. cit.

266 P. Lenartowicz, *Elementy teorii poznania*, op. cit.

267 R. Kupczak, "Ku afirmacji arystotelesowsko-tomistycznej teorii poznania (review of: Piotr Lenartowicz, *Elementy teorii poznania*)," *Kwartalnik Filozoficzny* 43, no. 2 (2015), pp. 202–204.

Stanisław Morgalla in his posthumous recollection of Lenartowicz wrote that his philosophical convictions "will be appreciated with time."[268] This view appears to be not without basis if those historians of science are correct who claim that science develops through subsequent revolutions, the results of which present completely new images of the world based on different assumptions, premises and canons of scientificity. Possibly in the future the thoroughness and insight of his investigations, the precision of his argumentation and the originality of thought into biological phenomena, life and the specifics of man will become a source of fruitful inquiry. And if that were to happen—which is, I feel merely a question of time—Piotr Lenartowicz may be recognized as a precursor of a new style of thinking about the intriguing phenomenon that is life.

[268] S. Morgalla, "Ojciec Piotr Lenartowicz SJ. Wspomnienie," *Religia Deon.pl*, accessed October 17, 2012, https://www.deon.pl/religia/duchowosc-i-wiara/zycie-i-wiara/art,744,ojciec-piotr-lenartowicz-sj-wspomnienie.html.

7.

Glossary of fundamental terms (excerpts)

(Natural) Biological species

Individual forms of a given living type—within the framework of the cognitive norms of reaction—may be joined by a very close, directly observable relationship despite the fact that their anatomy, histology, physiology or behavior are very different from each other. Precisely the obviousness of this directly observed relationship means that we are as if "forced" to recognize this whole set of varied forms and varied dynamisms to be an expression of the changeability of one and the same living form, that is of one and the same *natural species*. What is more we are intellectually "forced" to recognize that although a given, more or less momentary form constitutes only a small "particle" of a concrete living form (of a natural species), it is that very form that contains the actual … unusually rich and varied *developmental potential*. … from the point of view of the said developmental potential various ontogenetic morphological and physiological forms are mutually equivalent. This determines the genuine *unity* of a given living form (natural species). …

There can appear within the framework of some (natural) species *anti-hybridization mechanisms*. They do not appear in breeds or "artificial" varieties that are the result of man's breeding programs. Therefore to maintain the "purity" of such a breed (for example, of a setter or a pointer) requires the constant anti-hybridization intervention of man.

While in "wild breeds" (ecological breeds, ecotypes) the individuals as a rule create characteristic identifying features, in the form of definite sent or sound signals, of colorful patterns, appropriate instinct forms of the dynamism (e.g., of mating "rituals") etc. On the one hand this makes the finding of the right mating partner easier, while on the other hand features of this type create a type of "barrier" relative to individuals of, admittedly the self-same natural species, but different ecotype. Anti-hybridization mechanisms of this type serve first and foremost to preserve adaptive "conquests"—there are therefore *pro-adaptive mechanisms*. ... The fact that despite anti-hybridization mechanisms cross-breeding takes place amongst the individuals of "wild breeds" or the individuals of "wild breeds" and domesticated appears to clearly prove the unity of a given life form (natural species). ...

The developmental-adaptive potential—despite its richness—also has its borders. ... In biology there is often talk of the "reproductive isolation" of unrelated forms. In point of fact, the individuals of separate natural species do not cross breed—either in nature or as a result of man's operations. One may therefore state that the individuals of different natural species do not reproductively isolate themselves ... but are divided by the "gulf" of separate developmental-adaptive potentials.[269]

Intellect

Intellect (human)—according to the Aristotelian-Thomistic tradition—is a cognitive power which in organizing sensual cognition as well as reflecting on its results allows man to gain orientation in deeper, more significant layers of reality.

Thanks to the possession of intellect man may gradually better get to know the regularities, truths and principles that are fundamental for the existence of the mineral world, biological, psychic and spiritual life. ... Intellectual cognition equally broadens the scope of man's effective manipulation both through his own development as through the application of elements of his surroundings. ... Human

[269] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, pp. 294–301.

intellect—based on observation through the senses (in case of necessity "armed" in technical instruments of observation)—may with total obviousness perceive varied selections, necessities, significant correlations, presenting the "nature," "logic" of a given object or phenomenon.[270]

(a) Man recognized not only the accidents (incidences) and attributes (properties), but also the very substances—animate or inanimate—that is he becomes acquainted with the very essence, unity and principle in the activity of a concrete being. Man is acquainted not only with the repetition and correlations, but also with the deeper sources of natural dynamisms. ...

(b) Man having open access to relatively abundant information about beings, particularly material ones, may effectively act within the sphere of such entities. Man, having uncovered certain princi-ples in the action of nature, undertakes the subsequent so-called "inventions," that is he utilizes the natural regularities and correlations for his own aims, creating the new, supra-biological tools of his activity (instruments of observation, modification, consumption and communication). The cognition of psychological truths allows man to impact—positively and negatively—on the immanent activity of others.

(c) Knowing one's surroundings, the acquisition within it of orientation is in man a free, unforced, immanent or liberated dynamism. The concept of freedom represents here the freedom to have orientation in reality and the freedom for the rational, selective use of this orientation.[271]

Intelligence

Such words as rationalism, intelligence, judiciousness, intellectuality, belong to a group of terms whose meaning partially coincide and

[270] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, p. 169.

[271] P. Lenartowicz, "Słownik niektórych terminów filozofii AT czyli arystotelesowsko-tomistycznego opisu rzeczywistości," in P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych* (Kraków: Wyższa Szkoła Filozoficzno-Pedagogiczna "Ignatianum," Wydawnictwo WAM, 2000), p. 162.

overlap. Let us attempt to more exactly test what there is in common in the meaning of these terms. When a jackdaw builds a nest it carries out various actions in the appropriate order, acts such as finding the right twigs, carrying them to an appropriate place and weaving them together into an appropriate shape. If we were to observe a man weaving a basket we would recognize these operations as a manifestation of intelligence. We are dealing in both of these cases with the multiplicity and variety of the objects (the large number of twigs of an appropriate elasticity and length), with the multiplicity and variety of the undertakings, as well as with a certain unity in the effect of these activities, and it is this unity which decides that a given object or operation was "appropriate." The unity of the effect expresses itself in the finished nest or in the finished basket, which are widely defined as the aim of these diverse operations. This aim decides which twigs and which operation will be deemed "appropriate." The "appropriateness" in the examples described concerned the length of the twigs, their elasticity and, in this respect, they were selected as material to build the nest or weave the basket. "Appropriateness" also concerned the spatial correlation between these twigs and the selective operations served to create this "suitability."

"Appropriateness," "selectivity," "correlations," are taken in by our consciousness as purposeful activities. Therefore "rationalism" particularly is an expression of intelligence while in the case of certain human undertakings (for example the construction of a telescope to observe celestial bodies) an expression of intellectualism. ...

Biological intelligence. Animals ... possess intelligence (they act rationally). They are able to correctly orientate themselves in the superficial properties of the surroundings in which they live, they are able to acquire experience, remember individual content and recognize certain general regularities. Their actions—even those instinctive ones—require the constant updating (actualization) of the data of their sensual orientation. ... an increasing number of biologists ... are becoming aware that it is not only man, and not only animals, but all forms of life that act in a purposeful manner (teleologically), that is rationally. ...

Intellectual intelligence. What is dependent ... for the obvious superiority of man over other biological forms? Namely man

towers over all biological forms not only with his biological intelligence but equally his intellect.

Man is not superior over the cheetah in running, nor the owl in night vision. He does not have inherent instinctive architectural abilities like those displayed by, for example, termites, beavers or weaverbirds. But man constructs tools which allow him to outstrip the cheetah and to see better at night than the owl. These are derived from the intellect he possesses.[272]

Life

This is an ambiguous term. It may refer to the life of bacteria, the life of termites, dolphins, people, angels, and even the life of God himself. It may mean a select, abstracted from all others level of life—for example the biological life of man, the psychic life of animals... etc. Certain levels of life are more accessible for our human cognition, others are difficult in access or almost inaccessible. Below we shall attempt to define certain levels of life.

Biological life—orientated in the sources of raw material and the internally integrated dynamics of the construct of varied, multilevel tool-making structures and their utilization in order to create the optimal conditions ("dowry") for the repeating of the whole of this dynamic. A good illustration of biological life is the life of plants. Individual generations starting off from the level of relatively simple seeds create body organs and prepare the seeds that constitute the primordium and "dowry" of the subsequent generation. ...

Psychic life—manifests itself in the construction of external (in relation to the body) material and social structures thanks to orientation, memory, experience, inherent, instinctive dynamisms of action, evaluation and information exchange. An illustration of psychic life is the construction of a web by a spider, an extremely complex set of actions connected with the reproduction (e.g., mating dances), care and upbringing of offspring, learning and the utilizing of experience.

The *Spiritual* life (of man)—involves an attempt to achieve a maximum orientation in reality and—in being based on cognition—on the

[272] P. Lenartowicz, "Czy empiria biologiczna ma jakieś znaczenie dla filozofii człowieka?," pp. 252–256.

free (autonomic) construction of a completely exceptional, unique, personal and perfect form of happiness which is the life of a person, is personality. The aim of spiritual life is the shaping and perfecting of personality). An illustration of the spiritual life of man is the fascination in some aspect of reality and the achieving of perfection (cognitive and executory) in this area. The spiritual and religious upbringing of children belongs to the sphere of religious life.

The *Natural religious* life (of man)—involves the free-willed cognition, recognition and subordination to the laws of life (natural law) written into nature by the Creator. This is natural religiosity. The fruit of religious life is respect for Nature—in this for other people—as well as the friendship and cooperation of man with beings surpassing him in their perfection. Genuine and true religious life is encountered in all human cultures—with the exception of atheistic "culture." ...

Supernatural religious life—the conscious and free-willed adoption of gifts for nothing deserved, including the purification of internal sinfulness and the gift of supernatural life, that is the proposition to participate in the life and happiness of God himself. ... Supernatural life exceeds the possibilities of natural cognition, demanding faith in the authenticity of Divine Revelation. Supernatural life is not the beginning of religious life—"grace built in nature"—but in an exceptional, infinite way its supplementation and perfection (cf. John Paul II's encyclical *Fides et Ratio*).[273]

Living organism

As a result of many encyclopedias and biology textbooks we have become incorrectly used to perceiving a living organism (a living being) as being singled out from its surroundings, an exceedingly complicated *structure*. ...

Meanwhile when we observe the development of a seed into a tree we do not merely note the structure but equally the *process of building* the structures. The tree grows. New branches appear, new leaves, the trunk is strengthened. It is this that is the *dynamism of life*, *the result* of which, *the outcome* are the varied structures and their

[273] P. Lenartowicz, J. Koszteyn and J. Bremer, *Wprowadzenie do zagadnień filozoficznych*, pp. 188–190.

correlated systems. The same most obviously applies to animals—e.g., frogs, beavers or man. It follows here to note that even when a frog, beaver, man or any other living form achieves maturity, then their actual body organs (e.g., heart or liver) will not be exactly the organs from a few days past, for the chemical particles from which they are comprised undergo a constant, relatively quick *exchange* thanks to the endless process of *metabolic turn-over*. … The complex structure of a living form changes therefore minute by minute but the individual oak, beaver, frog, man remains all the time the *very same* individual for as long as the *developmental dynamism* lasts, that is construction and constant reconstruction and repair (that is regeneration) of the body's organs.

The dynamic notion of a living form (developing and constantly regenerating) would not be complete without describing … adaptive potential, expressing itself as ecological polymorphism. … Observations (not infrequently connected with carefully planned experiments) show that the morphology, anatomy and physiology of individuals of a given living form may change in a clear correlation with changes to environmental conditions … The scope of the changeability (polymorphism) of a given life form is called the *reaction norm* … of a given life form. … This means that in wanting to descriptively exhaust the whole developmental, structural and dynamic adaptability of a concrete biological form necessary are long-term observations and experiments provoking the given form into revealing its actual possibilities.[274]

Soul

The Aristotelian concept of the soul is … based on the results of the observation of life processes and here not of all but of those belonging to a certain, particular type—namely to the phenomena of development and regeneration. For the concept of soul constitutes its own attempt at solving problems resulting from the observation of the phenomena of development. One can see clearly in these phenomena various actions, their mutual correlation in time, their mutual subordination, which is best expressed by the term integration. …

[274] P. Lenartowicz, *Ludy czy małpoludy. Problem genealogii człowieka*, pp. 288–293.

The immanent dynamism of the living form manifests itself in the construction of varied structures, ones appropriate for the needs of a given organism. This suitability is achieved through selectivity, through the tendency to build correlated structures as a result of their final function or role (locomotory, biosynthetic, protective etc.). … For the immanent dynamism is selective, correlated, integrated and subordinated to the wholeness of a concrete individual of a living form. …

What … process of selection is connected to the concept of the soul? Well the soul, according to Aristotle, is the principle of life. While life depends on the selective seizing of certain, selected particles of matter and placing them—for a moment—into the structure of the fountain of life (that is on nutrition, metabolic change) as well as on utilizing the constructed structures of the body and the energy taken from the surroundings to realize what we call the behavior of a concrete living form. …

For many people the notion of the soul is connected with an exit beyond the law of nature, the law of physics and chemistry. Meanwhile the laws of mineral matter are preserved in the dynamism of life. No organ of the body—not the heart, the liver, or nerve cells act against the laws of physics and chemistry. Similarly, none of the many machines of car plants act against them, actually acting thanks to the laws of physics and chemistry. All structures of the body without exception are constructed from elements of mineral matter. All forms of biological dynamism make use of the structural-energy potential of this matter. What differentiates a living body from mineral matter is its unusual selectivity.

Mineral dynamism—that is the varied physicochemical processes—is the effect of the very nature of the world of minerals. Biological dynamism *selectively limits* (*narrows*) the dynamism of the mineral world. …

… let us move onto the discussion of the third fundamental concept on which the Aristotelian concept of the soul is based. Here we have in mind the notion of whole and indivisible developmental potential. … The active, immanent, whole, teleological potential of a living form was shown in the pioneering experiments of Driesch, Morgan, Spemann and many others. … One can clearly see from these experiments that the mutilation of the structures does not result in a mutilation of the developmental potential of the given life form. Experiments on totipotency may constitute an argument to use the ancient thesis that in a living form the "whole (the dynamic potential)

is in the whole and this self same wholeness is contained in every part" (*totum in toto, totum in qualibet parte*). …

The active developmental-adaptive potential is the reality recognized by the intellect yet unperceivable to sensual intelligence itself. In Aristotelianism the conceptual equivalent of this active potential was the "substantialist form" of a concrete living being, that is its soul (*psyché*). The modern notion of a "genetic program" is very close to the concept of *psyché*. Every life cycle is the manifestation of the dynamism of one and the same active developmental-adaptive potential, which is spatially indivisible. … This potential is neither large nor small (less in an acorn yet great in a thousand-year-old oak). It does not possess a shape or any other feature connected with spatial dimension. It is also timeless: that is unchanged in time. In each phase of the life cycle it is the same even though it works differently. …

So what is the soul (ψυχή)? It is an internal, comprehensive, immanently active and indivisible factor, which in orientating itself in its surroundings and modifying them according to its own needs, constructs from raw mineral matter an integrated system of organs of a biological body, it operates through those organs and communicates with other living forms.

A soul with properties thus defined … appears in plants and animals and in man. … In man the soul possesses also other, most important properties—the ability for intellectual examination as well as relatively greater freedom in the manipulation of their own body and own environment.[275]

Theory of knowledge

Theory of knowledge, referred to by Aristotle as *Organon*, is a part of philosophy. It is the starting point and main "controller" of the cognitive process, and therefore equally of the process of philosophizing. According to Aristotle—whose approach to the researching of reality is the corner stone of this book—philosophizing has to commence from making oneself aware of the actual achievements, possibilities, truths and errors of human cognition. …

[275] P. Lenartowicz, "Dusza," pp. 95–114.

Theory of knowledge is also referred to as epistemology. In Greek *episteme* means qualitative knowledge (e.g., scientific) while *gnosis* refers to every type of knowledge and therefore colloquial, mystical, supernatural knowledge or cognition based on trust (that is faith). …

What is knowledge? Knowledge is its own form of "storing" the results of our cognitive effort (that which is derived from direct contacts with natural objects and phenomena, as equally that connected with reflection on natural reality). Knowledge may be "stored" in our memory, that is remembered, as equally it may be "coded" by means of linguistic signs and in this form it may be "stored" in books, journals, on CDs etc. …

Epistemology needs to be differentiated from the methodology of sciences as well as from so-called logic. The methodology of science is involved in the testing of ways of conduct occurring (chiefly) in the natural sciences. The term "logic" has had in the history of philosophy very many meanings …, however in our times two meanings are primary. Logic, primarily, means the internally not contradictory, consequential way of expressing oneself on a given topic, that is coherent linguistic practice. Secondly, it means the science arousing or researching such coherent linguistic systems. …

Theory of knowledge arose because man has great difficulty in comprehending reality. Cognitive theory is intended to make life easier (something students in no way believe in). Man sometimes himself commits mistakes or is tricked into adopting false views on reality. Theory of knowledge is therefore—to a degree—a theory for the creation of illusions and one that aids in avoiding these illusions. Theory of knowledge—in this vale of tears—is as necessary as medicine.[276]

Wholeness/entirety

In talking about "wholeness/entirety" one needs to understand that this term may relate to several different phenomena:

A. The wholeness (*integratio in causa*) of a concrete substance, for example a rabbit, skylark, Mr. XY (such an entirety consists in, for example, a fertilized cell of a concrete living substance). Here the matter concerns dynamic potential, and not spatial structure.

[276] P. Lenartowicz, *Elementy teorii poznania*, pp. 2, 43–47.

B. The wholeness (*integratio in fieri*) of developmental systems, that is of phenomena leading to the creation of spatial structures of a concrete, one of many, functional system (e.g., embryogenesis, the biosynthesis of a nanomachine).

C. The wholeness (*integratio in effectu pure structurali*) of passive structures of a functional system (e.g., of a nanomachine, the bone system, DNA structures, the eye, the brain, neurons).

D. Dynamic wholeness (indivisibility) (*integratio in actu ultimo, in effectu dynamico*), that is the dependence of dynamism on the properties, number, shape, scale, spatial orientation, and the distance of all the parts of a concrete functional system at once.[277]

[277] P. Lenartowicz, "Wiedza przyrodnicza – nauka – religia a spór pomiędzy monizmem i pluralizmem bytowym," p. 82.

II.

Piotr Lenartowicz SJ: Selected Writings

Edited by Jolanta Koszteyn

Phenomena of life: repetitive epigenesis

P. Lenartowicz, Chapter Three: "Phenomena of life: repetitive epigenesis," in P. Lenartowicz, *Phenotype-genotype dichotomy: An essay in theoretical biology*, Roma: Pontificia Università Gregoriana, 1975, pp. 35–70.

In this part of our study we will investigate some concrete data concerning the actual manifestations of life. This will lead us to a deeper understanding of the essential elements which characterize the question-raising element of genetic theories.

This investigation will be carried out in two steps.

First, the hereditary characteristics of an organism will be distinguished from the nonhereditary ones, and their common empirical properties will be analyzed, abstracted and generalized. This will lead us to a realization as to why the phenomenon of repetitivity and the phenomenon of increase in heterogeneity constitute something to be explained by an appropriate causal theory.

Secondly, the phenomenon of integration which pervades basic phenomena of heredity will be analyzed, abstracted and defined. This will help us in a fuller understanding of sane necessary postulates which have to be included in the causal theory.

The first step will thus lead us to the concept of repetitive epigenesis, the second to the concept of integrated epigenesis. The repetitivity and integration will constitute, as we will see, the main question-raising observational properties of these epigenetic phenomena which are registered within the sphere of living organisms.

3.1. The distinction between the hereditary and non-hereditary trait

We have to analyze once again the notion of heredity, this time the modern one. This should reveal the basic premises of this notion and realize the essence of the distinction between the hereditary phenomena as opposed to the non-hereditary ones. Being conscious of the two different approaches we discussed in the previous chapter, we will approach the analysis of hereditary traits from two extremes. We will analyze the hereditary trait in its Weismannian holistic aspect and in its Mendelian analytic aspect. We will see that in both cases the idea of repetitive epigenesis comes out very clearly.

Mendelian genetics is founded upon the distinction between hereditary and non-hereditary (acquired) traits. The origin of non-hereditary (acquired) traits is reducible to the environmental influences, or in other words, to the purely physicochemical causality of the inanimate world. Acquired characters ... are defined as "phenotypic modifications arising purely by environmental influences during the developmental process of an organism."[1] The notion of acquired characters helps us to understand what is the more exact meaning of the causal reducibility in genetics and to discover these elements of hereditary traits which prevent us from reducing their origin to the environmental influences.

It is obvious that the idea of causal irreducibility is to be hidden somewhere in the criteria which are used to distinguish the non-hereditary (acquired) traits from the hereditary ones. So we have to consider the definition of hereditary trait.

3.2. Definition of the hereditary trait

The notion of the hereditary trait is opposed to that of the acquired trait. ... The criteria of the distinction between them make reference to the phenomena of reproduction, on the one hand, and to the notion of "environmental influences," on the other.[2] This may be well illustrated by the following definition: hereditary trait:

[1] R. Rieger, A. Michaelis and M.M. Green, *A glossary of genetics and cytogenetics* (Berlin, Heidelberg: Springer-Verlag, 1968), p. 55.

[2] Cf. ibidem.

(1) "appears in successive generations,"
(2) "does not fluctuate in response to environmental changes."[3]

It seems, then, that the definition of the hereditary trait, its recognition, is dependent upon earlier observational and interpretational steps, namely:

(a) recognition of a group of living bodies tied together by the link of reproduction phenomena;
(b) recognition of the difference between a living body and its surroundings.

The first premise puts forward the problem of the non-arbitrary delimitation of the basic entitative unit of life, an organism. Without this delimitation the notion of "generations" makes no sense.

The second premise forces us to reflect upon the way in which the selection of traits for genetic study is made and to a deeper reflection upon the non-arbitrary means of distinguishing between the organism and its surroundings.

Let us then consider the concept of organism, as presupposed by the elementary genetic ideas.

3.3. The basic unit of heredity: life cycle

The life-span of any living form is limited. Its maximum length, in time dimension, is species specific and hardly modifiable by external factors. The prolonged existence of life phenomena is thus possible because of the succession of generations. The continuity of life is not a steady state but a periodic fluctuation between a structural minimum, in terms of heterogeneity, and a maximum. The single periods are recognized because of the repetitivity of their observational properties, upon any observational scale range, and are commonly referred to as life cycles. Within a single period, heterogeneity (asymmetry) of events, analyzed along the time vector, is, on the whole, absolute.

The continuity of periods might be illustrated by the following examples:

frog...egg...tadpole...frog...egg...tadpole...frog...egg...

[3] A.S. Baer, W.E. Hazen, D.L. Jameson and W.C. Sloan, *Central concepts of biology* (London, New York: Macmillan Company, Collier-Macmillan, 1971), p. 138.

… Theoretically, the division, which is purely mental, between the periods may be made at any arbitrarily selected point along the time vector. It might be put between the egg and the tadpole, or between the tadpole and the frog, but in each case the phenomenon of repetitivity would be saved. Each element arbitrarily selected along the time vector reveals its particularity, and each one of them reappears in due time. We may ask, then, whether the continuity of the periodicity is absolute or not. The absolute continuity would mean that a separation of one period from another is always arbitrary, independently of the point at which the division line was drawn. If, on the other hand, it were possible to recognize such points which manifest an intrinsic property distinguishing them from all the other points, we might say that the continuity of periods is not absolute, but only relative.

The specific, extraordinary property of some points would serve as a non-arbitrary criterion of that mental division between the single periods. Now, are such points recognizable within the continuous line of periods? Because structural heterogeneity increases along the time vector and still does not exceed a species specific maximum, there is such a point at which the heterogeneity drops back again, in a relatively short time, to the species specific minimum. This apparent reversal of the general trend (towards greater heterogeneity) marks the transition between the parent and its offspring.

The life cycle, as delimited by the above mental process, constitutes the minimal notion of living organism, and, we should add, genetic study cannot start until there are at least two such minimal units.

The term "cycle" might wrongly suggest that a given entity was brought back to its initial state. In reality, life cycle means a real, unidirectional, physical change. Repetitivity of this change is observable not within this change but comparing entitatively different life cycles. The nature of continuity between the individual life cycles is not quite obvious. Certainly it does not mean the entitative identity of material elements which were built into the evolving structures of consecutive "cycles." It means that the overall pattern of transformations was identical or at least similar.

The idea of the life cycle converges with the Weismannian notion of phenotypic phenomena. The life cycle as a whole constitutes here the primary observational evidence and the reference point both for further study of its details and for their proper interpretation.

> ... the life cycle is the central unit in biology. The notion of the organism is used in this sense, rather than that of an individual at a moment in time, such as the adult at maturity. ... The life cycle is a summation of all the molecular or biochemical steps, one following another in a well-ordered sequence.[4]

The most important property of the life cycle concept is its dynamic character. The life cycle is a process, and any true part of it is a process, too. Any part of it reveals not a three- but a four-dimensional structure. Consequently, no static entity can be identified as a true part of the life cycle.

There is another point to be raised here. The life cycle as a whole means a continuous transformation from a more homogeneous state towards a more heterogeneous one. So, generally speaking, the parts of the life cycle reveal the same characteristic, too. In other words, both life cycle and its parts, or details, are dynamic, epigenetic events.

The essentially holistic notion of the life cycle is opposed by the analytic Mendelian notion of the hereditary trait. In the case of the hereditary trait, a special new methodological approach is applied. Individual life cycles are compared one with another, point by point. As a result of this procedure, some observational phenomena, or hereditary traits, are picked out from the whole context of the life cycle.

We will now have to reflect upon this process of the selection of traits.

3.4. Fragmentary units of heredity: hereditary traits

Unlike the Weismaimian, the Mendelian notion of phenotype is static in the overwhelming majority of cases. It is a fragmentary structural pattern which has appeared upon a more or less arbitrarily selected stage of the life cycle. The selection of a Mendelian trait is thus double-fold. First, it selects among different stages of the intrinsically indivisible and continuous life cycle process. Secondly, it selects a part of the whole static pattern observed upon this mentally "frozen" stage.[5]

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[4] J.T. Bonner, *Size and cycle: An essay on the structure of biology* (Princeton, NJ: Princeton University Press, 1965), pp. 3–4.

[5] The obstinate refusal to recognize the dynamic (epigenetic, developmental, physiological) nature of life cycle and the reduction of the notion of an organism to its "frozen" structural, transient form observed upon an arbitrarily selected level of the temporal dimension was analyzed by J.H. Woodger *Biological principles*

The color of the eyes, for instance, is a fragmentary static property of a greater structure which has appeared relatively late during the life cycle. ...

We might say that Mendelian genetics starts its investigation of hereditary phenomena where Weismannian had come to an end. Mendelian genetics simply presupposes the concept of the life cycle, but it goes beyond it in making a comparative study of selected traits as they appear within the context of their respective life cycles. The selection of traits for study constitutes the starting point of Mendelian genetics, and we will have to consider now the criteria of this selection.

The Mendelian notion of hereditary phenomena starts with a detail of the life cycle, a detail which was recognized by comparing the differences existing between life cycles. This detail is sorted out from the non-hereditary details of these cycles, the sorting out being based upon the two independent criteria mentioned in the definition of the hereditary trait. Now, the relative independence of these two criteria creates a logical, purely formal problem as to the logical adequacy of the division between the hereditary and the non-hereditary, or the genetic and the acquired, traits of the life cycle. From the point of view of pure logic, two independent criteria divide a set of entities not into two but into four different sub-sets. In our case, a suspicion might arise that the application of these two criteria leaves two sub-sets of phenotypic traits unmentioned.

In order to verify this suspicion, we will construct a model of the classification of phenotypic traits based upon the two criteria implied by the definition of the hereditary trait. Then we will check which of the model sub-sets is non-empty. Finally we will analyze the problem of the nature and the origin of the members of different sub-sets.

3.5. The model of classification of phenotypic traits

Phenotype means any observable trait of the life cycle. Our model of the classification of phenotypic traits does not introduce anything

(London: Routledge and Kegan Paul Ltd., 1967), pp. 302ff, 422ff. See also Whitehead's suggestion in *Time, space, and material: Are they, and if so in what sense the ultimate data of science?* (1919) about the role of mathematical mentality in the development of this a-temporal static way of representing four-dimensional observational phenomena. Cf. J. Kockelmans, "A.N. Whitehead," in J. Kockelmans, *Philosophy of science: The historical background* (New York: Free Press, 1968), pp. 414ff.

new into the definition of the hereditary trait. It simply makes use of the explicitly stated criteria, which according to the accepted views are basic for the recognition of the hereditary traits within the whole set of phenotypic traits.

This classification might be represented as follows:

Table 3.1

CRITERIA	GROUPS OF PHENOTYPIC TRAITS			
	1st	2nd	3rd	4th
(1) repetitive appearance within the successive life cycles	+	+	–	–
(2) dependence upon environmental influences	–	+	–	+

Anticipating the results of the analysis which will be carried on later, we will tag the above four groups with a proper name. That will simplify our terminology. The first group will be referred to as the "basic" phenotype, the second group as the "adaptive" phenotype, the third as "individualizing" phenotype, and the fourth as the "traumatic" phenotype.

Before we pass on to the discussion of the possible application of the proposed classification of descriptive traits abstracted from the integrated pattern of the life cycle, we should explain more fully the notion of the environmental influence.

3.6. The notion of the "environmental influence"

The environmental influence means a physical or chemical influence of any material entity present in the surroundings of the given life cycle. The notion of the influence should be distinguished from the notion of "triggering effect." In the latter case, a given physical or chemical influence releases a whole series of events within the body of an organism, and these events are not reducible to the environmental influence alone. Let us take an example. An external, environmental agent may exert a pressure upon the surface of my skin and modify the external shape of my body. This modification has to be considered as caused by the environmental agent. But at the same time, the sensory nerve endings are sending a series of electrical impulses up to my central nervous system, producing, let us say, dilatation of the pupils

in my eyes. Are the electrical impulses and the dilatation of pupils attributable to the environmental influence? We may say that the impulses were "released" by the environmental change, but that the difference between the "causal influence" and the "triggering" (release) influence seems, intuitively, to be irreducible.

Let us take another example. The temperature of the body of a frog changes under the influence of the environmental sphere, and these changes are reducible to environmental influences. On the other hand, seasonal variations of temperature may trigger a complex series of events which in some animals leads to the appearance of thicker fur. It might be that the environmental temperature change really influenced the appearance of this phenomenon, but nonetheless it cannot be reduced, as a whole, to the environmental influence alone.

Another important point must be stressed here. The environmental influence may be conceived of as "any physically possible physical influence," or as a concrete environmental influence registered here and now. Of course, we do not know any organism which could withstand "any possible physical influence." It means that the range of independence from the environmental influences as postulated for the 1st and 3rd group in our classification (see Table 3.1) has to be understood in the context of certain limits within which an organism reveals a virtual lack of dependence on the environmental sphere.

After these complementary explanations we may now pass to the discussion of the four separate groups of phenotypic traits. ...

3.7. The "individualizing" phenotypic traits

Looking at our classification scheme, one may ask whether the 3rd group of phenotypic phenomena is not absolutely imaginary. Would it be possible to demonstrate the existence of any structural or dynamic phenomenon which would be independent of the environmental influences and at the same time unrepetitive? In fact, it is possible. The antigens are such entities, for on the biochemical or, more generally, the subcellular level of bodily organization they fulfill the criteria set for our 3rd group of phenotypic traits. An antigen, in fact, is a rather highly complex chemical substance which displays physical properties quite unique among sexually reproducing organisms for the given, concrete life cycle. Antigens do not seem to play any role in the functional species specific events of the life cycle. Their

origin, on the other hand, is irreducible to random environmental influences. They appear *de novo* in every single life cycle and constitute an individualizing, distinctive trait of this particular life cycle. The variety of antigens is thus practically infinite, at least in relation to the number of actually living organisms. But there are other, descriptive traits of single life cycles which are unrepetitive, too, like the fingerprint pattern, some peculiarities of the overall pattern of skin pigmentation, of hair distribution and so on.

These and similar characteristics or "peculiarities" of individual life cycle are usually taken separately, as if their "ensemble" had no special, indivisible meaning at all. But is there any justification for this procedure? Is this "ensemble" of "individual peculiarities" really deprived of any intrinsic unity? In order to explain ourselves better, let us turn to the structure of the antigen which constitutes a biochemical "individualizing" trait of a given, concrete life cycle. If we were to try to break down a protein antigen into its parts, its uniqueness would vanish. It will be split into twenty basic amino acids, and these structures, although characteristic of living organisms, are common to all of them. Only the whole antigen is unique. Its parts are not. Similarly, only the whole pattern of hair color and distribution, of eye color and shape, of skin pigmentation, of the peculiarities of the nose and ear shape, the whole pattern of fingerprints are unique. Fragments of this overall pattern are not. An individual life cycle is physically recognizable, identifiable because of this unique set of characteristics which are unique only as a whole. Baby animals are recognizable by their parents because of this unique pattern of macroscopically observable traits. The case of monozygotic twins is a good exception from this rule. Monozygotic twins are not unique either in the macroscopic pattern of characteristic traits or in the biochemical structure of their antigens.

The 3rd group of characters might be compared with the catalogue number of a single copy of a book. The copies of the same edition of the same book may have a different catalogue number, and it will help us to identify single concrete copies of them.[6]

[6] Theoretical physicist Gamow postulated that "the hereditary properties of any given organism could be characterized by a long number written in a four-digital system." G. Gamow, "Possible relation between deoxyribonucleic acid and protein structures," *Nature* 173, no. 4398 (1954), p. 318.

3.8. The "traumatic" phenotypic traits

In the case of living organisms, there is another set of observable characteristics which are also unique, but essentially reducible, in the sense of their origin, to the environmental influences. … Some environmental influences produce wounds, burns and other damages. The pattern of these damages is unique because of the randomness of environmental influences. If these damages were not regenerated, repaired, or the repair was not completed, the remains of the original environmental influences would constitute a permanent unique individualizing pattern, characteristic for a given concrete life cycle. The elements of this pattern belong to the 4th group of phenotypic characters. They are not hereditary …

The 4th group of observational traits is "individualizing" in the same sense in which different copies of the same edition of the same book are differently affected by time and usage, so that although just after printing and binding process they were practically indistinguishable, now they are easily identifiable.

3.9. The "adaptive" phenotypic traits

There is a large amount of evidence for the existence of phenomena which are obviously parallel to some environmental changes but which still cannot be adequately explained without reference to the intrinsic properties of the organism itself. Traditionally these phenomena were treated as an example of adaptation, but in modern genetics they are referred to as a case of "phenotypic flexibility." Let us look at some examples:

(1) "In lower vertebrates, sex reversal can sometimes be brought about by changes in temperature."[7]

(2) There are strains of *Escherichia coli*, the common bacterial form permanently present in human intestines, which can grow and reproduce on two or three hundred different types of nourishment. If the *E. coli* are fed, for example, on lactose, they will

[7] U. Mittwoch, "How does the Y chromosome affect gonadal differentiation?," *Philosophical Transactions of the Royal Society of London, Series B, Biological sciences* 259, no. 828 (1970), p. 116.

make a particular set of enzymes; if the lactose is replaced by glucose, a new set of enzymes will appear *de novo*.[8] ...

(3) "*Celloniella palensis*, a colonial Chrysomonad occurring in cold, swift brooks, varies tremendously in form according to local conditions. In strong currents, the alga forms wavy, leaf-like colonies up to 2 cm long. The jelly sheath is held fast to stones by a stalk and spreads in to irregularly branched lobes. At the edge of the lobes and in the region of the stalk are numerous cells, each with a yellow-brown, cup-shaped chromatophore ... Where water plunges over a rocky edge, *Celloniella* forms a gel structure entirely different from that in running water. It is a crust consisting of several layers whose margins contain calcium carbonate granules ... Finally, beneath an overhang where the water trickles down and drops away, the Chrysomonad forms sacs. These are filled with a liquid, and the cells lie in the sturdy surface layer, which contains numerous $CaC0_3$ granules ... If the stones with pieces of crust are placed in running water, arches arise in the course of one or two days in which cell division is rapid; and in the course of the next four days irregularly cylindrical extensions several millimeters long, pointed at the end and with lateral bulges, begin a transition to the leaf-like colonies. If pieces of leaf-like, encrusted, or saclike colonies are placed in still water, the formation of motile forms is triggered. After only a few minutes the cells swim out, each with one long flagellum. These swarmers can divide and can transform into amoeboid forms, which creep around with blunt pseudopodia. In cool water they attach and begin to make jelly."[9]

In all the above examples the observed changes were parallel to the changes in the environmental sphere, and completely reversible

[8] Cf. D.A. Glaser, "Biological control mechanisms in simple organisms," in *Biology and the physical sciences*, ed. S. Devons (New York, London: Columbia University Press: 1969), pp. 74–84. There is a long-lasting discussion on the right interpretation of the mechanisms involved in this kind of phenomenon ... More recent evidence concerning the non-random control of gene-action in procaryotes seems to diminish credibility of a mutational interpretation of the facts. Cf. I.H. Herskowitz, *Principles of genetics* (New York: The Macmillan Co., 1973), pp. 411–423.

[9] A. Kühn, *Lectures on developmental physiology* (Berlin: Springer-Verlag, 1971), pp. 130–131.

within the same, single life cycle. The capacity to undergo these transformations is thus species specific and dependent upon the environmental influences. We may conclude that at least in some forms of life the phenomena fulfilling the criteria of the 2nd group of phenotypic traits may be observed. They show a double parallelism. They follow the pattern of environmental fluctuations and at the same time they reappear with a non-random repetitivity in the context of continuous series of life cycles.

3.10. The "basic" phenotypic traits

In this case the phenomenon of repetitivity is most obvious and the relative independence from the environmental fluctuations most pronounced. The phenomena of the 1st group constitute the basic, necessary element of life in general, and of heredity in particular.

Examples may be drawn from any level of bodily organization. Both structure and dynamics of digestive, respiratory, metabolic, excretory or reproductive machinery are repetitive down to their detailed biochemical organization. From the biochemical point of view, greater repetitivity of structural and dynamic pattern than that we observe in basic, common metabolic processes is physically impossible.

3.11. Some general remarks concerning the proposed classification

Now, how may we summarize the results of our classification? It has revealed, first, that two different forms of individualizing traits can be recognized within the whole set of phenotypic characters. One (the 4th group) is lacking any epigenetic origin and is reducible to the purely environmental influences of the inanimate matter which constitutes the surroundings of an organism. The second form of the individualizing traits (3rd group) appears, on the contrary, as a result of typically epigenetic process, and although it is unique with respect to other organisms, it shows a patent repetitivity within the immanent sphere of the single, same life cycle.

Secondly, our classification has revealed two different forms of influence which the inanimate environment exerts upon the sphere of the organism. One form of this influence is purely physicochemical, and it is evident in the case of the 4th group phenomena. The other form of this influence we have called "triggering effect," and

this provisional term will be analyzed and defined in a more precise way in the next chapter of our essay. This triggering effect is manifested in the 2nd group of phenotypic traits.

Finally, our classification has revealed clear-cut differences between the first three subsets (groups) of phenotypic traits, on the one hand, and the fourth one, on the other. These differences are represented in Table 3.2.

Table 3.2

Group	Examples of phenotypic traits characteristic for the group	Repetitivity (structural)	Origin	Repair and regeneration	Specificity
1st	Reproductive, excretory and other physiological systems	External and internal[10]	Epigenetic	Observed at least during development	Species specific
2nd	Adaptive, reversible transformations of the 1st group phenomena	External and internal	Epigenetic	Observed at least during development	Species specific
3rd	Antigens (molecular, organellar, cellular); fingerprint patterns, pigmentation, patterns ... and the like	External (veget. reprod.) and internal	Epigenetic	Observed	Race specific
4th	Any sort of mutilations, burns, abrasions ... etc.	Random	Environmental causality	Absent	No specificity

Summing up, we may say that:

(a) The definition of the hereditary traits divides the whole set of phenotypic characters of a living organism into four non-empty sets of characters.

[10] External repetitivity means here the identity of the heterogeneous pattern as revealed by comparing the two different life cycles. Internal repetitivity means that a heterogeneous pattern is repetitively observable within the same life cycle. Muscle cells, myofibrils, myosin molecules, are repetitive both externally and internally (they are identical both in the same organism and in different specimens of the same species).

(b) One of these sub-sets, the fourth, is composed of traits which are causally reducible to the environmental influences, and this reduction is complete. In other words, the fourth group of phenotypic characters originates as a result of purely physicochemical environmental influences.

(c) Three others groups are not reducible one to another but, because they are believed to be irreducible, in the sense of their origins, to environmental influences, they represent hereditary traits of the life cycle.

In the first and second group of traits, the epigenetic nature of their origin is obvious. The phenotypic traits classified in the first group constitute the essence of the life cycle. In the favorable environmental conditions, the phenomena of the second group may not appear at all, while the phenomena of the third group are also deficient in the case of vegetative reproduction. So the phenotypic traits of the first group constitute the minimal set of observational evidence which is irreducible to environmental influences. The bacterial cells, which multiply in a non-sexual way and are thus deprived of the hereditary "individualizing" traits (3rd group) still reveal all the essential phenomena of the first and second group of phenotypic traits.

> The newly formed cell differs from a cell about to divide not only in size but ... in its composition, and this composition changes qualitatively in a fixed sequence throughout the cell cycle ... The bacterial cell behaves as a unit in that all its components are duplicated together in each cycle and that it changes its relative composition in appropriate ways in response to changes in its environment.[11]

We will now discuss in some detail the epigenetic origins of the phenomena which were classified in the third group of phenotypic characters.

These traits for years constituted the main object of genetic study. As we have seen, the hereditary characters of this group are not directly

[11] W.D. Donachie, N.C. Jones and R. Teather, "The bacterial cell cycle," in *Microbial differentiation: 23rd Symposium of the Society for General Microbiology*, ed. J.M. Ashworth and J.E. Smith (Cambridge: Cambridge University Press, 1973), p. 30.

involved in the functional and developmental events of the life cycle. For this reason, it was easy to study their "re-appearance" pattern in a practical separation from the more essential mechanisms of the life cycle. For the sake of simplicity, their origins within the life cycle were also left aside. In this way the main feature of the first groups, namely, epigenetic, *de novo* formation, was seldom mentioned in the context of the phenomena belonging to the third group of phenotypic characters.

For this reason, we will reflect for a while upon the details of the transformations which lead to the appearance of a hereditary trait belonging to the third group of phenotypic characters.

3.12. The hereditary individualizing phenotypic trait (3rd group) and its developmental path

Let us reflect for a while upon the nature and origin of an "elementary" hereditary character such as color of the eyes. It is recognizable only after the head tissues and the eyeballs are formed. In other words, a single fertilized egg cell has to multiply, the anatomical structures of the embryo have to be relatively differentiated, before the color of the eyes will appear. The color of eyes results from the fact that the great number of the specifically (in the biochemical sense) equipped cells are distributed in a limited area of the internal surface of the iris. Those cells are able to produce a special yellow, brownish or dark brown sort of pigment which is called melanin. Depending on the qualitative and quantitative properties of this pigment within the iris cells, the iris, which is originally quite transparent, becomes grey-blue, blue, violet, green, brown or almost black. The melanin-producing cells are selectively distributed in different parts of the body, and they develop from the early embryonic, undifferentiated ectoderm, together with the neural tissues. During embryogenesis they undergo a specific form of differentiation (*epigenesis*) which leads to the appearance in them of the special enzymatic complexes capable of producing the melanin pigment. While this differentiation takes place, the cells themselves migrate from their source in the neural crest to the eyeball primordia which at the same time undergo another form of differentiation leading to the formation of the light- and color-sensitive receptors of the retina and of other structures determining the proper functioning of the organ. ...

Melanophores do not appear *in instanti*. They constitute the final stage of a partial life cycle of a given body. If we forget about … developmental context in which the color of eyes appears, we would not find any reason (any physical reason) why the melanophores are not present within the lens of an eye, or in the joint cartilage, or at the tip of the tongue. …

3.13. The concept of the developmental path

Even if we have broken down observationally the whole adult living body into a number of hereditary traits, basic, individualizing or adaptive, we have to admit that they do not appear out of nothingness. They are the end-points of a temporal series of physical events, which, if we look back in time, converge with the "neighboring" series in the single cell of a fertilized egg. The developmental paths of different hereditary traits are different and have to be different because physical laws cannot be violated, and the different traits are prepared by different physical events, not by the same ones. The existence of a hereditary trait postulates the existence of an appropriate developmental path and, at the same time, is explained by this developmental path.

3.14. Biochemical level of developmental path phenomena

Two important facts have to be realized here. First, even if we could dissect the adult form of an organism down to its single chemical molecules, their appearance in the adult form is due to the developmental process which involved much more complex structures than the "end product." The production of a hemoglobin molecule, for instance, involves many preliminary synthetic stages from the synthesis of amino acid molecules up to the synthesis of two pairs of different polypeptides (alpha and beta polypeptide) and the non-protein complex protoporphyrin molecule, the heme.

Unicellular autotrophic organisms can grow successfully in an environment composed of water, carbon dioxide and some mineral salt provided that light energy is available. Yet their molecular structure is essentially as complex as the structure of a metazoan egg, as far, at least, as their cytoplasm is concerned. This means that every single macromolecule which is physically necessary for their normal biochemical processes is built *de novo* from the molecules of water, carbon dioxide and mineral salts present in the environment. Consequently,

each such functional macromolecule (an enzyme molecule, coenzyme molecule, cell-membrane mureins, phospholipids, polynucleotides, and so on) is not only a hereditary trait of those simple organisms but the end stages of a very complex synthetic process, quite analogous to the developmental path of multi-cellular hereditary traits observable in pea plants or *Drosophila* flies. The *de novo* formation of structures is not limited to the macrostructures of a whale or an elephant. The *de novo* formation process is observable in every structural element of a living body. Every living organism, including blue-green algae and pleuropneumonia-like organisms up to man's organism, are able to synthesize *de novo* an impressive variety of amino acids, sugars, carbohydrates, purines and pyrimidines, and the like.

3.15. The "metabolic turnover" phenomenon

Radioisotope studies have revealed that every structural part of any living organism is not only built *de novo* once, but all the details of the structure are constantly renewed, old "bricks" being thrown out, or digested, and the new ones synthetized and replaced in the proper place and order. ...

> It was thought [before] that once cell components, such as proteins or membrane lipids were synthesized, they remained intact for the lifetime of the cell ... [after Schoenheijner et al. (1930's) radioisotope studies] ... it was found ... that the proteins of the liver cell exist in a dynamic steady state, in which a relatively high rate of synthesis is exactly counterbalanced by a relatively high rate of degradation.[12]

The same author adds a whole list of the "half-life" cycle of different chemical components in rat tissues *in vivo*. The protein synthesizing apparatus undergoes rapid degradation and the *de novo* synthesis occurs with fantastic speed.

> ... each liver cell in the adult rat synthesizes 650 ribosomes, 650 5S RNA and 11,000 molecules of tRNA each minute.[13]

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[12] A.L. Lehninger, *Biochemistry. The molecular basis of cell structure and function* (New York: Worth Publishers, 1970), p. 282.

[13] J.D. Thrasher, "Turnover of intracellular proteins," in *Cellular and molecular renewal in the mammalian body* ed. I.L. Cameron and J.D. Thrasher (New York: Academic Press, 1971), p. 154.

We should add that the biochemical processes involved in the destruction of "useless" highly organized compounds differ from the biochemical processes engaged in the *de novo* production of them.[14]

The concept of a "development" or a "synthesis" is not restricted to the period of the embryogenesis alone. An adult organism, whether a bacterium or a man, might be compared to a fountain which has a relatively constant "shape" (a fan, a cascade, and so on) but whose elements are in constant movement. Let us suppose now that the shape of this fountain changes from a little microscopic spring to a colossal fan of water. This will help us to understand, in terms of molecular biochemistry, what the developmental path of, let us say, a mammalian limb, means.

But this metaphor is still inadequate in many important aspects. The details of a fountain, granted that they are moving, are nevertheless homogeneous, down to the level of single water molecules. The living organism is heterogeneous in its chemical details, in its sub-cellular details (nucleus, Golgi apparatus, mitochondria, lysosomes, endoplasmic reticulum, desmosomes, chloroplasts, flagellae, and so on), in its cellular details (cartilage cells, muscle cells, glandular cells, neural cells, bone cells, glial cells, and so on), and in its "organic" structures (veins and arteries, glands and bones, joints and eyes, and so on). Each organizational level is not only composed of the various simpler elements of the "lower" level, in various numerical proportions and in various spatial arrangements of those elements, but at the same time each organizational level, in its whole range of variously shaped structures, undergoes the constant exchange of elements which are formed and renewed all over the life span.

> … the individual cell … remains … essentially invariant, despite the incessant turnover and reshuffling of its content … small molecules go in and out, macromolecules break down and are replaced, particles lose and gain macromolecular constituents, divide and merge, and all parts move at one time or another. … Yet … the various activities of all parts remain coordinated in the maintenance of the standard pattern of order in any given cell. It is an order of relations rather than of fixed positions.[15]

[14] Cf. H.R. Mahler and E.H. Cordes, *Biological chemistry* (New York: Harper and Row, 1971), pp. 488–489.

[15] P. Weiss, "From cell to molecule," in *The molecular control of cellular activity*, ed. J.M. Allen (New York: McGraw-Hill, 1962), pp. 5–7.

The developmental stage (embryogenesis) is only macroscopically, observationally the most impressive expression, manifestation of this continuous *de novo* formation, which, in fact, lasts until the death which immobilizes it. In a way, a dead body is like a frozen fountain. In the proper conditions it might be preserved in the structurally unchanged state during any time period, but it could not be considered any longer as a "living" body.

Summing up, this closer analysis of the hereditary trait has led us to a rather general statement about the ubiquity and continuous pervasiveness of the *de novo* formation processes in the living body.

But the metaphor of a fountain which changes its shape gradually and grows in its dimensions is inadequate not only because of the homogeneity of its "material." It is inadequate from the point of "functionality" of its elements. What does this mean?

3.16. The intrinsic integration of the metabolic turnover

We will discuss the problem of functionality in two steps.

First, the parts of an organism, let us say, of a fruit fly, form a sort of physical mechanism, in which the precision of each part is a physically necessary premise of their collective functioning. Now, if all the parts, all the chemical elements of this fly are in a constant flow, the substitution of the new details have to be precise enough to permit the continuation of this collective function.

> Although the structure and metabolic activities of a cell are organized for its preservation, the protein components are continually being destroyed and replaced throughout the cell's existence.[16]

So the process of the exchange of the biochemical machinery, of the chemical molecules, their destruction and replacement, has to be coordinated in some way. The elements of the fountain show no special mutual functional relationship; that is why their "replacement" does not presuppose any controlling agency (or system of agents).

Secondly, the parts of an organism are not in a functional relationship just from the beginning of a concrete, particular life cycle. During the developmental phase the parts are gradually formed in such a way that in the adult form their mutual functional relationship

[16] I.H. Herskowitz, *Principles of genetics*, p. 22.

is physically determined. The embryonic tissues are achieving their functional structure step by step, the limbs grow out of the completely non-functional primordia, the red blood cells develop from the cells which contain no hemoglobin molecules, the eye-lens cells develop from the cells which are not capable of producing crystalline proteins. This fact is not limited to the microscopic phenomena. Upon the molecular level of bodily organization the whole series of "precursors" (functionally inactive molecules) precedes the final appearance of the molecule of a hormone, of a contractile protein fiber, of an enzyme, and so on.

So even before the final functionality of the whole organism is reached, its parts are developing gradually in a way which physically predetermines their final dynamic cooperation. And here again, the problem of mutual integration of the developmental processes seems to be quite evident.

The individualizing hereditary traits, on the other hand, are not functional, at least upon the level of a single organism. (They may, however, play considerable role on the social level of an organism's life). But the individualizing hereditary traits are physically indivisible from the functional, or developmental, structures of the "common" and/or adaptive hereditary traits.[17] The colour is physically inseparable from the eye, the shape and color of the hair is inseparable from the hair itself and the hair cannot exist without the skin, which belongs among the basic traits (1st group). Fingerprint pattern cannot exist without the hand which is a "basic" hereditary character. So the lack of functional link between the parts of the "individualizing" phenotype does not detract in any significant way from our preceding statements on the observed link between the developmental and functional phenomena of the life cycle.

3.17. Reduction of the repair and regeneration processes to the developmental process

The permanence and continuity of metabolic turnover during the whole life cycle leads to an important observation. Traditionally, the

[17] Cf. P. Weiss, "1+1 ≠ 2: When one plus one does not equal two," in *The neurosciences: A study program*, ed. G.C. Quarton, T. Melnechuk and F.O. Schmitt (New York: Rockefeller University Press, 1967), p. 821; J.H. Woodger, *Biological principles*, pp. 358ff.

life cycle was divided (mentally) into developmental, or embryonic, and adult, or functional, phases. Now, if during the functional adult phase virtually all structures undergo a constant destruction (catabolism) and renewal (anabolism), we might say that the developmental processes persist in spite of the fact that the functional state is achieved. Although the *de novo* formation of the body is not visible (in the sense in which it was macroscopically observable during the embryonic phase of the life cycle), the developmental process goes on as during the developmental phase.

Because, however, the functional (adult) state of the phenotypic structures is already achieved, the phenomena of metabolic turnover are not visible. Above the molecular level, structures have reached the steady state and the continuation of the developmental processes in the form of metabolic turnover may be detected only by special observational techniques. If, however, a local damage produces a "gap" in the structures, the developmental processes may "fill" it with new, functional structures, which in some cases is visible even on the macroscopic level. The macroscopic "gap" has revealed the presence of the continuous developmental process, it did not release it.[18] If this hypothetical assumption were true, the process of the repair and regeneration would not have to be explained by postulating special regulatory, adaptive mechanisms. It might be interpreted as the manifestation of the same process which is responsible for the appearance of the whole life cycle and for the continuity of the metabolic turnover. ...

3.18. The reduction of the biological phenomena to the molecular level of structures and events

As we have seen from the above evidence, the epigenesis and repetitivity of biological phenomena are not less impressive on the biochemical level of bodily organization than it is on higher, cellular or organic, levels of this organization. Because of the essential repetitivity of molecular events within the cell, their detailed description becomes possible, and in fact, even *in vivo* electron microscope observations reveal a non-random pattern of movements and changes on the level of greater molecular complexes. This direct evidence is

[18] Cf. R.J. Goss, *Adaptive growth* (London: Logos Press, 1964); R.J. Goss, *Principles of regeneration* (New York: Academic Press, 1969).

further strengthened by the results of indirect observations and calculations. The modern view on the nature of the living cell is basically dynamic, and the traditional opinion about the random arrangement of the chemical compounds in cytoplasm was shown to be wrong.

> Typically, in living systems, important microscopic fluctuations are generated by microscopic machines whose sequence of states is not random. We should not be prevented from studying the macroscopic effects of submicroscopic activity by adherence to the traditional postulate of statistical thermodynamics, that all microscopic variables are random and that all machines are macroscopic.[19]

3.19. On the observational irreducibility of the epigenetic phenomena

As we shall see in the next chapter, the functionality of biochemical processes is conceptually equivalent to the functionality of such macroscopic devices as the optical system or the musculoskeletal locomotory system.

> There is no dividing line between structures in the molecular and in the anatomical sense: macromolecules have structures in a sense intelligible to the anatomist and small anatomical structures are molecular in a sense intelligible to the chemist.[20]

The repetitive *de novo* appearance of biochemical machinery within the cell is thus as intriguing as the *de novo* appearance of an adult elephant's body is. The question-raising evidence is the same in macroscopic and in the microscopic, molecular aspect of the living body. The postulate of conceptual reduction of macroscopic evidence to the level of molecular evidence changes nothing in the nature of the main problem which intrigues us. Hereditary transmission of biochemical structures does not seem to be less mysterious than the transmission of macroscopic, anatomical properties. But in a way, the postulate of reduction forces us to construct in our minds the

[19] K. Kornacker, "Living aggregates of nonliving parts: a generalized statistical mechanical theory," in *Progress in Theoretical Biology*, Vol. 2, ed. F.M. Snell and R. Rosen (New York: Academic Press, 1972), p. 9.

[20] P.B. Medawar, *Induction and intuition in scientific thought* (Philadelphia, PA, 1969), p. 105.

extremely complex four-dimensional non-random replica of a cell, or an organism. The number of details, structures, heterogeneous events which appear upon the biochemical level exceeds by several orders of magnitude the heterogeneity of relatively crude and imprecise ideas based upon macroscopic observations. The descriptive reduction, in other words, amplifies the question-raising evidence, instead of reducing it. The postulate of genotype, which was invoked under the impact of the macroscopic, relatively imprecise and relatively simple evidence has now to explain causally the astronomical number of structural and dynamic details recognized on the biochemical level of life.

3.20. The concept of the epigenetic event

The preceding analysis of the life cycle concept, of the developmental path concept and of the metabolic turnover concept has served to prepare some empirical evidence for the elaboration of the precise and more generalized notion of epigenesis.

The epigenetic events constitute the main observational question-raising evidence which provoked the origin of the "phenotype-genotype" distinction. It is essential now to have a clear, unequivocal understanding of the essential and relevant (from the theoretical point of view) elements of this concept.

These essential elements seem to be as follows:

(a) Epigenesis is an event, not an a-temporal state. Its most basic property lies in the change from a less complex to a more complex structure. Consequently, an epigenetic event cannot be described in terms of a single structure, however complex. Two different structures, at least, constitute the minimal descriptive evidence for an epigenetic phenomenon. These two different structures, or states, cannot be conceived as coexistent. If that were so, the dynamic element of the epigenesis would vanish, and the two structures could be reduced to an a-temporal state.

(b) The two above structures have to be really different from one another. By "really," we mean "physically." So the concept of epigenesis implies the concept of physical change. If it were not so, epigenesis would not provoke any need for a causal explanation.

(c) The two structures are not only different from one another, but one of them is more complex than the other.

(d) The two structures are observed to appear in a temporal order such that the less complex precedes the more complex.

Epigenesis means an increase in complexity. But how can complexity be measured? Which entity is more complex and which is less complex? Before we try to formulate a more general concept of an increase in complexity, let us consider a concrete epigenetic process such as production of protein molecules.

3.21. The notion of the change (increase) in complexity

The majority of proteins is made up from twenty different, basic forms of amino acid molecules. The single molecules are linked together by the so-called peptic bonds, so that a long chain (polypeptide) is formed, in which different forms occupy a certain position (sequence position). The properties of a given polypeptide chain, which quite often is more than 100 amino acid molecules long, depend on the sequence of different amino acid molecules within the chain.

What does it mean when we say that "a given polypeptide chain is more complex than the random set of single, free amino acid molecules which might be obtained by the destruction of its peptide bonds"? It means that from the same pool of free amino acids we might obtain a completely different sequence, the polypeptide chains showing completely different properties and that the number of these different possible polypeptide chains obtainable from the same pool of amino acids is extremely high.

In fact, from a hundred free amino acid molecules representing twenty different forms of them, we might obtain 20^{100} forms of polypeptides.[21]

[21] "The number of possible proteins of the molecular weight 60,000 Da (human haemoglobin has the m.w. 65,000 Da, yeast alcohol dehydrogenase has the m.w. 140,000 Da) is 10^{625}. This means that if the entire observable universe were packed with protein molecules, each one different, and if each of these have changed into a different one every second since the sun started to condense from interstellar gas, not every possible protein molecule would yet have existed, by a very large margin." J.W.S. Pringle, *The two biologies: An inaugural lecture delivered before the University of Oxford on 24 October 1963* (Oxford: Oxford University Press, 1963), p. 15. We should add that ... "It is important to stress that the amino acid sequences of polypeptide chains designed to be the fabric of protein molecules only make functional sense when they are in the three-dimensional arrangement that characterizes them in the native protein

In more general terms, then, an increase in complexity means a change towards an integrated structure composed of parts which, as such, were not intrinsically determined to form this particular structure, but might, in principle, form a greater number of different integrated structures.

In the same sense the fantastic figures, "feathers" and other configurations of crystals iced in winter on the window illustrate complexity of structure. It is quite obvious that the same number of water molecules might be arranged in many different configurations. So the complex structure taken as a whole demonstrates only a small fragment of the structural potentiality we recognize in its parts taken as a set of separate, individual units.

The epigenetic change as such does not seem to provoke any particularly difficult causal interpretation. The patterns observed in the inanimate world are often very complex and they may serve as the illustration of true epigenetic phenomenon. What does create the problem is the *repetitivity* of this phenomenon. The pattern of the ice crystals on the window is not repetitive. The complex pattern of bodily structures, even in the case of the simplest living organisms, is complex and repetitive at the same time. And this does provoke the question of the origins of this repetitivity.

The complexity of a single polypeptide chain of the major extracellular nuclease of *Staphylococcus aureus*, with respect to the random set of free amino acids into which it can be broken down, may be expressed by the relation 2^{800}:1. If the *Staphylococcus* nuclease is repetitively formed from the random set of amino acids, and all the other, incredibly numerous polypeptide forms are not, we have to postulate some physical constraints which will be able to control the process of the *Staphylococcus* nuclease production with the utmost physically possible precision.

The hereditary characters in the living body are all produced by the epigenetic process. And all of them reveal a striking repetitivity which is not less pronounced on the biochemical level than it is on the higher levels of bodily organization.

The repetitive appearance of complex structures from among the homogeneous, or less complex, may, in turn, be rephrased in terms of

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structure (i.e., *in vivo*)." C.B. Anfinsen, "Principles that govern the folding of protein chains," *Science* 181, no. 4096 (1973), p. 228.

the adequate restrictions. These restrictions have to be postulated in order to explain the strange lack of other complex structures equally possible from the point of view of possibilities inherent in the simpler state. In other words, the repetitivity of one particular complex state is the manifestation of a sort of probabilistic deficit.[22] The problem of epigenesis in the case of living bodies amounts to the explanation of the constraints which restrict the increase of complexity in such a way that the resulting complex structures are strictly identical.

3.22. The question-raising nature of the repetitive epigenetic phenomena

We might rephrase the question-raising element of the repetitive epigenesis in this way. The final, complex structure which arises as a result of the epigenetic process is composed of parts which previously were not determined to this particular structural form. They were able, according to the external determinations, to form one of innumerable integrated complex structures. So the parts alone do not provide us with the explanation of why this particular form was synthesized. If this form had appeared only once, we might attribute its origins to the random set of external determinations. If, on the contrary, it reappears again and again, the external determinants cannot be considered as random any more. They have to be conceived as repetitive, too.

The epigenetic nature of the hereditary phenomena does not allow us to accept any explanation based on the re-description of the earlier stage.[23] For the earlier stages, being less complex than the later ones, are not intrinsically determined to a particular more complex form, but to a greater number of them. That is precisely what is meant by the notion of the increase in complexity, or heterogeneity.

The repetitive epigenetic phenomenon cannot be causally reduced, either to the intrinsic determinations operating within structural

[22] Bogdanski writes: "D'une manière générale on peut affirmer que les lois de la biologie reposent sur une structure d'interdictions immanents à chaque niveau dimensionnel ce qui exclu la probabilité d'un hasard au niveau d'un phénotype." Ch. Bogdanski, "Les êtres vivants comme une des principales classes des systèmes autorégulateurs naturels," *Bulletin biologique de la France et de la Belgique* 106, no. 1 (1972), p. 24.

[23] Cf. W. Coleman, *Biology in the nineteenth century: Problems of form, function and transformation* (New York: John Wiley and Sons, 1971), p. 42.

parts of the entities involved in this event, or to the earlier structures preceding the appearance of the more complex ones.

Summing up, the hereditary phenotype cannot be causally reduced to its own redescription. The postulate of an adequate causal agency seems necessary. This agency, as we already know, is called genotype or genome. Before we pass to the analysis of this agency, we shall discuss another aspect of hereditary phenomena, namely the integrative epigenesis.

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Fossil hominids: an empirical premise of the descriptive definition of *Homo sapiens*

P. Lenartowicz and J. Koszteyn, "Fossil hominids: an empirical premise of the descriptive definition of *Homo sapiens*," *Forum Philosophicum* 5 (2000), pp. 141–176.

At present, it seems absolutely certain … that at least four million years ago, in Africa, some creatures resembling modern man were living, and that at least two and half million years ago, in Africa, stone tools were produced. In contrast with the firm, scientifically-arguable belief that all modern human tribes … belong to a single species,[1] in paleoanthropology an equally firm scientific belief is maintained that the extinct man-like forms belong to several different, "presapient," "prehuman," more ape-like species.[2]

No philosopher ignores the theoretical consequences of this situation. There is, however, a big epistemological paradox hidden at the bottom of it. There is no agreement among philosophers how to describe the clear gaps between the actually living primate forms and in particular how to understand the mental superiority of the modern living man … over the modern living apes …

On the biological side of the problem, there is no consensus how to classify the distinctive hominid or human biological traits, such

[1] Cf. A. Littlefield, L. Lieberman and L.T. Reynolds, "Redefining race: the potential demise of a concept in physical anthropology," *Current Anthropology* 23, no. 6 (1982), pp. 641–647; J. Marks, "Anthropology and race," *Nature* 377, no. 6550 (1995), p. 570.

[2] Cf. B.A. Wood, "Human evolution," *BioEssays* 18, no. 12 (1996), pp. 945–954.

a bipedalism, the erect posture of the body and the functional complex of human masticatory system. One can, therefore, wonder how these extremely difficult and debatable topics might be solved on the basis of the fragmentary, mineralized remains. ...

Geographical and temporal dimension in the history of man

The timescale of the remains referred to in this paper comprises the period of the last 5 million years (myr). The historical times can, roughly, be identified with the Holocene period, i.e. the present, post(inter)glacial stage. The end of the last glaciation occurred some 10–15 thousand years (kyr) ago. The previous stage, called the Quaternary Period, the Pleistocene or glacial stage, lasted about 2.5 myr. The beginning of the preglacial, Pliocene period is adopted as 5 myr ago.

In paleoanthropology there is a consensus to accept all the Holocene hominid remains as the remains of *Homo sapiens*, no matter how different are the details of their anatomy.[3] The earlier remains, however, depending on their cranial morphology or brain capacity are commonly argued to represent different biological species (*Homo erectus*, *H. ergaster*, *H. habilis*) or even different genera (*Australopithecus*, *Paranthropus*, *Ardipithecus*). The number of taxonomic schemes and opinions under discussion is confusing.[4] We will use the term *hominid* to denote any pre-Holocene biological fossil remain which is indicative of human form of locomotory dynamism or somehow linked with such a form. ...

B i o l o g y a n d t e c h n o l o g y. A close relationship between the development of man's biological structures (the actual phenotypic variation) on the one hand and the level of technology on the other

[3] Cf. "AAPA statement on biological aspects of race," *American Journal of Physical Anthropology* 101, no. 4 (1996), pp. 569–570.

[4] Cf. C.L. Brace, "The creation of specific hominid names: Gloria in excelsis deo? or ego? or praxis?," *Human Evolution* 8, no. 3 (1993), pp. 151–166; G.A. Clark, "Some thoughts on the Black Skull: an archaeologist's assessment of WT-17000 (*A. boisei*) and systematics in human paleontology," *American Anthropologist New Series* 90, no. 2 (1988), pp. 357–371; G.G. Simpson, "The meaning of taxonomic statements," in *Classification and human evolution*, ed. S.L. Washburn (London: Methuen & Co. Ltd., 1964), pp. 1–31.

is beyond a doubt even without paleoanthropological evidence. Diet, thermoprotection, physical exercise shape the musculature, body proportions and skeletal traits of present human populations both in a progressive and a recessive sense.[5] The progress of technology has to be distinguished from the actual level of technology. Each level of technology creates a new, starting platform for further technological advances. The density of a population plays a crucial role in the promotion of specialized practices. A small group has neither means nor reasons to promote a highly sophisticated technology. Though it may sound trivial, this creates a kind of elementary conceptual background for understanding the situation of mankind during the glacial epoch.

G l a c i a l e p o c h. During this epoch relatively rapid, dramatic changes in the global temperature and water resources took place, in a 41 kyr rhythm at the beginning and since about 800 kyr in the circa 100 kyr rhythm.[6] It is important to stress that, as a rule, biologically adverse changes towards a cooler and more arid climate were relatively very fast, at least ten times faster than the climbing back to the original level. This rhythm affected many biological species, not just hominids. Still, one has to remember that "fast" in the geological sense means more than 200 human generations.

Why is "technology" so important? Though our cities made of glass, concrete and indestructible plastic compounds will survive, we believe, many millions of years to come, what kind of remains can we reasonably expect from our Pleistocene ancestors? We may expect that their biology was much more developed than their technology. They had to rely on their own muscles, their teeth, their legs and their crude tools. In this sense, they were certainly close to the few remaining "primitive" populations of today. When analyzing their foot skeleton we should be aware that from using shoes we have an unnaturally adducted toe. Analyzing their musculature, we have to keep in mind

[5] Cf. C.B. Ruff, "Climatic adaptation and hominid evolution: The thermoregulatory imperative," *Evolutionary Anthropology* 2, no. 2 (1993), pp. 53–60; C.B. Ruff, E. Trinkaus, A. Walker and C.S. Larsen, "Postcranial robusticity in *Homo*. I: Temporal trends and mechanical interpretation," *American Journal of Physical Anthropology* 91, no. 1 (1993), pp. 21–53; M.D. Russell, "The supraorbital torus: 'A most remarkable peculiarity'," *Current Anthropology* 26, no. 3 (1985), pp. 337–360.

[6] Cf. M.E. Raymo, "Glacial puzzles," *Science* 281, no. 5382 (1998), pp. 1467–1468.

that the lean body mass of an Australian Aborigine differs from the lean body of a Barbie doll.[7] We have to understand that early hominids had no mills, no pestles, no mortars or even ovens or pots. These were invented much later. They had to spend much time and effort in processing their food. But these people did invent cooking and grinding devices. The biological transformation of their body came later.[8]

Paleoanthropological reconstruction has to detect and restore the pretechnological biology of man. Only that kind of reconstruction will do justice to the biological changes which follow the technological progress of a hominid, and therefore are diagnostic of his truly distinctive human capacities.

Hominid masticatory system and food technology

Teeth, being made of the hardest and most resistant material constitute about 60% of the fossil evidence.[9] No wonder that the reconstruction of the masticatory system can be done with a reasonable precision. Early hominid masticatory system was different from the pongid system and different from our human system.[10] The word "different," however, is ambiguous. The differences between the pongids and early hominids are mainly qualitative (differences of role and dynamism—like between an omnivore and a folivore). The differences between the early hominids and modern humans are mainly quantitative differences of scale and robusticity—like between a small dog and a big one.

The major dental trait which distinguishes hominids from pongids are canine teeth. In pongids canines are big, deeply rooted in the jaws, sharply pointed and sticking out above (in upper jaw

[7] Cf. N.G. Norgan, "Interpretation of low body mass indices: Australian aborigines," *American Journal of Physical Anthropology* 94, no. 2 (1994), pp. 229–237.

[8] Cf. M. Henneberg, "Evolution of the human brain: Is bigger better?," *Clinical and Experimental Pharmacology and Physiology* 25 (1998), pp. 745–749.

[9] Cf. P.V. Tobias, "The place of *Australopithecus africanus* in hominid evolution," in *Recent advances in primatology*, vol. 3: *Evolution*, ed. D.J. Chivers and K.A. Joysey (London, New York: Academic Press, 1978), pp. 373–394.

[10] Cf. K.A. Kaszycka, "Funkcjonalno-adaptacyjne uwarunkowania zmienności morfologicznej twarzy australopiteków," *Przegląd Antropologiczny* 57, no. 1/2 (1994), pp. 39–50; B. Kujawa, "Adaptacyjne aspekty hominizacji. Part 2: Przystosowania pokarmowe," *Przegląd Antropologiczny* 57, no. 1/2 (1994), pp. 51–64.

below) the teeth row. ... In man the canine tips are almost on the same level with other teeth, and are blunt or even worn out. ... The lack of the prominent canine in the hominid mandibles is evident.

... distinctive masticatory trait of the early hominids was the extremely developed molar dentition. ...

Human dentition is characterized by a relatively thick layer of enamel. The surface of the molar teeth is shaped as a number of shallow "mortar and pestle" forms, which indicates the diet composed of nuts, grass seeds and other hard material to be crushed. That kind of dentition is radically different from the dentition of the leafeaters.[11]

Dentition makes part of a complex dynamic system. The bigger the teeth are, the longer their roots are, the more robust the jaw bones, the more developed are the muscles which move them. The dimension, shape, the properties of the enamel layer of teeth is functionally correlated with the body size and the quality of food to be processed. ...

Modern hominids have a broad neurocranium and small teeth. The arch of the mandible is therefore hyperbolic and does not stick out to the front, but is hidden underneath of the big neurocranium. In the early hominids the braincase was small and arch of their mandibles—to accommodate their relatively big teeth—had to be shaped like U letter, and their jaws stuck out to the front (prognathism).

The earliest biological manifestations of technological progress

Our (*Homo sapiens*) modern masticatory system copies all these distinctively hominid traits, but it is very much reduced. This reduction is developmentally and functionally integrated.[12] First of all our teeth have smaller working surfaces and shorter roots. Consequently the alveolar module of the jaws is constricted. The masticatory musculature is also reduced. This in turn is reflected in the "gracilization" of the maxillary and mandibular bones, in the restriction of the muscular attachments on the braincase and zygomatic arch, and in the evident reduction of the bony structures which have to provide

[11] Cf. J.G. Fleagle, *Primate adaptation and evolution* (San Diego: Academic Press, 1988), pp. 240–242.

[12] Cf. J.M. Calcagno and K.R. Gibson, "Human dental reduction: Natural selection or the probable mutation effect," *American Journal of Physical Anthropology* 77, no. 4 (1988), pp. 505–517.

a proper rigidity and resistance of the braincase.[13] The shape of the modern human skull is evidently modified by the influence of food technology.

We believe that the prominent prognathism and the general robusticity of the masticatory system should be interpreted as an original endowment of mankind which, because of the advances in food technology, was gradually reduced. This process of reduction, sometimes even degeneration (caries), is observed since at least 1.5 myr, through Holocene, well into 20th century.[14]

Summing up, the early hominid dentition was clearly different from the pongid pattern of dentition and sometimes even more different than ours. For a certain period of time the bigger specimens had more robust masticatory system. Gradually however, in spite of the constant trend towards a bigger body—Cope's Rule—the hominid masticatory system, a biological paradox, became more and more reduced.[15] One has to postulate a dynamism which liberated this organ from a substantial amount of its work. In other words it seems rational to hypothesize that the early hominids started processing food (cooking it or grinding) well before a million years ago. The discrepancy between the masticatory and neural dynamisms in the Pleistocene series of the hominid skeletal remains constitute an important, although indirect, evidence of the early technological progress.[16]

Fossil data demonstrate the antiquity of the typically human, bipedal locomotion

There are many skeletal fossil fragments which argue for the habitual bipedal locomotion of all the known hominids. The position of

[13] Cf. M.D. Russell, "The supraorbital torus: 'A most remarkable peculiarity'," pp. 337–360.

[14] Cf. J.M. Calcagno, "Dental reduction in post-Pleistocene Nubia," *American Journal of Physical Anthropology* 70, no. 3 (1986), pp. 349–363; J.M. Calcagno and K.R. Gibson, "40 000 years of tooth size reduction: Evidence, mechanism, and controversy," *American Journal of Physical Anthropology* 75, no. 2 (1988), p. 193; J.M. Calcagno and K.R. Gibson, "Human dental reduction: Natural selection or the probable mutation effect," pp. 505–517.

[15] Cf. for instance J. Alroy, "Cope's rule and the dynamics of body mass evolution in North American fossil mammals," *Science* 280, no. 5364 (1998), pp. 731–734.

[16] Cf. M. Henneberg, "Evolution of the human brain: Is bigger better?," pp. 745–749.

the *foramen magnum* in the basicranium, the shape of pelvic bones, femur bones, the foot bones—all these and several other subtler details either confirm habitual bipedal locomotion, or exclude a habitual brachiator-like, or knuckle-walking, typically pongid locomotory activity. The foot-prints dated some 3.5 myr ago are indistinguishable from the footprints left by the modern habitually unshod, "primitive" South American Indian.

Femoral bones are present in the fossil hominid material as proximal or distal fragments. A reconstruction of a whole femoral bone from such a fragment is possible, on the condition that the pelvic bones from the same individual body have also been discovered—which happens extremely rarely. But a single, intact femoral bone enables us to determine what kind of locomotion was habitual for the once living body. One has to assume that the body had two identical, but mirror copies of the femoral bone. Then one has to assume, that a certain distance separated the femoral heads—the distance between the two femoro-illiac joints. Finally, one has to assume that the flexion in the knee joints was on a horizontal axis.[17] ...

In pongids femoral bones run vertically to the knee joints while in man, the femoral bones run obliquely, so that the knees meet in the sagittal plane. This means that man walks as if on a line. During the consecutive steps the center of the body mass does not have to be switched laterally in relation to the position of the foot. In the pongids, because of the parallel orientation of the femur bones, the lateral shift of the body mass—during the bipedal walk—is considerable. So a pongid, during the bipedal walk, characteristically waddles from side to side. ...

... the shape of the pelvic bones in a hominid dated circa 2–3 myr ago ... is evidently man-like and fits well into the framework of bipedal locomotion and vertical gait,[18] as suggested by the hominid femoral bones. There is a controversy between those who consider the bipedal and quadrupedal (knuckle-walking) system of locomotion as integrated, indivisible sets of anatomical and behavioral, mutually exclusive conditions, and those who believe in the possibility of a gradual

[17] Cf. C.O. Lovejoy and K.G. Heiple, "A reconstruction of the femur of *Australopithecus africanus*," *American Journal of Physical Anthropology* 32, no. 1 (1970), pp. 33–40.

[18] Cf. M.H. Day, *Guide to fossil man* (London: Cassell, 1986), pp. 287–288, 320.

transformation of the latter into the former system. We don't think that the last hypothesis is mechanically, anatomically and behaviorally sound.

The data called to argue for the ape-like features of the early hominids are scanty, indirect and ambiguous, while the evidence of their man-like locomotory structures is not only broad but—and it is important—integrated from the dynamic point of view. The erect posture and bipedal locomotion are both well documented in the fossil fragments. This cannot be wiped out by the evidence which is fragmentary, ambiguous or dynamically independent. …

The earliest known stone tool collections are undistinguishable from the stone tools produced and used in the Christian era

Modern "primitive" tribes are far from being the most skilled in stone-tool production. Some of them utilize the sharp edges of simple stone flakes, some have been observed to produce simple Acheulean tools, known already 1.5 myr ago.[19] The "golden era" of the most sophisticated stone tool production techniques is dated for the Late Pleistocene and the Early Holocene period. …

Summing up, the present fossil evidence demonstrates the production of stone-tools between 2–3 myr ago. The raw material of the proper kind was selected, the desired, sharp edges were struck out from a blunt, round stone, and the dimension of the tool was evidently controlled. Guilbaud analyzed some important cognitive premises of stone-tool production.[20] One can guess that the stone tools were used to skin and quarter hunted animals and to produce wooden

[19] Cf. G.J. Barstra, "*Homo erectus erectus*: the search for his artifacts," *Current Anthropology* 23, no. 3 (1982), pp. 318–320; D.J. Mulvaney, *The prehistory of Australia* (London: Thames and Hudson, 1969); J.P. White, "Ston naip bilong tumbuna: the living stone age in New Guinea," in *La Préhistoire: problèmes et tendances*, ed. F. Bordes and D. de Sonneville Bordes (Paris: Éditions du CNRS, 1968), pp. 511–516.

[20] Cf. M. Guilbaud, "Debitage from the upper Castelperronian level at Saint-Césaire. Methodological approach and implications for the transition from Middle to Upper Paleolithic," in *Context of a late Neandertal: implications of multidisciplinary research for the transition to Upper Paleolithic adaptations at Saint-Césaire, Charante-Maritime, France*, ed. F. Lévêque, A.M. Backer and M. Guilbaud (Madison, WI: Prehistory Press, 1993), pp. 37–58.

arms or other wooden tools. These kinds of tools have been produced since then until historical times, even until Christian epoch. Who was responsible? From that time, only two candidates are available. One is the gracile *Australopithecus africanus* (Southern Africa) and *Australopithecus afarensis* (Central and Eastern Africa). The second candidate is the robust *Australopithecus robustus* (South Africa) and *Australopithecus boisei* (Central and Eastern Africa). All these forms manifest a well-developed, habitual pattern of bipedal locomotion and the manifestly human form of dentition.

Brain size and man's psychological capacities

The Plio/Pleistocene hominids had small braincases. The variability range of the earliest forms is some 400–500 cm^3. This is about one-third of the human present mean adult brain volume. This fact is commonly interpreted as evidence of a lesser behavioral capacity of the early hominids. Two theoretical premises are at the bottom of this interpretation. One is that there is a certain fixed relation between the absolute brain volume and the behavioral capacity of an animal.[21] A small brain cannot—according to this opinion—hold enough neural cells to drive the higher psychological dynamisms characteristic to mankind. We may call it the Absolute Hardware Hypothesis of "Sapientization" (AHTS). The second premise—we may call it the Proportionate Hardware Hypothesis of "Sapientization" (PHTS)—claims that a certain level of brain/body size proportion is crucial in determining "sapient" behavior.[22] Neither hypothesis can be considered firm enough to conclude on the "prehuman" or "presapient" status of the early hominid.[23] Some reasons for utmost caution regard our biological knowledge, and some regard the very nature of fossil remains which are fragmentary, dynamically inert and microscopically mineralized.

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[21] Cf. L. van Valen, "Brain size and intelligence in man," *American Journal of Physical Anthropology* 40, no. 3 (1974), pp. 417–423.

[22] Cf. H.J. Jerison, *Brain size and the evolution of mind: The 59th James Arthur Lecture on the Evolution of the Human Brain* (New York: American Museum of Natural History, 1991).

[23] Cf. R.J. Skoyles, "Human evolution expanded brains to increase expertise capacity not IQ: A resolution of the normal IQ but small brain anomaly," *Psycoloquy* 10, no. 002 (1999), accessed October 10, 2009, http://www.cogsci.ecs.soton.ac.uk/cgi/psyc/newpsy?10.002.

Let us consider the purely animal aspect of man's psychology (sense cognition, memory, instinctive behavior... and so on). On this level man can be compared with, for instance, dogs. In the species of dogs we can observe even two order-of-magnitude differences of body size, and the proportionate differences in the absolute volume of brain case without any significant difference in the psychological dynamisms. It is also well documented that since Pliocene the equid braincase increased its volume more than three times—that is even more than the hominid braincase.[24] ...

The historical population of man exhibits a striking variability of the absolute brain size. The range of this variability is differently stated by different authors. Even the same author in the same monograph can give different values. E.g. Hockett estimates the range as 750–1700 cm^3 on page 364, and as 1000–2200 cm^3 on the page 397.[25] The present variability of human brain volume extends from well below 700 cm^3 to well above 2000 cm^3.[26]

There is no doubt that a concrete human body size is related to the brain size. Beals et al. point out that the robust and relatively heavy arctic people and the diminutive tropical forest pygmies differ in their average brain size by some 300 cm^3.[27]

> McHenry (1976[28]) estimated the number of extraneurons in East African *Australopithecus* and also in South African *Australopithecus robustus* at 4.3×10^9 and in modern *Homo sapiens* at 8.2×10^9. The difference of 3.9×10^9 extraneurons is taken to indicate an enormous discrepancy in behavioral capacities of these two species separated by over a million years evolution. However, ... the difference

[24] Cf. C. de Miguel and M. Henneberg, "Variation in hominid body size estimates: Do we know how big our ancestors were?," *Perspectives in Human Biology* 4, no. 1 (1999), pp. 65–80.

[25] Cf. C.F. Hockett, *Man's place in nature* (New York: McGraw Hill Inc., 1973), pp. 364, 397.

[26] Cf. R.L. Holloway, "The casts of fossil hominid brains," *Scientific American* 231, no. 1 (1974), pp. 106–115; P.V. Tobias, "Brain-size, gray matter and race – fact or fiction?," *American Journal of Physical Anthropology* 32, no. 1 (1970), pp. 3–25.

[27] Cf. K.L. Beals, C.L. Smith and S.M. Dodd, "Brain size, cranial morphology, climate, and time machines," *Current Anthropology* 25, no. 3 (1984), p. 324.

[28] Cf. H.M. McHenry, "Early hominid body weight and encephalization," *American Journal of Physical Anthropology* 45, no. 1 (1976), pp. 77–83.

between the individuals of modern *Homo sapiens* may be as large as 4.5×10^9 extraneurons.[29]

... The average brain weight/body weight ratio of humans is 1:45, while it is 1:30 for a New World monkey (*Hapale rosalia*) and 1:25 for a common mouse.[30] Was the brain weight/body weight ratio of the early hominids different from the present human populations? That depends on the reconstruction of their body weight.

Body proportions and body size

There has long been controversy regarding the accurate reconstruction of the hominid body size. This controversy is rooted in two assumptions of a rather limited validity. The first one—*the encephalization hypothesis*—claims that more advanced behavior requires a bigger brain or a higher brain/body index. The second assumption—*the gradual sapientization hypothesis*—claims that the earlier part of the hominid lineage must have been mentally and behaviorally more primitive than the later part of it. The second premise is of crucial importance to the theory of human evolution from an unknown primate ancestor. These two premises may influence the process of reconstruction, creating an imagined scenario of the dynamism under investigation. The scenario is this: Early hominids had smaller brains, bigger bodies and an undeveloped human behavior. No wonder that the reconstruction of the body size and the body proportions in hominids is crucial. ...

The reconstruction is based on the teeth dimensions, locomotory bones, diet and the locomotory habit.

Teeth and locomotory skeleton. Among the earliest fossil remains there were many of the diminutive size. Small femoral bones, small pelvic bones, small feet bones, small braincases, even few remaining skeletons and the earliest stone tools were of diminutive size.[31] The

[29] M. Henneberg, "Brain size/body weight variability in *Homo sapiens*: consequences for interpreting hominid evolution," *Homo* 39 (1990), p. 126.

[30] Cf. M. Henneberg, "Evolution of the human brain: Is bigger better?," pp. 745–749.

[31] Cf. J. Chavaillon, "Evidence for the technical practices of early Pleistocene Hominids, Shungura Formation, Lower Omo Valley, Ethiopia," in *Earliest man and environments in the Lake Rudolf Basin*, ed. Y. Coppens, F.C. Howell, G.L. Isaac and R.E.F. Leakey (Chicago: University of Chicago Press, 1976), pp. 565–573.

only elements which were not smallish, but even bigger than in *Homo sapiens*, were teeth. Bigger teeth—of course—had bigger alveolar structures, stronger jaws, more developed muscles and more prominent muscular attachments.[32] This fact marks the beginning of a controversy. According to the assumption that Big Teeth means Big Body, early hominids had relatively very heavy bodies.[33]

However, one has to be aware that our modern, reduced dentition is rather inadequate from the purely biological point of view. Most of the modern human tribes prepare their food by grinding and cooking, so that the role of the masticatory system is considerably reduced. Only a few, relatively small human populations, the "wild" ones, have retained a relatively well-developed masticatory system. But their stature/body size index is surprisingly low.[34] Early hominids had to masticate their food for hours, perhaps, but it does not necessarily mean that their stature/body size index was higher.

H o m i n i d d i e t. If hominids ate the same food we do (habitual seedeaters and meat eaters), then the proportion of their viscera to the rest of their body was about the same. In that case, the regression line (e.g., Quételet's index) for a 110 cm small stature would predict some 20 kg. Consequently their diminutive braincase would have held a brain which had the same proportion to whole body weight as our "fully human" brain. Recent investigations indicate that early hominids feed on a high-quality foods even before the invention of stone tools.[35]

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[32] Cf. M.H. Wolpoff, "Sagittal cresting in the South African australopithecines," *American Journal of Physical Anthropology* 40, no. 3 (1974), pp. 397–408.

[33] Cf. H.M. McHenry, "How large were the australopithecines?," *American Journal of Physical Anthropology* 40, no. 3 (1974), pp. 329–340; H.M. McHenry, "Petite bodies of the 'robust' australopithecines," *American Journal of Physical Anthropology* 86, no. 4 (1991), pp. 445–454; H.M. McHenry, "Body size and proportions in early hominids," *American Journal of Physical Anthropology* 87, no. 4 (1992), pp. 407–431.

[34] Cf. N.G. Norgan, "Interpretation of low body mass indices: Australian aborigines," pp. 229–237.

[35] Cf. M. Sponheimer and J.A. Lee-Thorp, "Isotopic evidence for the diet of an early hominid, *Australopithecus africanus*," *Science* 283, no. 5400 (1999), pp. 368–370; G. Vogel, "Did early African hominids eat meat?," *Science* 283, no. 5400 (1999), p. 303. Cf. also K.A. Kaszycka, "Funkcjonalno-adaptacyjne uwarunkowania zmienności morfologicznej twarzy australopiteków," pp. 39–50; B. Kujawa, "Adaptacyjne aspekty hominizacji. Part 2: Przystosowania pokarmowe," pp. 51–64.

If, on the other hand, they were habitual fruiteaters and leafeaters—like gorilla and chimpanzee—then their viscera and the related musculature would have been much bigger, and consequently—in spite of a diminutive stature—their weight considerably higher than that of a modern man of the same stature.

Hominid locomotion. If hominids moved along in essentially the same way we do, then their body size proportions would have been similar to ours. If however, they were habitual brachiators, then the musculature of the upper part of their body would have been much bigger and consequently their weight—calculated from the length of their femur—was considerably higher than ours.

The fossil fragments which prove habitual bipedalism of the early hominids are numerous and fairly integrated; whereas those which might suggest habitual brachiation are scanty and ambiguous. Therefore one cannot put habitual brachiation hypothesis on the same foot as the well supported habitual bipedalism hypothesis. Consequently one should not abandon the bipedal proportions of the body in favour of the brachiation hypothesis.

The method of reconstructive calculation. The speculative structure of such a calculation is rather complex. It includes the selection of a primary empirical parameter, the selection of the assumed relation between the parameter and the structure under reconstruction, and finally the selection of a mathematical, approximate function. A selected fossil fragment (e.g. femoral bone) is measured in a selected aspect (e.g. its length or circumference or its robusticity). Then a relation between the measured parameter and the whole body weight is assumed. This relation is often indirect. For instance, the femur length serves to reconstruct the stature of the vanished body, and the reconstructed stature is used to calculate the hypothetical body weight.

In the habitual bipedalism the whole weight of the trunk, upper limbs and head is carried by two femoral bones. Construction of a single femoral bone reflects half of this weight. In the pongid quadrupedalism construction of the femoral bone reflects less than one fourth of the body weight—because the front part of the body is more developed than the rear one. According to the evolutionary hypothesis of the hominid origin, the early hominid femur carried about one fourth of the body weight. No wonder that the body weight

calculated on the basis of such an assumption was twice as big as the calculated body weight of a habitual bipedalist.[36]

When early hominid teeth are used as primary empirical data to reconstruct the total weight of no longer existent body, one has to accept a proper reference group. Which extant primate group is appropriate to serve as a reference group in such a reconstruction? Karen Steudel claimed the body weight of a gracile *Australopithecus africanus* was 36 kg—about twice as much as its calculated body weight when the obese human population was taken as the reference group. The body weight of the *A. robustus* was claimed to be almost 60 kg. Steudel's primary empirical data consisted of the palate breadth, the breadth of the orbit, the distance between the zygomatic bones and the circumference of the lower part of the femoral bone.[37] The first three parameters are evidently dependent on the development of the masticatory system. Her reference group included quadrupeds. The calculation therefore doesn't seem reliable. "Teeth as perennial favorites for predicting body weight did not always provide reliable estimates"—Sigrid Hartwig-Scherer writes.[38] Steudel confesses: "It is possible that my results slightly overestimate body weight because of the quadrupes included."[39] …

Few words have to be added on the selection of the mathematical function used to calculate the correlation between the primary empirical data and the body stature/weight. Some mathematical formula of regression are using just coefficients,[40] some add a constant

[36] Cf. C. de Miguel and M. Henneberg, "Variation in hominid body size estimates: Do we know how big our ancestors were?," pp. 65–80.

[37] Cf. K. Steudel, "New estimates of early hominid body size," *American Journal of Physical Anthropology* 52, no. 1 (1980), pp. 63–70.

[38] S. Hartwig-Scherer, "On body-weight prediction in human evolution," *Current Anthropology* 37, no. 4 (1996), p. 661. Cf. also R.J. Smith, "Biology and body size in human evolution. Statistical inference misapplied," *Current Anthropology* 37, no. 3 (1996), pp. 451–481.

[39] K. Steudel, "New estimates of early hominid body size," p. 69.

[40] Cf. M.R. Feldesman, "Femur/stature ratio and estimates of stature in children," *American Journal of Physical Anthropology* 87, no. 4 (1992), pp. 447–459; M.R. Feldesman and J.K. Lundy, "Stature estimates for some African Plio- Pleistocene fossil hominids," *Journal of Human Evolution* 17, no. 6 (1988), pp. 583–596; M.R. Feldesman, J.G. Kleckner and J.K. Lundy, "Femur/stature ratio and estimates of stature in mid- and late-Pleistocene fossil hominids," *American Journal of Physical Anthropology* 83, no. 3 (1990), pp. 359–372; M. Henneberg, J. Hugg and E.J. Townsend, "Body weight/height relationship: exponential solution," *American Journal of Human Biology* 1, no. 4 (1989), pp. 483–491.

length.[41] In the latter case the presence of this constant severely modifies (increases) the estimated stature at the lower end of the scale.

Smith has pointed three reasons why the statistical inferences of the body mass in fossil species are flawed: (1) The analogy between the past and present is formed incorrectly, resulting in inferences about the past on the basis of relationships that have not be examined in living species. (2) Confidence intervals for predicted values make most inferences of minimal or no practical use. (3) The reduction of biological variation among extinct species to a kind of "body-mass determinism" is statistically invalid and clearly wrong biologically.[42] ...

The problem of a reliable reconstruction of the whole early hominid body is of crucial importance for two main reasons: first, because of an entrenched belief that brain volume plays a decisive role in determining human intellectual capacity; and second, because of the role the reaction norm plays in the proper taxonomic classification of a given living body. ...

The reconstructions of the external aspect of the australopithecine body

The hypothetical character of paleoanthropological reconstructions culminates in the numerous pictures, drawings and representations of the woolly ape-man creatures with dark skin, chimp-like nasal aperture and idiotic look.[43] Practically the same had happened to the Neanderthal man, who for many years was represented as a strange and dangerous beast. Boule's reconstruction of the La Chapelle-aux-Saints old man suggested an anatomy half-way from a chimpanzee. Straus and Cave proved that the Neanderthal skeleton was pathologically changed and that the changes were not different from those

[41] Cf. G. Olivier, "The stature of australopithecines," *Journal of Human Evolution* 5, no. 6 (1976), pp. 529–534; H.M. McHenry, "Femoral lengths and stature in Plio-Pleistocene hominids," *American Journal of Physical Anthropology* 85, no. 2 (1991), pp. 149–158; A. Thoma, "Stature = 3,74 fémur + 0?," *Anthropologie et Préhistoire* 105 (1994), pp. 29–32.

[42] Cf. R.J. Smith, "Biology and body size in human evolution. Statistical inference misapplied," pp. 451–481.

[43] Cf. for instance J. Jelínek, *Wielki atlas prahistorii człowieka*, transl. E. and J. Kaźmierczak (Warszawa: PWRiL, 1977); K.F. Weaver, "The search for our ancestors," *National Geographic* 168, no. 5 (1985), pp. 560–623; R. Gore, "The dawn of humans: The first step," *National Geographic* 191, no. 2 (1997), pp. 72–99.

observed in the modern man affected by chronic arthritis.[44] Recent, serious attempts to reconstruct his external traits are produced a quite different result.[45]

In the case of the *Australopithecus*, the "bestialization" attempts are as arbitrary as an attempt to make him look like a modern man. Some Paleolithic cave paintings and designs represent the female profiles with a marked prognathism, relatively small braincase, but with a nice and elaborate coiffure. Besides, the structure and thermoregulatory functions of hominid skin are essentially different from that of pongids.[46]

The role of adaptive (phenotypic) changes

The problem is this. Suppose our digging into the past reveals that the old hominid remains have always been within the range of modern variation of anatomical traits. The problem of the genesis of man would remain unsolved.

Suppose, on the other hand, that the actual, Holocene variability of mankind is—to some extent—a manifestation of intraspecific and generally adaptive (phenotypic) changes. Why would the same kind of changes have to be repressed or inoperative during the glacial epoch?

One has to carefully distinguish between (1) the problem of the origin of a new biological taxonomic unit, a new genus or family, and between (2) the problem of the origin of "sapientization" conceived as a psychological, not just a physiological trait. The difference between these two problems is founded in the idea of biological organs ("body tools"). The termite's, beaver's or bird's nest demonstrates that some animals are structurally and behaviorally capable of producing a material culture. It would be quite gratuitous to claim that an imaginary, intelligent ("sapient") form of termites would have to change their body structures, or its locomotory dynamism in order to build a shrine

[44] Cf. W.L. Straus Jr. and A.J.E. Cave, "Pathology and posture of Neanderthal man," *The Quarterly review of biology* 32, no. 4 (1957), pp. 348–363.

[45] Cf. R. Gore, "The dawn of humans: Neanderthals," *National Geographic* 189, no. 1 (1996), pp. 2–35.

[46] Cf. W. Montagna, "The evolution of human skin," *Journal of Human Evolution* 14, no. 1 (1985), pp. 3–22; P.E. Wheeler, "The loss of functional body hair in man: the influence of thermal environment, body form and bipedality," *Journal of Human Evolution* 14, no. 1 (1985), pp. 23–28.

and to institute some religious ceremonies. If termites do not manifest such an activity, it would be wrong to suppose that the main reason is the lack of tool. It seems that they are lacking a kind of behavioral capacity we call "human intelligence"—whatever it may mean. The biological differences between man and ape cannot prove that the apes are "nonsapient" because of their body structures. The hypothesis that the key structures are the brain or the DNA of the reproductive cell is, at the moment, just an SF fantasy not a serious biological thesis based on reliable evidence. One cannot distinguish the fine, histological structure of a man's brain from the same structure in an ape, or a dog.[47]

Consequently, it is reasonable to distinguish between our animal, purely biological uniqueness (bipedal locomotion, characteristic form of masticatory activity) and man's psychological uniqueness (production of material culture) of the intellectual kind. Paleoanthropological research tries to reconstruct both of them. Some fossil data argue for the antiquity of the material culture, while other data argue for the antiquity of man-like locomotion and mastication. One cannot however observe both in the same body—as it is possible only with the living man. … There is no way to give an ultimate answer to the doubt whether an australopithecine body found in the vicinity of stone tools was in fact their producer, or their victim.[48] …

Reaction norm: a descriptive definition of mankind

The notorious lack of a consensus on the idea of "sapientization" has left anthropologists at the mercy of an inevitably incomplete inductive description of *Homo sapiens*. This kind of description is used with many other biological groups and it was labelled the "reaction norm."

The term "reaction norm" was introduced by Richard Woltereck[49] and it carries at least three irreducible concepts. The first is a conviction

[47] Cf. M. Henneberg, *Evolution of human brain size. Pfizer Basic Medical Science Lectures, 8th Series* (Cape Town: University of Cape Town, 1988), pp. 48–58.

[48] Cf. G.A. Clark, "Some thoughts on the Black Skull: an archaeologist's assessment of WT-17000 (*A. boisei*) and systematics in human paleontology," pp. 357–371.

[49] Cf. R. Woltereck, "Weitere experimentelle Untersuchungen über Artveränderung, speziell über das Wesen quantitativer Artunsterschiede bei Daphniden," *Verhandlungen der Deutschen Zoologischen Gesellschaft* 19 (1909), pp. 110–173.

that a great variety of intraspecific forms is never manifested in a single living specimen. The second is a belief that all actual, partial manifestations have their origin in a fundamentally identical agent which is present in every reproductive cell of a given species. The third is the conviction that this agent has to be identified with the chromosomal set of the reproductive cell. The second idea is crucial. This belief is fundamental to the idea of a single human "family" and the modern rejection of racist ideology.[50]

Paleontological reaction norm

The reaction norm of the extant animal species can be verified. The capacity to produce fertile progeny is a decisive test of the true specific identity. This test, for obvious reasons, cannot be used in paleontology. Unfortunately, it is not always used with the extant species. This methodologically inexplicable situation can be illustrated by the actual taxonomic confusion with Old World monkeys (e.g. Cercopithecinae). Some authors divide this group into ten genera, others put all the forms within the same genus. In both cases, the number of distinct species is impressive (about 50). But had the fertility test been consistently applied, quite a number of Cercopithecinae "species" would vanish. Hill[51] and Fleagle[52] report the intergeneric hybrids in 9 of the 10 genera of this group.

In paleontology the original biological continuity of a species under study is irreparably broken by the fragmentarity of fossils, their spatial and temporal, quite accidental distance. The discontinuity of the fossil material, therefore, should not be treated as a manifestation of taxonomic distance. No extant species is morphologically homogenous, monomorphic. An assumption of the monomorphic character of fossil hominids is gratuitous, arbitrary.

> … Pure races, in the sense of genetically homogenous populations, do not exist in the human species today, nor is there any evidence that they have ever existed in the past. … There are obvious physical

[50] Cf. "AAPA statement on biological aspects of race," pp. 569–570.

[51] Cf. W.C.O. Hill, *Primates: Comparative anatomy and taxonomy*, vol. 6, *Catarrhini: Cercopithecoidea: Cercopithecinae* (Edinburgh: Edinburgh University Press, 1966).

[52] Cf. J.G. Fleagle, *Primate adaptation and evolution*, op. cit.

> differences between populations living in different geographic areas of the world. Some of these differences are strongly inherited and others, such a body size and shape, are strongly influenced by nutrition, way of life, and other aspects of the environment. … Distinctive local populations are continually coming into and passing out of existence. … There is no causal linkage between these physical and behavioral traits.[53]

Henneberg and Thackeray statistically analyzed the variability of fossil hominids according to four parameters: cranial capacity, body height, body weight and molar teeth size. The present day variability of human populations was taken as a reference group. The authors were able to show that since 4.5 myr ago the variability of the parameters studied did not change, but was almost the same on any arbitrarily selected temporal horizon. Therefore, in conclusion, the authors propose extending Wolpoff's Single Species Hypothesis (originally restricted to the *H. erectus* forms) onto all hominid fossil remains since 4.5 myr ago.[54] …

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[53] "AAPA statement on biological aspects of race," pp. 569–570, points: 3, 4, 8, 10.

[54] Cf. M. Henneberg and J.F. Thackeray, "A single-lineage hypothesis of hominid evolution," *Evolutionary Theory* 11 (1995), pp. 31–38. For Wolpoff's Single Species Hypothesis cf. M.H. Wolpoff, A.G. Thorne, J. Jelínek and Y. Zhang, "The case for sinking *Homo erectus*. 100 years of *Pithecanthropus* is enough!," in *100 Years of Pithecanthropus. The Homo erectus problem*, ed. J.L. Franzen (Frankfurt am Main: Courier Forschungs-Institut Senckenberg, 1994), pp. 341–361.

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The credibility of natural statement/theorems
(Aristotle contra Feyerabend)

P. Lenartowicz, "Wiarygodność twierdzeń przyrodniczych (Arystoteles contra Feyerabend)," in *Nauka – Religia – Dzieje. III Interdyscyplinarne Seminarium w Castel Gandolfo, 6–9 sierpnia 1984*, ed. J.A. Janik and P. Lenartowicz, Kraków: Wydział Filozoficzny Towarzystwa Jezusowego, 1986, pp. 73–100.

Is it possible to rely on theorems expounded "from the position of the natural sciences"? Are the currently widespread academic views, those current at the end of the 20th century, at all credible, or maybe only within an extremely limited sense, and then only from a particular viewpoint or possibly only within a certain timeframe? It is known that at least a few views held by the academics of previous generations have been questioned through progress in knowledge itself. Does our generation find itself in a certain privileged and with it exceptional situation?[1] The problem of the credibility of the natural sciences is resolved in an array of ways, for example through the research of history, scientific progress.[2] But—as some will say—how do we know that the method employed in historical research is credible? I personally do not see any reasons to question the fundamental credibility of the results of historical research per se yet I am of the view that the problem of credibility itself should be solved from the other "end." It follows—to my mind—to first reflect over

[1] Cf. E. Mackinnon, "The truth of scientific claims," *Philosophy of Science* 49, no. 3 (1982), pp. 437–462.

[2] Cf., for example, F. Rohrlich and L. Hardin, "Established theories," *Philosophy of Science* 50, no. 4 (1983), pp. 603–617.

the credibility of our doubts. Doubts may be harbored by anyone, not merely by an academic. However, an academic should in a way much clearer than is the case for a layman perceive the invalidity and destructive impact of a certain type of doubt on the course of the cognition of reality.

At present I will attempt to discuss the crucial theses of two opposing views on the credibility of natural theorems—the optimistic viewpoint of Aristotle and the fairly pessimistic views of Paul Feyerabend.

So why have I chosen these two and not other philosophers? I have chosen Aristotle because he is the closest to me. I consider his theory of cognition as obviously correct although I will not argue that he is the final word on the matter. While the views of Feyerabend surfaced at the last meeting held at Castel Gandolfo,[3] during a discussion on the subject of mathematics, theory and facts in natural cognition. Here are the words of one of the said participants:

> At times it is supposed that facts exist, and that these facts can only be interpreted with the help of theories; this is an illusion. Only a theory is able to perceive facts. Facts may be only isolated from the perspective of some theory or other. As a result classic are labors in the defining of certain simple concepts, such as—for example—a theory corresponds with the facts. As is known this is impossible. One cannot claim that facts validate a theory and therefore it is true; or that they are inconsistent with it and therefore refute it.
>
> What is more, research into the history of science has shown that people by no means give up on previous theories simply because the new are more convincing, or that some new facts have been uncovered. The transfer from one universal theory to another is achieved on the route of the dying out of predecessors; undoubtedly one may claim historical and extrasubjective reasons.[4]

[3] II Interdisciplinary Seminar at Castel Gandolfo, 6–9 September 1982 (editorial note).

[4] K. Michalski, "Dyskusja po referacie Prof. A. Białasa 'Cząstki elementarne 1982'," in *Nauka – Religia – Dzieje. II Seminarium Interdyscyplinarne w Castel Gandolfo, 6–9 wrzesień 1982 roku*, ed. J.A. Janik and P. Lenartowicz (Kraków: Wydział Filozoficzny Towarzystwa Jezusowego, 1984), pp. 116–117.

I do not see any reason to argue over the correctness of the above statement. All of man's activities—and therein academic undertakings—are to a certain degree contaminated by irrational elements. But the crux of what Dr. Michalski had to say is the thesis that the empirical element has a secondary significance in matters of academic scientific truth and the credibility of natural knowledge. This is a thesis taken directly from Feyerabend's doctrine. Aristotle's position is completely the opposite. Following this introduction we shall move onto an outline of both positions.

The Fundament of the Validity of Science according to Aristotle

According to Aristotle true science does not commence from a position of zero knowledge. Academic knowledge—according to him—commences somehow from the level of the "third story." Its fundament is the story of cognition accessible for the lower animals, the story of cognition for all creatures, and indeed finally the story of cognition of an uneducated man, yet of one properly developed. ...

On the starting point for academic knowledge

Man according to Aristotle initially starts to know everything that lower creatures know through using their senses. He becomes acquainted therein with shape, hardness, mass etc., the material traits of objects, while through the use of certain senses he also gets to know certain forms of energy (e.g., light, sound, temperature), their intensity and quality. Of course, this does not mean that lower creatures possess the abstract concepts of energy or matter, mass or light. Secondly, man becomes acquainted with what ... higher animals know. Higher animals according to Aristotle do not simply register but remember the objects and events observed. What is more they develop their own kind of experience (Greek *empeiria*). In other words, animals are able to recognize the permanence of relations between certain objects, events, processes.[5]

[5] Cf. Arystoteles "Analityki wtóre," in *Analityki pierwsze i wtóre*, transl. K. Leśniak (Warszawa: Państwowe Wydawnictwo Naukowe, 1973), Book II 19, 99 b–100 a; J. Dębowski, "Idea bezzałożeniowości w filozofii Arystotelesa," *Studia Filozoficzne* no. 1 (1984), pp. 3–18.

… However, they are not able to cognitively go further i.e., to speculate on experience gained and conduct reflection on this.

We are approaching the third "story" of cognition and the knowledge connected with it. Aristotle perceives within man's consciousness possibility, ability, a power enabling the obtainment of a further stage in cognition; one based on the content derived from experience. He calls this power intellect (Greek *nous*). What is the role of intellect? *Intellegere* comes from the Latin *intus legere*—thereby meaning "internal reading." The intellect "looks" within the interior of the essence of experience. It consequently looks at what has occurred in the sensory, as a rule changeable image of reality. What does the intellect "see" there? According to Aristotle within the matter of sensory experience the intellectual consciousness is able to perceive the principle (Greek *arché*, Latin *principium*), that is the fundamental ontological structure of the observed subject's being. It is this very principle that means that the subject possesses certain and not other traits that fall under the senses. For this principle is "the essence" of the given subject, and its cognition constitutes the cognition of the subject's very nature, understood as its existence.

Not every "principle" within contemporary natural studies is what Aristotle called *arché*. The principle of displacement was apparently hit upon by Archimedes while taking a bath. I conjecture that immersing himself in a tub he noticed simultaneously the rising water level and the lessening weight of his body. The principle of displacement therefore expresses the essence of "experience," that is a certain constant relation between mass and the volume of the immersed body, and the specific gravity of the medium in which the body is immersed.

It is not always easy to perceive the principle (*arché*) of a given phenomenon. If the empirical material is appropriately prepared or presented then even a child is able to differentiate the relation between phenomena and the principle determining a given phenomenon. Those who have perceived a given principle for the first time have often had to go through a host of taxing observations—sometimes becoming aware of the principle of a certain phenomenon by chance, while testing something else. Yet on once noticing this principle, on having "understood," it was easier for them to organize the material structures or events—that is experiments—for this principle to equally become obvious for others. For Galileo it was no easy

matter to perceive the principle of the tides of the sea. Despite the many observations conducted and known about even in the days of antiquity, ones confirmed by the daily observations of sailors and recognized by many astronomers (including by Kepler), he doggedly persisted in his ascertainment that the tidal cycles happened but once a day. He was consequently not able to perceive the role of the factor which first and foremost determines the cyclical movement of the waters of the oceans and seas—the gravitational influence of the Moon.[6] Newton was the first to discover the principle of gravity even though … millions of people had witnessed its effects on a daily basis. We, having before us the path already cleared by Newton, have no reason to even remember this and other principles laboriously uncovered by the generations of naturalists past. Knowing what needs attention we are able to perceive (by intellect) these principles during every occasion that happens.

On induction

The term "induction" means today—concisely speaking—the process of knowing the whole on the basis of knowledge about its fragments. Hence the modern polemics on the subject of induction revolve around the question: how is one to reconcile an awareness as to a knowledge deficit with the credibility of scientific declarations? The proposed solutions are as a rule some form of mitigated extrapolation through the concept of a greater or lesser probability. Induction—in the modern understanding of the word—concerns consequently the first two stories of the process of reality cognition: the story of sensory observations as well as that of registered correctness.

The Aristotelian meaning of the term induction (Greek *epagogé*) has only a little in common with the notion as given above. For *epagogé* means seeing new meanings—those which are imperceptible to the senses. *Epagogé* does not depend on extrapolation but on the intellectual perception of what constitutes the essence, the fundament, the nature of the object being researched. There is a radical difference

[6] Cf. J. Casanovas, "Conflicts between faith and the new astronomy in the XVII century. Reflections on the Galileo question," in *Science and Faith. International and Interdisciplinary Colloquium, Ljubljana, Yogoslavia, May 10–12 1984*, ed. Z. Roter and F. Rodé (Ljubljana, Rome: Slovene Academy of Sciences and Arts, Secretariat for Non Believers, 1984), pp. 29–48.

between the extrapolation of perceived regularities into areas of the subject still obscured, and the discovery of the intrinsic "mechanism" of the ontological structure that underlies the observed regularity. Aristotelian induction is getting to know the said mechanism within the experimental material obtained during any earlier cognition. In Aristotelianism *inductio* practically represents the same as *seductio*—enticement, allurement, temptation—for induction leads the mind to recognize principles and rules (*arché*). What is enticed is experience (*empeiria*), while the mind (*nous*) is subject to temptation. Certain minds more easily succumb to induction, while others are more resistant, critical. In practice this means that the number of concrete, individual observations, the quantity and quality of data needed to comprehend a principle or rule can vary for various people. Some minds grasp the fundamental element of a principle "in flight," while others require a huge amount of empirical material to do so, while others still, though admittedly creating the notion of the principle, quickly do so erroneously. The ideal naturalist should possess two minds—one adapts to induction, while the other decisively opposing this sort of intellectual temptation. Here it follows to recall that the process of induction—in the above described Aristotelian sense—is the foundation of the process of scientific cognition, while the results of inductive cognition constitute the starting point for academic research *sensu stricto*. However, inductive cognition does not strictly speaking belong to scientific methods of research—even though an academic employs induction in exactly the same way he/she uses his/her other senses, sight, hearing, touch etc. Induction, equal to sensory cognition, is an element of the pre-scientific, everyday, colloquial cognition of/acquaintance with reality.

The essence of scientific cognition is based, according to Aristotle, on reasoning, which is the testing of the relations existing between the principles discovered through induction. Incidentally, principles exist differently in learnt about subjects and differently in the consciousness. There exist in consciousness so-called "concepts," abstract from experience, which may identically relate to an array of subjects. The content of the notions determines the sense of the "terms" of reasoning, the significance of the words used in syllogism. For reasoning is conducted upon the basis of a set of elementary principles of logic, rules penetrating all subjects, "omnipresent" rules. Everyone who has reached the level whereby the development of consciousness

enables the process of induction, has to discern these principles with the totality of self-evidence. The perception of principles in things is the final guarantee of their objectivity, genuineness. The rules of logic although—as Aristotelianism states—deduced from the experience of things themselves, contain within themselves an extremely meagre information source.

Are the principles of logic ontological principles?

The majority of philosophers of the Aristotelian-Thomistic current consider this to be the case. In my view one of them, called the law of contradiction (or as some would rather "non-contradiction") does not belong to ontological principles but to those of existence. The law of contradiction as it was formulated by Aristotle i.e., "it is impossible that the same thing belongs and does not belong to the same thing at the same time and in the same respect,"[7] is—in my opinion—the most economic definition of "impossibility" adopted as a departing point for critical cognition. On the basis of the definition of impossibility there is subsequently formed the notion of error. Suárez considers the content of the "law of contradiction" as completely correct—*quia nullum aliud impossibilius inferri potest*.[8] The conception of impossibility, in a similar way to the conception of the absurd, does not express any existential content. As the process of criticism involves the elimination of valueless, false, erroneous notions then the law of contradiction constitutes the fundamental criterion for such an elimination. For it is an essential instrument of cognition only in as far as elements of falsehood, error, superstition, misunderstanding can get through to it.[9]

Aristotelian logic places the final foundation layer under the edifice of academic knowledge, academic knowledge in the strict sense. Earlier stages of knowledge, pre-scientific knowledge, enter into the structure of this edifice as significant, essential elements. A part of pre-academic knowledge is pre-symbolic in nature i.e., it does not possess its symbolic expression in any language system whatsoever. Incidentally,

[7] Arystoteles, *Metafizyka*, transl. K. Leśniak (Warszawa: Państwowe Wydawnictwo Naukowe, 1983), Book IV (Γ), 3, 1005 b 18–19.

[8] F. Suárez, "Disputationes Metaphysicae," in *Opera Omnia*, vol. 25, ed. C. Berton (Parisiis: Apud Ludovicum Vivès, 1866), Disputatio 3, Sectio III 9, 114 a.

[9] Cf. ibidem, Disputatio 3, Sectio III 9, 113 a–b.

what Jodkowski calls "the silent functioning of the paradigm,"[10] may in my opinion be an expression of this pre-symbolic and non-reflected experience. The possession of a system of linguistic signs is not a condition for the holding of knowledge of the experience type.

Animals acquire knowledge even though they possess no language. Bears in American national parks carry out inspections of car boots on their own initiative. They have acquired experience on the subject of cars, and knowledge on where to look.

Even knowledge on the principles/laws of being does not have to be marked by linguistic signs when reasoning is directly using it—it is enough to "notice" the principle and to "understand" its action/functioning. Yet if someone wants to research the relations between principles/laws then they will have to make recourse to the instrument of linguistic signs. For man is dependent in his actions on material notions and representations.

Consciousness is able to perceive individual principles/laws in the depicted contents of experience. However, principles abstracted from the material content of experience become ungraspable for the consciousness: the consciousness is simply unable to operate with them. A linguistic symbol is as if a visible hilt attached to a given abstract concept, principle, while consciousness is thanks to this "hilt" able to collate with itself, to compare the individual principles, in a word to "manipulate" them. The linguistic symbol is as if a small label attached to the rich content of a notion. Consciousness in some of its scientific actions is able to operate by means of these labels without any recourse to the memory—besides in cases of necessity—of what the content of the notion is.

Therefore a linguistic system serves in science to test the relations between the notions, the principles of subjects. It is an obvious matter that the means by which a linguistic system is utilized in scientific research is but a part of the many varied and important functions of a linguistic system. The sense of many linguistic expressions that are fundamental for science/learning is dependent on an experience which is pre-scientific in nature i.e., of those sensory contents which lead the consciousness to the recognition (cognition) of a given principle (notion).

[10] Cf. K. Jodkowski, "Milczące funkcjonowanie paradygmatu," *Studia Filozoficzne* no. 1 (1981), pp. 53–65.

On "universals"

In contrast to the fairly widespread belief, principles (*arché*), ... do not have to be "universal," i.e., applicable to every subject, every existence/being. They are the principles of a concrete being, regardless of whether there exist another or greater numbers of beings possessing an identical principle or set of principles. Within the cognitive process man's consciousness, in order to acquire experience, has to deal with a certain minimum number of identical—with regard to their nature—beings, or observe one, singular being in its various stages and various actions.

Let us try to compare, in a tabular form, the most important elements of the Aristotelian conception of levels of cognition (cf. Table 1). ...

Table 1.

Level of cognition	Cognitive power	Type of cognition	Language system
1. phenomena	the senses	empiricism	not essential
2. regularities	the senses	empiricism	not essential
3. principles (*arché*)	intellect	empiricism	not essential
4. relations	intellect	theory	essential
5. classifications	intellect	theory	essential
6. hierarchies	intellect	theory	essential

Firstly, the concept of empiricism—in the sense of the direct contact of the cognitive power with the subject of cognition—is within Aristotelianism much broader than in other epistemological concepts. For it covers equally the direct contact of the intellect with the subject of cognition, although this contact is conditioned by previous sensory experience. It is easier to understand against such a background why Aristotelianism accepts the experience of obviousness as a conclusive and sufficient criterion for the truthfulness of cognition and here not only for the senses but as equally for the intellect.

Secondly, in Aristotelianism empirical cognition is treated as independent (in its genesis) from the process of using a linguistic system.

Thirdly, the symbolic system becomes essential only at the level of theory. Aristotelianism treats language as a form of intellectual

discovery, like an invention of the intellect. Here one needs to explain that this does not exclude the sense of using a symbol in relation to empirical data. Symbols can be useful or even essential in the phase of working out or utilizing the results of cognition, but they do not become through this something essential in the phase of obtaining information about a subject. For initially man gets to know new contents and only then names them in one way or another.

Fourthly, theoretical cognition is not identical to the entirety of intellectual cognition. For, according to Aristotle, the foundations of theory are within intellectual cognition of the empirical type. Therein empiricism may constitute here either "experience" understood as an awareness of truthfulness existing in the world of phenomena sensorially perceived, or more broadly as the direct examination of a subject. In the latter case this may be a sensory or an intellectual examination.

Fifthly, as results anyway from the previous ascertainments, reliability of scientific ascertainments is based to a decisive degree on the credibility of pre-scientific, colloquial cognition.

Let us now move onto another, opposing concept of academic cognition, that is to the views of Paul Feyerabend.

The fundamental non-reliability of science according to Feyerabend

Feyerabend's views on the subject of the reliability of human cognition may be expressed in the form of the following theses:

1. That which actually exists (reality) differs radically from the way in which it presents itself to people.
2. The task of theory is permeation of the sphere of phenomena and the discovery of reality.
3. Universal theory (not being a part of any other theory and relating to everything that exists) is ontologically important (that is it shapes our conception of the whole of reality both that observed as that not observed).
4. Every such theory possesses its own language—one completely untranslatable into the language of another such theory.

5. Every sentence of such a theory is a theoretical sentence—as a result of the logical connections with other sentences of the theory.
6. Every sentence of such a theory is (potentially) an observable sentence—as a result of the reason for its creation.
7. There do not exist sentences that are purely observable (of a meaning independent of theory).
8. The truthfulness or falsehood of any statement whatsoever depends on the theory.
9. The individual statements of a theory are not subject to interpretation or verification—only theory as a Whole may undergo verification.
10. The chief methodological norm is the creation of theories incompatible with the adopted point of view. The monopoly of a theory slows down progress in the acquisition of knowledge.[11]

Many have analyzed Feyerabend's views. Motycka has shown in a way I find most convincing that Feyerabend's thesis on disproportion is a negative, destructive thesis and as such brings nothing to the positive conception of science/learning.[12] ... Some comprehend Feyerabend's statements far less well, admitting to the incommensurateness of theory only to a certain respect but never in the absolute sense.[13] The real or alleged, universal or merely exceptional incommensurateness of scientific theory is undoubtedly a philosophical problem. For me there lies at the source of this problem something far more fundamental and namely the problem of the value of empirical cognition and in particular the sensory. For me, the germ of Feyerabend's views lies here and possibly that of all sceptics, starting with the Ancient Greeks. The thesis as to the unreliability of sensory

[11] Cf. K. Wieczorek, "Przyczynek do krytyki feyerabendowskiej tezy o niewspółmierości," *Studia Filozoficzne* no. 11 (1981), pp. 75–82.

[12] Cf. A. Motycka, "Czym żyją filozofowie nauki? (Słowo o sile polemiki)," *Studia Filozoficzne*, no. 9/10 (1982), pp. 79–91.

[13] Cf. for example K. Jodkowski, "O dwu rodzajach niewspółmierności interteoretycznych w ujęciu Paula K. Feyerabenda," *Studia Filozoficzne* no. 7 (1980), pp. 79–91; A. Łodyński, "Kuhn, Feyerabend i problem niewspółmierności teorii naukowych," *Studia Filozoficzne* no. 5 (1980), pp. 19–40; I. Szumilewicz, "Spór o niewspółmierność teorii naukowych i jego historyczny rodowód," *Studia Filozoficzne* no. 1 (1980), pp. 23–33.

observations and empiricism is so deeply rooted in the consciousness of certain methodologists that it is treated by them as almost a "fact"—obvious and uncontroversial.[14] …

The term "empiricism" usually referred to such an orientation in philosophical cognition which attributed the greatest value to statements expressing content, the features of reality exposed through the direct contact of the consciousness with that reality. One may differentiate from amongst the many forms of empiricism an empiricism exclusively sensory ascribing a monopoly to the senses both in the observation as equally the analysis of reality, as well as an Aristotelian sensual empiricism in which the senses are the only instrument in the consciousness's contact with the external world, but they are not the only instrument of observation and analysis of what the consciousness has contact with. Feyerabend considers himself to be an empiricist, but the term "empiricism" has here a completely different meaning. I am of the view that in this case the most apt determination of the fact would be "verification empiricism," as opposed to "cognitive empiricism." For Feyerabend does not treat sensory perception as the source of information about reality. Perceptions, according to him, provide for the consciousness images that are radically different from the actual state of affairs. Certain sensory perceptions may be forecast/predicted though by theories, while their subsequent discerning thereby becomes a confirmation of the correctness of the theory.

The following fundamental misgivings are levelled against Feyerabend's cognitive empiricism:

(a) the absence of the bases to differentiate the perception of the subject from the perception of illusion,
(b) the absence of bases to differentiate the objective element of perception from the physiological-psychological element,
(c) the contents of sensual perception are internally dependent on their linguistic expression,
(d) the content of sensual perception is dependent on the theoretical convictions of the observer.

[14] Cf. for example W. Sady, "O mechanizmie rewolucji naukowych," *Studia Filozoficzne* no. 4 (1981), pp. 3–16.

Here are a few quotes from the famous work *Against method*, published in 1975, in which the author sketches out his "anarchistic theory of knowledge." They are an illustration of Feyerabend's position on the feasibility or rather unfeasibility of sensory cognition:

> ... To answer this question it suffices to remember that observational reports, experimental results, "factual" statements, either contain theoretical assumptions or assert them by the manner in which they are used. ... Thus our habit of saying "the table is brown" when we view it under normal circumstances, with our senses in good order, but "the table seems to be brown" when either the lighting conditions are poor or when we feel unsure in our capacity of observation expresses the belief that there are familiar circumstances when our senses are capable of seeing the world "as it really is" and other, equally familiar circumstances, when they are deceived. It expresses the belief that some of our sensory impressions are veridical while others are not. We also take it for granted that the material medium between the object and us exerts no distorting influence, and that the physical entity that establishes the contact—light—carries a true picture. All these are abstract, and highly doubtful, assumptions which shape our view of the world without being accessible to a direct criticism. Usually, we are not even aware of them and we recognize their effects only when we encounter an entirely different cosmology: prejudices are found by contrast, not by analysis.[15]
>
> Questionable views on cognition, such as the view that our senses, used in normal circumstances, give reliable information about the world ... The sensory impression, however simple, contains a component that expresses the physiological reaction of the perceiving organism and has no objective correlate. This "subjective" component often merges with the rest, and forms an unstructured whole which must be subdivided from the outside with the help of counterinductive procedures. (An example is the appearance of a fixed star to the naked eye, which contains the effects of irradiation diffraction, diffusion, restricted by the lateral inhibition of adjacent elements of the retina and is further modified in the brain).[16]

[15] P. Feyerabend, *Against method: outline of an anarchistic theory of knowledge* (London: Verso, 1978), p. 31.

[16] Ibidem, p. 66.

The lack of credibility in sensory evidence is additionally heightened through the subjective, and not altogether too clearly conscious influence of history, understood in the sense of the inherent views of a given epoch ..., as equally in the sense of the scientist's personal experiences.[17]

According to Feyerabend, an empiricist does not possess a criterion allowing for a correct and effective differentiation of the valuable result of sensory cognition from an illusion. Illusion may be broadly understood. Certain illusions may result from the superficial similarity of objects/subjects, others from the correctness or disturbances of psychological-physiological processes, others in turn from certain intellectual prejudices or blinkering or be due to arbitrary decision.

Feyerabend tells the reader numerous facts from the history of research and scientific discoveries, comparing with each other manifold ways of interpreting "these same" facts, "these same" experiments, demasking the inconsistencies, the oversights and the arbitrariness, the mistakes and the prejudices. This account is obviously to make the reader aware of the reasons which Feyerabend has for being able to tolerate the hitherto views on the subject of the developmental mechanism in academic/scientific knowledge. Yet the author seems to forget that his arguments reach the reader through the reader's senses, that they could be contaminated by a dose of psychological-physical elements that ends up against the backcloth of personal experiences. Feyerabend spins his tale in such a way as if he himself believed that certain mistakes in observation really were mistakes and could be objectively differentiated from the truth, that certain prejudices do in fact differ from objective information about a subject; that what is visible is really visible and perceived via the sense of sight, while what is not visible is invisible to the senses. Feyerabend's accusations on the subject of the slight or zero role played by the senses in acquainting oneself with the real are consequently "making a mountain out of a molehill." For can one suppose that he accredits to his own arguments some form of extraordinary and exceptional independence taken from all the deformations which he is exposing left, right and center? Of course it is an impossibility to prove that no one ever mistook reliable proof provided by the senses with an illusion. Yet the rejection of the credibility of sensory cognition merely on the basis

[17] Cf. ibidem.

of the occurrence here and there of oversights is a mistake of not only monstrous disproportions but something almost suicidal for the sense of Feyerabendian rhetoric.

The monstrousness of this thesis takes on an increasing blatancy the more telling the examples of errors, oversights, and prejudices advanced by Feyerabend become. They have all been discovered, revealed, exposed. Without this he would not be able to shake the ingenuous (good-hearted) cognitive optimism. However, their discovery is rather a telling argument in favor of this very optimism. The fact of exposing, of revealing a mistake, oversight, illusion, prejudice allows him to say that the cognitive powers have turned out to be efficient equally where circumstances led the senses astray, where the cognitive process had to undertake a critical selection from amongst varied interpretations suggesting themselves. Here someone could defend Feyerabend by saying that the critical process happens not in sensory cognition but through theoretical procedures. In such a case, however, criticism would involve—in the final settlement—an arbitrary evaluation, the selection of sensory data, and the term "sensory illusion/delusion" would constitute merely a label hung on the sensory contents quite literally wherever anyone fancied. It is worth comparing Feyerabend's thesis of the incredibility of sensory experience with the content presented earlier in the Aristotelian conception. Experience, accessible still at the "animal" level, leads—according to Aristotelism—to a knowledge about what material sensorially cognated circumstances of the cognitive process influence the image of the world and which do not. Poor lightening may lead to an inability to perceive certain hues, certain media such as water or hot air can result in changes to the image of objects' shapes. All of these circumstances are registered by sensory receptors and are accordingly analyzed by the central nervous system, which already in childhood learns to gradually introduce the relevant corrections, or an element of doubt where—as sensory experience teaches—circumstances take places changing the image of the cognate subject. The correct interpretation of observations made is consequently a form of experience application and is achieved—according to Aristotelianism—not through the introduction to the consciousness of theses of some speculative, contrived construction, but through the partially subconscious cognitive process. Criticism, the element of doubt appears within the consciousness almost automatically as one of the numerous, complex results of the sensory cognition

of the world. The source of doubt comes from available observations, and thanks to this doubt there is verification, which has to be constantly used with the results of sensory cognition.

The above remarks cannot pretend of course to be of the ranking of matter-of-fact and systematic criticism of the thesis on the incredibility of sensory cognition. I would like to somewhat reinforce it by referencing a recently published article of Fodor's ..., who is also irritated by the skeptical views of contemporary methodologists of science.

The illusion of the senses and the credibility of the senses

Fodor analyses the epistemological consequences of the psychological phenomenon known as the Müller-Lyer illusion.[18]

Here are the sensory data which compose the phenomenon of this illusion (cf. Fig. 1):

1. Line A and line B are exactly the same length,
2. Line B seems to be longer than line A.

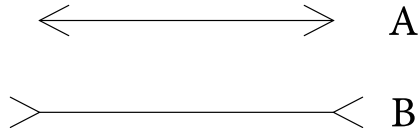

Fig. 1.

A comparative evaluation of the section lengths leads here to a contradiction. Both parts of this contradiction are registered as clear evidence of the senses. This contradiction cannot be tolerated. The consciousness of the absurdity, the existential impossibility of what appears as contrary is one of the first acquisitions of a mind which has reached cognitive maturity. (This or another consciousness is expressed in the form of a linguistic thesis called the principle of contradiction, is secondary and not important).

The contradiction manifesting itself in ... the Müller-Lyer phenomenon means that the mind searches for some form of solution—yet

[18] Cf. J. Fodor, "Observation reconsidered," *Philosophy of Science* 51, no. 1 (1984), pp. 33–34.

only one that would salvage the credibility of both elements of the contradiction. Just such an explanation is supplied by contemporary psychology.

For someone with a certain experience of three-dimensions, Figure B may appear to be the internal edge of some block, for example the inner edge of an open suitcase. Yet it could appear as if the horizontal line of Figure B is to be found somewhat further from the observer than the four oblique lines—"the edges of the suitcase lid." Figure A may appear to be the external edge of some block, for example a cuboid box, and hence the horizontal line of this figure could be situated closer to the observer than the horizontal line of Figure B. Man's experience of perspective leads to a subconscious correction to the fact of reducing the angle measure of objects further off. The one of the two objects of exact same dimensions which is further from the observer will appear to be smaller (it is going to give a reduced projection on the retina) than the second, which is closer (and hence produces a greater projection on the retina). An experienced individual knows that both objects are identical in dimensions. Therefore, in observing figure A and B, someone who would consider them to be three-dimensional objects (which is linked to a certain experience in perspective) in seeing that line B—even though it is further away—is as long (according to the angle on the retina) as line A, will treat it as being in fact longer than line A. According to psychologists, since small children do not possess sufficient experience of three-dimensional space, they are not subject to the illusion described above.

After these explanations Fodor moves on to a critique of the theses of sceptics having chiefly in mind N.R. Hanson, T. Kuhn, N. Goodman and P. Churchland. If the content of our convictions and theoretical understandings were to impact in such a way on our sensory registration of the world as the sceptic deems it to be then an understanding of the mechanism behind the Müller-Lyer illusion should free us from falling for such an illusion. Yet an individual who already knows that the illusion exists still succumbs to it in the same way as previously. Our sensory cognition is, Fodor concludes, in contrast to the ascertainments of the sceptic, not significantly dependent on theoretical views.

Here it is worth drawing attention to one more aspect of the phenomenon of sensory illusion. The expression of contradictions in sensory experience is a feature characteristic for illusions. The impression of contradiction directs the mind to search for an explanation that will

eradicate the unbearable absurdity of the situation. In this way, thanks to the revealing of the illusion, a cognitive process sets in which reveals the mechanisms that are difficult to be spontaneously and directly observed or noticed. For the recognizing of illusion as illusion is a privileged form of sensory experience. Its content is rich, richer to a certain degree than other more common perceptions. In order to better illustrate the above statement we shall consider one more example of sensory illusion—the illusion of "spoon bending."

When a teaspoon is placed in a glass of water and looked at from the side it may be noticed that the teaspoon is bent at the boundary of the liquid and the air. If one were to touch this place with one's fingers one can state that the spoon is in fact completely straight. So the senses are sending as contradictory information:

1. sight: the spoon is bent,
2. touch: the spoon is straight.

It is physics that provides an explanation for this contradictory information. Touch registers the shape of the spoon. Sight registers the light energy reflecting from the surface of the teaspoon. This energy is "broken" on crossing over from one physical medium (water) to another (air). This explanation does not question the correctness reliability of sensory observations. On the contrary, the results of these observations constitute the starting point as well as an important element in the final explanation of what ostensibly turns out to be a contradiction.

Feyerabend uses our knowledge about sensory illusion in his arguments but it is difficult to agree with his line of reasoning. He appears to believe that illusions are an illustration of objective incommensurability, which he appears to understand as a form of contradiction. He tries to convince the reader that the very same picture (cf. Fig. 2a), depends on one's mental attitude or mindset which will create in one's consciousness two different images so different that seeing one completely excludes being able to see the other.[19] In reality I feel what we are dealing with here is not two but three images. One of these is a flat image which lends itself not only to observation but also drawing. … The two other images are three-dimensional interpretations of the first.

[19] Cf. P. Feyerabend, *Against method: outline of an anarchistic theory of knowledge*, chapter 17.

These two interpretations do really mutually exclude each other. So which of these three images is the result of sensory cognition? There can be no doubt that in the original and rigid sense it is the first picture that is this. However, the two others are the result of placing the actual sensory image against the backcloth of previous cognitive experiences. That there exist two possible three-dimensional interpretations of a two-dimensional drawing is not a new problem for it is comprehensible for those who know the geometrical relations between blocks and their projections on a plane.

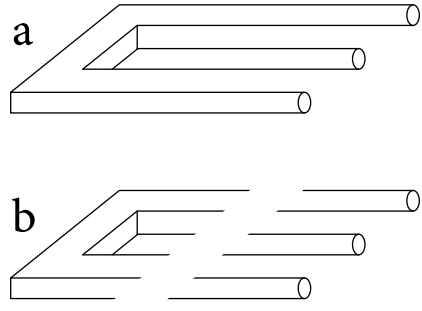

Fig. 2.

The "ambiguity" of the figure presented in the drawing 2a does not constitute any "incommensurability" between the three-dimensional interpretations of this flat figure. The right part of the flat figure presented in the drawing 2a has a different shape than the left part. Difference does not have to mean incommensurability in the radical Feyerabend understanding of the word. The right part of the drawing is interpreted as a part of another three- dimensional solid; the left as a part of a completely different solid (cf. Fig. 2b). For these two different, three- dimensional interpretations do not concern the entirety of the drawing just fragments as such. The contradiction arises only when the consciousness demands a simultaneous extrapolation of two different reconstructions of parts onto a single entirety of the drawing. Drawing 2a is a geometric "chimera," but its chimera qualities only appear in the consciousness thanks to a cognitive, subconscious tendency to utilize to the maximum the sensory data available. While the drawing illustrates the fact drawn from elsewhere that certain data may at times be too limited to allow one to unequivocally

arrive at an interpretation or alternatively that the data in one respect speaks out for one interpretation and in a different respect for another interpretation.

So it appears as if sensory illusions are contemporarily understood in accordance with the Aristotelean understanding of the cognitive process. In the perception, the testing and understanding of the two illusions discussed above, one may note an element of direct sensory relations on the subject of the actually observed subject, the element of experience expressing a previously observed constancy and correctness/regularity in the subject's traits, an element of logical principles (the principle of eliminating contradictions) as equally an element playing out the deeper, significant nature of the subject (the independence of sizes in space, the dependence of the dynamic radiating from the properties of the conducting center). It also follows to state that progress in the understanding of the mechanism for the creation of illusions is neither necessary for their registration nor does it have any influence on their observation. This is obviously not a full answer to all that is contained within Feyerabend's doctrine. However, to a significant degree it seems this weakens the credibility of his claims, strengthening with the same trust in the cognitive possibilities of man as well as in the actual progress in the shaping of natural scientific concepts. A critical approach to Feyerabend's doctrine does not mean an uncritical relation to the actual state of knowledge and does not have to result in dogmatism in the understanding of concepts about the world temporary/makeshift or approximated to the ones we hold. ...

Between non-criticism and skepticism

Here are the most often used epithets exposing the varied forms of the error of cognition:

(a) imprecision,

(b) subjectivity,

(c) fragmentariness,

(d) irrelevance.

These varied headwords which express the conviction as to the fallaciousness of one or another view on reality are inseparably connected

with the complementary notions of precision, objectivity, wholeness/integrity, essence, non-contradiction, rationality. In my view anything that appears upon the "screen" of our consciousness—regardless of whether this will be a concrete image of sleeping dreams or the image of a rainbow in the sky—may be evaluated by consciousness itself, thanks to reflection, through the prism of the above-mentioned features.

A concrete fragment of the image of sleep dreams may be arbitrarily selected from the whole of their set, a description of this image may be more or less detailed, certain of its features may be magnified as a result of subjectively one-sided sensitivity, significant features (e.g., from the viewpoint of a psychoanalyst) of this picture/image may be omitted in an oral account, and may finally contain inconsistencies leading to contradictions. This same set of alternative qualifications may be utilized—and is *de facto* used—in natural history e.g., in biology.

The mistake, in my opinion, lies in the incorrect decision in choosing between the elements of the alternative qualifications presented in Figure 3.

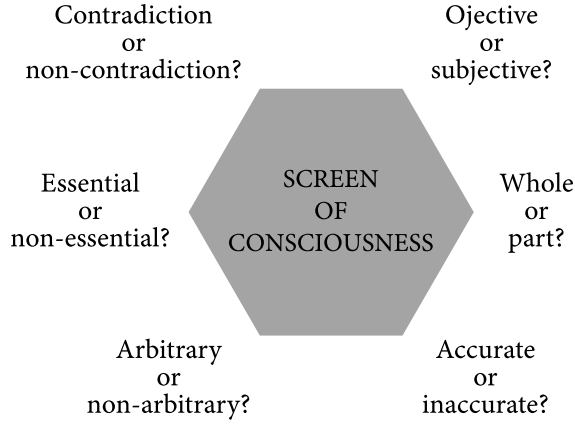

Fig. 3.

In order ... to create the conditions for an eventual mistake, it follows first to understand what is being discussed. One needs to

understand the difference between what is significant and what is insignificant, one needs to understand the difference between what is wholeness/integrity and what is merely a part of a whole… etc. But this is only a condition for committing a mistake—not the mistake itself. The mistake appears when we are making the incorrect choice. Hence the position of the sceptic, as can be seen, is no way safer than that of the cognitive optimist. Both these positions suppose a certain earlier knowledge which should be doubted. Here it follows to add that if someone uses the term "contradiction," having in mind the notion of antithesis—some are of the view that Hegel acted in this way[20]—then we are dealing not with a mistake in cognition but with a linguistic misunderstanding. And in just such a situation the edge of skepticism moves from the matter of cognition to the problem of interpersonal understanding.

What is certainty and at the same time the credibility of natural knowledge? Certainty—or so it seems to me—is not some homogeneous notion nor is it a homogeneous state of consciousness. Certainty is the resultant of a multi-aspectual, multi-sided evaluation of a cognitive situation in a given concrete case. Above I have listed six such aspects which join some concrete content contained in our consciousness (present on the "screen of consciousness") with the rest of our knowledge, with other results of cognition. In a concrete case there may occur a difficulty in evaluating essence or in the evaluation of completeness (wholeness/integrity) or in the evaluation of the objective worth/value of the information obtained or acquired. Hence, in the consciousness of a naturalist or scientist in general there may—or even there should—appear uncertainty, doubt.

The sources of these doubts are sometimes straightforward though sometimes difficult to reveal. Deep reserves of experience only partly formulated and reflected on may as it were automatically trigger a red light of doubt, although the consciousness is not always able to indicate the reasons for this anxiety. Despite this the said anxiety will be objectively justified and rational (in as far as it expresses the recalled experience), although for the time it appears as something irrational, or instinctive. Animals, similarly, thanks to inborn mechanisms are able

[20] Cf., for example G. Patzig and E. Berti, "Contraddizione," in *Concetti fondamentali di filosofia*, vol. 1, ed. H. Krings, H.M. Baumgartner, C. Wild and G. Penzo (Brescia: Queriniana, 1981).

to react to anxiety, or even by means of some integrated action a long time before an earthquake or other cataclysm. I do not imagine that an experimenter, observer of nature possesses any inborn/inherent instinct informing them about the actual state of things, an instinct activating anxiety and doubts where they are needed. A naturalist registers, however, through his cognition more than he is aware of. The correct state of doubt (I shall pass over the pathological) may, I assume, be released by the knowledge acquired—regardless of whether this knowledge was reflected on or verbalized.

Skepticism is the basis of *"not fair."* Normally it gives belief to all, even the most unlikely accusations of error or falsehood but it does not want to lend belief to the obvious significance of facts. An uncritical mind obviously disregards errors and falsehoods. A skeptical consciousness obviously disregards truth and credibility. One comes across in every person—and a naturalist is also a person—some kind of greater or lesser sphere of non-criticism or a lesser or greater area of skepticism. A proportional way of looking at reality is however a fundamental condition for every genuine act of cognition and scientific discovery.

Proportionalism in the way of viewing reality does not mean in my belief some form of symmetry between a mistake and truth, or symmetry between the recognition of truth and the recognition of a mistake. A mistake is not the "partner" of genuine cognition, it is not merely a "cognitive loophole." A mistake is something more dangerous—for it leads to a consciousness of the fiction blocking any further search, further cognitive efforts. The blocking of cognition may involve satisfying the hunger for a valueless substitute. Prejudices, superstitions, charlatanism are an example of the mistakes committed by uncritical people. For the blocking of cognition may equally involve the rejection of what had been a valuable cognitive achievement. Skepticism, however, does not want to admit that its suspicion, uncertainty, distance in relation to the cognitive process may be a mistake or misunderstanding. The consciousness of the sceptic, so demanding in relation to the proofs of cognitive correctness, does not perceive the requirement for the proofs of a mistake/error. Every suspicion of error appears valid to the sceptic. Only truth is suspect. When the matter concerns a mistake, verification seems to be unnecessary. I would therefore call skepticism "negative gullibility," in other words "non-criticism."

Blind conviction in the absolute reliability of the cognition of error results in the sceptic not being able to make themselves aware of how highly the process of discovering an error is dependent on the establishment of objective truth. An extremely good example of this blindness is a sizeable part of Feyerabend's arguments in his book *Against method*. The author reports a mass of facts, sayings, makes reference to known physiological and psychological mechanisms in order—on their basis—to formulate a valid thesis that the senses are not reliable. I am not able to understand how the content of these arguments could have possibly reached my consciousness as the senses would have distorted the sound of the words or the shape of the letters! On what basis would I have believed stories about some lens or retina of the eye, not to mention about contents such as "radiation," "diffraction," "aberration," "refraction" etc.! I shall reiterate: Feyerabend on the reliability of sensory experience constructs a thesis that the senses are unreliable/ not credible.

The credibility of natural knowledge should not be evaluated in the distorted mirror of skepticism. For skepticism attacks not only the results of cognition, but the value of the very instruments of cognition. Consequently, skepticism goes hand-in-hand with the elimination of the notion of objective truth—and therefore of that which in the natural sciences was always the most important goal of research efforts.

Feyerabend is merely one of many at present well-known methodologists of the natural sciences who attempt to popularize and advertise skeptical views. Although he entitled his book an "outline of an anarchistic theory of knowledge," he did not want to be associated with anarchists in the colloquial meaning of the word. Therefore he preferred to call his mental orientation Dadaism. Who is a Dadaist?

> A Dadaist would not hurt a fly-let alone a human being. A Dadaist is utterly unimpressed by any serious enterprise and he smells a rat whenever people stop smiling and assume that attitude and those facial expressions which indicate that something important is about to be said. A Dadaist is convinced that a worthwhile life will arise only when we start taking things *lightly* and when we remove from our speech the profound but already putrid meanings it has accumulated over the centuries ("search for truth"; "defense of justice"; "passionate concern"; etc. etc.). A Dadaist is prepared to initiate joyful experiments even in those domains where change

> and experimentation seem to be out of the question (example: the basic functions of language).[21]

This obviously sounds delightful and favorably tickles our lofty sense of humor. Having fun is not forbidden by law whatsoever. ... Everyone is free to write about science in whatever way they fancy and everyone is free to read it. But the way in which some philosophers of science treat Feyerabend's views are a long way from Dadaism. Treating Dadaism seriously is an insult to a Dadaist. Personally, I do not take Feyerabend's views seriously. In my arguments against skepticism I have made use of Feyerabend's texts in the way one makes use of a fairy tale. For a fairy tale can at times express certain contents in a more colorful, vivid way and consequently more bluntly than could ever grey reality.

Summing up

Are scientific statements reliable/credible? Feyerabend treats the sense of academic/scientific statements as its own way of viewing reality, a way which changes within history exactly like fashions in clothes or architectural styles change. Science in the way Feyerabend evaluates it is not credible in the colloquial, fundamental sense of the word.

> ... wherever we look, whatever examples we consider, we see that the principles of critical rationalism (take falsifications seriously; increase content; avoid ad hoc hypotheses; "be honest"—whatever that means; and so on) and, a fortiori, the principles of logical empiricism (be precise; base your theories on measurements; avoid vague and untestable ideas; and so on), though practised in special areas, give an inadequate account of the past development of science as a whole and are liable to hinder it in the future.
>
> For what appears as "sloppiness," "chaos" or "opportunism" when compared with such laws has a most important function in the development of those very theories which we today regard as essential parts of our knowledge of nature.
>
> Ideas which today form the very basis of science exist only because there were such things as prejudice, conceit, passion; because

[21] P. Feyerabend, *Against method: outline of an anarchistic theory of knowledge*, footnote 12, p. 21.

> these things opposed reason; and because they were permitted to have their way. ...[22]

So what is credibility for Feyerabend? I consider that it is merely the shadow of the monsters of Truth and Reason. They fade and wither, and together with them credibility withers and fades.

Feyerabend's utterances on the subject of cognition, truth and reason obviously match those of Nietzsche.[23]

The absolute freedom, freed/liberated from the law of the subject (reason) and the object (reality) of arbitrary action is the joint ideal of Nietzsche and Feyerabend. The difference appears in the fact that Nietzsche perceived the source of this said freedom in the death of God, while for Feyerabend it rests in the incurable defeat of the cognitive process. Both were consistent in their dotting of the i's. They warded off the one sin—consciously or unconsciously: the sin of hypocrisy.

And how did Aristotle respond to the question as to the credibility of scientific statements?

In Aristotle scientific statements are not credible *en bloc*. Science, according to Aristotle, is the process of the slow shaping of consciousness on an image and the similarity to natural reality. Here science is comprehended as the similarity to the embryonal process in which there gradually appear the rudiments of molecular, cellular, and tissue structures, the primordia of body organs and components. The notion was here defined as *conceptus mentis*—that is something that "was conceived in the mind" and there it shapes itself until it has reached the mature stage. In the way that the embryo of the child developing in the womb draws from the mother's body the appropriate particles of matter and selectively constructs from them its body on "image and similarity," so the contact of consciousness with reality involves the laborious, gradual, selective obtainment of significant data, as well as the gradual, selective reconstruction—based on these data—of an increasingly precise and fuller image of reality.

The credibility of scientific cognition constitutes its maturity. One may only talk about the credibility of a few scientific notions—that is mature. Other concepts are only just taking shape, while their structure

[22] Ibidem, pp. 179–180.

[23] Cf. H. de Lubac, *Le drame de l'humanisme athée* (Paris: Éditions Spes, 1950), pp. 59–60.

contains still too many ambiguities, too little maturity for them to be considered as final and inviolable—that is credible. In Aristotelianism science is a stage, an advanced stage of the normal, spontaneous activity of man—more scientific knowledge should be treated as an element of the ideal of a mature man, on a par with his mature artistic creativity, and his complete ethical development.

In Aristotelianism all the stages in the cognition process are valuable and all—beginning from the cognitive achievements of a baby—constitute an element and foundation of the final perfect image of the world. The radical difference between Feyerabend and Aristotle lies in the fact that the former, through the disqualification of the initial results of cognitive actions, got to ridiculing the most advanced actions. While for the latter not only achievements but equally mistakes recognized at the earlier stages of cognition served in paving the way for the increasingly greater credibility of subsequent stages.

And yet there is some truth in Feyerabend's claims. The popularity and influence he attained and which he has exerted to now is an obvious example that in science rationality may *de facto* be eliminated for the benefit of an anarchic attitude or alternatively a Dadaistic one. It may also turn out that certain theories popularized at present ("a significant part of our knowledge about nature") are the daughters of opportunism, chaos, hubris and superstitious prejudices. So when this becomes clear and obvious for all, will someone then say that Feyerabend was right? The diagnosis of a cancer neither compromises the doctor nor overshadows the conception of normal tissues—quite the reverse the concept of normal tissues has enabled the discovery of the cancer and has in turn resulted in a deepening and perfection of knowledge about normal tissues. Similarly pseudoscience and pseudo-methodology are not the grave of empirical and rational cognition. They are merely their parasites and a background against which the value of cognition becomes clearly discernible.

Translated by Guy Russell Torr

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