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Eriugena and al-Kindi - Ninth Century Protagonists of Pro-scientific Cultural Change[1]

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Abstract

Ancient Greek philosophers were the first to postulate the possibility of explaining nature in theoretical terms and to initiate attempts at this. With the rise of monotheistic religions of revelation claiming supremacy over human reason and envisaging a new world to come, studies of the natural order of the transient world were widely considered undesirable. Later, in the Middle Ages, the desire for human understanding of nature in terms of reason was revived. This article is concerned with the fundamental reversal of attitudes, from "undesirable" to "desirable", that eventually led into the foundations of modern science. One of the earliest, most ingenious and most interesting personalities involved was Eriugena, a theologian at the Court of Charles the Bald in the 9th century. Though understanding what we call nature is only one of the several aspects of his theological work, his line of thought implies a turn into a pro-scientific direction: the natural order is to be understood in abstract terms of 'primordial causes'; understanding nature is considered to be the will of God; man encompasses the whole of creation in a physical as well as a mental sense.

Basically similar ideas on the reconciliation of scientific rationality and monotheistic religions of revelation were conceived, independently and nearly simultaneously, by the Arab philosopher al-Kindi in Bagdad. Eriugena was more outspoken in his claim that reason is superior to authority. This claim is implicit in the thought of Nicholas of Cusa with his emphasis on human mental creativity as the image of God's creativity; and it is the keynote of Galileo's 'Letter to the Grand Duchess Christina' some 800 years later, the manifesto expressing basic attitudes of modern science.

[1]This article in English is based on the monography (in German): A. Gierer "Eriugena, al-Kindi, Nikolaus von Kues - Protagonisten einer wissenschaftsfreundlichen Wende im philosophischen und theologischen Denken", Acta Historica Leopoldina 29 (1999), Barth Verlag in MVH Verlage Heidelberg

Philosophy of nature: the decline and its reversal in the Middle Ages

Science aims at a rational understanding of nature, based on general laws and principles that can be expressed in abstract theoretical terms without explicit references to myths, spirits, or Acts of God. Scientific rationality may be traced back to the ancient pre-Socratic philosophers, who introduced such general concepts as laws, mind, elements, numbers. Heraklit postulated fire as the origin, and 'Logos' as the unifying principle of all things. At the same time, explanations were proposed for distinct features of nature, such as the moonlight, the rising of the River Nile, and the hail. Later, Aristoteles conceived a philosophy of nature inspired by biological phenomena, with an essential role for teleological principles. We can regard him as the founder of biology as a science. In particular, he recognized common features of all forms of life, including the plants: reproduction and growth. These features were conceived of as expressions of the 'vegetative soul'. Additional, higher capabilities were attributed to animals and humans - perception - and to humans alone: reason.

A discussion of the further development of philosophies of nature up to the rise of monotheistic religions of revelation in the first centuries A.D. is not essential to my present topic. This rise, then, initiated a fundamental change of attitudes towards scientific efforts: When it was envisaged that this, our lower world, was destined to perish, it was widely considered that understanding it in a rational manner was unnecessary, if not undesirable, because it would contribute nothing to salvation. In particular, Augustinus in his later phases, emphatically rejected scientific curiosity. In 415, fanatical Christians in Alexandria murdered the mathematician and philosopher Hypatia, although her famous school in the Hellenistic tradition was highly esteemed by pagan as well as Christian scholars. Though the background story is complex (Dzielska, 1995) - she supported a political faction opposing the patriarch's interference in secular matters - the event may be taken as symptomatic in more than one aspect. The conversion of the Roman Empire into an ecclesiastical regime ushered in a decline of intellectual inquiry by limiting its topics and scope. Though early Christian theology integrated and transformed ideas of Hellenistic philosophy, scientific investigations and rational explanations of nature were not encouraged in the centuries to come.

Some 800 years later, Christian universities were flourishing in Europe, with theologians playing a leading role. The 'Book of Nature' was claimed to be a part of God's revelation to man and complementary to the Bible; the rational understanding of the natural order mainly in Aristotelian terms was regarded as in accordance with God's will. It had to be anchored in Christian beliefs, but, as Albertus Magnus put it, "When I investigate nature I am not interested in miracles." There were running conflicts between what we might call in modern terms the 'liberal' and the 'fundamentalist' positions, with serious controversies between theologians of the time; Aristoteles was accepted, repressed, accepted again, and eventually vehemently defended by religious authorities against further developments of scientific and philosophical thought. Since then, there has been an uninterrupted development of ideas on how to explain nature, though this has not been free of conflict or unchallenged. In the 17th century Aristotelian notions were replaced by the new discipline of mathematical mechanics as the basis for explanations of events in space and time, a line of thought leading from Galileo, Kepler and Newton right on into modern science. The Bible is not to be considered a source of knowledge on astronomy or other branches of science, and we should be free to study and explore nature in scientific rather than theological terms: this attitude was widespread at the universities in the late Middle Ages; later it was at the root of the conflict between Galileo and the church, only to become generally accepted by Western society in the centuries to follow.

The topic of this article is the reversal of the decline of intellectual inquiry on nature at

some stage in the Middle Ages, which eventually led to the burgeoning philosophy of the late medieval period that in turn prepared the way for modern scientific thought in Europe. Though there is no single event or personality that can be pinpointed as responsible for this reversal, it is revealing to study an early protagonist, and indeed a most ingenious and interesting one, John Eriugena. He lived in 810-877, approximately midway between the assassination of Hypatia in 415 and the rich and vigorous intellectual life at the University of Paris in the 13th century.

Eriugena - life and thoughts

Eriugena was an Irish theologian at the court of Charles the Bald, a Carolingian King of the Western mainly French part of the divided Empire of Charlemagne. The Carolingians had revived interest in education, albeit on a rather modest scale, and with the main objective of improving the administration. They had some contact with the Byzantine and Arabic world and a fragmentary knowledge of Ancient Greek and Latin traditions insofar as they had been integrated by early Christian theologians. Charles the Bald was rather exceptional in that he strongly favoured Greek culture. Eriugena was one of the few of his contemporaries in Northern Europe who had a good knowledge of Greek and had access to works written in this language.

One task assigned to Eriugena was to review the radical doctrines of predestination advocated by the Saxon monk Gottschalk (following the line of thought of Augustinus in the later phase of his life): God has destined most human beings for damnation and has created hell to punish them. This doctrine does not leave much room for personal responsibility, and there are other reasons why it is not very appealing. Eriugena, rejecting it, insisted that God cannot, in any sense, will the misery of men, and that hell does not really exist, but is a metaphor for the absence of salvation. This, however, was apparently going too far in the direction of human freedom for the religious authorities; his views, pejoratively referred to as 'Scots' porridge', were condemned in two synods a few years later.

Nevertheless, Charles the Bald continued to support Eriugena. He was asked to translate the works of Dionysios Areopagita. This author was thought to be identical with the Dionysios who is recorded as listening to St. Paul's sermon at the Areopag in Athens (Acts 17,34), but was actually a 5th/6th century writer. He was one of the main proponents of Christian neo-Platonism: of God, we can only say what he is not; creation is mediated through ideas; salvation is the return of everything to God.

In the theological spirit of neo-Platonism, Eriugena then wrote his main work 'The Division of Nature', with the Greek title 'Periphyseon'. Eriugena's concept of "Nature" includes spiritual and mental, as well as spatiotemporal, aspects. According to Eriugena, God, who creates but is not created, created the primordial causes. These are mediators of creation that underlie the natural order. They can be conceived of, if at all, only in abstract theoretical terms and are inferred from their effects. Primordial causes are created and do themselves create: they generate the order of the spatiotemporal real world. This, in turn, is created but does not create. In it, man is created both as the highest of animals, thus encompassing all of creation, and at the same time as the image of God in a mental sense. Man, and the world, will eventually return to God.

My article focuses on nature in the modern sense of the term, that is, on the spatiotemporal world that is, to use Eriugena's terminology, part of nature, namely that which is "created but not creating."[2] Eriugena insists, as other neo-Platonists had before him, that

[2]Topics related to science are remarkably scarce in the literature on Eriugena, even though the spatiotemporal world is the subject of one of the five books of the 'Division of Nature'. This is perhaps not only because scientists rarely write on Eriugena, but also because the material on which Eriugena based

the real world is the lowest part of nature, but this does not prevent him from developing a particularly keen interest in it. After all, it is created for the sake of man, and God has endowed human beings with cognitive capabilities for understanding it. We can achieve this in abstract theoretical terms that are closely analogous to the "ideas" of Greek philosophy: the primordial causes. Their recognition, in turn, guides us to an intuitive vision of God: we know that He is, but not what He is. This line of thought clearly encourages observations and abstract thoughts on the natural order without direct reference to theological terms. This positive attitude initiated a deep interest in the 'Book of Nature', which eventually, in a modified and elaborated form, led on to modern science based on the interplay of observations and ideas.

Eriugena's main work is voluminous, with many diversions and repetitions, and often not easy to understand. I do not claim to add significantly to the interpretation of his basic philosophical concepts and notions. However, it is revealing to note that thorough studies published on these aspects yielded conclusions [3] that are consistent with my view that Eriugena's ideas (and perhaps even superficial attention to and misunderstanding of these ideas) encouraged rational explanations of nature in the centuries that followed. Only some of the sections of Periphyseon, amounting to about two hundred pages, are directly relevant to my topic. Of the five books of the 'Division of Nature', the end of the second and the beginning of the third introduce the primordial causes as the generating abstract ideas underlying the order of nature. The second part of the third book deals with the real world in terms of the six days of creation. On the basis of the knowledge of and notions about nature that were available to him in his own time, Eriugena combines concepts of physics, astronomy and life with philosophical ideas, mostly taken from ancient philosophy. Eriugena makes no claim to originality with respect to these components, but he chooses and composes them in an intelligent, not to say ingenious, manner. He insists that reason is superior to authority. According to him, many interpretations of the biblical texts are possible, and we should choose those that are most in keeping with reason.

The first day's creation when heaven and earth were created and light came into being is interpreted as the creation of the primordial causes which are in the dark because they are not recognizable by themselves, and their transition into their effects, which are recognizable in the light.

With respect to the second day of creation, the formation of the firmament, a rigid shell separating the higher and the lower waters, is interpreted as the creation of the four elements; these are the persistent components of all things, derived from the immutable laws and primordial causes of the upper waters to give rise to the world of mutable, composite bodies symbolized by the lower waters. The separation of water and land on the third day of creation is meant to set the stage for differentiated structures as distinct from the unstructured parts of the world and to protect the land, making it habitable for plants, animals, and man. In the section on the fourth day of creation, Eriugena proposed that the earth was spherical and astronomy was a mathematical science. In the sections dealing with the creation of life on the third, fifth and sixth days, he insists that plants have life. A key role for life processes is attributed to the seminal force underlying reproduction and growth.

his views is all drawn from tradition, and because 'retrospective' science history involves no prestige in the field nowadays. However, Eriugena made highly selective and creative use of the material available to him in his time, and a retrospective history can be revealing as long as we do not deny any claims for truth in science and we search into past efforts for their creative impact and not only for what has been confirmed by later scientific results.

[3] Otten (1994): "The anthropology of Johannes Scotus Eriugena" is an example of a study of Eriugena's ideas, in this case with an emphasis on theological aspects, with a main conclusion much in line with the perspective of my present article: "Despite the gigantic scope of nature, it appears that the human mind ... serves as its leading principle." "Being and being understood by the human intellect are closely interrelated" (p. 40). "Being is that which can be understood" (p. 43).

The last part of the third and the beginning of the fourth book of 'Periphyseon' then give us to understand that man is the epitome of all creation: created on the same sixth day as the higher animals, man encompasses the whole of creation, body, life, sense, memory, fantasy; at the same time, he is created in the image of God in a mental sense, participating in the celestial essence by virtue of reason, intellect, and memory of eternal and divine things.

The following quotations, introduced by summarizing comments from myself, are taken from the edition of Eriugena's 'Division of Nature' edited and translated by Sheldon Williams (1987). They are admittedly highly selective and abridged, and my comments are intended to substantiate Eriugenas ideas insofar as they encouraged a rational understanding of nature. With respect to the general theological and philosophical ideas in which they are embedded, the reader is referred to the work of Bett (1964), the introduction to the Sheldon-Williams edition (1987) of Eriugena's 'Periphyseon' and, in particular, to the book on Eriugena by Beierwaltes (1994). In a few of my summarizing comments (relating the fiery nature in Eriugena's text to the modern concept of energy and the seminal force to genetic information) I may go a bit too far in relating his notions to modern scientific ideas, but on balance, it is not my intention to claim that Eriugena had a vision of the content of the modern science of our days. In fact, most of his concepts, such as those on matter and form, are closely related to Aristotelian physics and more remote from modern sciences than my selective and abridged quotations may suggest. The point I would like to emphasize is that he had a vision suggesting that a rational understanding of nature was both possible and desirable. It was this notion that induced the historic reversion from the decline of theoretical thought about nature to its further development.

Eriugena on nature and human understanding[4]

(a) Nature, human cognition and theoretical concepts

Reason is superior to authority in the search for truth:

> *Every authority which is not upheld by true reason is seen to be weak, whereas true reason is kept firm and immutable by her own powers and does not require to be confirmed by the assent of any authority.*[5]

> *Abraham knew God not through the letters of Scripture, which had not yet been composed, but by the revolutions of the stars.*[6]

> *It is God's will that we understand the natural order: I would not say that the constitution of this world lies outside the understanding of the [specifically human] rational nature when it was for [that nature's] sake that it was created. Yet the Divine Authority not only does not prohibit the investigation of the reasons of things visible and invisible, but even encourages it. For, says the Apostle, "from the creation of the world His invisible things are seen, being understood from the things that have been made....". We ought not like irrational animals [to] look only on the surface of visible things but also [to] give a rational account of the things which we perceive by corporeal sense.*[7]

[4]Numbers preceded by E. refer to pages in the English translation, and those preceded by P.L., to paragraphs of the Latin source, Migne's Patrologia Latina 122 in the Sheldon-Williams (1987) edition of Eriugena's 'Division of Nature'

[5]E. 110; P.L. 513B

[6]E. 357; P.L. 724A

[7]E. 356,357; P.L. 723B,C

The bible allows for many interpretations; we should search for those that conform best with our rational understanding of nature:

> *Reason itself insists that we should understand the relation which exists between the sacred text and reality. There are many ways, indeed an infinite number, of interpreting the scriptures.*[8]

Even in cases in which we cannot be sure, we should distinguish the likely and intuitively plausible from the less likely interpretations:

> *[Among the interpretations] ...I shall choose what true reason ... may instruct ... It would not be rash in me to dare to prefer, after consulting the truth, the likelier to the less likely.*[9]

God created the primordial causes. They are the origin of the real world and encompass its natural order:

> *The primordial causes are called primordial precisely because they are first created by one creative Cause of all things, and (themselves) create the things that are below them.*[10]

It is God's will that the primordial causes are recognizable for the human mind by their effects:

> *It pleased God that the original causes established before every creature beyond any intellect should be overspread with a light of intelligence and manifested to the intellects whether human or angelic ..... He preferred to name the manifestations through forms and species .... day, and to call their transcendence in their principles, incomprehensible and unknown to every created intellect, night.*[11]

'Primordial causes' are nearly synonymous with what Greek philosophers called 'ideas' as the abstract principles of everything:

> *The primordial causes then are what the Greeks called idea, that is, the eternal species or forms and immutable reasons after which and in which the visible and invisible world is formed and governed.... They are said to be the principles of all things...* [12]

There is an infinite number of primordial causes; their sequential order is a construction of the human mind:

> *It is not strange that the primordial causes should extend to infinity.... This sequence of primordial causes that you ask me to set out distinctly in a definite order of precedence is constituted not in themselves but .... in the concept of the mind which investigates them...* [13]

[8] E. 390; P.L. 749C
[9] E. 319; P.L. 690C
[10] E. 148; P.L. 547D
[11] E. 322; P.L. 693A
[12] E. 228, 229; P.L. 616A,B
[13] E. 239; P.L. 623D, 624A

The six days of creation refer not to a chronological, but to a logical order. God created everything at once in the primordial causes:

> *[Interpretation of "In the beginning God made heaven and earth ..."]: The primordial causes of things visible and invisible were established altogether and at the same time.*[14]

> *The sixfold quantity of the first six days and their intelligible division is understood to refer to the causes of established things and of their first downrush simultaneously into the initial constitution of the world.*[15]

The initial transition of the primordial causes into differentiated and ordered natural reality is the meaning of the First Day of Creation:

> *[".... and the Spirit of God fermented the waters"]. For what is to be understood by the Spirit of God fermenting, fertilizing (and) nourishing the waters of the primordial causes except the distribution and ordering of those things which in the Word are made simply, as of one form and one (substance), into the differences of all the genera (and) species and wholes [and] parts and individuals?* [16]

(b) The domain of science

Insight into primordial causes is wisdom, and knowledge of the natural order of reality is physics; science deals with the spatiotemporal world as well as with its abstract features:

> *[Ecclesiastes:] Wisdom was created first of all things.*[17]

> *Of reason also two species are known, wisdom the one, science the other .... science is the power by which the contemplative mind discourses on the nature of the things which proceed from the primordial causes through generation and which are divided into genera and species by means of differences and properties ....whether joined to bodies or free from them, whether it is distributed over places and times or outside space and time, unified and indivisible by reason of [its] simplicity .... and this species of reason is called physics.*[18]

The human mind understands the order of nature which can be conceived of in theoretical terms like space, time, quantity in the effects of the primary causes:

> *Physics considers the substantial reasons of nature.*[19]

> *The knowledge in the creative wisdom is ... the primary and causal essence of the whole of creation while the knowledge in the created nature .... subsists as the effect of the higher knowledge ... in the human soul... This applies to all the attributes which are observed [!] to be attached to the essences of all creation .... : sensible species, quantities, places, times and like attributes without which the essence cannot be understood.*[20]

[14] E. 319; P.L. 690C
[15] E. 329; P.L. 699B
[16] E. 166; P.L. 563C,D
[17] E. 313; P.L. 685D
[18] E. 245; P.L. 629A
[19] E. 330; P.L. 700B
[20] E. 426,427; P.L. 779A,B

The human mind encompasses the order and structure of the non-rational domains of nature: animals, plants, things:

> *Not only is irrationality created in the [human] mind, but also every species, difference and property of irrationality, and all things which are naturally learnt concerning it, since the knowledge of all these and similar things is established in it. By similar things I mean those which nature contains besides the animals, such as the elements of the world, the genera and species of grasses and trees, quantities and qualities.*[21]

The natural order is a mathematical order:

> *The infinite multitude of all things visible and invisible assumes its substance according to the rules of numbers which arithmetic contemplates, as the supreme philosopher Pythagoras .... testifies. Nor does Holy Scripture deny this, for it says that all things have been made in measure and number and weight.*[22]

Astronomical knowledge is not derived from a literal interpretation of the Bible, but by theoretical analysis of nature. The earth is a sphere; planets circle around the sun:

> *Erathostenes ... calculated without any mistake that the circumference of the whole earth is 252 000 stades.*[23]

> *As the philosophers affirm, the distance from the earth to the Sun is the same as that from the Sun to the stars ... Jupiter and Mars, Venus and Mercury [but not Saturn] pursue their orbits around the Sun.*[24]

Fiery nature was created in the beginning of things. (This concept goes back to Heraclitus; it is not unrelated to 'energy' in modern physics):

> *The effect of the fiery nature is light; so it is not inappropriate that the fiery nature which was created in the beginning of things should be called by the name of the light which was later to proceed from it but till then was concealed within it...* [25]

Real composite bodies of transient existence are composed of persistent elements:

> *All composite and corruptible bodies, which occupy the lowest place in all the natures, are from something, not from nothing..... They are made from the qualities and the quantities of the simple, invisible, and insensible bodies which are called elements for the reason that from their concourse the investigators of nature say that all bodies are composed, and into them are resolved and in them are preserved.... The elements are not made from nothing but come from the primordial causes.*[26]

The world is created to be habitable - an early version of the 'anthropic principle':

[21] E. 414-415; P.L. 769B,C
[22] E. 273; P.L. 652A
[23] E. 350, 351; P.L. 717D, 718A
[24] E. 327, 328; P.L. 697D, 698A
[25] E. 320; P.L. 691B
[26] E. 287; P.L. 664A

The masses of water everywhere diffused in hollow places and in the lowlands of the earth were gathered together in one gathering by the divine decree for this reason, that they should not by the piling up of their inundations cover the whole surface of the earth, but that the dry land adorned with plants and trees and rich in different kinds of animals and girt with the most wide shores of ocean and the different seas and protected from the force of the flood tide by the sandy barriers made strong by the power of the divine ordinance should appear for the purpose of human habitation.[27]

The life force or seminal force organizes and administers biological reproduction, development and growth. (This concept is closely related to the Aristotelian notion of the vegetative soul as the basis of all forms of life, including plants; it also reminds us of the modern concept of 'genetic information'):

The creation of the power of the crops and the trees in their primordial causes .... is usually named the force of the seeds[!], in which that species of soul which is called the nutritive and auctive exerts its operation, namely by administering the generation of the seeds[!] and by nourishing the things that are generated and by bestowing upon them growth through the numbers of places and times... The seminal force of crops and trees, which is causally created in the inward reasons of substances, proceed through generation into sensible forms and species...[28]

This tangible earth and water are bodies composed of the qualities of the four elements; and they bring forth nothing of themselves, and in spite of all appearances no natural species is born of them. No: it is by the operation of that Life Force which is called the nutritive [!], in accordance with the laws and principles which were implanted in those [four] elements, that the potency of the seeds which they contain bursts forth from the secret recesses of creation, as far as it is permitted by the Divine Providence, through the genera and the forms into the different species of grasses, twigs, and animals.[29]

The seminal force appears to be immaterial, yet is expressed materially:

The seminal power while by itself invisible and incomprehensible [!] multiplies itself into infinite forms and species, and though it eludes all keenness of the mind when it is sought becomes subject to the bodily senses.[30]

(c) The image of man

The soul of man administers the body; it processes, integrates, abstracts, memorizes and evaluates experience:

The soul in itself is simple and without corporeal quantity or spatial extension, in the body which it controls by its presence... At one and the same moment of time it perceives the phantasies, that is, the images, of the stars in the light from the eyes ... of voices by the sense of hearing .... of odours by the sense

[27] E. 339; P.L. 708A,B
[28] E. 335,336; P.L. 704C,D
[29] E. 390; P.L. 749C,D
[30] E. 306; P.L. 679B

of smell ...., of flavours by the sense of taste, and of all things which can be felt by the sense of touch; having perceived these phantasies, first formed with marvellous rapidity ..... it receives them ..., commends them to the memory, orders them ... and acknowledges or rejects them...[31]

Reality can be (re-)constructed in the human mind - though we do not understand why:

The species of sensible things as the quantities and qualities [!] which I reach by my corporeal senses are in a certain way created in me; for when I imprint the phantasies of them in my memories, and when I deal with them within myself by division and comparison and ... collect them into a kind of unity, I notice a certain knowledge of things that are external to me being built up within me. And .... when I seek earnestly after certain concepts ... of intelligibles which I contemplate with the mind alone, as for example, the concept of the liberal arts, I feel them born and becoming within me; but the relation between this knowledge and the things themselves which are its object I do not fully grasp.[32]

Human intellect, though invisible and immaterial, can be physically expressed as sounds and letters:

Our own intellect although in itself it is invisible and incomprehensible, yet becomes manifest and comprehensible, by certain [signs] when it is materialized in sounds and letters ... While it breaks into various figures comprehensible to the senses it never abandons the incomprehensible state of its nature.[33]

Man is closely related to higher animals, sharing all their features except reason, but he is also created in God's image. In man, all of nature is created:

Man is not inappropriately called the workshop of all creatures since in him the universal creature is contained. He has intellect like an angel, reason like a man, sense like an [irrational] animal, life like a plant, and subsists in body and soul: [there is no creature that he is without]. [For] outside these you (will) find no creature.[34]

The Earth was commanded to bring forth the land animals on the sixth day, the day of creation of Man also, because their nature appears to exhibit a closer resemblance to that of Man. For excepting reason and intellect there is nothing in the nature of the human animal which the naturalist may not also observe in these others.[35]

God willed to place man in the genus of the animals for this purpose: that He wished to create every creature in him... He wished to make him in His image and likeness .... so His image should transcend all created things in dignity and grace.[36]

[31] E. 367; P.L. 731C
[32] E. 409; P.L. 765C
[33] E. 250; P.L. 633B,C
[34] E. 369; P.L. 733B
[35] E. 389; P.L. 749A
[36] E. 408; P.L. 764B

In his higher nature which consists in reason and mind and interior sense ..., and with the memory of the eternal and divine things, man is altogether other than animal. For all these attributes he shares with the celestial essences, which... transcend in a manner beyond our comprehension everything which is contained in the animal nature.[37]

Among the wise it is maintained that in man is contained the universal creature. For, like the angel, he enjoys the use of Mind and Discursive Reason; and, like the animal, the use of physical sense and the capacity to administer his body.[38]

All men are essentially equal, becoming different only by contingent effects:

That form that is called "man" is no greater in the infinite multiplication ... than is that unique and first man who became the first to partake of it .... The dissimilarity of men from one another in feature, size, and quality of their several bodies, and the variety of custom and conduct [!] result not from human nature .... but from .... places and times, from generation ..., their habitats, the condition under which each is born... [39]

The human mind begets knowledge about itself:

The mind begets the knowledge of itself and from it proceeds the love of itself and of the knowledge of itself, by which itself and its knowledge of itself are united.... The mind seeks by the powers of reason nothing else but to learn in what way and how much it knows itself and loves itself and its knowledge of itself and when this whole is converted to the knowledge and love of its Creator (then) the most perfect image of Him is achieved.[40]

... but the highest form of knowledge is that essentially man can know only that he is, and not what he is:

To the human mind it is given to know one thing only [about itself], that it is - but as to what it is, no sort of notion is permitted ..... the Divine Likeness in the human mind is most clearly discerned when it is only known that it is, and not what it is.[41]

[37] E. 393; P.L. 752D
[38] E. 396; P.L. 755B
[39] E. 333, 334; P.L. 703A,B,C
[40] E. 222; P.L. 610C,D
[41] E. 417, 418; P.L. 771B,C

Al-Kindi and the beginnings of Islamic-Hellenistic philosophy

It is most remarkable that profound attempts to reconcile rational thoughts on the natural order with a monotheistic religion of revelation were being made independently and almost simultaneously in a rather distant place; in 9th century Baghdad. Cultural life in early Islam flourished under the rule of the Abbasides, in particular of Harun el Rashid and his successors in the Baghdad of the Stories of 1001 nights; and this included an ever increasing interest in intellectual matters, Indian mathematics, Persian arts, and, last not least, Greek philosophical ideas, mainly of Byzantine sources, often mediated by Nestorian Christians. Basra was an early centre of the relatively rational philosophic movement called the Mutazila. It were mainly physicians, not theologians who were engaged in an attempt to reconcile rational thought with religious revelation of the Koran. The great Kalif El Mamun endorsed and supported the Mutazila, though he took resort to rather intolerant methods. His successors reverted to more fundamentalistic lines of policy, but the influence of the Mutazila' rational lines of thought continued to exert their influence.

The first creative Arab-Islamic philosopher was al-Kindi (ca. 805-873) in Baghdad [42]. Whether he belonged to the Mutazila is a matter of dispute; his thoughts are related to this movement but he also took exception to some of its main stream notions. Al-Kindi admired the pagan Greek philosophers and insisted that philosophy, the knowledge of the reality of things according to human capacity, was developed and should go on being developed by continuous efforts from one generation to the next. It is Allah's will that we search for such knowledge as part of our search for truth that includes knowledge of the Divine.

> *We owe great thanks to those who have imparted to us even a small measure of truth, let alone those who have taught us more, since they have given us a share in the fruits of their reflection and simplified the complex questions bearing on the nature of reality. If they had not provided us with those premises that pave the way to truth, we would have been unable, despite our assiduous life-long investigations, to find those true primary principles .... which have taken generation upon generation to come to light.*[43]

Al-Kindi agreed with main lines of Aristotelian philosophy, with one important exception: In accordance with the Koran, he considered the universe as finite in time and space; but he did not merely claim authority of the Koran, but attempted to prove, by somewhat oversophisticated logical arguments, that anything real must be finite.

An essential aspect of rational, scientific explanations of nature is the validity of theoretical laws and principles governing the order of nature without reference to direct actions of God. It was, of course, accepted that the principles themselves, and, implicitly, their consequences result from God's will. Nevertheless, non-theological concepts of the natural order, such as Eriugena's primordial causes, almost synonymous to the Greek 'ideas', or al-Kindi's related notions on intermediate causes, were thin ice and viewed with suspicion by religious authorities. When al-Kindi introduced intermediate causes explicitly, he argued with great caution, emphasizing that, in any case, the ultimate reason of all events is

[42] An introduction to al-Kindi's philosophy is given by M. Fakhry (1983), pp. 66-94, with references for the ideas and statements of al-Kindi that I have discussed; also by El Ehwany (1983), pp. 421-433. All quotations are based on the edition by Abu Rida (1950-1953). Translations of al-Kindi's "First Philosophy" are quoted from Ivry (1974). I am most indebted to Josef van Ess, Tübingen, for the explanation and translation of particularly interesting passages of al-Kindi's text; two of them are quoted, as indicated in the footnotes.

[43] Abu Rida 102, translation by Fakhry, 1983

Allah's will; but he still insisted on the distinction between remote and more immediate causes, the latter being obviously more accessible to rational explanations.

> *If somebody shoots an arrow and kills a living being, the archer is the remote cause for the death of the animal, whereas the close cause is the arrow. The general remote cause for everything that exists is God who has created everything.*[44]

However, implicitly, al-Kindi, by endorsing much of Aristotelian philosophy of nature, explains the normal functioning of the real world according to rules set by God but not by God's continuous interventions; these rules are accessible to the human mind, in particular with respect to the elements and the cosmic order. The cosmic order is the result of original divine wisdom. Thus, God, according to al-Kindi, is the ultimate cause of creation, but there are intermediate and subordinate agents, so that 'Allah's universal disposition of things, through the decrees of His wisdom', is brought out[45].

Let us recall Eriugena's statements that the human mind can understand much about the spatiotemporal world but not much of itself; al-Kindi, too, insists that human cognition is limited, depending on more or less intuitive presuppositions, especially if the self-understanding of human beings is involved:

> *Not every intellectual pursuit is found through demonstration, since not everything has a demonstration ....; nor does a demonstration have a demonstration for this would be without end... That which does not end in knowledge of its principles is not knowable, and it would not be knowledge at all. Thus, if we desired to know what is man, he being that which is living, speaking and mortal, and we did not know what is "living", "speaking" and "mortal", then we would not know what is man.*[46]

The soul, according to al-Kindi, is itself immaterial, but is susceptible to conjunctions with matter (see Fakhry, 1983, 72,84). God's all-pervasive power and wisdom ordered the universe rationally and harmoniously, and He made man the epitome of the whole of creation :

> *Therefore, men of wisdom, the ancient philosophers who did not speak our language, called man "microcosm", because in man all forces are combined, that are found in the universe: generation, life and reason.*[47]

Inferences on the relation between authority and reason are not unambiguous in al-Kindi's writings, but even when he insists on the supremacy of prophetic revelation over normal human reason he adds that there are many important questions that have not been dealt with by the prophets. To answer them is the purpose of philosophy.

Similarities between the ideas of Eriugena and of al-Kindi are obvious. They almost certainly knew nothing about each other, but the circumstances and influences were similar in some aspects in the two distant places. Both Harun el Rashid and Charlemagne, and their respective successors, particularly el Mamun and Charles the Bald, developed cultural interests. Sources of Ancient Greek philosophy were available in both cultures, and neo-Platonic philosophy was an influence both on Eriugena and on al-Kindi. Not only

[44] Abu Rida 163, translation by J. van Ess, private communication
[45] quoted according to Fakhry 1983, p.79
[46] Abu Rida 111, 112; translation by Ivry, 1974
[47] Abu Rida, 260; translation by van Ess, private communication

Eriugena's, but also al-Kindi's interests were not restricted to general philosophy, but extended explicitly into the realm of science; thus, al-Kindi wrote on mathematics and optics. Of course, there were also striking differences in circumstances and thoughts. One of them I have already mentioned: in Baghdad and Basra the new emphasis on rational inquiry drawing on Hellenistic sources was largely the work of physicians, whereas in Christian Europe theologians took the leading part. Further, Eriugena was more clearcut in postulating the superiority of reason over authority, and more rational in that he did not, as al-Kindi did, consider celestial bodies as animate.

Among scholars influenced by al-Kindi, I would like to mention Isaac Israeli (850-950) [48]. He was a famous Jewish physician of Egyptian origin who worked some time for the Fatimides. It is not known whether he had personal contacts with disciples of al-Kindi, or just read his works. Isaac Israeli was said to have had a ready tongue, lived to an age of over a hundred, never married, and had no children. In our context it is remarkable that he took a strong interest in the functions of the brain. According to Isaac Israeli, mind is essential for life. While mind originates in the heart, it ascends to the brain and exerts, from there, its influence over the body. The frontal part of the brain is the site of integration of perception, fantasy and anticipation of possible future states and events.

In summary, it appears that the work and thought of al-Kindi contributed significantly to setting the stage for the subsequent flourishing of Islamic-Hellenistic philosophy, culminating in the works of Ibn Sina and Ibn Roshd, and these, in turn, later inspired the intellectual development in Christian Europe, particularly in the 13th and 14th century.

Comparisons and consequences: Eriugena, Cusanus, Galilei

Eriugena's idea that a rational understanding of nature in theoretical terms is within the scope of human cognition, and should be pursued, gained impetus in the late Middle Ages. Leading theologians regarded the *'Book of Nature'* as God's revelation implying that in this respect, reason is superior to authority, and the mind of man, created in the image of God, encompasses the natural order. Though accompanied by never-ending controversies between traditionalists and rationalists even up to the present, European science has since managed to evolve as the unruly offspring of Christian theology.

It is not easy to decide to what extent, explicitly or implicitly, Eriugena himself contributed to the initial turn of attitudes and to the early phases of this historical development. Parallel thoughts from independent sources and general influences of the Zeitgeist made their contributions, as did developments by way of inspiration partially rooted in Eriugena's thoughts. Direct influences of his writings are hard to trace. An assessment is difficult because his works were repeatedly condemned, even as late as 1225. This implies that they could not easily become widely available, but it also means that they must have been fairly well known at least in some circles, as otherwise condemnation would be pointless; and his ideas may well have been passed on anonymously and been the subject of considerable discussion[49]. It appears likely that one of the most remarkable intellectual figures around 1000, pope Sylvester II, Gerbert of Aurilliac, was influenced by Eriugena. Thierry of Chartres' (ca. 1100-1150) challenging idea that God created the elements and the laws of nature, after which the world, including life, developed by itself, is much in line with Eriugena's style of rational thought. Both of them considered the order of nature as accessible to the human mind and proposed daring abstract and rational interpretations of the Six Days of Creation; but whereas Eriugena emphasized that essentially everything was created at once in the primordial causes, Thierry introduced evolutionary processes

[48] see Altmann and Stern (1958)

[49] The direct and indirect influences of Eriugena's ideas in the late Middle Ages and the early Renaissance are discussed by Bett (1964), Sheldon-Williams (1987) and Beierwaltes (1994).

in time as a consequence of the creation of the elements and the laws of nature.

In any case, Nicholas of Cusa read Eriugena, including part or all of 'Peryphyseon'[50]. Many of Cusanus' ideas [51] are related to his predecessor's, but they were further developed in the creative and explorative spirit of the early Renaissance. The novel keynote in Cusanus' philosophy was creativity which was characteristic for the Renaissance in the arts, in politics, and, eventually, in science. According to Cusanus, the statement that man was created in the image of God means that human creativity resembles God's creativity. Just as God created the world in reality, man creates the natural order conceptionally in his mind. The will of God is for the two to correspond. We are encouraged to investigate nature rather than just contemplating it and relying on tradition. Quantitative experiments are essential. They will help in the making of better machines and in the understanding of chemical processes, such as combustion. In the philosophy of nature we are free to deviate from biblical tradition to the extent that an almost infinite universe, with a centre everywhere or nowhere and a moving earth, is conceivable. Man is created with free will.

In the spirit of the Renaissance, man is considered not only as the epitome of creation as a species; even more, his dignity is expressed in his individuality, making him unique and different from others: it is God's will that his individual features are a source of self-esteem and satisfaction, and thus allow him to admire others and to live with them in peace.

The most original part of Cusanus' philosophy refers to our cognitive capabilities. Although there are limits to human knowledge, these limits, and the reasons for them, can themselves be understood by the human mind. For instance, measurements are relative and never free of presuppositions. (This is reminiscent of the situation in modern physics with quantum indeterminacy setting limits on measurements that are themselves a law of nature; and of modern mathematics with stringently proven theorems on undecidability and the impossibility of consistency proofs). Perhaps Nicholas of Cusa's greatest contribution to philosophy is the way he interpreted the insights into the basic limitations of knowledge in a positive way: such "learned ingnorance" - knowledge of the limits of knowledge - is the highest form of knowledge, because it leads us to metatheoretical (and, for Cusanus, theological) intuitive ideas and visions on man, the natural order as a whole, and its causes.

In the early Renaissance, religious authorities took a relatively liberal attitude to philosophical thoughts, even Epikouros being tolerated for a while. Later, however, the upheavals of the reformation and counter-reformation in the 16th and 17th centuries led to a new rigidity and narrowmindedness, culminating in the Galileo trial; and it was this conflict that then initiated a slow process of separation of scientific from theological lines of thought. With the Enlightenment in the 18th century it was realized that religion was an option, not a must, reiterating that man is created with free will. Since then, agnostic and religious lines of thought co-exist.

Galileo's moving *'Letter to the Grand Duchess Christina'* [52] of 1615, exactly 1200 years after the assassination of Hypatia and about eight centuries after John Eriugena wrote the *'Division of Nature'*, is an early manifesto of the spirit of modern science. It is, in many ways, characteristic of the late Renaissance; and yet it also bears remarkable similarities to statements of Eriugena, who claimed the superiority of human reason over

[50] W. Beierwaltes (1987)

[51] A comprehensive introduction into the philosophy of Cusanus is given by K. Flasch (1998). The relation of Cusanus' ideas to Eriugena, and the recent evidence on Cusanus' direct knowledge of Eriugena's writings, are subjects of an article by Beierwaltes (1994), p. 266-312. In a book of the author of this article (Gierer 1991) the central sections (p. 123-184) deal with Cusanus' ideas as far as they are related to a rational understanding of nature and its limitations. My book contains references on the subject and some other matters dealt with in this article.

[52] For translation into English see Finocchiaro (1989)

authority. The following synopsis of a few quotations from Eriugena and Galileo will provide a demonstration of this point.

Galileo Galilei (1564-1642) "Letter to the Grand Duchess Christina" (1615) [53]	**John Eriugena (ca. 810-877) "The Division of Nature"** [54]
In disputes about natural phenomena one must begin not with the authority of scriptural passages but with sensory experience and necessary demonstration, for the Holy Scripture and nature derive equally from the Godhead. Experts of theology should not arrogate themselves the authority to issue decrees in the professions they neither exercise nor study.[Quoting Cardinal Baronio] "The Holy Spirit is to teach us how one goes to heaven and not how heaven goes."	Every authority which is not upheld by true reason is seen to be weak, whereas true reason is kept firm and immutable by her own powers and does not require to be confirmed by the assent of any authority.
The Holy Scripture can never lie, as long as its true meaning is grasped; but [...] this is [...] frequently very different from what appears to be the literal meaning of the words. After becoming certain of some physical conclusions, we should use these as very appropriate aids to the correct interpretation of scripture and to the investigation of the truths they must contain.	Reason itself insists that we should understand the relation which exists between the sacred text and reality.
I do not think [...] that the same God who has given us senses, language and intellect would want to set aside the use of these and give us by other means the information we can acquire with them. Who wants the human mind put to death? Who is going to claim that everything in the world which is observable and knowable has already been seen and discovered?	I would not say that the constitution of this world lies outside the understanding of the [specifically human] rational nature when it was for [that nature's sake] that it was created. Yet the divine authority not only does not prohibit the investigations of things visible and invisible but even encourages it [...] We ought not like irrational animals look only on the surface of visible things but also give a rational account of things which we perceive by corporal sense.

[53] according to Finocchiaro (1989)

[54] according to Sheldon-Williams (1987), E.110,390,356,357; P.L. 513B, 749D, 723B,C)

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