DEWESTERNIZING & ISLAMIZING THE SCIENCES:
OPERATIONALIZING THE NEO-GHAZALIAN, ATTASIAN VISION[1]

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PART I

1. Introduction: The *Dewesternization of Knowledge*

Professor Dr. Syed Muhammad Naquib al-Attas is the founder and first director of the International Institute of Islamic Thought and Civilization (ISTAC). He wrote many works on the foundational, intellectual challenges facing Muslims today, amongst the most famous and important of which is *Islam and Secularism*.[2] Here, we shall discuss Chapter V of that book on "The Dewesternization of Knowledge."[3] This particular chapter has struck a deep chord not only among thinking Muslims but also among many non-Muslim activists and thinkers involved in the worldwide post-development and counter-globalization movement.[4] According to Professor al-Attas, *knowledge is not neutral*. He says:

> It seems to me important to emphasize that knowledge is not neutral, and can indeed be infused with a nature and a content which masquerades as knowledge. Yet it is in fact, taken as a whole, not true knowledge, but its interpretation through the prism, as it were, the worldview, the intellectual vision and psychological perception of the civilization that now plays the key role in its formulation and dissemination. What is formulated and disseminated is knowledge infused with the character and personality of that civilization—knowledge presented and conveyed as knowledge in that guise so subtly fused together with the real so that others take it unawares *in toto* to be real knowledge *per se*.[5]

What he means is that practically all the natural and social sciences that we all study now in the modern academia are mostly the direct or indirect results of research of authors belonging to Western civilization which have its own worldview, belief systems and cultural values, which may or may not be in harmony with our own Islamic worldview, belief systems and cultural values, or with traditional values in general with their focus on the Transcendent rather than the purely, this-worldly human. Western knowledge and sciences are based on certain basic, underlying assumptions about God (or ultimate reality), man and nature, and the meaning and purpose of human life. These basic assumptions influence the way western scientists and intellectuals conceive of the meaning, scope and purpose of their research, the way they undertake their research and the way they interpret and understand the results of their findings and discovery, which they then write down in their books and journals and present to us, gullible Muslims for the most part, as knowledge. In fact, their basic assumptions determine what they count *or* do not count as data, facts, information, evidence, science and knowledge. In the end, what they present to us as knowledge *in their view* may not in fact be true knowledge *in our view* (assuming we are self-conscious of our view), but rather pseudo knowledge masquerading as true. Therefore Muslims who care deeply about their Islamic worldview cannot accept Western claims of knowledge or western *truth-claims* at face value; they will have first to subject these western claims to careful, critical and informed examination and scrutiny *(tabayyun).* In short,

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[1] Paper presented at the One-Day Colloquium on Islam & Secularism organized by HAKIM and Curiosity Institute in Kelana Jaya, Selangor on July 24 2010 (see www.wia.my).
[2] (Kuala Lumpur: ISTAC, 1993).
[3] Ibid., 133ff.
[4] Syed Muhammad Naquib al-Attas, *The De-Westernization of Knowledge* (Penang: Citizens International), with an Introduction by Claude Alvares. On post-development thinking, see Wolfgang Sachs, ed., *The Development Dictionary: A Guide to Knowledge as Power* (London: Zed Books, 1999).
[5] *Islam & Secularism*,

what is knowledge to them may not be knowledge to us, what is true and valid for them may not be so for us, and what is beneficial for them in their sociocultural context may not be beneficial to us in our sociocultural context. Therefore Muslims, both students and lecturers, have to be very critical when they study and teach Western textbooks on the natural and social sciences, including textbooks on mathematics, especially applied mathematics.[6]

The fact that a particular, ascending hegemonic system of knowledge is value-laden in itself may not be too much of a problem if that system is laden with values that at their metaphysical core can find a common ground or points of convergence with other, traditional systems of knowing and doing that are now on the decline due to the influence of the hegemonic one---points of convergence that might perhaps be generative of a shared vision toward a true multicultural, peaceful coexistence over the medium and long term. But if it turns out that the hegemonic system is one that threatens and even destroys both the natural and cultural diversity of the world,[7] leading to a "flat world"[8] or to a "monoculture of the mind"[9] or to an endless "wasteland"[10] or to a "silent spring,"[11] "global warming" or "climate change," then it is imperative on all thinking people of conscience to do a thorough deconstruction of that hegemonic system of knowledge so as to expose its true face to the world. Professor al-Attas is quite explicit and forceful in claiming that the Western system of knowledge is in fact such a destructive hegemonic system of knowledge, when he says, for instance, that this system of knowledge or rather system of "what masquerades as knowledge" is one "which has, for the first time in history, brought chaos to the three Kingdoms of nature, animal, vegetal and mineral," which means of course, to the biosphere as a whole. Hence the imperative of "dewesternization" and "Islamization" for Muslims, or what can be more or less correspondingly called "decolonizing methodologies," by the prominent Maori thinker and academic Linda Tuhiwai Smith for recovering the traditional knowledge systems of the Maoris.[12] If al-Attas's critique of the intellectual systems of the West comes across as rather blunt and uncompromising then it is not much more so than the critiques of others, Muslims and non-Muslims alike from both the Orient and the Occident, for instance in the works of Claude Alvares (India)[13] and Serge Latouche (France).[14] For those not familiar with the Attasian critique, which is at once Islamic and cross-culturally humanitarian, it is worthwhile to have the gist of it presented here in his own words:

> I venture to maintain that the greatest challenge that has surreptitiously arisen in our age is the challenge of knowledge, indeed, not as against ignorance; but knowledge as conceived and disseminated throughout the world by Western civilization; knowledge whose nature has become problematic because it has lost its true purpose due to being unjustly conceived, and has thus brought about chaos in man's life instead of, and rather than, peace and justice; knowledge which pretends to be real but which is productive of confusion and scepticism, which has elevated doubt and conjecture to the 'scientific' rank in methodology and which regards doubt as an eminently valid epistemological tool in the pursuit of truth: knowledge which has, for the first time in history, brought chaos to the Three kingdoms of Nature: the animal, vegetal and mineral. It seems to me important to emphasize that knowledge is not neutral, and can indeed he infused with a nature and content which masqueradcs as knowledge. Yet it is in fact, taken as a whole, not true knowledge, but its interpretation through the prism, as it were, the worldiew, the intellectual 'vision' and pschological perception of the civilization that now plays the key role in its

[6] Adi Setia, "Some Upstream Research Programs for Muslim Mathematicians: Operationalizing Islamic Values in the Sciences through Mathematical Creativity," in *Islam & Science* (Winter, 2008).
[7] Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge: Cambridge University Press, 1988), especially pp. 339ff.
[8] Thomas L. Friedman, *The World is Flat: A Brief History of the Twenty-First Century* (Farrar, Straus, Giroux, 2007). For the counter-thesis, see Nancy Birdsall, *The World is Not Flat: Inequality and Injustice in our Global Economy* (Helsinki: UNU-Wider, 2006).
[9] Vandana Shiva, *Monocultures of the Mind: Biodiversity, Biotechnology and the Thrid World* (Penang: Third World Network, 1995).
[10] Theodore Roszak, *Where the Wasteland Ends*: *Politics and Transcendence in Postindustrial Society* (Berkeley: Celestial Arts, 1989).
[11] Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 2002).
[12] Linda Tuhiwai Smith, *Decolonizing Methodologies: Research and Indigenous Peoples* (London: Zed Books, 2001).
[13] Claude Alvares, *Science, Development and Violence: The Revolt Against Modernity* (Delhi: Oxford University Press, 1992).
[14] Serge Latouche, *The Westernization of the World: The Significance, Scope and Limits of the Drive towards Global Uniformity*, trans. Rosemary Morris (London: Polity Press, 1996).

> formulation and dissemination. What is formulated and disseminated is knowledge infused with the character and personality of that civilization — knowledge as presented and conveyed as knowledge in that guise so subtly fused together with the real so that others take it unawares *in toto* to be the real knowledge per se.[15]

In the next section I just want to discuss briefly his approach to dewesternizing and Islamizing knowledge, followed by further sections on some brief examples and a research program for operationalizing the project of the Islamization of the sciences, both "human" and "natural," though in the final analysis, all sciences are human and reflective of human ethical and cognitive values and hence all sciences are value-laden without exception even mathematics and logic, or rather *logics.*

2. Knowledge & The Worldview of Islam

One useful definition of knowledge (*'ilm*) is the intelligent ordering of our experience of, and interaction with, the world.[16] Such a definition obviously emphasizes man, specifically his mind, as the active locus of knowledge. Through the creative exercise of his intelligence, man orders the infinitely numerous particular facts of his world-experience into a coherent, meaningful whole constituting his knowledge. So the mind of man is not at all comparable to a computer diskette which merely passively records just-so-many billions of information-bytes. From this perspective, knowledge is less concerned with any particular "external" object than with integrating both the subject and the object into a single dynamically harmonious unity. In other words, knowledge in Islam is also about the self-knowing of the knower of his or her ownself---that the one who knows must also know himself for his knowledge to be valid, meaningful and beneficial.

For any sincere and reflective Muslim, especially one who lives in the modern westernized, secularised, 'globalized' age of systemic mass consumerism, the notion of Islamization (i.e., making something or even one's self conform to Islam) takes up a large space in his or her intellectual consciousness. But without coming to a proper vision of the relationship between Islamization, knowledge and education, and how they all relate to the individual man and to society at large, and the contrast of Islamization with Westernization or secularization, all efforts at "making things conform to Islam" can only be reactive and hence confused, futile and self-destructive.

This concern for authentic 'Islamization' has for many years engaged the attention of the founder and first director of the International Institute of Islamic Thought and Civilisation (ISTAC), Professor Syed Muhammad Naquib al-Attas. He has undertaken an intellectual and practical mission of Islamization that has more to do with a certain "reordering" of Muslim thinking, by which things, both physical and non-physical, are put into their proper relationship with one another, and thus "made to conform to Islam." This proper and correct interrelation among things (referred to as *adab*) is of fundamental importance in Professor al-Attas's educational philosophy and practice. *Adab* does not only refer to socio-professional ethics and good manners, but, more importantly, to right knowledge and its expression in proper action *('ilm* and *'amal*). Accordingly, the true purpose of education in Islam is: "to produce men and women of right and proper *adab* towards their own selves, towards God, the Holy Prophets, leaders and parents; and towards Ianguage, the natural environment, and the various products of human imagination and skills."[17] This process of gradually instilling *adab* into our consciousness and conduct is called *ta'dib.* For Professor al-Attas, the concept of *ta'dib* projects the true meaning and method of education in Islam since its meaning at once encompasses the rational, the moral and the social dimensions of human life. In short, *ta'dib,* as both a concept and method of authentic education, brings to fruition the good that is latent in every man.

Without this "reordering in thinking," the Muslim man and woman in the modern age can never be truly "free." He or she shall always be subject to the intellectual and cultural hegemony of alien, largely secular ideological systems---a slavish imitator of the "western success" that is in reality not his or her own, since he or she did not define it, but was only seduced and beguiled by it. So Professor al-Attas's educational

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[15] *Islam & Secularism,* 133ff.

[16] Following al-Jurjani, al-Attas defines knowledge (*'ilm*) as constituted of a complementary dual passive and active cognitive process, namely as "the arrival of meaning to the soul, and the arrival of the soul at meaning." See his *The Concept of Education in Islam: A Framework for an Islamic Philosophy of Education* (Kuala Lumpur: ISTAC, 1991). For a detailed treatment of his conception of knowledge in the context of his educational philosophy and practice, see Wan Mohd Nor Wan Daud, *The Educational Philosophy and Practice of Syed Muhammad Naquib al-Attas* (Kuala Lumpur: ISTAC, 1998).

[17] My thanks to Professor Wan Mohd Nor Wan Daud for this formulation.

philosophy and practice have also to do with the true meaning of freedom, namely, *the capacity for making the right choices*---for making the choice for the *better (ikhtiyar* = to search out what is good, better or best amongs *known* options and alternatives). This choice obviously implies conscious knowledge that differentiates between what is good and what is evil, what is correct and what is wrong, and what is proper and what is improper. Without this knowledge that is to be imparted through the process of *ta'dib* the notion of freedom (*huriyyah*) can only be an empty slogan. This capacity for making the choice for the better empowers Muslims to, firstly, appreciate their rich intellectual, cultural and moral heritage, and, secondly, to benefit consciously and creatively from other, non-Muslim cultures and civilizations, and co-exist with them in a way that is in harmony with their religious and cultural identity, with their belief in their origin and in their ultimate destiny, and with their vision of the permanent reality underlying the ephemeral nature of worldly existence. [18]

The most fundamental conceptual starting-point of Professor al-Attas's educational philosophy which defines its goals and guides its practice, is the Islamic vision of the unchanging truth and reality underlying the temporal life of this world. This vision or Worldview of Islam is a fixed, unchanging, final and absolute vision because it is grounded in and derived from Revelation. This not merely a theoretical claim, for Muslim historical experience has shown that the fundamental elements of this worldview, such as the conception of God, of the nature of man and the psychology of the human soul, and the meaning of knowledge, of happiness, of virtues and vices, and of prophethood, have not changed throughout the long ages of the Islamic epoch. Obviously, the Worldview of Islam is not merely a view of this visible, material and sensual world as detached from the other unseen, metaphysical and spiritual world. But rather, it is a view of existence as a whole that encompasses the temporal and the eternal, the seen and the unseen worlds. It is important for Muslims to be self- conscious of their worldview in order for them to be able to structure creatively their knowledge-system with respect to their identity, and also with respect to non-Islamic cultures and civilizations they come into contact with, or which impact on them, in today's world.

It is quite true that all of the major elements of the Worldview of Islam are already taught in the subject of Islamic *'Aqidah* (Islamic creed) which they have already learnt at secondary schools or at the Islamic religious schools and madrasahs. So in one sense the Worldview of Islam is a repetition of Islamic *'Aqidah*, but in another sense it is not, and hence it is something similar yet new and different. Most lessons in Islamic 'Aqidah are imparted to students in a more or less dogmatic fashion without requiring much thinking or reflection on their part, and wihtout requiring them to critically relate the *Aqidah* to their respective academic disciplines and to modern intellectual and social challenges. However, in the way al-Attas elaborates on the Worldview of Islam, Muslims are encouraged to acquire a deeper and more reflective understanding of the 'Aqidah. A deeper and more reflective understanding means that the approach will be more rational, philosophical and critical, requiring the practice of conceptual analysis and semantic mapping as well as discussion, debate and argumentation to get to the meanings of things behind the superficial terms, names and labels. It also reqires them to know a lot more about their own history and civilization as well as the history and civilization of the West, in particular, and the East, in general. Like Islamic 'Aqidah, the Worldview of Islam will still be about the *Arkan al-Iman* = the Pillars of Faith, but this time the focus will be on working out in some detail their implications for the way we lead our lives as Muslims, the way we conceive of and practice our respective academic disciplines and the way we response to intellectual and social challenges arising from the secular, Western worldview of modernity, and the way we can bring our Tradition to bear constructively on the secular systems of thinking and doing we find ourselves in in today's world. Thus the Worldview of Islam is, for Muslims today, what can be called the *Kalam* of the Age (*Kalam al-'Asr*), or the Dialectics of the Age.[19]

In general we can say that most of the Western perceptions of the meaning of worldview rely and focus more on the experience of physical, sensible existence and on the material aspects life. They do not give much consideration to issues related to the unseen world and the hereafter, or to Transcendence. In other words, considerations of the possibilty of life after death and hence ultimate reality or transcendence do not loom large in western secular thinking and discourse on the meaning of 'worldview'. Hence by 'worldview'

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[18] For some significant initiatives in this regard pass and present see for instance, *Islam in Tibet & The Ilustrative Narrative, Tibetan Caravans*, with a foreword by His Holiness The Dalai Lama, trans., Jane Casewit, ed. Gray Henry (Louisville, Kentucky: Fons Vitae, 1997); Reza Shah Kazemi, *Common Ground Between Islam & Buddhism,* with an essay by Shaykh Hamza Yusuf (Louisville, Kentucky: Fons Vitae, 2010). See also the global A Common Word initiative at www.acommon.word.com.

[19] Adi Setia, *The Form & Function of Dialectical Theology: The Perpetual Relevance of al-Ghazali & Fakhr al-Din al-Razi* (Dubai: Kalam Research & Media, 2010), forthcoming.

they usually mean a set of foundational, speculative assumptions as a general guide to life in this world as the only world. Thus the Western conceptions of worldview rests upon a very narrow and arbitrary ontology. This set of basics assumptions constituting a worldview may undergo historical changes since they consider a worldview to be a product of transient human culture and experience, and not at all informed by any mandate from Heaven. According to them, even religion itself is produced by peoples and their cultures, and not something that is essentially *revealed* by a higher, transcendent authority and reality to whom all humanity owes their allegiance.

In contrast, a worldview in the perspective of Islam is considered to be a system of truths derived from revelation. Hence Muslims believe that the Worldview of Islam is not a cultural product of Arabs, Indians, or Malays, but rather it is rooted in, and derived from, the revealed word of God without corruption and change through time, place or generations. Although this revealed worldview is understood in thought and practice by Muslims in their diverse historical and cultural contexts, backgrounds and experiences, yet it is still the same common universal worldview of all Muslims, east and west. For Muslims, a 'worldview' is not merely a view of this temporal world, but it is more so a view of the next eternal world, in relation to which this world is but a very transient way station. Professor Dr. Syed Muhammad Naquib al-Attas has given a very good, precise and accurate definition of the term 'Worldview of Islam' (Malay, *pandangan alam Islam/pandangan hidup Islam*; Arabic, *ru'yat al-Islam li'l-wujud*) in his book *Prolegomena to the Metaphysics of Islam*. His definition of the Worldview of Islam is slightly paraphrased below:

> The worldview of Islam is the vision of reality and truth that reveals to the Muslim mind what existence is all about. It is a metaphysical survey of the visible as well as the invisible worlds, including the perspective of life as a whole. In this holistic perspective of life, the *dunya*-aspect of life is thoroughly integrated into the *akhirah*-aspect of life, and in which the *akhirah*-aspect of life has ultimate and final significance.[20]

The worldview of Islam is grounded in the fundamental teachings of the Qur'anic revelation and the Sunnah of the Messenger, peace and blessings of God be on him. In this worldview the relation between man, nature and God is made clear, and the meaning and purpose of this temporary earthly life is explained. All human practical and rational knowledge with respect to himself, to nature and to God is judged to be either true (*haqq*) or false (*batil*) by reference to the worldview of Islam as defined above. For example, when coming to an understanding of what Islamic Science really means, Muslim scientists will first have to understand the relation between man the scientist/knowing subject, the physical world/nature/object of study in science, and God/Creator of man and nature. Therefore the three basic elements in the worldview of Islam which are of direct relevance to Islamic Science is the Islamic view of man, of nature and of God or the Ultimate Reality, the Transcendent Source of all creation. Al-Attas also elaborates on the meaning of the 'Worldview of Islam' in the following words:

> • The worldview of Islam is "a metaphysical survey of the visible as well as the invisible worlds including the perspective of life as a whole."
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> • "The worldview of Islam encompasses both *al-dunya* and *al-akhirah*, in which, the *dunya*-aspect must be inextricably linked to the *akhirah*-aspect, and in which the *akhirah*-aspect has ultimate and final significance."
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> • The worldview of Islam is "the *vision of reality and truth* that appears before our mind's eyes revealing what existence is all about; for it is the world of existence in its totality that Islam is projecting. Thus by 'worldview' we mean *ru'yat al-Islam li al-wujud.*"
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> • "The worldview of Islam is characterized by an authenticity and a finality that points to what is ultimate, and it projects a view of reality and truth

[20] (Kuala Lumpur: ISTAC, 2001), 1—5.

> that encompasses existence and life altogether in total perspective whose fundamental elements are permanently established."

In the *Prolegomena*, Professor al-Attas highlights and elaborates on some of the "most salient" fundamental elements of the Worldview of Islam, namely:

- the nature of God (ontology/theology)
- the nature of Revelation (theology)
- the nature of His Creation (cosmology)
- the nature of man and the psychology of human soul (psychology/anthropology)
- the nature of knowledge (epistemology)
- the nature of religion (theology/ethics/morality)
- the nature of freedom (ethics/morality)
- the nature of values and virtues (axiology)
- the nature of happiness (ethics/morality/eschatology)

3. Dewesternization & Islamization

In essence, the process of Islamization is the revivification of the Worldview of Islam within the hearts and intellects of Muslims, and the cognitive and practical ordering of their physical and spiritual experience of existence in accordance with it. In *Islam and Secularism*, Professor al-Attas defines Islamization as follows:

> Islamization is the liberation of man first from magical, mythological, animistic, national—cultural tradition opposed to Islam, and then from secular control over his reason and his language. The man of Islam is he whose reason and language are no longer controlled by magic, mythology, aninmism, his own national and cultural traditions opposed to Islam, and secularism. He is liberated from both the magical and the secular world views. We have defined the nature of Islamization as a liberating process. It is liberating because since man is both physical being and spirit, the liberation refers to his spirit, for man as such is the real man to whom all conscious and significant actions ultimately refer. The liberation of his spirit or soul bears direct influence upon his physical being or body in that it brings about peace and harmony within himself in his manifestation as a human being, and also between him as such and nature. He has, in liberation in this sense, set his course towards attainment to his original state, which is in harmony with the state of all being and existence (*i.e. fitrah*). It is also liberation from subservience to his physical demands which incline toward the secular and injustice to his true self or soul, for man as physical being inclines towards forgetfulness of his true nature, becoming ignorant of his true purpose and unjust to it. Islamization is a process not so much of *evolution* as that of *devolulion* to original nature; man as spirit is already perfect, but man as such when actualized as physical being is subject to forgetfulness and ignorance and injustice to himself and hence is not necessarily perfect. His 'evolution' towards perfection is his progress towards realization of his original nature as spirit. Thus in the individual, personal, existential sense Islamization refers to

> what is described above in which the Holy Prophet represents the highest and most perfect Example; in the collective, social and historical sense Islamization refers to the Community's striving towards realization of the moral and ethical quality of social perfection achieved during the age of the Holy Prophet (may God bless and give him Peace!) who created it under Divine Guidance.[21]

Al-Attas's conception of Islamization has been recognized by many thinking Muslims of note[22] to be by far the most articulate, authentic, coherent and comprehensive one. Clearly, Islamization is fundamentally an educational program of the most profound order, requiring the long-term combined efforts of authoritative, farsighted and committed scholars and teachers who share a common vision of its goals and methods. The mission of Islamization obviously has its social, political and legal implications, but these are to be realised over the long term by many conscientious individuals thoroughly imbued with *adab* in their thinking and acting, and in their private and public conduct. For the crisis of Muslims today is basically the intellectual and spiritual crisis of identity due to their loss of true knowledge and of true *adab*. Therefore the way forward out of the crisis for Muslims is self-knowledge, self-understanding, self-definition and self-reformation, spiritually, intellectually and socially, both at the level of the individual and at the level of the communal.[23]

In the present context of freeing oneself from the intellectual hegemony of the West, *Islamization entails dewesternization.* As a matter of fact Professor al-Attas is saying to the effect that dewesternization is a condition of Islamization:

> In appraising the situation with regard to the formulation and dissemination of knowledge in the Muslim world, we must see that the infiltration of key concepts from the Western world has brought confusion which will ultimately cause grave consequences if left unchecked. Since what is formulated and disseminated in and through universities and other institutions of learning from the lower to the higher levels is in fact knowledge infused with the character and personality of Western culture and civilization and moulded in the crucible of Western culture..., our task will be first to isolate the elements including the key concepts which make up that culture and civilization....These elements and key concepts are mainly prevalent in that branch of knowledge pertaining to the human sciences, although it must be noted that even in the natural, physical and applied sciences, particularly where they deal with interpretations of facts and formulation of theories, the same process of isolation of tile elements and key concepts should be applied; for the interpretations and formulations indeed belong to the sphere of the human sciences. The 'islamizanon' of present—day knowledge means precisely that, after the isolation process referrred to, the knowledge free of the elements and key concepts isolated are then infused with the Islamic elements and key concepts which, in view of their fundamental nature as defining the *fitrah*, in fact imbue the knowledge with the quality of its natural function and purpose and thus makes it true knowledge. It will not do to accept present—knowledge as it is, and then hope to 'Islamize' it merely by 'grafting' or 'transplanting' into it Islamic sciences and principles; this method will but produce conflicting results not altogether beneficial nor desirable. Neither 'grafting' nor 'transplant' can produce the desired result when the'body' is already possessed by foreign elements consumed in the

[21] *Islam & Secularism*, 44—45.
[22] For instance, Ali A. Allawi, *The Crisis of Islamic Civilization* (New Haven, CT: Yale University Press, 2009). See also, Wan Mohd Nor Wan Daud & Muhammad Zainiy Uthman, *Knowledge, Language, Thought and the Civilization of Islam: Essays in Honor of Syed Muhammad Naquib al-Attas* (Skudai, Johore: UTM Press, 2010).
[23] For more on this in terms of an operational framework, see the excellent paper by Umar Faruq Abd-Allah, "Living Islam with Purpose," at http://www.nawawi.org/downloads/article6.pdf.

> disease. The foreign elements and disease will have first to be drawn out and neutralized before the body of knowledge can remoulded in the crucible of Islam. [24]

Elsewhere in the book he specifies some of the foundational Islamic elements and key-concepts that have to be infused into a particular discipline after it has been first dewesternized and desecularized, namely:

1. The concept of religion (*din*);
2. The concept of man (*insan*);
3. The concept of knowledge (*'ilm* and *ma'rifah*)
4. The concept of wisdom (hikmah);
5. The concept of justice (*'adl*);
6. The concept of right action *'amal* as *adab*);
7. The concept of the university (*kulliyah-jami 'ah*);

4. Some Brief Case Studies on Why *Knowledge is not Neutral*

(a) Case study I: Economics: In mainstream western economics textbooks, the field of economics is usually defined, more or less, as:

> the social science which examines how people choose to use limited or scarce resources in attempting to satisfy their unlimited wants.[25]

Islamic critique: From the Islamic point of view, the blessings or *ni'mah* of Allah in the world is unlimited, as stated in the Qur'an: *wa in ta'uddu ni'matuLlahi la tuhsuha* (*if you count the blessings of Allah, you shall not be able to exaust them*). But nevertheless, man must learn how to limit his bodily and material wants and desires by practicing the moral and spiritual ethics of contentment (*qana'ah*), detachment (*zuhd*) and gratitude (*shukr*). If worldly wealth and possessions are acquired for the pleasure of Allah, then they will be more than enough, but if these are acquired to satisfy one's greed and self-interest, then nothing will be enough for the subjective, selfish ego. In short, the secular definition of economics is in clear contradiction of its original etymological meaning as "household management" for the common good, as well as loaded with both cosmological and psychological assumptions that are untenable from the viewpoint of the worldview of Islam. The worldview of Islam as applied to the economic context would redefine economics as:

> *the provisioning and sharing, by mutual giving and receiving, of natural and cultural abundance for realising material and spiritual well-being for the common good*[26]

(b) Biology:

The theory of evolution is fundamental to modern biology. The theory of evolution says that:

> the Earth's species have changed and diversified through time under the influence of natural selection. Life on Earth is thought to have evolved in three stages. First came chemical evolution, in which organic molecules were formed. This was followed by the development of single cells capable of reproducing themselves. This stage led to the development of complex organisms capable of sexual reproduction. Evolution is generally accepted as fact by

[24] Islam and Secularism,
[25] http://ingrimayne.com/econ/Introduction/Defintns.html
[26] Adi Setia, "Waqf, Mu'amalah & the Revival of the Islamic Gift Economy," forthcoming, with more detailed elaboration in critical, constructive engagement with modern neo-liberal economic thought.

> scientists today, although debates continue over the precise mechanisms involved in the process.[27]

Islamic critique: This theory obviously goes against our belief as Muslims that all life on earth was created by a transcendent Creator of knowledge and wisdom.[28] Harun Yahya in his book *The Evolution Deceit* has given a detailed scientific refutation of the theory of evolution. Many scientists, Muslims and non Muslims alike, who believe in the existence of a Creator who created all life, have developed the alternative theory of *intelligent design* (called also *the creation hypothesis*)[29] to explain the origin and development of life. Hence there is a need for Muslim biologists to write new textbooks of *creationary* biology at the primary, secondary and tertiary levels of education based on the theory of intelligent design rather than on the theory of evolution. More importantly they need to develop a counter-theory of life's origins and development that is, on the one hand, in accord with Islamic metaphysics, and is, on the other hand, *empirically responsible*, i.e., capable of systemically addressing the same set of facts and evidence ostensibly addressed by the mainstream neodarwinian sysnthesis.

(c) Medicine:

Vivisection (the very term means "to cut alive" in Latin) is the way modern, business-driven medicine practically tortures live animals to test drugs in order to rid humanity of their ever lengthening list of old and new diseases. As a method of medical research it is relatively new (a hundred or so years old) and peculiar to modern Western medical culture.

Islamic critique: Quite apart from the extrinsic question of ethics in respect thereof, there is also a more fundamental intrinsic question, namely the question of the scientific integrity (or *cognitive value*) of the underlying, largely unexamined assumption of a significant degree of biological and physiological similarity between laboratory test animals and human beings justifying extrapolations of clinical results from one to the other. The Islamic Medical Research Program (IMRP) for Muslim medical researchers in this regard will be to find systemic alternatives of unquestioned scientific and ethical integrity to vivisection, including valid alternatives critically sourced from presently marginalized Western and eastern medical traditions which could be incorporated into the IMRP (Islamic Medicine Research Program). Some of these alternatives can also be gleaned by undertaking evidence-based medical research into the well documented but largely neglected vast corpus of the very successful one thousand years' old Islamic cosmopolitan medical tradition, as exemplified in the medical books of Ibn Sina and al-Zahrawi. As a matter of fact, the great Muslim physician, Ibn Sina, is against vivisection.[30] He says that medicinal drugs for tackling human diseases must be tested on humans not animals.

(d) Agriculture:

Modern agriculture which we have learnt uncritically from the West, is overly chemical intensive with widespread use of toxic pesticides, herbicides, synthetic nitrogen fertilizers and so on, which poison the earth, kill rural wildlife, even toxicify the harvests and disrupt the health of farmers and agricultural workers.

Islamic critique: Traditional farming methods have been perfectly adapted to local socio-natural conditions generating a symbiotic, holistic balance (*mizan, tawazun*) between the needs of humanity and the rights of nature to remain wild and biodiversified. As the word implies, agriculture is a *culture*, meaning to *cultivate life.* It is a whole *way of life* of mutual respect, communal give and take, and cooperative rather than competitive living. There are also agro-innovations of course, but innovations within ecological limits, as the case of Andalusian agricultural science and practice *('ilm al-filahah*) show. It is not a mere business, as the modern corruption of the original word into "agribusiness" would have it, which imposes the corporate

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[27] http://dictionary.reference.com/browse/evolution

[28] Adi Setia, "*Taskhir*, Fine-Tuning, Intelligent Design & the Scientific Appreciation of Nature," in *Islam & Science* (Summer, 2004).

[29] J. P. Moreland, ed., *The Creation Hypothesis: Scientific Evidence for an Intelligent Designer* (Downer's Grove, Illinois: InterVarsity Press, 1994).

[30] For the modern case against vivisection see Pietro Croce, *Vivisection or Science: An Investigation into testing Drugs and Safeguarding Health* (London: Zed Books, 1999).

tyranny of impersonal profit-maximization on once self-respectful, independent farmers and indigenous peoples, reducing them into wage- and debt-slaves, squatters on the very lands they once have had customary rights to but now "legally" wrested from them by faceless, soulless corporations. It is strange that agricultural food production, which once unquestionably served to *cultivate* the welfare of humankind and wildlife, should now, in the hands of big agrochemical companies like Monsanto, be seen to be working toward destroying the very ecological basis of that welfare. In order to return agricultural practice onto the ethical path of mercy (*rahmah*) toward humanity and nature, an authentic *Islamic Agricultural Research Program* (IARP) would be one that eschews harmful chemicals and pesticides altogether and instead looks into the various effective, eco-friendly and economically viable organic agricultural methods now available such as *permaculture*, and develop new ones by, for instance, drawing on the thousand year accumulated experience of a very successful Islamic agricultural tradition, the original, truly 'green' revolution in the history of agriculture.[31]

From the above brief examples, we can see that Muslims cannot accept western secular knowledge, sciences and disciplines at face value. Western sciences may or may not be knowledge depending on whether it is in harmony or not with the worldview of Islam and with our common *fitri* sense in regard to what is real and what is false, what is desirable and what is not, what is harmful and what is beneficial, what is relevant and what is not relevant, and whether these sciences are in line with our vision of the intermediate and ultimate purpose of our temporal life on earth.[32]

5. What is Islamic Science?

The concept of *Islamic Science* has been and is being discussed by many Muslim thinkers and academicians because they have realized that the study of the natural sciences by Muslims have to be undertaken in a way that is in accord with the worldview of Islam, i.e., undertaken within a *meta-scientific* framework of basic assumptions about man, nature and ultimate reality that are in line with the teachings of the Qur'an and Sunnah. Since science is *not* value-free, Muslim scientists obviously cannot go on uncritically doing a science (i.e., modern science) which grew out of the cultural context of the West and imbued with their assumptions about the world, man and ultimate reality, and which is *geared to their purpose*.

Western philosophers of science themselves, such as Paul Feyerabend and Thomas Kuhn, have shown that western, modern science is imbued with the cultural values of the West, and so that means that (1) modern science is not value-free, (2) it is not of universal relevance, and that (3) other cultures could have their respective distinctive ways of doing science according to their respective *value-systems*, and that they should be allowed to do so. For Muslims, this means that we could and should revive and rearticulate the philosophy and practice of Islamic Science as a science that is thoroughly imbued with Islamic cognitive and ethical values and directed to serving Islam, Muslims and the general well-being of humanity.

Professor Dr. Osman Bakar in his book *Tawhid and Science* has given a useful definition of Islamic science (there are also other useful definitions by other prominent Muslim thinkers but this one will do for now!) which can be re-expressed as follows:

> *Islamic science* is the science that is organically related to the fundamental principles of the Islamic worldview, including the principle of *tawhid*, and which encompasses the totality of the mathematical and natural sciences cultivated by Muslims and non-Muslims in Islamic culture and civilization.

The most important point in the above definition is the fact that in order for a science to be called *Islamic* (e.g., Islamic medicine, Islamic psychology, etc.) the principles and practice of that science must be *derived from* or

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[31] For the original, Islamic green revolution, see Andrew Watson, *Agricultural Innovation in the Early Islamic World: The Diffusion of Crops and Farming Techniques, 700—1100* (Cambridge: Cambridge University Press,). For an expose of the pseudo green revolution, see Vandana Shiva, *The Violence of the Green Revolution: Third World Agriculture, Ecology and Politics* (Penang: Third World Network, 1997).

[32] For more elaboration, see Adi Setia, "Al-Attas's Philosophy of Science: An Extended Outline," in *Islam & Science* (December 2003); idem, "*Taskhir*, Fine-Tuning, Intelligent Design and the Scientific Appreciation of Nature," in *Islam & Science* (Summer 2004); idem, "Islamic Science as a Scientific Research Program: Conceptual and Pragmatic Considerations," in *Islam & Science* (summer 2005); idem, "Three Meanings of Islamic Science: Toward Operationalizing Islamization of Science," in *Islam & Science* (Summer 2007); idem, "The Inner Dimension of Going Green: Articulating an Islamic Deep-Ecology," in *Islam & Science* (Winter 2007).

in accord with the framework of the worldview of Islam. The worldview of Islam means the Islamic view of man, nature/creation, and God, and the interrelation between all three (we shall say more about this later).

It ought to be remembered that Islamic science has a long and illustrious history. But it declined and is now large absent from the world stage mainly due to the long negative after-effects of European colonialism. The efforts toward reviving Islamic Science is to offer a viable alternative to Western science, because the latter is based on basic assumptions and values that are incompatible with the true beliefs and aspirations of the Muslim ummah, and moreover it is *systemically destructive of both culture and nature*. Even many Western scientists, thinkers, intellectuals and philosophers (e.g., Paul Feyerabend, Ivan Illich, Jerry Mander, Theodore Roszak, E. F. Schumacher, *et al*) have become disillusioned with modern, Western science, and they are busily formulating an alternative conceptual and practical framework for a new science that is friendlier to, and more in harmony with, both the natural and human environment. Other religious communities too, such as the Christians, Jews, Hindus and Buddhists, are trying to formulate alternatives to modern science—alternatives which are in harmony with their respective traditional religious worldviews, and which serves common interest rather than private interest.

PART II

6. Islamic Science, Islamization, and the Road Ahead: Some Conceptual Considerations

The idea of Islamizing the sciences has become a matter of much passionate discussion and debate among Muslim intellectuals and academicians, including professional scientists, mathematicians, engineers and technologists. Many books and articles have been written and seminars held to clarify the idea in conceptual and pragmatic terms. However, it would seem that little progress has been achieved so far toward achieving a broad consensus among them on a positive reception of the idea. Some, like Abdus Salam and Hoodbhoy,[33] reject the idea altogether, while others accept it wholeheartedly without a clear understanding of what the idea really means and entails for their scientific work, but most working scientists have only a hazy notion of the idea without any genuine intellectual commitment for or against it. This situation is not surprising given the realization that the idea of Islamization of sciences necessarily demands close, critical engagement with the philosophy, history and practice of both Islamic and modern science. Thus, only a very few Muslim scientists and philosophers of science such as Nursi,[34] al-Attas,[35] Nasr,[36] and Bakar[37] have been successful in articulating the idea with any degree of intellectual insight and rigor—though not all use the term 'Islamization'—based on a thorough knowledge of both the Islamic and Western scientific traditions, including the contemporary ubiquity of modern science with its dogmatic adherence to methodological naturalism.

However, after three decades or so of Islamization, [38] my feeling is that their works need to be further explicated in terms that can provide practical direction to scientists not exposed to the history and philosophy of Islamic and modern science. One thing that all parties in the debate have realized is that the Islamization of the sciences has to be far more substantial than merely citing the relevant Qur'anic verses and hadith texts, for the real intellectual challenge lies in articulating the religious textual relevance in conceptual terms rich enough to determine the content and direction of actual empirical scientific research. In view of this complex and difficult situation, it should be fruitful for Muslim scientists to conceive of the Islamization of the sciences or Islamic Science as a long-term scientific research program.[39]

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[33] Pervez Amirali Hoodbhoy, *Muslims and Science: Religious Orthodoxy and the Struggle for Rationality*, foreword by Mohammed Abdus Salam (Lahore: Vanguard Books, 1991). A comprehensive survey of Muslim intellectual responses to modern science is Osman Bakar, *Tawhid and Science: Essays on the History and Philosophy of Islamic Science* (Kuala Lumpur: Nurin Enterprise, 1991), 201-26.

[34] Yamine Mermer and Redha Ameur, "Beyond the 'Modern': Sa'id al-Nursi's View of Science" in *Islam & Science*, Vol. 2 (Winter 2004) No. 2, 119-60.

[35] Adi Setia, "Al-Attas' Philosophy of Science: An Extended Outline," in *Islam & Science*, Vol. 1 (December 2003) No. 2, 165-214.

[36] Seyyed Hossein Nasr, *Science and Civilization in Islam*, 2nd ed. (Cambridge: Islamic Texts Society, 1987).

[37] Osman Bakar, *The History and Philosophy of Islamic Science* (Cambridge: Islamic Texts Society, 1998).

[38] In his book *Islam and Secularism* (Kuala Lumpur: ISTAC, 1993), on page 44, Professor al-Attas defines 'Islamization' as "the liberation of man first from magical, mythological, animistic, national-cultural tradition opposed to Islam, and then from secular control over his reason and language."

[39] For modern scientific research programs see Imre Lakatos, "Falsification and the Methodology of Scientific Research Programmes" in A. Musgrave and I. Lakatos (eds.), *Criticism and the Growth of Knowledge* (Cambridge: Cambridge University Press, 1970), 91-196. Kalam physical theories are investigative in nature and hence are research programs, see Sabra, A. I., "Science and Philosophy in Medieval Islam:

Like other scientific research programs, such as kalam and falsafah physical theories,[40] Ibn al-Haytham's optics,[41] Newtonian mechanics,[42] Darwinian evolution,[43] Einstein's relativity,[44] David Bohm's ontological interpretation of quantum mechanics,[45] Chomskyan linguistics,[46] Eccles' and Popper's mind-brain interactionism,[47] cognitive psychology,[48] big-bang cosmology,[49] chaos and complexity theories versus intelligent design, irreducible/specified complexity and creation hypothesis,[50] and now superstring theory,[51] the scientific research program of Islamic Science has a core metaphysical component consisting of foundational, abstract theoretical assumptions underpinning the program, and a network of auxiliary hypotheses providing directions for the conceptual clarification and empirical investigation of this core metaphysical component, and hence providing also rational and scientific evidential support for it. Empirical clarifications, once achieved, may even lead to practical, useful technological and engineering applications which can serve to realize the axiological implications of the core metaphysical component in contemporary Muslim communities throughout the world.

The core metaphysical component here obviously consists of the fundamental elements of the Worldview of Islam (i.e., the Islamic vision of man, nature and ultimate reality), while the auxiliary hypotheses provide guidance (i.e., a hueristic) toward working out the operational implications of this worldview in empirical terms, for instance, the implications of (i) the Islamic vision of man for formulating a contemporary empirical Islamic psychology and epistemology,[52] (ii) the Islamic vision of nature for formulating an empirically fruitful alternative to Darwinian evolution,[53] (iii) the Islamic vision of ultimate reality for deciding between the Copenhagen instrumentalist and the Bohmian realist interpretation of quantum mechanics,[54] (iv) the Islamic

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The Evidence of the Fourteenth Century" in *ZGAIW*, 9 (1994), 1-42. For a critical overview of Islamic science, philosophy and theology as investigative scientific research programs, see Adi Setia's introduction to his unpublished doctoral thesis "The Physical Theory of Fakhr al-Din al-Razi" (Kuala Lumpur: ISTAC, IIUM, 2004), 1-23.

[40] See Adi Setia's "Introduction" to his unpublished doctoral thesis, "The Physical Theory of Fakhr al-Din al-Razi" (Kuala Lumpur: ISTAC, IIUM, 2004), 1-23.

[41] Muhammad Saud, *The Scientific Method of Ibn al-Haytham* (Islamabad: Islamic Research Institute, 1990); Saleh B. Omar, *Ibn al-Haytham's Optics: A Study of the Origins of Experimental Science* (Minneapolis: Bibliotheca Islamica, 1977); Heinen Anton, "al-Biruni and al-Haytham: A Comparative Study of Scientific Method," in Hakim Mohammed Said (ed.), *al-Biruni Commemorative Volume* (Karachi: Hamdard National Foundation, 1979), 501-13.

[42] Isaac Newton, *The Principia*, trans. by Andrew Motte (Amherst: Prometheus Books, 1995). See also E. A. Burtt, *The Metaphysical Foundations of Modern Physical Science: The Scientific Thinking of Copernicus, Galileo, Newton and Their Contemporaries*, reprint of 2nd ed. (Atlantic Highlands, NJ: Humanities Press, 1980).

[43] A recent, somewhat dogmatic, restatement of the neo-Darwinian paradigm is Ernst Mayr, *What Evolution Is* (New York: Basic Books, 2001).

[44] Albert Einstein, *The Meaning of Relativity* (London: Routledge, 2003); see also David Bohm's interpretation of relativity in his *The Special Theory of Relativity*, reprinted (London: Routledge, 2002).

[45] David Bohm, *Wholeness and the Implicate Order* (London: Routledge, 2002); idem and B. J. Hiley, *The Undivided Universe: An Ontological Interpretation of Quantum Theory*, paperback reprint (London: Routledge, 2002).

[46] Noam Chomsky, *Language and Problems of Knowledge: The Managua Lectures* (Cambridge, MA: MIT Press, 1989).

[47] Karl Popper and John Eccles, *The Self and Its Brain: An Argument for Interactionism*, reprinted (London: Routledge, 2003).

[48] Ray Jackendoff, *Patterns in the Mind: Language and Human Nature* (New York: Harvester Wheatsheaf, 1993); idem, *Languages of the Mind* (Cambridge, MA: MIT Press, 1992); idem, *Consciousness and the Computational Mind* (Cambridge, MA: MIT Press, 1987); idem, *Semantics and Cognition* (Cambridge: MIT Press, 1985).

[49] William Lane Craig and Quentin Smith, *Theism, Atheism and Big-Bang Cosmology* (Oxford: Clarendon, 1993).

[50] J. P. Moreland (ed.), *The Creation Hypothesis: Scientific Evidence for an Intelligent Designer* (Downers Grove, Illinois: InterVarsity Press, 1994); Michael Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996).

[51] M. B. Schwarz, J. H. Green, and, E. Witten, *Superstring Theory* (Cambridge: Cambridge University Press, 1988).

[52] Here, Muslim psychologists may draw from traditional Islamic faculty psychology and modern cognitive psychology of especially the Chomskyan school.

[53] The positive research program here may be referred to as the intelligent design or creation hypothesis based on the Qur'anic concept of *taskhir* and other related concepts such as *itqan* and *ihsan*; for elaboration, see Adi Setia, "*Taskhir*, Fine-Tuning, Intelligent Design and the Scientific Appreciation of Nature," in *Islam & Science*, Vol. 2 (Summer 2004) No. 1, 7-32.

[54] Here, Muslim scientists may also draw from and work out the empirical implications of Sufi ontology as outlined in Syed Muhammad Naquib al-Attas, *The Positive Aspects of Tasawwuf: Preliminary Thoughts on an Islamic Philosophy of Science* (Kuala Lumpur: Islamic Academy of Science, 1981), and further elaborated in his *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam*, 2nd ed. (Kuala Lumpur: International Institute of Islamic Thought and Civilization (ISTAC)), especially Chapters III, V, VI, VII and the Epilogue.

medical methodological alternative to vivisection,[55] (and so on and so forth. This research program pertains to both the ongoing conceptual clarification of various aspects of the Worldview of Islam, and the concomitant working out of their empirical implications for reviving Islamic science, technology and engineering. A major cognitive function of this Islamic Science Research Program (ISRP) as conceived above is to provide directions toward critical conceptual and empirical reevaluations of modern scientific theories which are found to be problematic from the perspective of the Worldview of Islam and its system of values, with a vision toward their eventual modification and even replacement with better theories if necessary, especially theories impacting on Islamic norms and beliefs.

The articulation of this Islamic Science Research Program (ISRP) necessarily requires critical, creative engagement at a deep theoretical level with modern science since it is the default science for which Islamic Science is here being proffered as the more viable alternative, at least for Muslims if not for humanity at large. Obviously, the ambitious scope of this multi-facetted research program for the revival of Islamic Science necessarily entails an interdisciplinary collaboration between scientists, technologists and engineers on the one hand, and historians, philosophers and sociologists of science on the other.

Also, the axiological, as opposed to the cognitive and methodological, aspects of Islamic Science will require the informed input of authoritative experts in Fiqh, Usul al-Fiqh and the Maqasid of the Shari'ah. Furthermore, non-Muslim intellectuals, academicians and scientists may also want to participate and contribute to the elucidation of the content of this research program given the present-day widespread self-critical spirit of modern science leading to serious consideration of scientific methodological pluralism[56] and the search for alternative, more "democratic" sciences and technologies, a.k.a., science and technology with a human face.[57]

7. Pragmatic Considerations I: Globalization and Techno-Scientific Creativity in the Islamic World

Universities (including other forms of public and private educational organizations) throughout the Islamic world may want to establish, say, departments, centers or institutes of integrated studies in science with a clear vision toward facilitating this wide ranging multi- and interdisciplinary collaboration at the local, regional and international levels of intellectual and scientific networking. This institutional framework provides a regular, ongoing formal intellectual platform for promoting interdisciplinary discourse amongst scholars and students toward acquiring a profound and sophisticated understanding of the Worldview of Islam in relation to science and technology and its clarification in terms of cognitive, pragmatic and axiological directions for empirical and technical research in the challenging global context of contemporary scientific and technological enterprise. Through the local, regional and international research and networking activities of these institutes of integrated studies in science, policy makers in the Islamic world can have access to responsible advice with regard to enhancing Muslim techno-scientific creativity while avoiding a scenario in which globalization—if "allowed to run its course"—results in the Islamic world remaining "at the receiving end of technology, i.e., continuing to use other people's technology to produce goods and services for other people's market without itself ever producing competitive technology."[58] Since long-term prosperity cannot be a borrowed one, it will have to be one whose conceptual and pragmatic bases are self-consciously defined first and foremost from within the context of Muslim societies. In practical terms, this means that the techno-scientific endeavor has to be eventually homegrown, cultivated and geared ultimately to serving the authentic creative and material needs of indigenous Muslim communities and then (when opportunity beckons) the global community at large. This means empowering promising young scientists and technologists to conceptualize, choose, propose, plan and direct their own research agendas, to pursue

[55]Here, Muslim medical researchers may draw from the history of Islamic medicine as well as from the modern scientific and methodological critique of vivisection by Pietro Croce, *Vivisection or Science?: An Investigation into Testing Drugs and Safeguarding Health* (London: Zed Books, 1999); see my review of this book in *Islam & Science*, Vol. 3 (Summer 2005) No. 1, 87-90.

[56]For instance, Paul Feyerabend's seminal *Against Method*, 3rd ed. (London: Verso, 1993).

[57]A useful collection of articles on the search for a democratic scientific future is Sandra Harding (ed.), *The "Racial" Economy of Science: Toward a Democratic Future* (Bloomington: Indiana University Press, 1993).

[58]Daud, Wan Ramli Wan and Zain, Shaharir Mohamad, "Indigenisation of Technology and the Challenge of Globalization: The Case of Malaysia," in *MAAS Journal of Islamic Science*, Vol. 15 (1999), 110.

plausible novel theories, to experiment, and to innovate in thinking and implementing, and lastly but not least, to be continually well-informed of, and hence to be involved fruitfully in debates on the shifting, global political economics of issues pertaining to intellectual property rights, research agendas, and alternative and emerging technologies.

In order for science, engineering and vocational students to be able to do meaningful non-trivial choosing and conceptualizing, it will not be enough to expose them merely to the "hard facts" of the standard, mostly western contextualized, textbooks and technical manuals. Provisions must also be made not only for teaching science and technology as such, but also for educating students in the creative conceptual foundations of theories, methodologies and techniques, as well as exposing them to the "cultural expectation matrices" within which the techno-scientific enterprise is socially supported and finds its axiological direction, purpose and meaning. This consideration is especially important in the overwhelmingly religiously oriented nations of the Muslim world, including countries like Malaysia, in which the major world religious cultures (Islam, Christianity, Buddhism and Hinduism) play a pivotal role in determining the worldviews and value-systems of their peoples, and hence, in providing their lives with a sense of ultimate direction, meaning and purpose. Here again, institutes of integrated studies in science, as conceived above, can provide the kind of historically and philosophically grounded conceptual and pragmatic perspectives needed to formulate scientific and technical educational policies geared to the attainment of a creative, holistic understanding of science and technology amongst students, teachers, intellectuals and policy makers.

8. Pragmatic Considerations II: Islamic Science as Re-Democratizing Science

Seen as a universal human activity, science is a way of thinking about and experiencing the world, and ordering it in thought and act, hence it is neither the invention nor the monopoly of the modern West, but a natural birthright of every human being who experiences and interacts with his or her environment. Just as there is cultural diversity amongst humankind, so too there is scientific diversity as part and parcel of this universal cultural diversity, which in turn is reflective, even expressive, of the diversity and complexity of the natural world. The history of Islamic science is the history of a truly scientific cosmopolitanism in which the positive, creative contributions of all ethnic and religious communities were welcomed, appreciated and critically integrated into the framework of an intellecto-spiritual and ethico-moral outlook toward the bounties of nature as a divinely bestowed trust. To be free and creative, Muslim scientists can and should learn from this rich history. They should reclaim their heritage and their birthright by renewing all that is good in their scientific history and rearticulate it in contemporary terms in full, unapologetic critical engagement with modern western science.

Therefore, the call for the revival of Islamic Science as a viable scientific research program is in a way a call for the redemocratization of the scientific endeavor of all mankind. It is a call for the study of nature in terms of not only its temporal utility, but also and more importantly, in terms of its transcendent significance for the ultimate salvation of humanity. Accordingly, there are two interlocking dimensions of study in Islamic Science. One pertains to utility, i.e., to the improvement of the sociomaterial conditions of temporal earthly life. The other, more important dimension pertains to intellectuality, i.e., to the contemplative appreciation that the way nature functions indicates that it is thoroughly dependent on an intelligent designer who transcends it and to whom scientists will be accountable for what they do in and out of their study of nature. The latter dimension is more important because it underlies the first and provides the scientific enterprise with an organizing, integrative vision of ultimate meaning, direction and purpose that can curtail the commercial monopolization of science and technology for individual and corporate greed masquerading as progress, development and change.

The problem now is that mainstream, western modern science ever since Darwin is thoroughly imbued with a naturalistic, reductionist, utilitarian and hence manipulative outlook toward the natural world. Naturalistic because it sees nature as self-subsisting and self-organizing and thus independent of the Creator; reductionist because it reduces all natural phenomena despite their unfathomable complexity to simple physical, linear, quantitative and quantifiable causes and effects; utilitarian and manipulative because it studies nature for the Baconian purpose of controlling, manipulating and exploiting it to realize vague, elitist notions of the "good life." The unabashed three-way wedding of science with multinational corporations and state power in the

West for controlling and exploiting the world's resources is a clear indication that much of modern scientific research may never achieve its self-proclaimed democratic, liberal and humanitarian goals.

To be precise, mainstream modern science and technology is basically the Euroamerican way of doing science and technology. This "technopoly"[59] is thoroughly imbued with a totally secular, utilitarian outlook to the natural and social world. To a large extent, its present-day global ubiquity is due to the after-effects of systematic colonial destruction of indigenous, holistic systems of science, technology, knowing and living, and their replacement with reductionist forms of knowing and living now indirectly (but nonetheless, aggressively) imposed on poor indebted nations through the various 'structural adjustments' programs of international lending institutions like the World Bank and International Monetary Fund. Again, Islamic Science conceived as a scientific research program carried out by Muslim institutes of integrated studies in science and technology can provide the formal research and scholarly framework for contributing the Islamic intellectual input to the global, grass-roots movement toward the *dewesternization* and hence *redemocratization* of science and technology. Toward the attainment of this goal, Muslims may share a common vision and mission with conscientious non-Muslims in the East and West through the various formal and informal avenues for mutual collaboration at their disposal.

PART III

9. Operationalizing the Islamization of Science

In Part I I have outlined briefly the need to reformulate the concept of 'Islamic science' as a long-term, practical empirico-conceptual research program.[60] This reformulation arises, in particular, in response to the question raised, often tacitly, by concerned, practising Muslim scientists, namely, "How do we actually go about realigning our scientific work along the lines envisaged by al-Attas,[61] Nasr,[62] and Bakar[63] in their many writings on various aspects of the philosophy and history of Islamic science?" So there is, on the one hand, a growing understanding of the concept of Islamic Science itself, while, on the other, a conundrum with regard to the execution of the concept in actual scientific work.[64] I think one of the main reasons for this four decades' old operational impasse is that the major writers on Islamic Science (or rather, on the Islamization of Science[65] have not engaged (or have not meant to engage) closely with the detailed, empirical aspects of the various disciplines of modern science as these are presently studied and practiced by Muslim and non-Muslim scientists the world over. For instance, while all three authors, al-Attas, Nasr, and Bakar, have written

[59]Neil Postman, *Technopoly: The Surrender of Culture to Technology* (New York: Vintage Books, 1993).

[60]Adi Setia, "Islamic science as a Scientific Research Program," in *Islam & Science*, Vol. 3 (Summer 2005) No. 1, 93-101.

[61] Syed Muhammad Naquib al-Attas, *Islam and the Philosophy of Science* (Kuala Lumpur: ISTAC, 1989), which also constitutes Chapter III of his *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam* (Kuala Lumpur: ISTAC, 2001), 111-142; idem, *The Positive Aspects of Tasawwuf Preliminary Thoughts on an Islamic Philosophy of Science* (Kuala Lumpur: ASASI, 1981); cf. Adi Setia, "Al-Attas' Philosophy of Science: An Extended Outline," in *Islam & Science*, Vol. 1 (2003) No. 2, 165-214.

[62]Seyyed Hossein Nasr, *An Introduction to Islamic Cosmological Doctrines* (Cambridge, MA: Harvard University Press, 1964); idem, *Science and Civilization in Islam*, 2nd ed. (Cambridge: Islamic Texts Society, 1987).

[63]Osman Bakar, *Classification of Knowledge in Islam: A Study in Islamic Philosophies of Science* (Cambridge: Islamic Texts Society, 1998); idem, *The History and Philosophy of Islamic Science* (Cambridge: Islamic Texts Society, 1999).

[64] On 9-10 February 2007, an intensive workshop attended by about forty selected Malaysian and Indonesian scientists was organized by Professor Shaharir Muhammad Zain, Professor Wan Ramli Wan Daud, Dr. Muhammad Alinor and Dr. Assanah Mydin of the Islamic Academy of Science, Malaysia (ASASI) to address this conundrum under the guiding theme of "Reviving Islamic science," with further, more specialized, national, regional and international workshops in the pipeline. This question is latent, especially in the last few chapters, throughout Muzaffar Iqbal, *Islam and Science* (Aldershot, UK: Ashgate: 2002); see the generally positive, non-scholarly review of Dr. Iqbal's book by John Maxwell Kerr accessible online at http://www.scimednet.org/library/reviewsN86+/N861gbal_islam.htm (accessed March 27, 2007). A more scholarly and intellectually challenging review is Roxanne D. Marcotte, "Review of Islam and Science," in *Ars Disputandi* (http://www.ArsDisputandi.org) Vol. 6 (2006), accessed March 27, 2007.

[65]That is, briefly speaking, critical integration of mainstream scientific research and its results into the conceptual framework of the Islamic worldview. Syed Muhammad Naquib al-Attas, Islam and Secularism, 2nd edn. (Kuala Lumpur ISTAC, 1993), 44 ff and 182 ff defines 'Islamization' as "the liberation of man first from magical, mythological, animistic, national-cultural tradition opposed to Islam, and then from secular control over his reason and his language." For his application of this definition to "present-day knowledge," including the human, natural, physical and applied sciences, see ibid., 162 ff. For the limited purpose of this paper, 'science' is simply taken to refer to "the systematic study of the natural world."

and argued against the Darwinian theory of evolution from the philosophical and metaphysical points of view,[66] none, to my limited knowledge, has so far offered a concomitant positive counter-theory that is both conceptually and empirically rich enough to account for the same observed biological phenomena ostensibly accounted for by the mainstream evolutionary theory. A positive, empirical counter-theory is important simply because Darwinian theory presents itself, and is understood, first and foremost, as an empirical, scientific theory rather than a metaphysical, philosophical one.[67] So, for lack of a well-articulated, empirically rich, counter-theory,[68] whether they like it or not, biologists, including those who privately believe in a transcendent creative agent of power and intelligence, are stuck with the default theory and they will continue to interpret known and yet to be discovered biological phenomena along the lines predetermined by that theory.[69]

That said, one has to admit wholeheartedly that the pioneering philosophical works of al-Attas, Nasr and Bakar are of fundamental importance for opening our eyes to the very possibility (hence, imperative even!) of constructing relevant counter-theories to mainstream Western theories, especially if the latter are shown to be grounded, whether explicitly or implicitly, in underlying metaphysical foundations incompatible with, or even undermining, the Worldview of Islam, i.e., the Islamic metaphysical vision of truth and reality.[70] The key-word here is *'construction'*, specifically, the proactive creative work of constructing viable alternative scientific theories that are, on the one hand, grounded in, or compatible with, Islamic metaphysics, while, on the other, *empirically responsible*, i.e., that can adequately account for the same sets of observed phenomena ostensibly accounted for by rival, un-Islamic or less-than-Islamic theories, and even, if possible, supersede them altogether.[71] I think that is the true operative essence of Islamic Science: that it has to be involved in an unapologetic, proactive construction of empirico-conceptual frameworks for interpreting and interacting with the world in a way that is self-consciously inspired by,[72] and hence, in harmony with, the ethico-cognitive principles of Islam.[73]

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[66]Osman Bakar, ed., *Critique of Evolutionary Theory: A Collection of Essays* (Kuala Lumpur: ASASI and Nurin, 1987), which include articles by Nasr, Bakar and others; cf. Syed Muhammad Naquib al-Attas, *A Commentary on the Hujjat al-Siddiq of Nur al-Din al-Raniri: being an exposition of the salient points of distinction between the positions of the theologians, the philosophers, the Sufis and the pseudo-Sufis on the ontological relationship between God and the world and related questions* (Kuala Lumpur: Ministry of Culture, 1986), 460-461.

[67] Harun Yahya's many colorfully illustrated anti-evolution books, especially the remarkable *Evolution Deceit: The Scientific Collapse of Darwinism and Its Ideological Background*, trans. Mustapha Ahmad (London: Ta Ha, 2000), brings to our attention in great detail the many scientific, as opposed to the philosophical or metaphysical, shortcomings of darwinian and neodarwinian evolutionary theories, but there is no attempt at all therein to construct a proper scientific counter-theory. On the other hand, Abdul Wahid Pallacken, "Origin of Genetic Information and Evolution of Biological Species" in *Islam & Science*, Vol. 3 (Summer 2005) No. 1, 7-42, both criticizes evolution and attempts to construct an alternative theory but its conceptual foundations are rather weak and largely ungrounded in the Islamic intellectual tradition, especially with regard to Islamic psychology and natural philosophy.

[68]Such as along the lines of Michael Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996). My review of Behe's book is published in *Jawha: Journal of Book Review*, Vol. 3 (February/March 2006) No. 1, 75-82.

[69]The analogy here is this: if you go to someone's house and point out to him its leaking roof and crumbling walls but fail to build for him (or teach him to build) a better house to live in, he will thank you very much for being so kind and go on living in it until it falls over and buries him in the rubble.

[70]Syed Muhammad Naquib al-Attas, *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam* (Kuala Lumpur: ISTAC, 2001).

[71] For instance, in the way atomism displaced hylomorphism, or in the way cognitive psychology (which is arguably more compatible with Islamic faculty psychology) displaced behaviourism. Another example is the way many alternative, traditional medical systems (such as Japanese kampo, Indian ayurvedic and Chinese acupuncture) are shown to be just as effective as (or even more effective than) modern allopathic medicine in treating the same types of illnesses, minus, of course, the side-effects inherent in modern synthetic drugs. So, if rival scientific theories can account for the same set of phenomena, or solve the same set of empirical problems, then the theories most compatible with the Islamic worldview should be identified, chosen, improved upon, extended and incorporated/integrated into the ISRP (Islamic Science Research Program).

[72] In the past when Islamic culture was predominant, it can be surmised that the Qur'anic inspiration for the pursuit of science was mostly tacit. It was there in, or as, the general intellectual ambience and need not be explicitly brought to the fore. This may explain why, as noticed by Roxanne D. Marcotte in "Review of Islam and Science," 3, there is little direct reference to the Qur'an in "most scientific works." But in today's Westernized world, especially in the light of the growing realization that the scientific enterprise is thoroughly value-laden, it is of the utmost imperative for Muslim scientists to be critically self-conscious about their Islamic worldview so that they can determine for themselves to what extent their work can or cannot be integrated into it and act accordingly.

[73] That is, principles derived from Islamic epistemology and axiology of science as will be elaborated in detail on another occasion, but see, meanwhile, Adi Setia, "Al-Attas' Philosophy of Science: An Extended Outine," in *Islam & Science*, Vol. 1 (December 2004) No. 2, 187-194 and 204-211.

Without this proactive vision or *proactivity*, we are left with three reactivities: (i) a shallow 'Qur'anic scientific-miracle' or 'tafsir ilmi'[74] approach that always seems to run after the tailcoats of (arbitrarily selected) modern, Western empirical discoveries, without ever coming out with original discoveries or insights of its own;[75] (ii) a repetitive, largely unsystemic, negative critique, however sophisticated, of various modern theories or methods incompatible with Islamic metaphysics or ethics without concomitant positive critique giving rise to viable, systemic counter-theories and counter-methods;[76] and (iii) an overly romanticized glorification of the so-called "golden age" of Islamic Science that assaults the hearing like the piteous lament of a defeated psyche. In the absence of this proactive, operative vision, Islamic Science will continue to be viewed by scientists, including personally pious Muslim scientists, as purely reactionary to the 'normal'[77] state of affairs, and thus fail to draw them into understanding and furthering its 'abnormal',[78] radical cause.[79] Due to the many excellent, published scholarly studies available, I think we now know more than enough about the history and philosophy of Islamic Science to argue for and formulate a more proactive, operative approach toward reviving Islamic Science in the manner envisaged by al-Attas, Nasr, and Bakar; i.e., in a manner that relates it organically and seamlessly to the authentic Islamic intellecto-religious tradition

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[74] Brief critical reviews of this approach are Mustansir Mir, "Scientific Exegesis of the Qur'an: A Viable Project?," in *Islam & Science*, Vol. 2 No. 1 (Summer 2004), 33-42; and Jalees Rehman, "Searching for Scientific Facts in the Qur'an: Islamization of Knowledge or a New Form of Scientism?," in *Islam & Science*, Vol. 1 No. 2 (December 2003), 245-252. See also Chapter 10 of Muzaffar Iqbal, *Islam and Science* (Aldershot, UK: Ashgate, 2002), for his less than optimistic review of the Qur'anic scientific exegesis project. A scathingly terse review by Taner Edis, "Qur'an-science: scientific miracles from the 7th century," accessible online at http://www2.truman.edu/~edis/writings/articles/quran-science.html, is interesting for drawing attention to parallel developments in the "Bible-science" of the literalist, fundamentalist Christian creationists. My personal view here is that the so-called *al-tafsir al-'ilmi* or scientific exegesis should be recast as *al-tafsir al-kalami* along the lines of Fakhr al-Din al-Razi's *Mafatih al-Ghayb* as exemplified in his exegesis of the the Qur'anic concept of *taskhir* in relation to certain aspects of observed human and natural phenomena, by which relation that concept is imbued with empirical and experiential content or meaning; see Adi Setia, "*Taskhir*, Fine-Tuning, Intelligent Design and the Scientific Appreciation of Nature," in *Islam & Science*, Vol. 2 (Summer, 2004) No. 1, 7-32. As exemplified in the *Mafatih al-Ghayb*, kalam exegesis today would involve rigorous semantico-conceptual analyses of Qur'anic concepts in order to draw out their logical implications for actual, empirical investigations of the physical world whose results may or may not coincide with the truth-claims of modern science. It is dialectical since it mediates disciplined, reflective intellectual dialogue between revelation and creation. It was through the kalam dialectical method that the natural sciences in the past were critically appropriated, naturalized, and incorporated into the conceptual framework of the Islamic worldview. This was a constructive process which generated a new, Islamized science of nature, which, I think, should be the whole point of a proper, contemporary scientific exegesis of any degree of intellectual profundity. Another consideration for not using the term *tafsir 'ilmi* is to preempt a narrowing, in the public consciousness, of the classical rich meaning of the term *'ilm* to the modern impoverished meaning of the term 'science'. This issue will be further elaborated at another opportunity, *insha'a ALlah*. Badi'uzzaman Sa'id al-Nursi's profoundly influential *Rasa'il al-Nur* can be read as a new approach to tafsir kalami for effective engagement with the intellecto-moral challenges of the modern age. The *Mafatih* and the *Rasa'il*, though seven centuries apart, are, in spirit and purpose, identical.

[75] And without bothering to consider the tentative and sometimes highly contentious nature of such discoveries or their underlying assumptions rendering them valid.

[76] On the whole, Islamic critiques of evolution, for instance, have remained repetitively of a general nature and hence conceptually and empirically stagnant and unproductive for the past three decades except lately in the works of Harun Yahya (especially Evolution Deceit), who engages it largely from within in greater scientific detail, but even here there is no attempt at a corresponding *counter-theory*. Another example is the relatively recent Islamic medico-fiqhi concern with certain biotechnological driven innovations (cloning, stem-cell therapy, organ transplant, gene therapy, etc.) in Western medicine with no attempt whatsoever at a deeper philosophical, methodological, sociomedical, and political economic critique of the whole system of modern medicine, hence the tacit unexamined assumption of a universal, context-free relevance of the medical problems driving these, largely private-interest, business-driven, for-profit rather than for-health, innovations. For a sampling of these medico-fighi concerns, see Ahmed Abdul Aziz Yacoub, *The Fiqh of Medicine: Responses in Islamic Jurisprudence to Developments in Medical Science* (London: Ta Ha, 2001); cf. V. Rispler-Chaim, *Islamic Medical Ethics in the 20th Century* (Leiden: Brill, 1993).

[77] 'Normal' here in the Kuhnian sense. Since most Muslim scientists, even very pious religious ones, are so totally immersed by education and training in mainstream modern Western scientific culture with little or no significant exposure to non-Western scientific systems, they lack the necessary comparative perspective for critically evaluating what they presently do as scientists. They simply cannot conceive of any other way to do science; even if informed of such alternative approaches, they will consider them 'abnormal' if not beyond their ken.

[78] 'Abnormal' here again in the Kuhnian sense, meaning simply what is not being done or pursued by the great majority of scientists for one reason or another. So 'abnormal' science is not necessarily quackery or pseudo-science; on the contrary, it can be just as rational and empirical as normal science or even more so, only that it has not yet grown influential enough amongst mainstream scientists to be counted as normal. For Thomas Kuhn's view of scientific change, see his influential *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970), which can be adapted, with qualifications, to our project.

[79] In this respect, Paul Feyerabend, *Against Method: Outline of an Anarchistic Theory of Knowledge* (London: Verso, 1986), can be read by Muslim scientists as opening the way for them to create better alternatives to Western science such as Islamic science.

while engaging closely and constructively with modern science, and thus revives it as an unapologetic constructive contributor to the contemporary technoscientific discourse.[80]

10. Some Important Lessons from the History of Islamic Science

In the Qur'an it is stated that "Verily, in their stories is a lesson for owners of hearts."[81] So I think we can try fulfilling the divine injunction implicit in this verse with regard to what pertinent lessons we, as "people of understanding," should draw from the successful scientific stories of our great Muslim scientists, philosophers, and theologians of yore.

First of all let us look briefly at scientists[82] such as Ibn Haytham (965-1040), acclaimed in both the East and West as the founder of modern optics by virtue of his seminal work *Kitab al-Manazir*.[83] His empirical optical discoveries and formulation of the scientific research methodology underpinning them were in the immediate context of close critical engagement with various ancient Greek optical and physical theories, in both their philosophical and empirical aspects. He was not satisfied by finding these theories wanting in one way or another (his *negative critique*), rather, he went further by systematically setting out to construct counter-theories that could be found not-wanting, i.e., that could stand up to rigorous, objective logico-mathematical analyses and refined, innovative observational testing (his *positive critique*). He was, similarly, constructively critical of Ptolemaic astronomy, so much so that his *al-Shukuk 'ala al-Batlamyus* (*Doubts about Ptolemy*)[84] laid the groundwork for subsequent improvements to it by al-Tusi (1201-1274)[85] and Ibn Shatir (1304-1375) that eventually lead directly or indirectly to the so-called Copernican "revolution."[86] Similar proactive, self-confident critical engagement is evident in the case of mathematicians such as 'Umar al-Khayyami (d. 1131) and Jamshid al-Kashi (d. 1429). The former formulated a new postulate to demonstrate Euclid's problematic fifth postulate (the parallel postulate) which eventually lead to the rise of non-Euclidean geometry, while the latter perfected the decimal place value notational system for both integers and fractionss.[87] In other sciences such as medicine, for example, one may cite the works of physicians such as Abu Bakr Muhammad Ibn Zakariyya al-Razi (865-925) with his *al-Shukuk 'ala al-Jalinus* (*Doubts about Galen*)[88] in which he criticizes Galen's humoral theory and postulates other material qualities from his own clinical observations and chemical experiments. In philosophy, the case of Ibn Sina (980-1037) is well known. Though greatly influenced by the Aristotelian philosophical system, he envisaged the need to bring the more problematic aspects of that system into greater harmony with Islamic metaphysics. His reformulation of the metaphysics of efficient causation is a case in point.[89] Then, in the case of kalam, we have the great theologian-philosopher al-Ghazali (1058-1111) who, in his celebrated *Tahafut al-Falasifah* (*Incoherence of the Philosophers*)[90] went further in Islamizing Aristotelianism by eliminating intermediary causation altogether and offering in its place a positive, alternative causal theory that is arguably even more empirically adequate than the criticized

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[80] It is in this regard that I find wanting writings on various aspects of the Islamization of the sciences by Ismail al-Faruqi and Ziauddin Sardar, as these generally bypass altogether the conceptual profundity of traditional Islamic and modern Western philosophico-scientific debates and appeal directly to Qur'anic categories with little or no systemic analysis and informative input. I think this "short-cut, rush-rush" approach is shallow, to say the least, and will paradoxically result in an uncritical, passive reception of the very same secular Western sciences it set out to "Islamize" in the first place. This paradoxical situation has already taken firm hold at the International Islamic University Malaysia which is basically premised on the Faruqian approach to Islamization.

[81] *Yusuf*: 111.

[82] Or rather those generally recognized as scientists in the modern sense of the term, though they were a lot else besides.

[83] A. I. Sabra, trans. and comm., The *Optics of Ibn Haytham: Books I-III: On Direct Vision*, 2 vols. (London: Warburg Insttitute, 1989); cf. Muhammad Saud, *The Scientific Methodology of Ibn Haytham* (Islamabad: Islamic Research Institute, 1990); cf. Saleh B. Omar, *Ibn Haytham's Optics: A Study of the Origins of Experimental Science* (Minneapolis: Bibliotheca Islamica, 1977).

[84] Arabic text edited with annotations by A. I. Sabra, 2nd ed. (Cairo: Dar al-Kutub, 1996).

[85] Unless otherwise stated, all dates refer to Common Era.

[86] Details in Edward S. Kennedy, *Astronomy and Astrology in the Medieval World* (Aldershot: Variorum, 1998); David A. King, *Islamic Mathematical Astronomy* (Aldershot: Variorum, 1998); George Saliba, *A History of Arabic Astronomy: Planetary Theories during the Golden Age of Islam* (New York: New York University Press, 1994); Noel Swerdlow and Otto Neugebauer, *Mathematical Astronomy in Copernicus's De Revolutionibus* (New York: Springer, 1984).

[87] Details in J. L. Berggren, *Episodes in the Mathematics of Medieval Islam* (New York: Springer-Verlag, 1986); cf Victor J. Katz, *A History of Mathematics* (Reading, MA: Addison-Wesley, 1998), for the excellent Chapter 7 on Islamic Mathematics, 238-287 passim; Daoud S. Kasir, *The Algebra of Omar Khayyam* (New York: AMS Press, 1972).

[88] Edited by Mehdi Mohaghegh (Kuala Lumpur: ISTAC, 1993).

[89] Michael Marmura, "Avicenna on Causal Priority," in Parviz Morewedge, ed., *Islamic Philosophy and Mysticism*, 3rd ed., (New York: Caravan Books, 1981).

[90] *Tahafut al-Falasifah*, trans. Michael Marmura (Provo, Utah: Brigham Young University Press, 2000).

and rejected peripatetic theory. This series of constructive thrusts and counter-thrusts eventually lead to the full-fledged atomism and occasionalism of post-Ghazalian, Fakhrurazian (d. 1209) kalam physical theory,[91] a development in which much of peripatetic natural philosophy was "appropriated" into mainstream, 'orthodox' intellecto-religious discourse and hence "naturalized"[92] (i.e., Islamized).

Again, these positive achievements were brought about in the wake of systemic engagement with both the 'hard' and 'soft' aspects of the Greek sciences, so much so that many, if not most, of the post-Ghazalian *mutakallimun*, even arguably right up to the mid-nineteenth century, were also practicing, accomplished scientists (*tabi'iyyin*) and philosophers (*hukama'*) in their own right.[93] This essentially *programmatic* nature of classical Islamic religio-scientific investigations (*bahth/mabahith*)[94] sketchily described above, which critically assimilated and built on the works of the past in order to go beyond them, was still more or less prevalent up to the advent and consolidation of global European colonial expansionism in the 19th century, even in the Malay-Islamic Far East.[95] In the case of technology as opposed to science and philosophy, this same constructive attitude can also be argued for again, right up to the mid-nineteenth century, especially in the case of Mamluk Egypt, Ottoman Turkey, Safavid Persia, Mughal India, Islamic Civilization in China, and in the case of some of the Sultanates of the Malay Archipelago of the Islamic Far East, although, admittedly, much textual and artifactual research needs to be done and published in order to render this thesis persuasive.[96] These Muslim scientists, philosophers and theologians not only cultivated a constructive approach to the 'foreign sciences' but they were also self-critical as well as mutually critical amongst themselves.

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[91] 'Adi Setia, "The Theologico-Scientific Research Program of the Mutakallimun: Intellectual Historical Context and Contemporary Concerns with Special Reference to Fakhr al-Din al-Razi," in *Islam & Science*, Vol. 3 (Winter, 2005) No. 2, 127-151; idem, "Atomism versus Hylomorphism in the Kalam of Fakhr al-Din al-Razi," in *Islam & Science*, Vol. 4 (Winter 2006) No. 2, 113-140. Cf. Dimitri Gutas, "The Heritage of Avicenna: The Golden Age of Arabic Philosophy, ca. 1000-1350," in Jules Janssens and Daniel De Smet, eds., *Avicenna and His Heritage: Acts of the International Colloquium, Leuven, September 811* (Leuven: Leuven University Press, 2002), 81-97; Ayman Shihadeh, "From al-Ghazali to al-Razi: 6th/12th Century Developments in Muslim Philosophical Theology," in *Arabic Science and Philosophy*, Vol. 15 (2005), 141-179; and A. I. Sabra, "Science and Philosophy in Medieval Islamic Theology: The Evidence of the Fourteenth Century," in *Zeitschrift fir Geschichte der Arabisch-Islamischen Wissenschaften*, 8 (1994), 1-42. See also A. I. Sabra's important forthcoming "Kalam Atomism as an Alternative Philosophy to Hellenizing Falsafa: An Interpretation of Ash'arite Kalam Ontology," as reported on the website http://www.ou.edu/islamsci/Sabra-publications05.pdf.

[92] This is the so-called 'Sabra's thesis'; see A. I. Sabra, "The Appropriation and Subsequent Naturalization of Greek Science in Medieval Islam," in *History of Science*, 25 (1987), 223-243; reprinted in F. Jamil Ragep et al. eds., *Tradition, Tramsmission, Transformation: Proceedings of Two Conferences on Pre-modern Science*, held at the University of Oklahoma (Leiden: E. J. Brill, 1996), 3-27.

[93] See, for instance, Peter Gran, *The Islamic Roots of Capitalism: Egypt, 1760-1840* (Austin: University of Texas Press, 1979) for the case of the important but little studied, Shaykh Hasan al-Attar (1766-1835) of Mamluk, Napoleonic and, later, Muhammad 'Ali Pasha's Post-Napoleonic Egypt.

[94] For instance, an early philosophico-scientific work of Fakhr al-Din al-Razi is entitled *al-Mabahith al-Mashriqiyyah* (*The Eastern Researches*), ed., Muhammad al-Mu'tasim biLlah al-Baghdadi, 2 Vols. (Beirut: Dar al-Kitab al-'Arabi, 1990).

[95] Shaykh Ahmad bin Muhammad Zayn al-Fatani (1856-1908), for instance, was a practicing surgeon, physician, medical researcher, and experimenter. He wrote medical treatises and encouraged his own countrymen, the Malay Muslims, to undertake scientific research into their own indigenous, medicinal resources. His student, Raja Haji Ahmad Tabib Riyawi, was also a medical author and known to make his own surgical instruments from bamboo. For detailed surveys of the sociohistorical background of these Malay-Islamic scholars who worked against a backdrop of increasing European and Siamese colonial encroachment, see Azyurmardi Azra, *The Origins of Islamic Reformism in Southeast Asia: Network of Malay-Indonesian and Middle Eastern 'Ulama' in the Seventeenth and Eighteenth Centuries* (Honolulu: University of Hawaii Press, 2004); and Engseng Ho, *The Graves of Tarim: Genealogy and Mobility Across the Indian Ocean* (Berkeley: University of California Press, 2006).

[96] In the case of the Malay-Islamic Far East, preliminary studies by Ustaz Haji Wan Muhammad Saghir Wan Abdullah and researchers affiliated with ASASI of the life and works of nineteenth-century Malay 'Ulama' who wrote in both Arabic and Jawi show many of them to be practicing, accomplished physicians, astronomers, logicians, mathematicians and philosophers. Among them we have Shaykh Ahmad bin 'Abdul Latif (1855-1916) who wrote *Rawdat al-Hussab* and *Alam al-Hussab fi 'Ilm al-Hisab* (Kuala Lumpur: Khazanah al-Fataniyyah, 2002), both on mathematics; and Shaykh Ahmad bin Muhammad Zayn al-Fatani who wrote *Luqtat al-Ajlan fi ma Tamassa ilayhi Hajat al-Insan* and *Tayyib al-Ihsan fi Tibb al-Insan* (Kuala Lumpur: Khazanah al-Fataniyyah, 2005), both on medicine. For Egypt, a study that comes to mind is Peter Gran, *The Islamic Roots of Capitalism: Egypt, 17601840*, op. cit; for India, Zaheer Baber, *The Science of Empire: Scientific Knowledge, Civilization and Colonial Rule in India* (Albany, NY. SUNY Press, 1996); and Frederic F. Clairmont, *The Rise and Fall of Economic Liberalism: The Making of the Economic Gulag*, rev. ed. (New York: Apex Press, 1996), especially Chapter 3 on "The Indian Dossier." For the case of Muslims in China, see, for instance, the excellent historical overview by Umar Faruq Abd-Allah, "Seek Knowledge in China: Thinking Beyond the Abrahamic Box," Nawawi Foundation Paper, accessible online at http://www.nawawi.org/downloads/article5.pdf, accessed April 1 2007. One can only surmise the real extent of indigenous Chinese-Islamic contribution to "Science and Civilization in China." The definitive, masterful study of Chinese science and technology from the earliest time till the modern era is Joseph Needham, *et al*, *Science and Civilization in China*, 7 Vols. (Cambridge: Cambridge University Press, 1954-2004).

The point here is not whether some of the later scholars of the last three centuries were aware of, and tried to "catch up" with, the scientific advancements of the colonizing imperialistic West, but rather to what extent they continued to identify, and address themselves to, religious, scientific and technological problems arising out of their respective indigenous sociocultural contexts, for creative science is, first and foremost, about solving one's own problems (i.e., problems you posit to yourself) not the problems of others (i.e., problems created for, and imposed on, you by others). For sure, many if not most of these "indigenous" contexts were to some extent conditioned by global Western civilizational challenges, yet, more often than not, these very challenges spurred the creation of dynamic, largely autonomous intellecto-cultural spaces rendering possible effective, proactive responses.[97] I dare say that these autonomous spaces only shrunk significantly and even disappeared altogether during the so-called postcolonial, "independence" era of the mid-twentieth century, which is rather ironic, though, in the final analysis, unsurprising, once the disembodied, insidious westernizing process had set in to complete the work left undone, or that could not be done, by the departing, "civilizing" imperialists.[98]

I think it is more fruitful for our particular purpose here to read the history of Islamic Science not as a long chronological series of ossified discoveries whose value is often obsessivly seen in the extent of them being anticipative or otherwise of modern discoveries, but rather as indicative of an underlying, creatively dynamic pattern of meaningful intellectualizing about the human and natural world within the over-arching context of religious experience of revelation. To be curt, those great Muslim scientists of the past were simply not worried about anticipating Copernicus or Newton or Einstein; rather, they were totally concerned about doing something that could be meaningful to themselves and to their community, and, perhaps, be acceptable to their Creator. Since that is the case with regard to our forebears, why are we today so much more concerned with catching up with the West than with doing really original, creative science that is *appropriate* (*munasibah*) to our socio-natural context and geared first and foremost toward solving our problems *as conceived by us*? The big question about any science or any technology is not whether it is advanced or backward, high or low with respect to the West, but whether it is truly useful and beneficial *with respect to us*.

From this autonomous perspective, the question of the "decline" of Islamic science is, to a large extent, an intellectual red herring. Therefore, the purpose of studying the history of Islamic science for Muslims today is not only to know who discovered what first, second, or last, but, more importantly, to rearticulate clearly in contemporary terms the often hidden, underlying creative thought processes leading to those discoveries and to bring to light their usually not-so-apparent background of internally generated problematics, regardless of whether these discoveries be of an empirical or conceptual nature. For it must be understood that these discoveries, if truly meaningful, were only discovered to solve problems or to achieve objectives that arose or were conceived from within the socio-intellectual dynamics of the then predominant, cosmopolitan Islamic world-civilization. Without achieving this deep-level understanding, those scientific artifacts, manuscripts and relics of the long bygone and (for most people) well-nigh forgotten past will have no substantive, larger meaning for the great majority of contemporary Muslims living in the immediate, everyday life of the real, overly westernized,[99] secularized[100] world (as opposed to the sterile, elitist life of expensive science

[97] The underlying, broad theoretical framework for this thesis in the case of the Malay-Islamic world is Syed Muhammad Naquib al-Attas, *Preliminary Statement of a General Theory of the Islamization of the Malay-Indonesian Archipelago* (Kuala Lumpur: Dewan Bahasa dan Pustaka, 1969).

[98] Serge Latouche, *The Westernization of the World. The Significance, Scope and Limits of the Drive towards Global Uniformity*, trans. Rosemary Morris (Oxford: Polity Press, 1996). In the case of Ottoman Turkey, Kemal Ataturk did what the occupying Western forces did not or could not do: abolish the Caliphate and institutionalize the complete secularization of Turkey. A recent Malaysian case in point is the overly hostile and politically motivated takeover of The International Institute of Islamic Thought and Civilization (ISTAC) by the International Islamic University Malaysia (IIUM) in 2002, thus eliminating a once vibrant, internationally acknowledged, autonomous intellecto-cultural space for the pursuit of a genuinely authentic Islamization of sciences. The takeover is being contested in court by the Founder-Director with little indication so far of an amicable resolution of the case even after five long years. Justice delayed is certainly justice denied!

[99] Serge Latouche, *The Westernization of the World: The Significance, Scope and Limits of the Drive towards Global Uniformity*, op. cit.

[100] Syed Muhammad Naquib al-Attas, *Islam and Secularism*, op. cit.

museums, grand exhibition halls, glossy coffee-table books and innumerable feel-good film documentaries)[101]. To clarify this issue further I think we need to demarcate three distinct yet interlinked operative meanings of the term 'Islamic Science'. By 'operative', (*'amali*) I mean what scholars or researchers actually refer to when they say they are "studying" or "talking about" Islamic science.

11. Three Meanings of Islamic Science

The first meaning pertains to the subject matter of the formal academic discipline that studies the history of the development of the empirical sciences and technologies in Islamic Civilization in relation to the sciences of earlier (e.g., Greek and Hellenistic, Indian, Persian, Egyptian) and later (i.e., medieval Latin European) civilizations. This meaning places Islamic Science squarely within the larger discipline of History of Science as envisaged by George Sarton.[102] In this case, Islamic Science simply means history of science in Islamic culture and society; it is less about conceptual theory than actual practices and empirical results. Some notable works, among many, indicative of this meaning are A. I. Sabra's *The Optics of Ibn Haytham*,[103] Daniel Martin Varisco's *Medieval Agriculture and Islamic Science: The Almanac of a Yemeni Sultan*,[104] Roshdi Rashed's *Encyclopedia of the History of Arabic Science*,[105] and Donald R. Hill's *Islamic Science and Engineering.*[106] The valuable, ongoing multi-volume reference work of meticulous research and documentation on the Islamic scientific and literary tradition undertaken by Professor Fuat Sezgin is, to a large extent, in this category.[107] Also, the excellent, well documented and illustrated scholarly articles accessible online through the website www.muslimheritage.com provide a very comprehensive survey of practically all the empirical sciences cultivated in Islamic Civilization.[108] One's mind can no longer pretend to be a *tabula rasa* with regard to the subject.

The second meaning pertains to the subject matter of the sub-discipline in Islamic Philosophy that serves to describe and clarify in objective, contemporary terms the methodological and philosophical principles that have guided or undergirded the cultivation of the sciences in Islamic civilization. This meaning renders Islamic science as part of philosophy and philosophy of science in general, and focuses more on the conceptual or intellectual rather than the empirical, practical or artifactual aspects of Islamic Science. Notable works in this regard are also many, including al-Attas's *Islam and the Philosophy of Science*, Nasr's *Introduction to Islamic Cosmological Doctrines*, Bakar's *Classification of Knowledge in Islam*, Franz Rosenthal's *Knowledge Triumphant. The Concept of Knowledge in Medieval Islam*,[109] Fazlur Rahman's *Avicenna's Psychology*[110] and many others. A useful internet resource in this regard is www.muslimphilosophy.com[111] covering practically all aspects of Islamic Philosophy, including philosophical aspects of Islamic Science. Moreover, many valuable articles and even whole books are downloadable from this website for free in .pdf format. Again, mere lack of access to the relevant references can no longer be offered as an easy excuse for ignoring the subject.

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[101] Recently, the Malaysian Ministry of Science, Technology and Innovation (MOSTI) in collaboration with Professor Fuat Sezgin's Frankfurt-based Institute for Arab-Islamic science held a three-month exhibition of Arab-Islamic scientific instruments, artifacts and manuscripts in Kuala Lumpur. The exhibition was very successful in terms of generating attendance and media coverage, and invoking in the general Muslim public a sense of pensive nostalgia for the Islamic technoscientific past. However, without critical appreciation of the actual sociocultural operative context of these exhibited artifacts, such nostalgic feelings will soon fade away and never be translated into positive action for reviving Islamic science in the real world. For a catalogue of the exhibition in three languages, Malay, English and Arabic, see Fuat Sezgin, *Scientific Excellence in Islamic Civilization: Islamic science Ahead of Its Time: Catalogue* (Kuala Lumpur: MOSTI, 2006).

[102] George Sarton, *Introduction to the History of Science*, 3 vols. (Baltimore: Williams and Wilkins, 1927-48).

[103](London: Warburg Institute, 1989).

[104](Seattle: University of Washington Press, 1994).

[105] Roshdi Rashed, ed. with Regis Morelon, 3 vols. (London: Routledge, 1996).

[106] (Edinburgh: Edinburgh University Press, 1994).

[107] Fuat Sezgin, *Geschichte des arabischen Schrifttums*, Vol. 1 ff. (Leiden: Brill, 1967 ff.; Institut fur Geschichte der Arabisch-Islamischen Wissenschaften: Frankfurt am Main, 1995 ff.).

[108] http://www.muslimheritage.com/topics/default.cfm, accessed March 26, 2007.

[109] (Leiden: E. J. Brill, 1970), a wide ranging, original study of the concept of *'ilm* (knowledge, science) in the Islamic intellecto-religious tradition.

[110] (London: Oxford University Press, 1952); cf. Syed Muhammad Naquib al-Attas, *The Nature of Man and the Psychology of the Human Soul: A Brief Outline and a Framework for an Islamic Psychology and Epistemology* (Kuala Lumpur: ISTAC, 1990), which also constitutes Chapter IV of the *Prolegomena*, 143-176; cf. Mohd Zaidi bin Ismail, *The Sources of Knowledge in al-Ghazali's Thought. A Psychological Framework of Epistemology* (Kuala Lumpur: ISTAC, 2002).

[111] http://www.muslimphilosophy.com/, accessed March 27, 2007.

Obviously it is in the latter category of works that the meaning of Islamic Science most overlaps with the meaning of Islamic Philosophy, while in the former case, Islamic Science can be and usually is studied on its own with little reference to Islamic Philosophy as such. Most scholars and researchers, when they talk about Islamic Science, are either referring to its empirical or philosophical aspects, or both. However, none, to my very limited knowledge, have tried to read Islamic Science in any systematic manner as an essentially *programmatic enterprise* in nature, i.e., as a *systemic research program* that has continually been creatively enriched and rearticulated throughout its history by the intellecto-scientific *ijtihad*[112] of succeeding generations of scholars, each generation in response to the demands and challenges of their age, although support for this reading can easily be gleaned from the many accessible published studies on various aspects of the history and philosophy of science in Islamic culture and civilization. This is not to say that these scholars of the past self-consciously viewed what they were doing as programmatic in the Lakatosian[113] sense of the term, but their actual intellectual attitude towards it, as can be gleaned from their works, certainly was programmatic in that sense.

Hence, al-Ghazali's *Tahafut al-Falasifah*[114] is not merely a one-off theological (*kalami*) reaction against peripatetic philosophy as articulated by al-Farabi and Ibn Sina, but it is actually an integral component of a ambitious and comprehensive programmatic outline for a *new kalam* (*kalam jadid*), a new kind of Islamic philosophico-theological system termed *kalam jadid* by Ibn Khaldun (1332-1406), who noted its significance for the subsequent intellectual history of Islam.[115] Al-Shafi'i's (767-820) *Risalah*[116] (84) is a program to set *fiqh* (Islamic jurisprudence) on a more organized disciplinary framework. Ibn Khaldun's celebrated *Muqaddimah*[117] is essentially a new socio-historical research program; and so on and so forth. Similarly, in order for us to revive Islamic Science today, we should build creatively on the works of al-Attas, Nasr, and Bakar, and in order to do that, we have to critically re-read their works, especially al-Attas's important *Prolegomena to the Metaphysics of Islam*, in an operative, programmatic framework of *vision in action.*

The third meaning of Islamic Science pertains then to the subject matter of a new discipline that serves to reformulate the concept of Islamic Science as a long term creative research program dedicated toward a systemic reapplication of Islamic cognitive and ethical values to science and technology in the contemporary world.[118] This reformulation, in order to be realized, will necessarily require leading Muslim scientists of high, contemplative (as opposed to merely technical) acumen to work toward a critical integration of the scientific endeavor into the conceptual framework of the Worldview of Islam, and the concomitant explication of the cognitive,[119] methodological and axiological implications of such integration for present and future empirical scientific research. This programmatic redefinition of Islamic Science will render it into a new over-arching 'paradigm' or 'research program'[120] pregnant with novel methodological, empirical and technical implications (and hence, novel discoveries) for remanifestating the Worldview of Islam in everyday individual and societal life through the vision and practice of a non-Western, authentically Islamic Science and Technology (IST)

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[112] In this regard, see Umar Faruq Abd-Allah, "Innovation and Creativity in Islam," Nawawi Foundation Paper, accessible online at http://www.nawawi.org/downloads/article4.pdf, accessed April 1, 2007.

[113] Imre Lakatos, *The Methodology of Scientific Research Programmes* (Cambridge: Cambridge University Press, 1984).

[114] *The Incoherence of the Philosophers*, trans. Michael Marmura (Provo, Utah: Brigham Young University Press, 2000).

[115] Ibn Khaldun, *Muqaddimah*, trans. Franz Rosenthal, 3 vols. (New York: Princeton University Press, 1958), 3: 53-53.

[116] Trans. Majid Khadduri (Baltimore: John Hopkins Press, 1961).

[117] Trans. Franz Rosenthal, 3 vols. (New York: Princeton University Press, 1958).

[118] This new discpline may tentatively be called Principles of Islamic science or Usul al-Ilm al-Islami in Arabic, or, to be more terminologically exact, *Usul al-'Ulum al-Tabi'iyyah al-Islamiyyah*. It will serve to mediate the empirical application of fundamental insights drawn from Islamic philosophy of science to actual scientific research in any scientific disciplines whatsoever. In short, it is to be a rigorously articulated operative Islamic history and philosophy of science, a kind of systemic critical thinking as applied to Islamic science, conceived somewhat along the lines of Ronald N. Giere, *Understanding Scientific Reasoning*, 4th ed. (New York: Holt, Rinehart and Winston, 1997). Giere's textbook is meant to guide students (and teachers), by close analyses of selected historical and contemporary case studies, to appreciate how the rarefied abstruse concepts so passionately debated amongst philosophers and historians of science are concretely grounded in, and hence relevant to, actual empirical scientific work.

[119] Or, epistemic.

[120] In the Kuhnian and Lakatosian sense, in, respectively, Thomas Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970); and Imre Lakatos, *The Methodology of Scientific Research Programmes*, op. cit. though my approach here is decidedly Lakatosian, since for our purpose here, the Lakatosian 'research program' has a more direct, constructive and operative relevance.

geared first and foremost toward identifying and solving the true problems and satisfying the real needs of the Ummah.

For the effective, substantial realization of this third, programmatic, meaning, leading Muslim scientists should take some time off from their busy formal professional teaching and research work to cultivate the philosophico-historical acumen necessary for grasping the first two meanings of Islamic Science in sufficient conceptual depth and informative detail. This acumen, once attained, will enable them to undertake the arduous theoretical and empirical work of fleshing out the direction and content of aspects of the Islamic Science Research Program (ISRP) applicable to their specializations or particular areas of research.[121] In practice, then, these three meanings have to be mastered and integrated into a single whole and applied to any particular scientific research project one is involved in.

From the history of science in Islam, we draw lessons from the successes and failures[122] of previous sages as constituting an invaluable heritage and resource for instilling self-confidence, breaking impasses and inspiring fresh ideas. From the lessons of Islamic philosophy, particularly where they pertain to scientific thought and practice, we learn the art of critical reflection and conceptual analysis by which we may harmonize between our human drive to know and our human need to be happy, so that the science we cultivate be a constructive rather than destructive aspect of our civilization. By reading the history and philosophy of Islamic science as programmatic in nature we build the capacity to construct and cultivate a new, contemporarily relevant Islamic Science and Technology that, on the one hand, will manifest and realize our value system and hence be directed toward fulfilling our physical, emotional and spiritual needs, and, on the other, engage constructively with Western modern science and technology. To further elaborate this new vision one needs to go into some details of the conceptual content of this general Islamic science Research Program (ISRP).

PART IV

12. Islamic Science Research Program (ISRP) I

In the Qur'an it is stated clearly that Allah will reveal His signs in the cosmic horizons and in our own selves until it shall be clearly manifest to us (and to humankind in general) that it (the Qur'an) is the truth/the real.[123] This verse implies that the revealed, metaphysical truths of the Qur'an have their physical, sensible, observable and experiential counterparts in phenomenal creation which manifest, indicate and instantiate these transcendent truths. But in other verses there is a caveat to the effect that these Divine signs are only recognizable as such by a people who think and reflect,[124] meaning those who think and reflect correctly in both the rational, discursive (*fikri, nazari*)[125] and the intellective, contemplative *('aqli, tafakkuri*) sense,[126] otherwise they might reject or misinterpret these signs and go on to view nature as bereft, or independent, of the Divine presence. This implies that these phenomenal signs, for most people, including scientists, do not self-evidently point to Allah, otherwise all will be believers as a matter of course as there will then be no cognitive testing of their innate, *fitri*[127] intelligence, and hence no intellectual motivation for

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[121] If medicine, then an Islamic Medicine Research Program (IMRP); if chemistry, then an Islamic Chemistry Research Program (ICRP); if agriculture, then an Islamic Agriculture Research Program (IARP); if physics, then an Islamic Physics Research Program (IPRP); if economics, then an Islamic Economics Research Program (IERP); if biology, then an Islamic Biology Research Program (IBRP); if psychology, then an Islamic Psychology Research Program (IPsyRP); if architecture, then an Islamic Architecture Research Program (IArcRP); and so on and so forth. Obviously we are not to "Islamize" every discipline and sub-discipline that is offered us in the academic market place, for it is an essential aspect of the general Islamic Science Research Program (ISRP) that it functions to axiologically differentiate between those disciplines whose mastery is important for the welfare of the Ummah and those which are superflous, or, even worse, intellectual red herrings. Here, a creative, applicative re-reading of Bakar's important study *Classification of Knowledge in Islam* will have a pivotal role to play. In this regard, see also al-Attas, *Islam and Secularism*, 164 ff.

[122] "Failures" in the sense of what, from the perspective of hindsight, they could have further achieved but did not.

[123] *Fussilat*: 53; for *al-haqq/al-haqiqah* as 'truth-reality, see al-Attas, *Prolegomena*, 125 ff.

[124] e.g., *al-Baqarah*: 164.

[125] Al-Attas, *Prolegomena*, 122 ff.

[126] i.e., ratiocination within the ambit of intellection according to Nasr, Science and Civilization in Islam, 21 ff; cf. al-Attas, Prolegomena, 122 ff.

[127] For a study of the concept of fitrah in the Islamic intellectual tradition, see Yasein Mohamed, *Fitra: The Islamic Concept of Human Nature* (London: Ta Ha Publishers, 1996).

the cultivation of the theoretical and practical sciences. In other words, as pointed out in various ways by Nursi (1878-1960),[128] Nasr[129] and al-Attas,[130] there is a certain degree of cognitive ambiguity in phenomena, in the sense that they both veil and unveil the Divine presence. The ultimate test for humankind on earth, and which they must pass in order to attain to true, everlasting salvation, is to perceive the Divine presence through the superficial veil of phenomena. This means that the *semiological ambiguity* of nature serves the purpose of being an intellecto-moral test of mankind's fidelity[131] to their Creator. Of course Islam teaches many ways by which one can see through the veil and attain to true knowledge/*ma'rifah* and hence true worship/*'ibadah*, but here we shall restrict ourselves to the way of discursive investigative science understood as systematic, empirical study of nature, which in the past was largely undertaken within the more general disciplinary frameworks of *falsafah, kalam and hikmah.*

There is the further consideration that the Qur'an is not only true/real with regard to what it says about ontological reality (*haqiqat al-wujud wa maratibuha*),[132] that is veiled and yet unveiled by the phenomenal world (*al-dunya*), but also with regard to what it says about both the physical and human aspects of the phenomenal world itself and the laws governing them. Again for most people, it is not immediately obvious that these lower phenomenal realities exhibit features confirming or realizing in detail what the Qur'an says about them by way of general, often allusive, indications, hence the need again for the cultivation of both the intellectual and religious sciences (*naqliyyat wa 'aqliyyat*). For instance, the Qur'an mentions that nothing in nature is in vain or wasted, (*rabbana ma khalaqta hadha batilan*)[133] a cosmic truth whose empirical ramifications are now borne out in all its factual, quantitative details through the ecological and environmental sciences.[134] The Qur'an mentions directly the healing and nutraceutical benefits of honey[135] and indirectly the therapeutic value of sleep,[136] general truths that, when clarified enough through the relevant biological and medical disciplines and research, become sucessfully applicable to specific health related situations.[137] With respect to the more ethico-moral domains of intellectual life, the Qur'an mentions the Prophet, *sallaLlahu 'alayh wa sallam*, as being sent as a "mercy for all creation" (*rahmatan li al-'alamin*),[138]

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[128] Yamine Mermer and Redha Ameur, "Beyond the Modern: Said al-Nursi's View of Science" in *Islam & Science*, Vol. 2 (Winter 2004) No. 2, 119-160 passim; cf. Yamine Mermer, "The Hermeneutical Dimension of Science: A Critical Analysis Based on Said Nursi's Risale-i-Nur" in *The Muslim World Review*, Special Issue: Said Nursi and the Turkish Experience, LXXXIX: 3-4 (July-October 1999), 27096 passim; Sukran Vahide, "The Book of the Universe: Its Place and Development in Bediuzzaman's Thought" in *A Contemporary Approach to Understanding the Qur'an: The Example of the Risale-i-Nur,* Proceedings of the the International Symposium held in Istanbul 20-22 September (Istanbul: Sozler Nesriyet: 1998), 466-483 passim.

[129] *Science and Civilization in Islam*, 21 ff.

[130] *Prolegomena*, 135-136.

[131] This refers to man's covenant with God mentioned in the Qur'an (al-A'raf. 172). For a profound elaboration on the implications of this primordial covenant for the meaning and practice of religion in Islam, see al-Attas, *Islam and Secularism*, 51 ff; idem, *Prolegomena,* 41 ff.

[132] That is, the Divine essence, attributes and acts, and the unseen spiritual realities such as angels and jinns, including eschatological realities and events.

[133] *Rabbana and khalaqta hadha batilan* ("O our Lord, you have not created this in vain ...," *Al 'Imran*: 191).

[134] In the past this verse may have inspired, for instance, the creation of oil-lamps in which the left-over soot was recycled into ink (brought to my attention by Naguib Mohd Nor, my aerospace engineering friend). Today we have the corresponding 'zero-waste' and 'waste-to-wealth' approaches in industrial and engineering processes gaining ground in the West and in Japan which can be appropriated by Muslim engineers within a comprehensive, well-articulated outlook towards the environment. This will necessitate, of course, the rejection of the so-called Gaia hypothesis underpinning the secular green movement in the West and Japan, and its replacement with an authentic, Islamic environmental ethical framework derived from the Islamic philosophy of nature; see, for instance, the relevant articles in Richard C. Foltz et. al., eds., *Islam and Ecology: A Bestowed Trust* (Cambridge, MA: Harvard University Press, 2003). For a concrete application of authentic Islamic environmental ethics in the case of Zanzibar's Muslim fishing community, see Sbah Ahmed, "Inspiring Change in Zanzibar" in *EcoIslam*, No. 1 (January 2006), accessible online through the website http://www.ifees.org.uk/newsletter_1_small.pdf. A more recent, similar case study is reported in Abdur-Razzaq Lubis et. al., "Pioneering Islamic Environmental Practice in Indonesia" in *EcoIslam*, No. 2 (September 2006), accessible online at http://www.ifees.org.uk/newsletter_2_small.pdf.

[135] *al-Nahl*: 69.

[136] *al-Furqan*: 47; al-Naba': 9.

[137] For a discussion, see Aisha Subhani, "The Virtue of Sleep" in *Seasons*, Semi-annual Journal of Zaytuna Institute, Vol. 3 (Spring 2006) No. 1, 67-73; and P. C. Morgan, "Honey as Medicine," in *Seasons*, Semiannual Journal of Zaytuna Institute, Vol. 1 (Autumn-Winter 2003-2004) No. 2, 79-90.

[138] *al-Anbiya'*: 107. For a beautiful commentary on this verse, see the Nawawi Foundation Paper by Dr. Umar Faruq Abd-Allah, "Mercy, the Stamp of Creation," accessible online in pdf format at http://www.nawawi.org/downloads/articlel.pdf.

inanimate, animate, and human. This, in itself, is a general abstract truth that becomes concretely self-evident for believers not living in the Prophet's lifetime through the science of *sirah* or prophetic biography.[139] We are obliged to obey Allah in all aspects of our life, a general moral, injunctive truth that is rendered objectively realizable in actual conduct through the science of *usul al-fiqh*[140] which intellectually mediates between the general normative injuctions of the Qur'an and Sunnah and their positive applications in the complexity of diverse personal and social contexts. We are obliged to obey the Prophet, a moral, injunctive truth for the realization of which the science of hadith criticism, with its distinctive testimonial logic of *sanad*[141] scrutiny, was cultivated and refined. So the programmatic reading of the Islamic sciences of nature could also be extendable to what is usually known as the "religious" sciences, especially if we want to revive the latter so as to be able to engage and overcome constructively and in a systemic manner the many complex socio-religious and political economic problems that are peculiar[142] to our present, overly westernized age. However, in order to keep this discourse within manageable limits, I shall restrict myself to the problem of reviving Islamic Science, in which science (*'ulum al-tabi'iyyah*) is taken to refer to the systematic investigation of nature.

13. Islamic Science Research Program (ISRP) II

As stated earlier in Part I above, the Islamic Science Research Program (ISRP), in general, consists of an unchanging core metaphysical component underpinning the program (referred as the Worldview of Islam = *Ru'yat al-Islam lil-Wujud*), and a surrounding network of auxiliary explicative theories and hypotheses for creatively relating the metaphysical abstract core to the concrete physical world. The role of the network of auxiliary theories is to provide directions for the conceptual clarifications and empirical investigations of various aspects of this permanent metaphysical core by relating them to corresponding aspects of the physical world, thus imbuing the former with experiential and empirical content or meaning. In other words, the auxiliary, theoretical network is that by which we intellectually *mediate* between the metaphysical worldview of revelation and the physical world of creation, through which mediation we provide rational and scientific support for that worldview, thus enriching and clarifying it conceptually and empirically until it becomes manifest to them (and to us also) that it (the Qur'anic worldview and all that it implies) is the truth/the real (*hatta yatabayyana lahum annahu al-haqq*).[143] Schematically, the ISRP can be represented in the form of three concentric circles as shown below:

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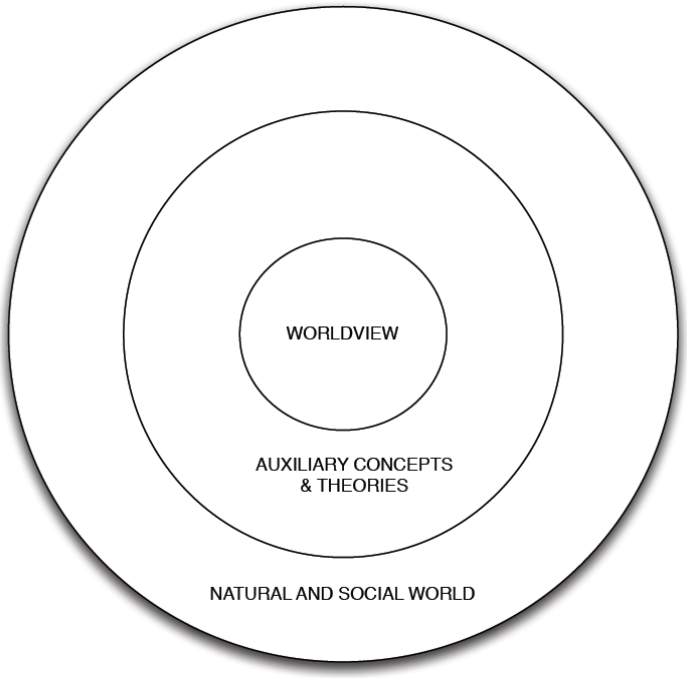
[139] The best so far in English, by scholarly consensus, is Martin Lings, *Mohammad: His Life Based on the Earliest Sources* (Allen and Unwin, 1983; Cambridge: Islamic Texts Society, 1991; Kuala Lumpur: A. S. Noordeen, n.d.).

[140] Mohammad Hashim Kamali, *Principles of Islamic jurisprudence*, 2nd rev. ed. (Cambridge: Islamic Texts Society, 1991); Kuala Lumpur: Ilmiah Publishers, 2000); cf. Imran Ahsan Khan Nyazee, *Theories of Islamic Law: The Methodology of Ijtihad* (Kuala Lumpur: The Other Press, 2002

[141]. The uninterrupted chain of authorities on which a tradition is based; see Muhammad Zubayr Siddiqi, *Hadith Literature: Its Origin, Development, Special Features and Criticism*, rev. ed. (Cambridge: Islamic Texts Society, 1993

[142]. "Peculiar" in the sense that many, if not most, of the problems of the Ummah today, in contrast to the pre-colonial past, are the direct results of the imposition, by insidious or direct means, of alien Western secular civilizational norms on traditional Muslim societies. Two very good examples of this contemporary intellecto-religious revival are Nuh Ha Mim Keller, *Port in a Storm: A Fiqh Solution to the Qibla of North America* (Amman: Wakeel Books, 2001); and Shaykh Afifi al-Akiti, *Defending the Transgressed by Censuring the Reckless against the Killing of Civilians* (UK: Aqsa Press, 2006; Germany: Warda Publications, 2006), the whole text of which is downloadable from the website http://wwwwarda.info/fatwa.pdf, accessed on April 1 2007

[143] *Fussilat*: 53.



The inner circle represents the unchanging, permanent, revealed metaphysical core expressed as the 'Worldview of Islam' (*Ru'yat al-Islam lil-Wujud*).[144] The middle circle represents the network of auxiliary theories and hypotheses which may be modified, changed or added to from time to time; this may be called the 'network of auxiliary theories' (*shabakah al-nazariyyat al-mulhaqah*). The outer circle represents nature (*al-tabi'ah*), the physical, sensible world itself, or simply, the 'physical world'. Islamic scientific creativity lies exactly in the middle circle and consists in articulating objective theoretical frameworks for facilitating a sufficiently detailed reading of the physical world as unveiling (affirmative of) rather than veiling (unaffirmative of) the truth and reality of the revealed, metaphysical core. By "objective" is meant that this "sufficiently detailed reading" is to be amenable to participation and scrutiny by non-Muslim scientists, if they so wish, even if they do not believe the metaphysical core, by reference to the very same physical world accessible to both Muslims and non-Muslims alike. It is by virtue of this objectivity that Muslim scientists involved in ISRP will have no problem recognizing and incorporating certain positive elements of Western and eastern sciences into their research.[145] It is not possible here to elaborate further on the creative nature of the middle circle of the ISRP, which is basically where the discursive reason (*fikr/nazar*) and contemplative intellect (*'aql*) mediate between the book of revelation (*kitab al-wahy*) and the book of creation (*kitab al-kawn*); however, we may invoke a simple general example.

[144] Adi Setia, "Islamic science as a Scientific Research Program" in *Islam & Science*, Vol. 3 (Summer 2005) No. 1, 93-101; (114.) Al-Attas, *Prolegomena,* 2; Cf. the diagrams in al-Attas, *Islam and Secularism*, 156-159.

[145] The basis of this shared epistemic objectivity is the mutual affirmation of a certain degree of methodological equivalence between Islamic and Western science, or between theistic and agnostic science; for a good discussion of this methodological issue see Stephen C. Meyer, "The Methodological Equivalence of Design and Descent" in J. P. Moreland, ed., *The Creation Hypothesis: Scientific Evidence for an Intelligent Designer* (Downer's Grove, IL: InterVarsity Press, 1994), 113-138. It is by virtue of this shared epistemic objectivity that the Greek sciences were appreciated by classical Muslim thinkers, that aspects of Islamic science and philosophy were appreciated by the Latin West, and that now we are witnessing amongst Muslims and westerners alike a general rethinking of modern science and technology and the quest for holistic, human- and nature-friendly alternatives.

The Qur'an says that the Prophet, peace and blessings of Allah be on him, was sent as a mercy to all the worlds (*rahmatan lil-'alamin*). If we, as Muslim scientists committed to Islam, are to follow in the footsteps of the merciful Prophet, then the way we study nature and interact with it (*mu'amalat al-nasi al-tabi'ata*)[146] is very much constrained by the prophetic ethics of cosmic mercy.[147] This means that much of what we do or take for granted in contemporary science and technology has to be seriously and systemically rethought since it is obviously unrestrained by the ethics of mercy. Modern science and its technological offshoots are, in many diverse, complex ways, very aggressive toward nature and, by extension, toward humankind as part of nature.[148]

If by definition science is "the study of nature," then obviously it is in the interest of science and scientists and humanity in general to preserve nature in order to guarantee its continued study by science. Thus *scientific curiosity entails moral responsibility,* which means that cognitive research of science has its inherent ethico-moral dimension which finds expression in its methods and technics. However, the paradox now is that the more science knows about nature, the more of it is devastated, and the less there remains of it to be studied and appreciated. It is as if the modern pursuit of abstract, cerebral science and its manipulative technological offshoots have to go hand in hand with the desolation and disappearance of living nature as an unavoidable consequence, but that position is unacceptably fatalistic for truly concerned Muslim scientists. For them, the Qur'anic ethics of universal, cosmic mercy shows the way toward another way of doing science that respects and preserves nature (and by extension humankind) rather than destroys it, and I believe that a well articulated ISRP involving all thinking, reflective and self-critical scientists will facilitate the way toward realizing that merciful science in practice. What follows are some particular case studies in brief by way of applicative illustration.

14. Some Further Case Studies in Brief

Vivisection (the very term means "to cut alive") is the way modern, business-driven medicine tortures live animals to test drugs in order to rid humanity of their ever lengthening list of old and new diseases.[149] As a method of medical research it is relatively new (a hundred or so years old) and peculiar to modern Western medical culture. Quite apart from the extrinsic question of ethics in respect thereof, there is also a more fundamental intrinsic question, namely the question of the scientific integrity (or cognitive value) of the underlying, largely unexamined assumption of a significant degree of biological and physiological similarity between laboratory test animals and human beings justifying extrapolations of clinical results from one to the other. The ISRP for Muslim medical researchers in this regard will be to find systemic alternatives of unquestioned scientific and ethical integrity to vivisection, including valid alternatives critically sourced from marginalized Western and eastern medical traditions which could be incorporated into the ISRP (or to be more specific, the IMRP, Islamic Medicine Research Program). Some of these alternatives can also be gleaned by undertaking evidence-based medical research into the well documented but largely neglected vast corpus of the very successful one thousand years' old Islamic cosmopolitan medical tradition.[150]

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[146] As pointed out by my colleagues, Dr. Zaini Othman and Dr. Mohd. Khialdin, this means that the concept of mu'amalah now largely restricted in the discipline of fiqh as applying to interactions and trans actions between human beings together with all its ethico juridical precepts (such as *la darar wa la dirar*, that is, "no harming and no reciprocating harm") are to be critically extended to all human interactions with the natural environment, especially technoscientific interactions, since it is these which are having the greatest impact on nature and natural resources.

[147] For a beautiful commentary on the cosmic mercy of the Prophet, see the Nawawi Foundation Paper by Dr. Umar Faruq Abd-Allah, "Mercy, the Stamp of Creation," accessible online in pdf format at http://www.nawawi.org/downloads/articlel.pdf.

[148] An eloquent indictment of Western technoscientific behavior toward nature by a Western observer is Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge: Cambridge University Press, 1988), where, on page 343, he says, "The sudden acceleration of environmental damage throughout the world since World War Two has been largely the consequence of our scientific enterprise ... there can be no getting around the fact that science has made possible the modern devastation of nature."

[149]Pietro Croce, *Vivisection or Science: An Investigation into Testing Drugs and Safeguarding Health* (London: Zed Books, 1999), reviewed by 'Adi Setia in Islam & Science, Vol. 3 (Summer 2005) No. 1, 87-90; cf. Moneim A. Fadali, *Animal Experimentation: A Harvest of Shame* (Los Angeles: Hidden Springs Press, 1997), and Ray Greek, *Sacred Cows and Golden Geese: The Human Cost of Experimenting on Animals* (London: Continuum International, 2000). An informative, eye-opening monograph on the proper treatment of animals according to the traditional Islamic sources is, Al-Hafiz B. A. Masri, *Animals in Islam* (Petersfield, Hants: Athene Trust, 1989).

[150] A good starting point for delving into the operative context of the Islamic medical tradition is Fazlur Rahman, *Health and Medicine in the Islamic Tradition: Change and Identity* (Chicago: Kazi Publications, 1998); cf. Franz Rosenthal, *Science and Medicine in Islam: A Collection of Essays* (Aldershot: Variorum, 1991); cf. Sheikh Nazim Adil al-Haqqani An-Naqshabandi, *Natural Medicines*, (London: Ta Ha Publishers, 1992).

Modern agriculture, to take another example, is overly chemical intensive with widespread use of pesticides, herbicides, synthetic nitrogen fertilizers and so on, which poison the earth, kill rural wildlife, even toxify the harvests and disrupt the health of farmers. Traditional farming methods have been perfectly adapted to local socio-natural conditions generating a symbiotic, holistic balance between the needs of humanity and the rights of nature. As the word implies, agriculture is a culture, a whole way of life of mutual respect, communal give and take, and cooperative rather than competitive living. There are also agro-innovations of course, but innovations within ecological limits, as the case of Andalusian agricultural science and practice show.[151] It is not a mere business, as the modern corruption of the original word into "agribusiness" would have it, which imposes the corporate tyranny of impersonal profit-maximization on once self-respectful, independent farmers and indigenous peoples, reducing them into wage- and debt-slaves, squatters on the very lands they once have had customary rights to but now wrested from them by faceless, soulless corporations. It is strange that agricultural food production, which once unquestionably served the welfare of humankind, should now, in the hands of big agrochemical companies like Monsanto,[152] be seen to be working toward destroying the very ecological basis of that welfare. In order to return agricultural practice onto the ethical path of mercy toward humanity and nature, an authentic Islamic Agriculture Research Program (IARP) would be one that eschews harmful chemicals altogether and instead looks into the various effective organic methods now available such as permaculture,[153] and develop new ones by, for instance, drawing on the thousand years' accumulated experience of a very successful Islamic agricultural tradition, the original, truly 'green' revolution.[154]

15. The Ethical and the Cognitive

To return to the question of scientific objectivity (i.e., the question of what should count as objectively verified knowledge and the research methods by which this objectivity is ascertained), this has more to do with the cognitive rather than ethical values underpinning the ISRP, though in Islamic scientific practice, the cognitive merges seamlessly into the ethical and becomes one with it. In other words, cognitive evaluation and ethical evaluation are both intrinsic to the scientific enterprise in Islam, as is quite evident in Ibn Haytham's much studied scientific methodology. The realization that scientific objectivity and methodological probity are not possible without concomitant ethico-moral integrity has been growing in the West and is now moving more toward the Islamic position thus allowing room for mutual constructive engagement on this important meta-scientific issue.[155] To illustrate very briefly how the concept of scientific objectivity actually operates in the ISRP with respect to cultivating a critical attitude toward Western science, let us consider the twin Qur'anic cognitive principles of *tabayyun* (investigation, scrutiny)[156] and *burhan* (proof, evidence).[157] Due to the global dominance of Western science, Muslim scientists are continuously bombarded with reports of promising new methods, discoveries and techniques in prestigious Western journals like Nature, Science, New Scientist and Scientific American. It will be irresponsible of them to take these reports at face value without undertaking their own investigation (*tabayyun*) into the often hidden underlying context of these

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[151] A. M. Watson, *Agricultural Innovation in the Early Islamic World* (Cambridge: Cambridge University Press, 1983).

[152] On the case against Monsanto, see, for instance, the relevant articles in Brian Tokar, ed., *Redesigning Life?: The Worldwide Challenge to Genetic Engineering* (London: Zed Books, 2001), which is reviewed in 'Adi Setia, Islam & Science, Vol. 1 (Summer 2005) No. 3, 91-92. See also, Nicanor Perlas, "Biotechnology or Sustainable Agriculture?" in *Kesturi*, Journal of the Islamic Academy of Science Malaysia, Vol. 1 (June 1991) No. 1, 43-80.

[153] Bill Mollison, *Introduction to Permaculture*, rev. ed. (Sisters Creek, Tasmania: Tagari Publications, 1997).

[154] A. M. Watson, *Agricultural Innovation in the Early Islamic World* (Cambridge: Cambridge University Press, 1983). For a powerful, impassioned indictment of the modern, big-business driven, state sponsored "green revolution," see Vandana Shiva, *The Violence of the Green Revolution: Third World Agriculture, Ecology and Politics* (Penang: Third World Network, 1997); see also idem, *Monocultures of the Mind: Biodiversity, Biotechnology and the Third World* (Penang: Third World Network, 1995).

[155] Larry Laudan, *Science and Values* (Berkeley, CA: University of California Press, 1984); R. Proctor, *Value-Free Science?. Purity and Power in Modern Knowledge* (Cambridge, MA: Harvard University Press, 1990); Helen Longino, *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry* (Princeton: Princeton University Press, 1990); John Ziman, *Reliable Knowledge: An Exploration of the Grounds for Belief in Science* (Cambridge: Cambridge University Press, 1978); idem, *Public Knowledge: Essay Concerning the Social Dimension of Science* (Cambridge: Cambridge University Press, 1968); idem, *Real Science: What It is and What It Means* (Cambridge: Cambridge University Press, 2000); and many other works of like nature, especially Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (London: Routledge,1998), and also Brian Martin, *The Bias of Science* (Canberra: Society for Social Responsibility in Science, 1979).

[156] *al-Hujurat*: 6.

[157] *al-Baqarah*: 111.

reports and ascertaining their empirical adequacy (*burhan*) and "epistemological autonomy" (*al-istiqlal al-'ilmi*) from powerful forces geared less toward global scientific enlightenment than narrow political economic enrichment.[158] Creative understanding and practice of *tabayyun* and *tabarhun,* as exemplified by Ibn Haytham, will help Muslim scientists to separate the wheat from the chaff of Western science and incorporate it into the ISRP. For instance, in the case of chemistry, the growing new field of 'green chemistry'[159] is something that shows great promise of eliminating the threat of toxic chemicals from the human and natural environment, thus realizing the ethico- juridical principle of *la darar wa la dirar* ("no harming and no reciprocating harm"), which is itself derived from the cosmic, prophetic principle of universal mercy.

Finally, there is the very important, strategic question of the appropriate higher educational institutional framework for realising the ISRP over the long term, especially by educating and training postgraduate researchers to creatively apply ISRP principles to their respective specializations.[160] As pointed out by S. Nomanul Haq, there is a great need to revise the way we educate university science students so that they know how to integrate their scientific knowledge and expertise into the more fundamental and higher goals of human life and thus avoid the destructive pitfalls of scientism.[161] True science is beneficial knowledge (*al-'ilm al-nafi')* that is geared toward serving rather than subverting these higher, human goals. And the highest goal, the summum bonum, is, of course, "to bring a sound conscience to the meeting with the Lord,"[162] and thereby attain His pleasure (*mardatiLlah*).

16. Concluding Considerations

The foregoing shows that the ISRP can be a very exciting, wide-ranging alternative scientific research program for Muslim scientists, especially if they are serious about wanting the Islamic worldview to be operative in the scientific and technological domains of life. We now have Islamic Law and Islamic Economics as operative, disciplinary realities in academic and public institutions, and there is no reason why Islamic Science, due to its cosmopolitan nature and universal appeal, should not attain similar or greater level of professional and popular acceptance, even amongst non-Muslims. All we need to do, in my opinion, is to recast the first and second meanings of Islamic science into the operative, programmatic framework of the third meaning and then apply this meaning to one's particular field of scientific specialization, provided, of course, that specialization is axiologically justifiable[163] from within the perspective of the Islamic worldview. I hope the foregoing has shown clearly, if somewhat sketchily, that the cognitive and ethical concerns inherent in the ISRP will eventually result in methods, techniques and even products that exhibit and embody those concerns and thus create a truly beneficial scientific future for Muslims, and, by extension, for the world.[164] All in all the central argument of my thesis can be summarized thus:

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[158] This consideration is particularly pertinent given the fact that much of post-World War II Western science operates within the broad policy matrix of the political economic report prepared for President Harry Truman by Vannevar Bush, who headed the Manhattan Project, entitled *Science: The Endless Frontier*; see Pietro Greco, "Comment: John Ziman" in *Journal of Science Communication*, Vol. 5 (December 2006) No. 4. See also the valuable collection of articles in Ziauddin Sardar, ed., *The Revenge of Athena: Science, Exploitation and the Third World* (London: Mansell, 1988).

[159] Mike Lancaster, *Green Chemistry: An Introductory Text* (Cambridge: Royal Society of Chemistry, 2002); Paul T. Anastas and John C. Warner, *Green Chemistry: Theory and Practice* (New York: Oxford University Press, 2000): V. K. Ahluwalia and M. Kidwai, *New Trends in Green Chemistry* (Boston: Kluwer Academic Publishers, and New Delhi: Anamaya Publishers, 2004). For the twelve principles of green chemistry according to the American Chemical Society and the United States Environmental Protection Agency, see: http://www.chemistry.org/portal/a/c/s/1/acsdisplay.html?DOC=greenchemistryinstitute%5Cgc_principles.html, accessed March 27, 2007.

[160] A thorough going treatment of this educational institutional question is Wan Mohd Nor Wan Daud, *The Educational Philosophy and Practice of Syed Muhammad Naquib al-Attas: An Exposition of the Original Concept of Islamization* (Kuala Lumpur: ISTAC, 1998), which expounds at length Syed Muhammad Naquib al-Attas, *The Concept of Education in Islam* (Kuala Lumpur: ISTAC, 1999), as concretely realised in the establishment of the International Institute of Islamic Thought & Civilization (ISTAC) in 1987. See also Wan Mohd Nor Daud, *The Beacon on the Crest of a Hill: A Brief History and Philosophy of ISTAC* (Kuala Lumpur: ISTAC, 1991), and Sharifah Shifa al-Attas, *ISTAC Illuminated: A Pictorial Tour of the International Institute of Islamic Thought & Civilization* (ISTAC) (Kuala Lumpur: ISTAC, 1998). A tertiary educational institute modeled on ISTAC is in the process of being established in Indonesia by the Institute for the Study of Islamic Thought and Civilization (INSISTS); may Allah ease the way toward the realization of this noble goal, gamin!

[161] "Science, Scientism, and the Liberal Arts" in *Islam & Science*, Vol. 1 (December 2003) No. 2, 267-271.

[162] *al-Shu'ara'*: 89.

[163] For an elaboration with regard to the "determining of the order of priority" of the sciences, see al-Attas, *Islam and Secularism*, 164 ff.

[164] This thesis shall, insha'a'Llah, be elucidated further through detailed analyses and syntheses of selected historical and contemporary case studies in a forthcoming monograph to be tentatively entitled *The Islamic Science Research Program: Principles and Practice*.

The twin historical and philosophical meanings of Islamic Science are to be integrated into a third operative, programmatic meaning pertaining to the systemic reapplication of Islamic cognitive and ethical values to science and technology in the contemporary world. This will involve critical integration of the scientific endeavor into the conceptual framework of the Islamic worldview, and the concomitant explication of the cognitive, methodological, and axiological implications of such integration for present and future scientific research. This *operative redefinition* of Islamic Science will render it into a new over-arching 'paradigm' or 'research program' pregnant with novel methodological and empirical implications (and hence, novel discoveries) for remanifesting the Worldview of Islam in everyday individual and societal life through the vision and practice of a non-Western, authentically Islamic science and technology geared first and foremost toward identifying and solving the true problems and satisfying the real needs of the Ummah.

You are the best community sent out for mankind;
you enjoin what is right and forbid what is wrong,
and you believe in Allah.[165]

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[165] *Al'Imran*: 110.