

ISLAMIC WORLD ACADEMY OF SCIENCES Newsletter



July-August 2009

Volume 23 Number 37

Major policy issues addressed at the 16th Conference of the Islamic World Academy of Sciences, held in Kazan (Russia)

on

*Science, Technology, and Innovation for Sustainable Development
in the Islamic World:*

Policies and Politics Rapprochement



H E Mintimer Shaimiev
President of the Republic of
Tatarstan

In his opening speech, Mr Shaimiev talked about the history of the Tatar people and how they became Muslims. He emphasized that Tatarstan was gradually placing itself as a bridge between the Islamic world and Russia, which itself became an OIC-observer member in 2005.

Below, is the full text of the speech of H E the President of Tatarstan.

With all my heart, I welcome you to the hospitable land of the ancient capital of Tatarstan.

It is for the first time that we are hosting such a representative Islamic Forum in the Russian Federation, and we are grateful to the Islamic World Academy of Sciences for choosing Kazan as a place of for the conference.

I am confident that this choice is not accidental. Tatarstan successfully develops scientific-technical, trade and economic and cultural relations with many Muslim countries. We are united by centuries-old historical and spiritual traditions that advance understanding and constructive dialogue.

In AD 922, our ancestors adopted Islam due to the active efforts of envoys of the Baghdad caliph al-Muqtadir Billah to Volga Bulgaria. Because of its advantageous geographical position Volga Bulgaria had a wide range of contacts with Arab countries in the Middle East. The Islamic civilization became a foundation for spiritual and material development of Tatars and many Turkic peoples in Eurasia. The evidence of that manifests itself in the many beautiful items of our cultural heritage.

The orientalist, academician Vasily Bartold called our land; the northernmost outpost of the Islamic World. It was so for centuries, and today - in the condition of globalization - Tatarstan is trying to make its contribution to strengthening of relationships between Russia and the Islamic World, between the West and the East.

In 2005, Russia obtained observer status in the Organization of the Islamic Conference (OIC). Tatarstan is rightly proud of its contribution to the development of relationships between the Russian

Federation and this influential organization and takes the lead in joint undertakings and projects. Our republic is an active participant in the work of the Group of the Strategic Vision "Russia – the Islamic World." We interact with the Arab League, IRCICA, the Research Centre for Islamic History, Art, and Culture, and other organizations. We promote stronger collaboration with the Muslim World in every possible way, reconfirming our mission as Russia's Eastern Gate. We see the international conference of the Islamic World Academy of Sciences with its 57 OIC member countries as an opportunity to consolidate our joint efforts in order to create new conditions for development of science and technology. This event is an example of unity of scientists from all over the world in the name of successful joint actions and achievement of common goals.

Today, Tatarstan is one of the dynamically developing regions of the Russian Federation, a large centre of Russian industry, engineering, oil production, petrochemistry, aircraft and automobile construction and agriculture. Last year saw the extraction of the three billionth ton of crude oil being extracted in the republic. Tatarstan manufactures heavy trucks (Kamaz) that are well known as winners of the Dakar Rally, our helicopters are in demand in many eastern countries. The republic is the largest producer of synthetic rubber, polyethylene, polystyrene and other polymers and chemical products.

Scientific research centres and universities are also the pride of the republic. Starting from the 10th -11th centuries, maktabas and madrasas (Muslim educational institutions) operated in big cities and villages of Volga Bulgaria, then the Kazan Khanate, where principles of

Dr Abdel Salam Majali,
Participants and guests of the
conference,

the Holy Qur'an, philosophy and natural sciences were taught, and treatises of Al-Kindy, Ar-Razi, Al-Khorezmy, At-Tabari and other great authors of the Arab world were studied.

Tatar scientific thought of the 17th - 18th centuries gained international reputation. Its representatives Qayum Nasyri, Shihabuddin Marjani, Rizaetdin Fakhreddin and others had influence on the development of Islamic theology, education and history. The Tatar theological school was truly established and further development of religious education and charity took place.

In the 1820s, the great mathematician and the head of Kazan Imperial University Nikolai Lobachevsky made a discovery of universal importance in developing non-Euclidean geometry. It was Kazan where Soviet organic chemistry came into existence as a worldwide scientific school, thanks to the efforts of the university graduates N. Zinin, A. Butlerov, G. Kamay and others.

Kazan physicists discovered the effect of paramagnetic resonance that underlies construction of medical tomographs.

Since 1807, the Oriental Division, the first educational institution of oriental studies in Russia, operated in Kazan State University, having become the largest such centre in Europe and home to domestic Arab and Turkic studies.

Educational institutions, ethnic and cultural variety, traditional high level of education of Tatars created favorable environment for professional linguists and large-scale research.

Today, activities of our leading institutes of higher learning and research centres coordinated by the Tatarstan Academy of Sciences are aimed at solving issues of innovative development of the republic, developing advanced manufacturing sciences, active integration of science, education and economy as well as establishing international contacts and relations including the scientific community of the Islamic world.

I believe that prospects of the Muslim community first of all exist in the sphere of new knowledge and innovative technologies. During the Golden Era, Arab scientists played a key role in the development of civilization and world science. While guided by rich experience and religious traditions accumulated through many centuries, it is important to continue to develop and multiply them as a source of knowledge.

Herein we should strictly follow the covenant of Prophet Mohammed: "learned persons on the Earth is comparable with stars on the sky." May these stars shine brightly, radiating warmth and reviving hope in people's hearts for a peaceful, bright and safe future of humankind.

I hope our conference will give strong impetus for creating a model of constructive endeavour and collaboration, integration into united scientific and technical space, accomplishing scientific investment policy directed to science intensive economy and high-technology production.

Today, the process of spiritual renaissance is in progress in the Russian society as well as in Tatarstan and Islamic theological ideas are developing quickly.

Over the last 10-15 years, studying history and the current state of Islam has developed into one of the important scientific trends. Three big institutes of humanities operate under the Tatarstan Academy of Sciences focusing on study of tangible and intangible culture of the Tatars, their centuries-old history in the context of Russian, Islamic and world civilizations. We are also opening a special research centre for Islamic studies under the Tatarstan Academy of Science.

Russian Islamic University plays a significant role in developing traditional teaching of Islam and preparing its own scientific and teaching personnel.

This March, in my speech at the King Faisal Centre for Research and Islamic Studies, I offered to organize an international Islamic conference in Kazan next year and devote it to the creative role of Islam in the modern world and dialogue between Eastern and Western cultures. I hope that this initiative will find understanding and will be supported by the Organization of the Islamic Conference.

Participants of the conference, guests of Tatarstan! Today in this hall we are having outstanding representatives of Islamic countries who work on resolution of global problems, who appreciate values shared by all humankind, peace and harmony, preserving friendly relations with all countries and peoples.

I am sure that consolidation of intellect, talent, greatness of spirit of Islamic scientists aimed at the well-being of science and progress will bring its fruitful result.

I sincerely wish you successful work, good health and prosperity.



**H E Mr Mohammadmian
Soomro
President, Islamic Republic of
Pakistan
Founding Patron
Islamic World Academy of
Sciences**

The President of the Islamic of Pakistan, in his capacity as Patron of the Islamic World Academy of Sciences; sent the following message to the conference which was delivered by H E Dr M A Mahesar, Assistant Co-ordinator General of COMSTECH.

Spectacular advances in science and technology in the last several decades are rapidly changing our lives in almost every sphere of human endeavour.

The development of agricultural biotechnology has allowed the production of high yielding and disease-resistant crop varieties. New varieties of cotton have been developed (Bt-cotton) which have the ability to naturally produce pesticides from within the plants.

Genes from bacteria with the ability to producing vitamin-A have been incorporated into a number of edible crops, thereby addressing the problem of night blindness in those children who do not receive doses of this vitamin.

New varieties of crops, resistant to drought and salinity are being developed, opening up possibilities of growing edible crops in saline soils.

Advances in health biotechnology are allowing the mapping of the entire human genome rapidly and relatively cheaply,



thereby heralding an era of pharmaceuticals tailored to individual human genomics profiles.

Advances in stem cell research have opened up possibilities of curing damaged tissues in the heart, liver, kidney and other human organs. New composite materials lighter and stronger than metal alloys are being developed which are being increasingly used in aircrafts, automobile and other industries.

Information Technology has transformed the world into a global village, and Pakistan is one of the few countries in the world today benefiting from these advances.

Every student in all public sector universities in Pakistan has access to 23,000 international journals and 45,000 textbooks and research monographs through the Digital Library programme of the Higher Education Commission.

The installation of video-conferencing facilities in universities in Pakistan by the Higher Education Commission has also resulted in lectures being delivered daily from technologically advanced countries in real time, with students having the ability to ask questions face-to-face interactively from a professor who may be thousands of miles away.

These and other exciting advances talking place are opening up huge possibilities for the development of the Ummah.

Unfortunately it is a stark reality that we in OIC member countries have failed to invest in knowledge, with the result that we are paralytically dependent on the West for most of our needs, be they pharmaceuticals, engineering goods, industrial machinery or our defence needs.

It is high time that we created world-class universities and Centres of Excellence within the OIC member countries so that we can transition to knowledge economies where innovation determines progress.

I hope that the 16th IAS Conference will deliberate on some of these issues and the scientific community in OIC member countries will be able to mobilize support and create the necessary political will amongst our leaders to invest massively in higher education, science and technology.



**HRH Prince
El-Hassan Bin Talal
Founding Patron
Islamic World Academy of
Sciences**

His Royal Highness, Prince El-Hassan Bin Talal, Founding Patron of the IAS also addressed the conference in telecast message, the text of which is shown below.

Dear Friends,

The world needs new ways of thinking about current challenges, and we need the wisdom of illumination coming from the East to affirm our shared humanity and uphold our unity in diversity, a movement parallel to what Karen Armstrong referred to as the wisdom of the ancient 'Axial Age' when humanity conflicts came into being through the insights of diverse yet complementary traditions. It is this new value base that I attempted to present to the United Nations General Assembly this year in the context of the 60th anniversary of the Declaration of Human Rights.

In our interconnected world and with the need for all to share the planet resources, it is essential for us to realize that the solutions for our problems require a consensus on a global code of conduct and ethic of human cooperation. As a member of the Independent Commission for International Humanitarian Issues and with representatives from twenty-eight nationalities, we presented the United Nations General Assembly in 1983 with a document entitled *Winning the Human Race?*, in which emphasis was made on multilateralism as a means to strengthen hope for a better future for all.

In May of this year I addressed the United Nations General Assembly with

the aim of shifting focus from state security to human security. In an intra-independent world security issues such as population growth, poverty, food, resources, ecology, migration, energy, peace and cultural understanding need to be addressed not just through the public and private sectors, but through engaging a third sector as well, the Commons, a powerful countervailing force dedicated to ensuring human security, cooperation, and sustainability across borders. The responsibility for such transnational issues must be taken on by individuals, communities, and civil society as well as international organizations, regional systems, and networks, to develop a common global action plan. The third sector exists in the interconnectedness of Global Commons – in the intersection of society and nature, education and employment.

The *Coalition for Global Commons* was launched in March 2008 in Berlin with a vision of an intra-regional citizens' conferencing so that conversations would not just be held between the intelligent few but rather be developed through collective knowledge and collective wisdom. In this context I would like to say that it is essential for us today to develop collective intelligence to enable our region, that is to say the West Asia region, and our neighbouring regions, South Asia and indeed Southeast Asia, to develop an Asian response to the systemic development of science and technology on the one hand, and research and development on the other.

Educating for life is an essential answer to educating for employment, and in this regard emphasis should be made on the importance of supra-national thinking, that is to say teaching by analogy – an approach of the Erasmus Mundus programme – where we place the rich in the shoes of the poor, and where we think of our neighbours' resources in the context of a regional call for a supra-national community of water and energy for the benefit of humanity. This is how Europe spoke of building bridges after two devastating world wars, with a community of Coal and Steel.

In an attempt to address environmental issues and climate change, in particular the ILO-initiated the "Green Jobs Initiative" to emphasise the importance of a green foundation. Important for that issue is Paul Volcker's emphasis on an asymmetric approach, that is, not only looking at investment *per se* as a yardstick of development, but looking at the importance of investment in human

capital. Climate change is accelerating due to human activity, affecting all life on earth. It is with this in mind that I express my belief in the intersection of society and nature and the importance of speaking of global warming in the context of human warning as a form of exercising our responsibility towards the other, whether society or nature.

The human dignity deficit is widening by the day, and not least is the gap between the rich and poor. Yet when examining the impact of globalisation, it is not only good economic governance that is to be addressed, but the importance of making the law work for everyone as well. In looking at the Millennium Development Goals I look forward in September to addressing this subject once again at the General Assembly, that is to say empowering the poor. As a member of the Commission on the Legal Empowerment of the Poor it is important to say that legal empowerment is the eradication of legal illiteracy in order to protect the poor and enable them to advance their interests as citizens.

I do want to emphasise that we are seeking not science as a franchise from the rich to the poor, but science as a partnership in developing our own resources and with hope participating in Global Commons in 2012 in the context of probity and answering clearly with our own convictions where we have failed and where we have succeeded. Only through this broad conversation, promoting the noble art of listening, can we overcome the fragile confrontation of cultures where we speak of Islam and the West or Islam and the rest.

In terms of our Islamic humanistic approach, it is essential to develop a democracy of doers and to move from the intelligent few to the intelligent many. In this context it is essential to develop collective intelligence in the many disciplines that are affecting us through attempting to close the human dignity deficit and emphasizing that economy means developing the grassroots capabilities of participation by future generations.

It is essential to create a basis for a culture of peace within a context of just law, and although some may say that law does not address the poor, it is essential to emphasise that the time has come to live up to international standards and international criteria of accreditation and of dissemination of knowledge in the context of an interconnected world. The time has come to interconnect our

objectives in promoting science as a template for progress.

I shall not address science as a mere objective, conceptual image of reality divorced from its cultural context, but rather as the essence of this great cultural movement which we normally call modernity, which has by no means spent itself, despite post-modernism.

Science as Culture

In a sense science is an objective enterprise, but not wholly so. In view of its internal mechanisms and methodologies it is a quintessentially intentional activity in two senses, in that it is intensely oriented towards its object and structurally determined by it. Otherwise, it would not be science – i.e., the systematic production of knowledge. However, even though mature science is determined by its object in its essential content, it is existentially determined by society and culture. By that I mean that science can only exist within specific socio-cultural contexts, and dies out without them.

Hitherto, the context within which mature (modern) science has existed is so-called modernity, which is a comprehensive cultural movement that characterizes the modern epoch (1492 to the present). In fact, science constitutes the soul and essence of modernity. Science has become the prime productive force and generator of cognitive structures in society. All other productive forces are increasingly becoming dependent on science and generated by it. All cognitive structures are imprinted by science, whether positively or negatively.

The challenge facing Muslims today is not appropriating science as such, or in isolation, but in appropriating modernity with all that this entails for Muslim cultures and religious values and ways of thought. This is the real challenge that should be met without losing sight of Islamic humanism and its lofty ideals.

Modernity is alien to us today. It will remain so as long as we fail to come to terms with the rational kernel of our own heritage. That is not to say that modern rationality is a mere replica of Arabic Islamic rationality. The former is a veritably new and revolutionary cultural phenomenon. However, there is a genuine affinity between the two, both historical and spiritual, and reclaiming our rationalist, humanist heritage, which has been banished for too long from our cultural space, could be a starting point

and catalyst to accept and meet the challenges of modernity.

Development and the Ontology of Social Being

Development, sustainable or otherwise, can never be an automatic, purely technical and mechanical process. It is not markets that create development, but consciously acting groups and classes of human beings. Thus, the way such active groups and classes view themselves and their societies enters in an integral manner into the very fabric of their developmental schemes and actions. To put it in a more philosophical manner of speaking, the ontology of our social being is an essential ingredient of our developmental plans. In social action, the subjective is an essential ingredient of the objective, even if it is often veiled with a barrage of technicalities. Basically, from the point of view of sustainable development, there are two broad perspectives on the ontology of social being: the Fetishistic and the Humanistic.

Fetishism tends to view society as being, in essence, a complex machine that runs in total indifference to human action, which it views as a mere cog in this machine. Of course, it is difficult to escape this conclusion regarding modernity or modernistic society. However, the problem does not reside in recognizing this essential dimension of modernity, but rather in ontologising it – i.e., in considering it not as a passing historical phase, but as a necessary ontological basis of the human condition as such. Basically, fetishism tends to 'thingify' social relations, and endow these 'thingified' relations, such as commodity, money and capital, with human traits and powers. Thus capital, rather than human labour and action, are viewed as the subject and object of social development and modernization. It also leads to an atomized view of society, which tends to foster atomisation in reality. Society is fetishistically viewed as an ensemble of atomized individuals related via the 'eternal' market. This tends to deprive society of its historicity, cultural specificity and materiality. For example, Southern social formations are treated as though they differed from Northern societies in degree only. Thus, the same 'universal' recipes are applied to them in total disregard of their cultural and socio-economic specificities, wreaking havoc and confusion in the process.

The principal defects in these fetishistic views and development plans are: (i) their reduction of the process of

development from a grand historical project to a mere appendage of government policy; (ii) their total disregard of social consciousness and the necessity of its modernization for modernizing the whole of society.

Viewed humanistically, society is not a mere 'mechanistic universe' – a machine running on its own in total disregard of human volition and action – but is a structure of human practices, which means that the essence of society is human practice and relations. From this humanistic perspective, the importance of mass action guided by social consciousness is revealed. Any social change is effected through social consciousness and practice. Thus, the latter enters the processes of social change as a necessary ingredient. A genuine process of modernization must entail the modernization of social consciousness. However, the latter is not isolated from the overall process of development and historical change; it is a product of countless leaps and breaks, both direct and indirect.

Science and Social Consciousness

By social consciousness, we mean the ways social groups in a given society view their world, respond to it, and act on it – i.e., the cultural and intellectual mechanisms that inform social action. By the modernization of social consciousness, we mean the creation of a scientific, rational, social consciousness capable of meeting the challenges of modernity, including the problems of poverty, unemployment, productivity and social peace. It is a social consciousness that has acquired its post-scientific essence and rationality via suffering modern, scientific, and intellectual revolutions both structurally and internally – a consciousness that has been shaken and revolutionized by the cultural challenges with which scientific rationality confronts all pre-modernistic traditions. In fact, scientific rationality is a permanent revolution, a constant questioning, both theoretical and practical, which constantly negates the actual in favour of the potential. It is this critical essence which traditional societies find hard to assimilate but cannot do without, in view of its essential link to modernity.

However, assimilating this critical, rational kernel is not a matter of governmental decrees and policies, but rather a complex cultural revolution in the context of a complex transitional historical process. The most notable model of this process is the modern European (Western) model. The modern

West has modernized itself – i.e., achieved the transition from pre-modernity to modernity – via a series of turns which may be classified into three types: economic (agricultural and industrial revolutions), political (Dutch, English, American, and French Revolutions), and cultural (Renaissance, Reformation, seventeenth century Scientific Revolution, the Enlightenment). A pivotal role in shaping modern Western consciousness has been played by the scientific revolution of the seventeenth century. This revolution was not a mere revolution in physical theory, but rather a fundamental socio-cultural revolution that ushered in new relations of force and a new perspective and philosophy. It was a comprehensive critique of all aspects of life, via which the scientific method was given prominence at all societal levels, and materialized into production-related institutions. In particular, this revolution succeeded in transforming Western cultural discourse from the pre-scientific, pre-Modernity variety to the post-scientific, post-modernity variety. The latter are not necessarily embodiments of scientific rationality as defined by the Enlightenment, but even its irrational discourses are imbued with the spirit and techniques of the scientific method.

This irreversible transformation left its mark on all aspects of Western life and distinguished it unmistakably from all other cultures. In particular, the Arab world has markedly failed in effecting such a transformation in the last two centuries. Its intelligentsia and cultural discourses are still pre-scientific and pre-modernity. Thus, a fundamental and urgent task facing the contemporary Arab world is how to modernize social consciousness (cultural discourse, the Arab intelligentsia) within the context of modernizing society at large? It is my contention in this paper that one of the crucial mechanisms for modernizing Arab social consciousness is Occidentalism, the antithesis of Orientalism.

Occidentalism versus Orientalism

If we define Orientalism as the mechanism whereby the Occident prepared its social consciousness for appropriating, colonizing and reshaping the Orient, Occidentalism may be defined as the contrary mechanism, whereby the Orient would prepare its social consciousness for appropriating, critically digesting, and reshaping its relationship with the Occident.

However, the marked disjunction between subject and object in the


Occidental mechanism makes the latter a dangerous, explosive, yet necessary, adventure. The pre-scientific Oriental subject is basically an ahistoric, finite, constrained, and impotent (passive) subject. When it engages the modern Occident, it encounters a historically dynamic, infinite, self-centered and creative subject-object, which ascribes to man all the powers and traits that were previously ascribed to God, including infinity and the power to create. The Oriental subject is most likely shattered by this overwhelming experience. It fails miserably to grasp its subject-object. It is given a choice; either it rejects the Occident and imprisons itself in its imagined emaciated past, or it reconstitutes itself at a higher level to meet the challenge again. The latter path is the path of Occidentalism. It is a continual process of deconstruction, reconstitution, and critical appropriation, oriented towards absolute negation and infinite openness. Of course, the danger of nihilism is always present, but this constant striving could lead to a modernized, modernistic, critical, scientific social consciousness, endowed with modernistic powers of knowing and acting, and capable of meeting the challenges of modernity, including the construction of a dynamic polity, state and productive base.

The Orient is crushed under the spell cast by both its ancient heritage and modern Occidental culture. To remove this spell, it has to critically appropriate both its heritage and the Occidental other.

This is the path of Occidentalism. The alternative is to remain a mere appendage to a pre-scientific imagined past, or a pre-modernistic image of modernity, or to both.

Islamic Humanism

One of the lasting contributions of the Algerian philosopher Muhammad Arkoun is his penetrating excavations of Islamic heritage and his illumination of humanist trends in the golden age of Islamic civilization. In fact, this broad and deep humanism runs through many intellectual currents in Islamic civilization before the advent of Islamic decline and strict theological dogmatism. The essence of this Islamic humanism is a deep and broad acceptance of the world and a deep and broad love for, and affinity with, the human essence qua human. This humanism sunk so deeply into the Islamic psyche that it turned into a distinctive literary and intellectual style and way of thinking, evident in such writers and thinkers as: Ibn Muqafa, Jahiz, Tawhidi,



Ibn Maskaway, Farabi, Ikhwan Al-Safa, Biruni, Suhrawardi and Ibn Araby amongst many, many others. It is this universal spirit, very much reminiscent of the humanism of the Illiad and Tolstoy, that was dismantled, together with Islamic theoretical reason, some five or six centuries ago. And it is this spirit that we should reclaim for Muslims and the world at large. Our Occidental project should simultaneously entail both the critical appropriation of modernity and the critical reclaiming of a lost spirit-Islamic humanism. This Great Spirit has been completely lost by Muslims and partially lost by modernity, as was realized principally by the late Roger Garaudy.

Modernity has transcended traditional cultures, opening up an infinite space of possibilities, but has simultaneously limited and narrowed down certain important dimensions of human existence. From this perspective, Occidentalism is not a mere appropriation of modernity in its permanent solidity, but is fundamentally a transformative process that simultaneously transforms modern Islamic consciousness and modernity itself towards a modern version of Islamic humanism.

This is a golden opportunity for the Islamic World to contribute towards solving the perennial problems of modern man, by modernizing the Islamic World and humanizing modernity simultaneously.

Sustainable Development via Democracy

Sustainable or humanistic development (in the sense of Farabi, Biruni or Ibn Araby) turns into its destructive opposite if it is not organically and necessarily accompanied by the empowerment of ordinary people, the ordinary man or woman in the street, the worker, blacksmith, carpenter and mason. Thus, the crucial question in this respect is: How do we empower the common man or woman?

Of course, this question is the fundamental question of democratic discourse, at least in its original Athenian form. Unfortunately, it has been smothered in modern democratic discourse by an emphasis on mechanisms and formalities, including the election process, parliament and free enterprise.

We should revive this lost question, both on the economic and political levels. The first step towards genuine

democracy— empowering the ordinary man or woman — is building an institutional framework for protecting the individual citizen from the tyranny of both the market and the state. The latter might very well be necessary evils in the modern world, but they should be delimited and constrained. The essence of democracy is constraining potentially repressive economic and political structures. Creating a network of NGOs and civil societies within the framework of a global civil society could be an effective means to curb the tyranny of both the state and the market, and create conditions for empowering the people, the individual working citizen.

This vision could be extended to sustainable development. We have witnessed many cases of development based purely either on the state or the market. To what extent have they actually succeeded?

A quick survey would show their successes have been very uneven, relative and short-term. However, all of them share this evil, that their human cost has been exorbitant. The greater their output in material terms, the greater their human cost and the greater the degree of dehumanization they have wreaked. The real challenge facing us today is how to effect development with a human face; how to reconcile material with spiritual well-being; how to humanize development and modernity; how to develop without compromising our human essence; how to progress without having to pay such a high spiritual price.

Creating this third sphere of empowerment, and having it play an active role in global development, could be a step forward in the right direction. By cooperating positively with states and markets and delimiting their tyranny at the same time, this sphere could start a new type of development that will further the cause of man, instead of nihilistically negating his human essence.

I believe that the Islamic World could play a major role in realizing this new project of sustainable development.

But first, it must meet the challenge of modernity and learn how to modernize its cultural and intellectual forms, whilst working towards reclaiming its lost humanist, rationalist soul for itself and for the entire world.



**Prof. Akhmet Mazgarov FIAS
President, Academy of Sciences of
the Republic of Tatarstan**

**Bismillahi al-Rahman al-Rahim
Dear Dr Abdel Salam Majali
Dear President of Tatarstan Mintimer
Sharipovich Shaimiev
Dear participants and guests of the
conference
Ladies and gentlemen**

Allow me to welcome you - our dear guests - on Tatarstan soil on behalf of all scientific community of the republic.

I would like to express my gratitude to all of you for your consent to participate in the 16th IAS Scientific Conference, to support our initiative to strengthen scientific and intellectual ties between Russia, Tatarstan and the Islamic World.

Let this conference become an important step in broadening cooperation in the field of science, economy and improvement of the welfare. Scientists note that there are necessary recurrences in the life of a person, countries and peoples.

In the beginning of AD 10th century, Volga Bulgaria, where our ancestors lived, was visited by an emissary from Baghdad and Islam was adopted as the official religion. Turks became a part of the Muslim civilization and this event determined their subsequent cultural development.

Development of professional knowledge in Volga Bulgaria was provided by the great scientific achievements in the Muslim world of that time. Monuments of religious canon were

perceived as common property of all peoples of the region and the Arabic language - as "above-ethnic language" of all cultural area.

Bulgarian scientists wrote in Arabic. Therefore, their works acquired general Muslim significance. "Dar al-gyilem" (Houses of science), academies of sciences of their way, organized in towns of Muslim East, gathered intellectual people from all the world, consolidated Muslims in the field of science and culture.

Educational-scientific academies, organized in the 11th century in Isfahan, Baghdad, Damask, Gazna, Basra and many other towns of the Muslim East by the vezir Nizam al-Mulku. They were called Nizamias in his honour. These academies integrated science into the educational curriculum of the medrese.

Under contemporary conditions these functions of a coordinating center were taken up by the Islamic World Academy of Sciences.

The emissary of the Caliph Al-Mukhtadir spent almost one whole year to reach to our ancient capital. His arrival manifested the cultural and ideological unity of the Ummah and ushered in an age of creativity.

Today, we accept representatives of the Islamic intellectual elite as ambassadors of goodwill. Times have changed: you can fly to Kazan in a few hours. But the aims remain the same - consolidation of the Muslim world in the name of progress and good, sustainable development of human society.

In the Middle Ages, the influence of the Muslim world on the culture of other peoples was the most impressive in the field of a scientific thought, theory of knowledge, logic, mathematics, geometry, algebra and medicine, geography, astronomy, philology and other sciences. Arabic natural-scientific knowledge became a scientific superstructure, theoretic guidance for Turkic-language scientists.

Names of Al-Gazali, Ibn-Arabi, Ibn-Rushd, Ibn-Sina (who was called Abugalisina by Tatars and revered as a saint and whose treatise on medicine "Kanun at-Tyib" written in 980 remained a classic manual for inquisitive minds until the beginning of the 20th century) became classic in Turkic-Tatar science.

Even in the second half of the 19th century - in the Age of Enlightenment of Tatars - and in the beginning of the 20th century-Renaissance, the Tatar scientific-social thought synthesized in itself the best achievements of the East and the West.

Science is international in its essence.

But major tendencies of its development depend upon features of

national mentality and historical past.

Under conditions of globalization, each nation and each country requires to understand reasons of change, which take place in the political and economic life of the world, and to preserve its own cultural identity and traditions.

This is imperative both for Tatarstan and for all Russia.

The Eastern prospect is also an internal challenge for Russia.

Subsequent development of the Russian society is impossible without preservation and development of cultural and socio-political traditions of peoples of a multinational country.

Delving in to the civilisational memory can lead to working out a new paradigm of the society development, because each generation actualizes scientific heritage in a new way. Moments of explosion in scientific and social thought always confirm internal unity (consensus) within the bounds of common civilization.

For example, a great Tatar scientist of the 19th century Shigabuddin Marjany, an ancestor of the national humanities, is known as a successor of the traditions of Al-Biruni, At-Tabari, Ibn-Batuta, and Ibn-Khaldun.

Also, the Tatarstan scientists are proud of the achievements of Rashid Sunyaev, a bright star of the world's astrophysical science. In this connection, we recollect sources of this science: an observatory of the 11th century under the guidance of the great scientist-mathematician and poet Omar Khayam, who proposed a new system of chronology to the world. Also, the astronomic laboratory of the 15th century of Ulugbek, the Samarkand ruler, who stated theoretical principles of astronomy.

Or the third example; the founder of poems with a well-defined overall metric pattern was an Arabian scientist of the 8th century; Khalil Ibn Akhmad al-Farikhidi. Together with the Islamic religion, this science ("gyilme garuz") penetrated into the Turkic world; works in Farsi and Turkish of Alisher Navoi and Zakhiraddin Babura subsequently appeared.

Not only wonderful Arabian and Persian but also Turk-Tatar poetry "spoke" Garuz for ages, provoking admiration. There are many such parallels in the history of science and culture.

Deeds, creations and ideas, in spite of political cataclysms and prohibitions in a society, remain in the historical memory of peoples. Science in present Tatarstan is a source of national pride and it has not lost its international authority in many trends.

This is manifested to a great extent by establishment in 1991 of Academy of Sciences of TR by the decree of President of the Republic of Tatarstan M. Sh. Shaimiev.

Today, the Academy of Sciences of TR and all scientific societies of the republic exist under the conditions of reformation of science and scientific-innovation activity.

Lately, particular attention is being paid to cooperation with foreign countries: Iran, Turkey, Kazakhstan, Azerbaijan, Uzbekistan, etc. Joint fundamental investigations and researches are being carried out in the field of natural and technical sciences.

Our scientists participate actively in international research projects. Every year, a number of concluded contracts increases. In the field of humanities, particular attention is given to exchange of scientific information. It is planned to start a project on the search of archived documents, manuscripts and publications about the history of the Tatar people in foreign archives, libraries and private collections and get them in originals and copies.

Every year, scientists of TAS go abroad for scientific business trips to give lectures, take part in prestige scientific forums, and visit foreign scientific centers. Many of these scientists are honorary members of foreign academies and international scientific societies, and they acquire prestige grants.

In the Tatarstan Republic, we see that science has become the subject of dialogue with various states. Such states are engaged in scientific-industrial and trade-and-economic cooperation with nearby and far-away foreign countries, and member countries of OIC.

These mutually advantageous ties are based on the common culture, economic and geopolitical interests. Such exchanges of socially significant information between scientific bodies and individual scientists result in increased scientific contracts and scientific-and-technical cooperation in the fields of new technologies, and highly profitable production.

We are open for cooperation with the Muslim world. Today, it becomes possible for Islamic countries to use with maximal efficiency their rich natural and manpower resources for the welfare of scientific progress.

I invite our foreign guests and scientists to take active part in the implementation of large-scale scientific-investment projects, planned currently in the Republic of Tatarstan and Academy of Sciences of TR.



**H E Ambassador Ali Salehi
Assistant Secretary General,
Organization of the Islamic
Conference (OIC)**

**Bismillah Arahman Arrahim
Your Excellency Mintimer Shaimiev,
the President of the Republic of
Tatarstan**

**Fellows of the Tatarstan Academy of
Sciences and the Islamic World
Academy of Sciences**

**Distinguished Guests and Participants
of the 16th IAS Science Conference**

Excellencies

Ladies and Gentlemen

It is an honour for me and a privilege to represent His Excellency the Secretary General of the Organization of the Islamic Conference (OIC) on the occasion of the 16th International Science Conference organized by the Islamic World Academy of Sciences and the Tatarstan Academy of Sciences under the patronage of His Excellency Mintimer Shaimiev, the President of the Republic of Tatarstan.

Let me begin by conveying to you the greetings and best wishes, for a successful conference, from His Excellency Prof. Ekmeleddin Ihsanoglu, the Secretary General of the OIC. Although, he was very much eager to attend this landmark event, however, due to pressing commitments, it was not possible for him to take part in this august gathering.

On behalf of the Organization of the Islamic Conference and on my own behalf, I would like to once again express my profound gratitude to His Excellency Mintimer Shaimiev, the President of the

Republic of Tatarstan, for kindly sparing his invaluable time to personally grace this occasion. His august presence at this ceremony is a clear manifestation of his keen interest in the activities of the Islamic World Academy of Sciences and the OIC in general and in the development of science and technology in particular.

My special appreciation goes to the sponsors of the conference namely; Professor Majali, President of the Islamic World Academy of Sciences; Professor Mazgarov, President of the Tatarstan Academy of Sciences and my dear and dedicated friend Professor Zou'bi; for choosing a timely and pertinent theme; "Science, Technology and Innovation for Sustainable Development in the Islamic World," for this Conference.

**Excellencies,
Ladies and gentlemen**

On the one hand, today, as we meet, the world, including the Muslim Ummah, is passing through a critical time. Its population as a whole is coping with various issues such as increase of energy cost, shortage of energy, climate change, environmental degradation, lack of access to clean drinking water, epidemics, regional conflicts and most lately shortage of food supply and the rising prices of food items, to name just a few. Never in the history of mankind were so many issues confronted globally and concurrently.

On the other hand, the dawn of the new millennium has been a historic turning point for mankind.

It has marked the beginning of a new era of globalization and knowledge based economy, which confer very high priority to the role of Science, Technology and Innovation. In this highly competitive world, the youth of the Islamic Ummah must be equipped with the necessary knowledge and expertise, especially in the area of new and cutting edge technologies. Therefore, special emphasis must be given to the education programmes in disciplines such as basic sciences and engineering in order to boost technological research and industrial development.

This conference lends us the opportunity to discuss and address some of the most important issues, namely those related to the 'Science, Technology and Innovation in the Islamic World for the benefit of the Ummah.'

Clearly, every generation has its own challenges. The main challenge for the

current generation is global warming leading to climate change. According to recent expert information, the global temperature is expected to rise between 1.8 and 4 degrees C by the end of the century and sea levels are likely to rise by 28-43 cm.

Therefore, climate change is a global problem in its causes and consequences and involves complex interactions between climatic, environmental, economic, political, institutional, social and technological processes and systems.

It requires a global response that could be achieved through international co-operation and local promotion of science, technology and innovation.

**Excellencies,
Ladies and Gentlemen**

Fortunately, the 11th OIC Summit Conference held in Dakar, Senegal in March 2008, adopted a new Charter for the OIC. Most importantly, for the first time, the charter has a clause relevant to the development of science, technology and innovation included in its objectives and principles. The charter says "to enhance and develop science and technology and encourage research and cooperation among member states."

The new charter gives us new impetus to further strengthen the initiatives already taken to implement strategies in the domain of Science and Technology adopted by the OIC Summit Conferences such as the Vision 1441 H and the Ten Year Programme of Action.

I would like to inform this august body on the most recent initiative taken by the OIC to map the potentially available and actually existing capabilities and capacities in the domain of science, technology and innovation in the Islamic World.

We have come to realize the need to come up with an innovative way of documenting such needed information based on current international experience. Therefore, the OIC working together with *Demos*, one of the United Kingdom's most influential think-tanks and *Nature* the world's foremost weekly scientific journal is launching an Atlas of Islamic-World Innovation project.

The Atlas maps key trends and trajectories in science and technology-based innovation across the 57-country membership of the OIC; in particular looks in detail at a geographically and

economically diverse sample of fifteen OIC countries, and offers a detached, independent and authoritative assessment of how their innovation capabilities are changing, and the opportunities and barriers to further progress; explores how relationships between science, innovation, faith, culture and politics are unfolding within these sample countries, and across the wider Islamic world; identifies new opportunities for collaboration between scientists, policymakers and companies in the Islamic World and Europe, particularly directed towards shared global challenges of climate change, poverty reduction and sustainability; produces a series of agenda-setting articles, publications and events which spark scientific, policy and media discussion and debate in the Islamic world and beyond; and builds the skills and capacity of science and innovation decision-makers across the Islamic world, and creates new networks for the exchange of ideas, policies and good practice both within the Islamic world, and between the Islamic world and Europe.

On 13-15 July, 2008 in Istanbul, Turkey; the first kick-off meeting for focal persons on the Atlas of the Islamic World Innovation was successfully convened. The OIC calls upon all its Members to participate more actively in the elaboration of the Atlas and hopes that this pertinent initiative will be pursued seriously and meticulously.

Excellencies, Ladies and Gentlemen

The Putrajaya Declaration issued at the 10th Session of the Islamic Summit Conference in October 2003 stated that we must recognize the leading role of Science and Technology for the

advancement of Ummah and the need to bridge the gap between the Islamic and the industrialized countries. Therefore, it is expected that all the OIC Member States fulfil their pledge to invest at least 1.4 percent of their GDP in research and development.

Such actions will contribute to the improvement of the quality of human capital and reduction in the technology gap between the OIC community and the developed world.

It was also recognized that there was an urgent need for Muslim countries to enhance cooperation among themselves by creating linkage and establishing environment conducive for partnership.

It is ardently hoped that such coordinated, focused and regular interaction between the OIC Member States materializes.

Moreover, the 10th Session of the Islamic Summit conference also adopted Vision 1441 on Science and Technology. A vision on the need for Muslim countries to rededicate themselves to mastering science, technology and innovation to ensure that they can face the challenges of the global economy with confidence.

OIC Member countries are committed to become a community that values knowledge and competent in utilizing and advancing science, technology and innovation in order to enhance their socio-economic well-being of the Ummah.

It is imperative upon all of us to take the challenges for joint actions within the framework of the OIC, based on common values and ideals so as to revive the Muslim Ummah's pioneering role as a fine example of tolerance and enlightened

moderation, and force for international peace and harmony.

The glory of Muslims in the scientific fields has to be revived.

Therefore, the emphasis given by the 16th Science Conference on Science, Technology and Innovation for Sustainable Development in the Islamic World, is very timely.

I am confident that, as you move forward with your deliberations, you will continue to challenge the minds through brainstorming and as a result change our Islamic world for the better.

We are at the same time mindful of course that change is never easy. Resistance must always be expected. The inertia of the status quo is very strong and this is especially true when the situation is serious and the changes required are huge.

There will be the ever-present temptation to undertake just incremental and cosmetic modifications. We need to recognize that these are not sufficient to revitalize and renew the state of science, technology and innovation. More is required.

Finally, I would like to once again express my gratitude to the Tatarstan Academy of Sciences for the excellent arrangements as well as the warm and welcoming hospitality, in this beautiful and gifted land. I wish you all success in your deliberations and hope that these noble endeavors of yours shall not go in vain.

**Wish you good luck,
May Allah bless all.**

Thank you.



President of Tatarstan receiving his certificate of IAS Honorary Fellowship; 16th IAS Conference, Kazan (Russia); August 2008.



Prof. Mohammad Abdollahi
(Iran)

Born in the North of Iran in 1965, he received his PharmD from the University of Tehran (UoT) in 1988, and his PhD (Toxicology/Pharmacology) from Tehran University of Medical Sciences (TUMS) in 1994. He then did a post-doctorate at the University of Toronto, Canada, in 2001. In 1994 he became Assistant Professor, and in 1998 became Associate Professor, and in 2003 he got his Professorship from TUMS.

The outcome of his research is more than 250 papers and involvement in writing 16 Farsi and two English-language books. He has supervised more than 200 Doctorate and Masters thesis.

He has been working on experimental and human models of diseases like gastrointestinal tract, salivary glands, liver, pancreas, and bone; to find out the mechanisms of action of xenobiotics and key biomarkers of toxicity. He also works in the field of meta-analysis of clinical trials. He has been involved in establishing Iran's Drug & Poison Information Centres, and is the president of the Iranian Society of Toxicology, as well as the Director of Iran's Examination and Evaluation Board of Toxicology. He is in the Review and Editorial Boards of more than 45 world-known specialty journals, and is a member of American Academy of Clinical Toxicology and Roster of Experts in Biological Sciences, Joint FAO/WHO Meeting on Pesticide Residues (JMPR) of the World Health Organisation.

He is the Laureate of the Islamic-World Academy of Sciences (IAS) Ibrahim Memorial Award for 2005, and has been selected as a Leading Scientist of the World in 2007 by the International Biographical Centre, Cambridge, England.

Prof. Abdollahi was elected as a Fellow of IAS in 2008.



Prof. Kadyr G. Gulamov
(Uzbekistan)

Prof. Kadyr G. Gulamov was born on February 17, 1945 in Tashkent, Uzbekistan. He is married and has 2 children.

Prof. Gulamov got his PhD in 1971 in the field of Physics and Mathematics from the Physical Technical Institute, Academy of Sciences, Republic of Uzbekistan. He became a full Professor in Experimental Physics in 1980 from the Joint Institute for Nuclear Researches, Dubna, Russia. He became a corresponding member of the Academy of Sciences, Republic of Uzbekistan, in 1989, and an academician in 1995. In the same year, he was elected a Fellow of the Islamic World Academy of Sciences.

Prof. Gulamov was a senior scientific researcher (1971-1983), head of the laboratory (1984-1989) in the Physical Technical Institute in Tashkent, and a Professor at the Faculty of Physics in Tashkent State University (1979-1985). In the period 1989-1999, he was the Director General of the Scientific Association "Physics-Sun" of the Academy of Sciences of Uzbekistan. In 1991 he was elected as Secretary General of the Academy of Sciences of Uzbekistan. In 1999 he was appointed the Chief of the Academy of Armed Forces. During the period 2000-2005 he served as a minister of defense of the Republic of Uzbekistan, after which he became a State adviser to the President of Uzbekistan on Science and Education.

He is currently a senior physicist at the Physical Technical Institute, Tashkent.

During the period 1993-2000 he was a representative of Uzbekistan in the NATO Scientific Committee, and during 1996-2000 a member of the ICSU Standing Committee on Science and Technology in Developing Countries.

Prof. Gulamov has over 300 scientific publications on High Energy and Nuclear Physics, most of which were published in international journals.



Prof. Pulat K. Khabibullaev
(Uzbekistan)

Prof. Khabibullaev was born on 14 October 1936 in Andijan, Uzbekistan. He is married.

He was a student at the Middle Asia State University in Tashkent, Uzbekistan (1955-1960), and a post-graduate at the Moscow Pedagogical Institute (1960-1963).

He was a lecturer in Physics at the Tashkent State Pedagogical Institute (1963-1972), Rector of the Andijan Cotton-Growing Institute (1972-1975), Director of the Institute for Nuclear Physics of the Uzbekistan Academy of Sciences (UAS) (1976-1988), Vice-President and then President of the UAS (1978-1984), Chairman of the Supreme Council of Uzbekistan (1984-1988), Chairman of the State Committee for Science and Technology of Uzbekistan (1994-present), and Chairman of the Committee for International Affairs of the Uzbek Parliament (1995-1997).

Prof. Khabibullaev has been a member of the UAS (1984), a Corresponding Member of the Russian Academy of Sciences (1984), a member of the Academy of Technological Sciences of the Russian Federation (1992), the International Academy of Electro-Technical Sciences (PAS) (1997), the Asia-Pacific Academy of Materials (APAM) in Sendai, Japan (1998).

He lists over 300 scientific papers as well as 12 monographs to his credit. He has been a supervisor or secondary supervisor of over 100 PhD and DSc theses. He is Chief Editor of the *Uzbek Journal of Physics* (1986-present),

He has received the following awards and honours: Prize and Big Gold Medal of the World Intellectual Property Organisation (WIPO) twice (1985, 1996), the State Prize of the Republic of Uzbekistan (1993), and Uzbekistan's Honoured Man of Science (1993).

Prof. Khabibullaev was elected as a Fellow of the IAS in 1996.



**Prof. Gulsen Oner
(Turkey)**

Prof. Oner was born on 3 January 1944 in Kemah, Erzincan, Turkey.

She was educated at Kandilli High School for Girls and went on to obtain an MD from the Faculty of Medicine at University of Istanbul, Turkey (1969), and a PhD from the Faculty of Postgraduate Education at Hacettepe University (1972).

She was an Assistant Professor in the Surgical Research Centre of Hacettepe Medical School (1972-1976), and attended the Medical Research Centre of the University College Hospital in London, UK, to train in Radioimmunoassay (1976). She then worked as an Associate Professor and Senior Researcher in the Surgical Research Centre of Hacettepe Medical School (1976-1985). She attended the Department of Pharmacology and Therapeutics in the Faculty of Medicine at the University of Calgary, Canada, to study the relationship between Neurohypophyseal Hormones and Zinc (1980), and studied the effects of Zinc deficiency on somatomedin levels in rats in the Department of Endocrinology of the Medical College at the University of Saskatchewan, Canada (1981-1982). She is now full Professor of Physiology and Head of the Department of Physiology and Biophysics, and Director of the Medical Research Centre, in Antalya Medical School at Akdeniz University, Turkey.

Prof. Oner's main areas of research interest are Trace Elements and Growth, and Trace Elements and Atherosclerosis. She is author or co-author of more than 70 scientific medical publications on various areas of endocrinology, serology and allergy diseases.

Prof. Oner is a Founding Fellow of the IAS in (1986).

Islamic World Academy of Sciences (IAS)

The IAS is an independent, non-political, non-government and non-profit making organisation of distinguished scientists and technologists dedicated to the promotion of all aspects of science and technology in the Islamic world.

The establishment of the IAS (then the "Islamic Academy of Sciences") was recommended by the OIC Standing Committee on Scientific and Technological Co-operation (COMSTECH), and approved subsequently at the Fourth Islamic Summit in Casablanca in 1984. The IAS' Founding Conference was held in Jordan in October 1986.

The government of Jordan hosts the IAS at Amman, where the Secretariat started functioning in 1987.

The IAS General Assembly decided to rename the IAS as the "Islamic World Academy of Sciences" in March 2005.

The main objectives of the IAS are:

- *To serve as a consultative organisation for the Ummah and for institutions in the field of science and technology;*
- *To initiate science and technology programmes of benefit to the development of Islamic countries;*
- *To promote research on major problems facing Islamic countries and to identify future technologies of relevance for possible adoption and utilisation; and*
- *To formulate standards of scientific performance and attainment and to award prizes and honours for outstanding scientific achievement to centres of excellence in all science and technology disciplines.*

IAS Newsletter

Published in English by the IAS Secretariat approximately three times per year.

Chief Editor: Moneef R. Zou'bi, Director General, IAS.

Editorial Assistant: Lina Jalal, Programme Officer, IAS.

The Secretariat welcomes the submission of any articles for publication in the newsletter (publication to be at the Secretariat's discretion).

Postal Address:

Islamic World Academy of Sciences
PO Box 830036 Zahran
Amman 11183 Jordan

Street Address

17 Djibouti Street, Sixth Circle,
Amman,
Jordan
Telephone: +962-6-552 2104/
552 3385
Fax: +962-6-551 1803

E-mail: ias@go.com.jo

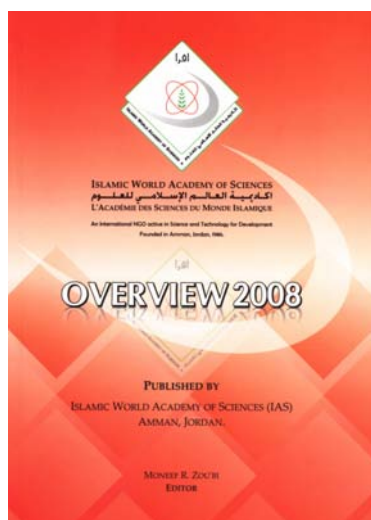
secretariat@ias-worldwide.org

<http://www.ias-worldwide.org>

Copyright © IAS, 2009, All rights reserved.

IAS - N37 - 09

Muslim Scholars*
**ABUL WAFI MUHAMMAD AL-
 BUZJANI**
 (AD 940-997)



IAS Overview 2008

The Secretariat of the Academy publishes, every two years, an *Overview* of the Academy summarising the programme of the Academy, and an update on the activities it implements in the various countries.

This publication also provides information about the background to the founding of the Academy and lists its achievements, particularly in the area of international co-operation.

This latest edition of the *Overview* in Arabic and English was published in 2008.



Abul Wafa Muhammad Ibn Muhammad Ibn Yahya Ibn Ismail al-Buzjani was born in Buzjan, Nishapur in AD 940. He flourished as a great mathematician and astronomer at Baghdad and died in AD 997/998. He learnt mathematics in Baghdad. In 959, he migrated to Iraq and lived there until his death.

Abul Wafa's main contribution lies in several branches of mathematics, especially geometry and trigonometry. In geometry, his contribution comprises the solution of geometrical problems with the opening of the compass; construction of a square equivalent to other squares; regular polyhedra; construction of a regular heptagon taking for its side half the side of the equilateral triangle inscribed in the same circle; construction of a parabola by points and geometrical solution of the equations:

$$x^4 = a \quad \text{and} \quad x^4 + ax^3 = b$$

Abul Wafa's contribution to the development of trigonometry was extensive. He was the first to show the generality of the sine theorem relative to spherical triangles. He developed a new method of constructing sine tables, the value of $\sin 30^\circ$ being correct to the eighth decimal place. He also developed relations for $\sin(a+b)$.

In addition, he made a special study of the tangent and calculated a table of tangents. He introduced the secant and cosecant for the first time, knew the relations between the trigonometric lines, which are now used to define them, and undertook extensive studies on conics.

Apart from being a mathematician, Abul Wafa also contributed to astronomy. In this field, he discussed different movements of the moon, and discovered 'variation.' He was also one of the last Arabic translators and commentators of Greek works.

He wrote a large number of books on mathematics and other subjects, most of which have been lost or exist in modified forms. His contribution includes *Kitab 'Ilm al-Hisab*, a practical book of arithmetic, *al-Kitab al-Kamil* (the Complete Book), *Kitab Al-Hands* (Applied Geometry). Apart from this, he wrote rich commentaries on Euclid, Diophantos and al-Khawarizmi, but all of these have been lost. His books now extant include *Kitab 'Ilm al-Hisab*, *Kitab al-Hands* and *Kitab al-Kamil*.

His astronomical knowledge on the movements of the moon has been criticised in that, in the case of 'variation,' the third inequality of the moon as he discussed, was the second part of the 'evection.' But, according to Sedat, what he discovered was the same that was discovered by Tycho Brache six centuries later. Nonetheless, his contribution to trigonometry was extremely significant in that he developed the knowledge on the tangent and introduced the secant and cosecant for the first time. In fact, a sizeable part of today's trigonometry can be accredited to him.

* Hakim Mohammad Said (Editor), 2000. *Personalities Noble*, National Science Council of Pakistan. Second Revised Edition (English and Arabic). Published by the Islamic World Academy of Sciences.