

FLASHES

A MONTHLY MAGAZINE ON KNOWLEDGE AND DEVELOPMENT BY THE
MOHAMMED BIN RASHID AL MAKTOUM KNOWLEDGE FOUNDATION

MARCH 2017
ISSUE 27

#YearOfGiving

Dubai 10X

Powering Into the Future

THE PROBLEM OF SPACE JUNK

100 million pieces of debris
and counting

COMPETITIVE HERITAGE

Celebrating the UAE's culture

WORLD GOVERNMENT SUMMIT 2017

Elon Musk outlines the road ahead



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FOREWORD

Dear readers,

The Mohammed bin Rashid al Maktoum Global Initiatives uses its initiatives and its affiliates – which includes the Mohammed bin Rashid al Maktoum Foundation – to provide resources to create innovative and effective methods to provide children around the world with education, disseminate knowledge, and support language.

As a result, a key founding principle of the Mohammed bin Rashid Al Maktoum Foundation in 2007 was to build an Arab generation equipped with knowledge, capable of facing the challenges of sustainable development in the Arab world, and enabling that generation to come up with innovative and sustainable solutions. We are delighted that this focus on the critical role of knowledge has been further highlighted by His Highness Sheikh Mohammed, in his capacity as Ruler of Dubai, Vice President and Prime Minister of the UAE, issuing Law No. (2) that has renamed the Mohammed bin Rashid Al Maktoum Foundation the Mohammed bin Rashid Al Maktoum Knowledge Foundation.

The new law clearly outlines the functions and powers of the Mohammed bin Rashid Al Maktoum Knowledge Foundation (MBRF), which is explained

in more detail in our News section on page 8.

One initiative that represents the work we do is the Nobel Museum. MBRF was the first ever Arab organisation to hold such a high-profile global knowledge event, and this year's The Nobel Prize in Physics: Understanding Matter has generated such an impressive turnout and enthusiasm by the public that following directives from His Highness Sheikh Ahmed bin Mohammed bin Rashid Al Maktoum, Chairman of the Foundation, we have extended its run until Thursday, May 4. The museum offers university students and school children an ideal platform to learn about the history, innovations, and discoveries of physics – an important and dynamic field of science.

One physics graduate who defines innovation, sustainability and the search of knowledge is Elon Musk, who presented his insights at the World Government Summit 2017 in Dubai. It is the aim of MBRF that the students and scholars attending the Nobel Museum will be as inspired as he was.

Jamal Bin Huwairb

CEO of Mohammed bin Rashid Al Maktoum Knowledge Foundation



Highlights of the World Government Summit



More than 4,000 prominent personalities from 139 countries participated in the fifth World Government Summit (WGS) 2017, which was held from 12 to 14 February in Dubai. This was the largest participation of its kind since the event was first launched in 2013, reflecting the leading stature of the summit on regional and international levels and the high interest from governments and global organisations. The event was held under the patronage of His Highness Sheikh Mohammed bin Rashid Al-Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai. Among the high-profile names who attended were the UNESCO Director-General, Irina Bokova; Managing Director of the International Monetary Fund (IMF), Christine Lagarde; Entrepreneur, Founder and CEO of Tesla and SpaceX, Elon Musk; Uber founder, Travis Kalanick; and Director General of IAEA, Yukiya Amano, to name just a few.

MARS 2017 PROJECT

The announcement of the Mars 2017 Project, which in its final stage plans to establish the first inhabitable human settlement on Mars by 2117, was an undisputed highlight. The project was unveiled by Vice President, Prime Minister and Ruler of Dubai, His Highness Sheikh

Mohammed bin Rashid Al Maktoum, and Abu Dhabi Crown Prince and Deputy Supreme Commander of the UAE Armed Forces, His Highness Sheikh Mohamed bin Zayed Al Nahyan.

His Highness Sheikh Mohammed said that the UAE is among the top nine countries in the world that invest in the space sciences, adding that it aims to accelerate the research in this domain. "The new project is a seed that we plant today, and we expect future generations to reap the benefits, driven by its passion to learn to unveil a new knowledge," Sheikh Mohammed said. "The landing of people on other planets has been a long-time dream for humans. Our aim is that the UAE will spearhead international efforts to make this dream a reality."

The first phase of the project will focus on preparing the human cadres able to achieve scientific breakthroughs to facilitate the arrival of humans on the Red Planet in the next decades. The Mars 2117 Project also aims to prepare an Emirati scientist team and to develop an international scientific consortium to speed up the research project.

The project will also focus on developing faster means of transportation to and from Mars, and come up with an integrated scientific visualization of how the settlement will

look like, and how life will be there in terms of food, transportation and energy among many others.

The Mohammed Bin Rashid Space Centre (MBRSC) is leading the Mars 2117 project and has been entrusted with preparing a 100-year plan for its implementation.

DUBAI 10X

His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai launched Dubai's plans to become the global capital for the future at the 2017 World Government Summit. Dubai 10X sets the Government of Dubai on a mission to be 10 years ahead of all other cities – hence the name 10X (with X symbolising experimental, out-of-the-box future oriented exponential thinking).

“With its forward-thinking vision and initiatives, the UAE Government is setting an example for authorities all around the world as it moves from simply forecasting the future to actively working to shape it,” HH Sheikh Mohammed asserted. Elaborating his directions, Sheikh Mohammed stated, “The future will not

be as patient with us as the present. The future belongs to those who affect radical changes, not those who make minor, gradual improvements. Today, I am calling on all government leaders and employees to embrace disruptive innovation and find new, creative and truly disruptive approaches and technologies to delivering their mission rather than incremental and minor improvements. We are a young and energetic government who wants to be a leader in disruptive innovation and technology.”

Disruptive innovation refers to exploiting available technologies to deliver new or existing services in radically different ways that are design-thinking-based and customer-focused, in contrast to incremental innovation, which focuses on making good services better for existing customers. Instead, disruptive innovation will create new operating and business models that replace traditional services and provide multiple times the value for end users and customers.

MUSEUM OF THE FUTURE

On 11 February His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of the



3D PRINTED REPLICA OF PALMYRA'S ARCH

The UAE has ambitious plans in the field of 3D printing. The Dubai 3D Printing Strategy is a unique global initiative that aims to exploit technology for the service of humanity and promote the status of the UAE and Dubai as a leading hub of 3D printing technology by 2030. It focuses on three major sectors: construction, medical products, and consumer products.

However, there are many more applications as the unveiling of a 3D Printed replica of the 1800-year-old Palmyra's Arch of Triumph during the World Government Summit proved. The 3D printing technology allowed for rebuilding the past by scanning and storing one million photographs of the original arch to recreate it; consequently preserving the history of the destroyed structure which was blown up by the extremist group Daesh, for the future generation.

The creation of Palmyra's Arch of Triumph is a joint global project between the Museum of the Future in Dubai and Institute for Digital Archaeology, Harvard, Oxford, which aims to preserve historical artifacts.





UAE and Ruler of Dubai, inaugurated the Museum of the Future. The opening came ahead of the fifth annual World Government Summit, and the museum draws attention to three main challenges resulting from climate change – water supply, food security and self-sufficient cities. Set up by the Dubai Future Foundation, the museum proposes three new solutions, unveiling how countries can adapt to climate change and lead the future. It also underlines the importance of adapting to future implications of climate change.

“The museum is a global platform where top-tier experts can identify the most prominent scientific and technological trends of the future. It is a catalyst for future forecasting and study efforts, and plays a pivotal role in setting up policies and strategies that allow the world’s governments to benefit from the technologies of the future and their potential,” HH Sheikh Mohammed said.

The Museum of the Future will be a permanent fixture in Dubai, exhibiting the inventions and technologies of the future. It is an ideal platform that embodies bold ideas and develops pragmatic solutions, as well an incubator for innovation. [f](#)

Name Change Reflects MBRF’s Core Mission

The ‘Mohammed Bin Rashid Al Maktoum Knowledge Foundation’ has replaced the original ‘Mohammed Bin Rashid Al Maktoum Foundation’ as the official name of the organisation. This change was in line with the organisation’s aim to improve scientific research and provide a strong impetus for writing, publishing and translation, in addition to encouraging Arab and Islamic intellectual endeavours.

The name change was propagated by His Highness Sheikh Mohammed bin Rashid Al Maktoum in his capacity as Ruler of Dubai, Vice President and Prime Minister of the UAE by issuing Law No. (2) on the Mohammed Bin Rashid Al Maktoum Knowledge Foundation and Law No. (1) appointing His Highness Sheikh Ahmed bin Mohammed bin Rashid Al Maktoum as Chairman of the Foundation.

Dubai Crown Prince and Chairman of Dubai Executive Council His Highness Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum issued Executive Resolution No. (11) of 2017 appointing Jamal bin Huwareb as the Managing



Director of the Mohammed Bin Rashid Al Maktoum Knowledge Foundation.

The new law outlines the functions and powers of the Mohammed Bin Rashid Al Maktoum Knowledge Foundation, which include designing, managing, building and maintaining a high-quality knowledge base, providing scholarships and human development programmes, developing the skills of future leaders, as well as launching specialised programmes and providing funding for these activities.

The Foundation will be tasked with

supporting public policies, scientific research and specialised reports; establishing companies, institutions and foundations whose work is related to the Foundation’s field of work; sponsoring local and international awards in the field of literature and science; organising or participating in exhibitions, conferences, symposiums and workshops in this regard; publishing periodicals related to the work of the Foundation as well as supporting writings, publications and translations and promoting a culture of reading. [f](#)

How To Win The Nobel Prize

Those who were wondering how to win a Nobel Prize had their questions answered at the first workshop held at the Nobel Museum 2017. The “How to Get the Nobel Prize” workshop drew crowds of physics experts, professionals, influential stakeholders in the field and university students. Gustav Källstrand, Senior Curator of the Nobel Museum in Sweden, and Anna Sjöström Douagi, Programme Director of the Nobel Center, presented it.

During the workshop, Källstrand spoke of renowned physicists, such as Albert Einstein, who was known to rely on his imagination in scientific experiments. Källstrand identified several key factors that lead to innovation such as working hard, having faith in what we do, investing time in research, and educating ourselves about studies that have already been conducted in the field.

Meanwhile, Anna Sjöström Douagi cited the “Nobel Center” as an example of an environment that encourages innovation, teamwork, and a focus on solutions; Douagi describes the Center as a platform for seminars and educational discussions with a creativity-friendly “incubator environment”.

Douagi went on to reveal details of the Nobel Prize Headquarters, the “Nobelhuset” a project the Centre plans to open in 2020. The “Nobelhuset” will serve as a hub where experts can meet, communicate, and generate ideas; regular meetings with Nobel Prize laureates are also in the cards – including scientists, inventors, and young innovators.

The second workshop explored Dark Energy, Cosmology, Black Holes, and String Theory and featured Ulf Danielsson, Professor of Theoretical Physics at Uppsala University – Sweden.

Professor Danielsson spoke of the significant developments that have taken place in experimental sciences over the past few decades, which supported the efforts to explore the universe and study dark energy. Dark energy was discovered in 1998 and makes up 72 per cent of

THE NOBEL PRIZE IN PHYSICS: UNDERSTANDING MATTER

The annual Nobel Museum is organised by Mohammed bin Rashid Al Maktoum Knowledge Foundation (MBRF) – a member of the Mohammed bin Rashid Al Maktoum Global Initiatives. This third edition was held under the title *The Nobel Prize in Physics: Understanding Matter*, with the main aim of introducing the public to the discoveries and scientific achievements of Nobel laureates in physics and disseminating knowledge.

Due to popular demand, the Nobel Museum has extended its run to May 4.

the size of the universe, Professor Danielsson explained; it can be described as the energy that counters Earth’s gravity and is the main catalyst to the universe’s rapid expansion, driven by constantly recurring Big Bangs.

Danielsson also discussed the stages of development of the universe since the Big Bang, and explored how it will look in the future according to several research studies. Furthermore, Danielsson offered an explanation of string theory, which is paramount to understanding physics.

REACHING FOR THE MOON AND THE STARS

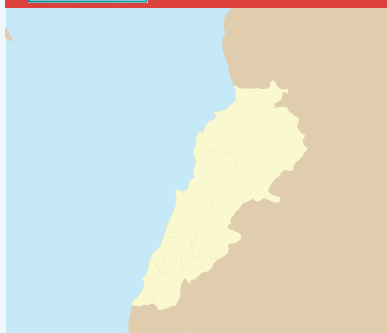
Space exploration has taken centre stage recently with the UAE announcing the

long-term goal of colonising Mars in the next 100 years through the Mars 2017 project. The UAE already has plans to launch a Mars probe by 2020.

In order to realise these ambitious plans, it is necessary to have talented people. That is why the Mohammed bin Rashid Al Maktoum Knowledge Foundation (MBRF), in collaboration with the UAE Council of Scientists, held two interactive workshops as part of the Nobel Museum 2017.

The workshops explored space travel and discussed stars, moons, and the universe going all the way back to its formation. Moreover, the workshops shed light on the Mohammed bin Rashid Space Centre, underlining the development of the UAE Space Programme. The aim is to motivate school students to pursue a career in space studies, all the while promoting innovation and scientific research – the ultimate goal being to create a new generation of young Emirati space. 





Reading Rank Overall: 1st
Total Reading Time Per Year: 59 hours
2016 Sample Size: 17,561
Number of Arab Countries Sampled: 22

The Arab Reading Index (ARI) was first released in 2016 and aims to provide an objective assessment of the state of reading in the Arab region

under the wider vision of the Arab Knowledge Index. As reading is the basic tool in knowledge acquisition, exchange, and dissemination this assessment is of primary importance. The Arab Reading Index focuses mainly on reading within the more general knowledge development concept, emphasising the role of reading as a tool for enlightenment and empowerment.



96%

EXTENT OF
READING



80%

ACCESS AND
AVAILABILITY



59
AVERAGE TOTAL
READING HOURS
(ANNUAL)



93%

PERSONAL
ATTRIBUTES



AVERAGE
NUMBER
OF BOOKS
READ



59 hrs
Average of total
reading (annual)

Reading matter
sourced from



95%
Family



32 hrs
Electronic
documents



94%
Skills and abilities

ابت

20

In Arabic

أ

10

In foreign languages



77%
School



28 hrs
Printed documents



87%
Motivation



12

Work related



29
Average number
of books read
(annual)



69%
Society



25 hrs
Work related



93%
Attitudes



16

Not work related



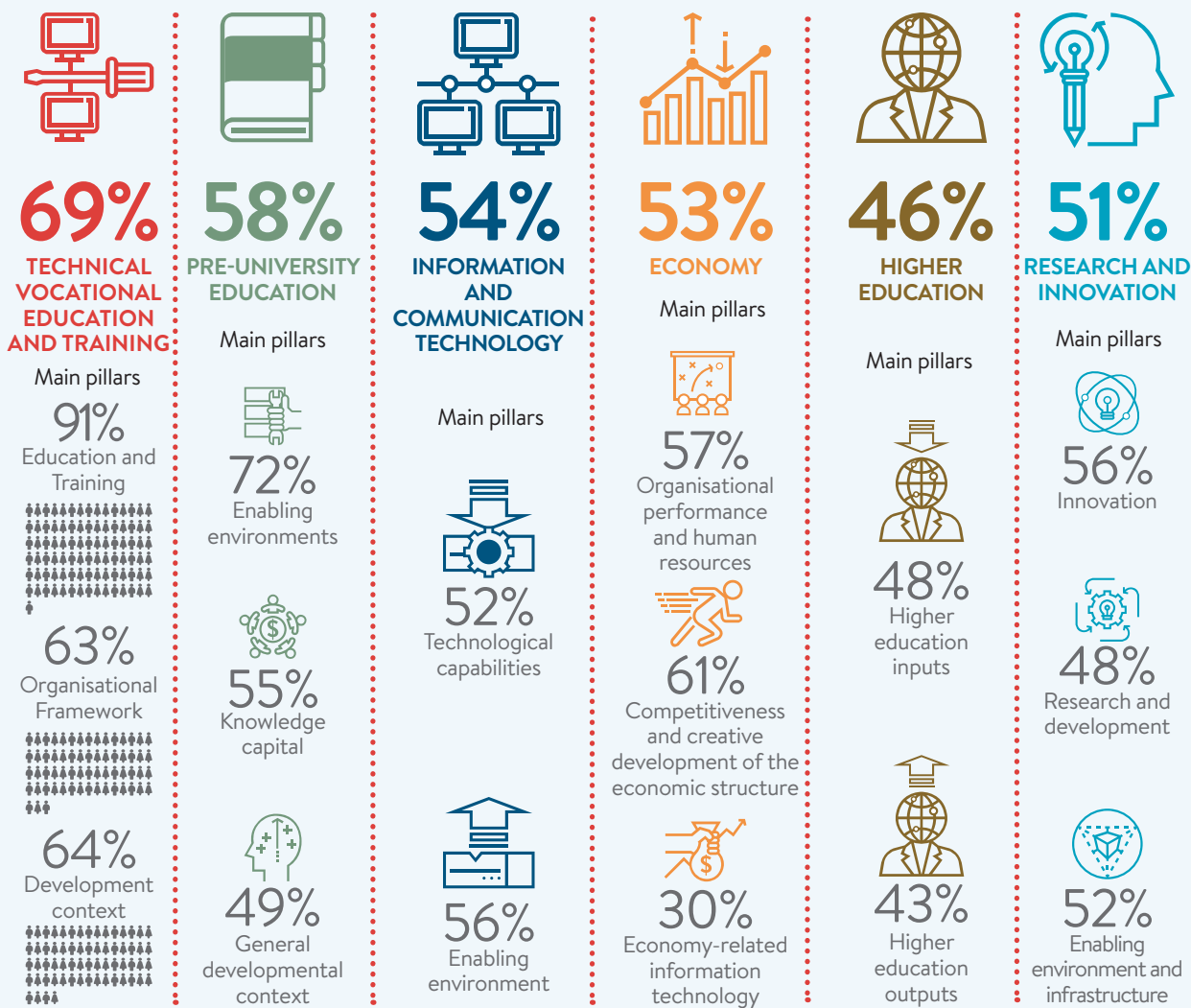
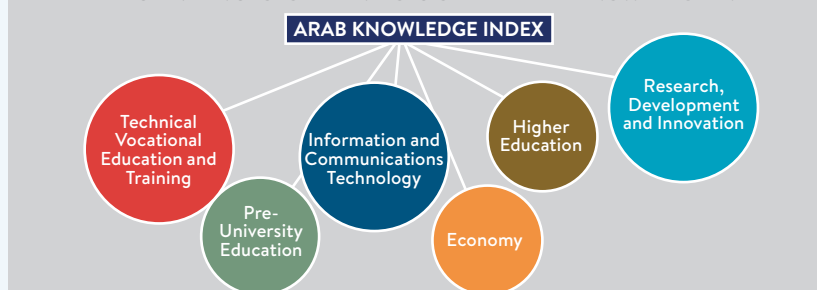
34 hrs
Not work related

The Arab Reading Index is done in partnership by the Mohammed bin Rashid Al Maktoum Knowledge Foundation (MBRF) and the United Nations Development Programme (UNDP).

Number of Arab Countries
Sampled: 22

The Index, which was initially launched at 2015's Knowledge Summit, monitors the status of knowledge in 22 Arab countries to help decision makers, experts and researchers to implement development policies and identify knowledge gaps.

THE SIX MAIN SECTORAL INDICES OF THE ARAB KNOWLEDGE INDEX



The Arab Knowledge Index is a joint initiative between the Mohammed bin Rashid Al Maktoum Knowledge Foundation (MBRF) and the United Nations Development Programme (UNDP).

SAVING



THE SEAS

Pollution and overfishing have wiped out an estimated half of all commercial fish since 1970, while climate change has compounded the problem. However, there's growing evidence that preserving precious marine areas can help stop overfishing, repopulate the ocean and lessen the impact of climate change. >





Average per capita fish consumption globally increased from 9.9kg in the 1960s to 19.2kg in 2012.

Marine scientists believe a bleak future awaits the world's oceans. The Census of Marine Life, a decade-long international survey of ocean life completed in 2010, estimated that 90 per cent of the big fish had disappeared from the world's oceans, primarily due to overfishing. The WWF Living Blue Planet Report 2015 index for all utilised fish species indicates a 50 per cent reduction in population numbers globally between 1970 and 2010. Exploitation is identified as the main threat in the vast majority of cases; other threats listed include habitat degradation/loss and climate change impacts.

The impact on some specific species is even more severe. Around one in four species of sharks, rays and skates is now threatened with extinction, due primarily to overfishing. Coral reefs provide some of the most biologically rich, productive and economically valuable ecosystems on Earth. Over 25 per cent of all marine species live in and around coral reefs, and yet they cover less than 0.1 per cent of the ocean. Three-quarters of the world's coral reefs are currently threatened and at current projected levels of global warming and ocean acidification they could be lost altogether by 2050.

Studies have documented a steady increase in ocean temperatures since the 1950s. In 2014, this warming was compounded by a strong El Niño that brought record-breaking heat to much of the Pacific Ocean, with devastating effects. Serious coral bleaching has now

reached nearly 15 World Heritage marine sites, including the Great Barrier Reef, Phoenix Islands Protected Area, Aldabra Atoll in the Seychelles, Lagoons of New Caledonia, and Papahānaumokuākea.

Seagrass meadows provide a range of ecosystem services, from catching sediment and stabilising the seabed to providing grazing for dugongs, manatees and green turtles, as well as critical habitat for commercially important fish species. They are also highly efficient at storing carbon dioxide, with research indicating that 83,000 tonnes of carbon are stored per square kilometre of seagrass meadow, which is twice as much as a typical terrestrial forest. However, seagrass coverage worldwide has declined by about 30 per cent over the last century.

Mangroves provide spawning grounds, nurseries, nutrients and shelter for many species, including fish, reptiles, amphibians, mammals and birds. Worldwide, nearly 20 per cent of mangrove cover was lost between 1980 and 2005 equal to nearly 3.6 million hectares. A UN report reveals that global mangrove deforestation is resulting in economic losses of up to \$42 billion annually.

These figures make bleak reading, especially when you consider that nearly three billion people rely on fish as their major source of protein. Fisheries and aquaculture assure the livelihoods of 10 to 12 per cent of the world's population, yet 29 per cent of marine fisheries



The global population is expected to grow by another 2 billion to reach 9.6 billion people by 2050 – with a concentration in coastal urban areas.



Ship traffic has quadrupled over the past two decades, with the largest growth in the Indian Ocean and the Western Pacific Seas.

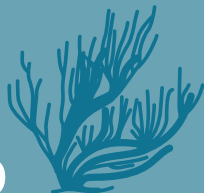


\$14-35 billion

Subsidies that encourage overfishing mostly in developed countries, are worth an estimated \$14-35 billion – even though the global fishing fleet is 2-3 times larger than the ocean can sustainably support.

50% DESTROYED

Half the world's corals and a third of all seagrasses have been lost.



3-5°C
ocean warming by 2100

At current rates of temperature rise, coral reefs will disappear by 2050.

are overfished. It is estimated the world's oceans generate economic benefits worth at least \$2.5 trillion annually, but it is clear that this resource is being totally mismanaged.

Against this background, and with more than 5,000 scientific papers published since 1980 to support them, it is clear that marine protected areas (MPAs) are important in protecting fish species, reefs, seagrass meadows, mangroves and other habitats. Conservation is one motivator for creating MPAs, but it's not the only one. There is also an economic incentive. In 2015, the World Wide Fund for Nature reported on multiple research projects that documented MPAs' effectiveness at reducing poverty and food insecurity and boosting employment, showing that in several scenarios the benefits of MPAs significantly outweigh the costs.

National Geographic explorer-in-residence Enric Sala, who heads the Pristine Seas project, often refers to specific protected areas as "fish banks." You prohibit fishing in one area to establish a principal stock while allowing fishing beyond its borders, taking in the spillover population as "interest" on the account. For example, in an analysis of Spain's Medes Islands, Sala's team found that less than one square kilometre of protection brought the local community 200 additional full-time jobs and €10 million per year through tourism – 50 times more than the revenue from fishing.

A small marine protected area in Baja California Sur, Mexico, Cabo Pulmo National Park, is the poster child for such efforts. The biological richness of this North American reef was threatened in the latter half of the 20th century as artisanal, sport, and commercial fishers decimated fish populations. Concerned for the future of their reefs and livelihoods, local communities pressured the government to declare the region off-limits to fishing. In 1995, with support from the University of Baja California Sur and the National Institute of Ecology, the marine area adjacent to Cabo Pulmo was declared a Natural Protected Area, with severe restrictions on fishing and other resource extraction. Scientific monitoring has shown that fish biodiversity is growing in the park, while fish biomass in the park increased by over 460 per cent between 1999 and 2009 alone. In the same time period, the biomass of top predators such as groupers increased by 11 times.

As a result, governments are taking action to create more MPAs or increase their size. Last year in August, outgoing US President Obama significantly expanded the Papahānaumokuākea Marine National Monument near Hawaii. This action preserved just over 1.5 million square kilometres of ocean territory, temporarily making it the largest MPA in the world. It held that title until October, when the European Union and 24 countries – including Russia, China and the United States – agreed



80% of all tourism is based near the sea.



X 3-5

Deforestation of the planet's mangroves is exceeding average global forest loss by a rate of three to five times.



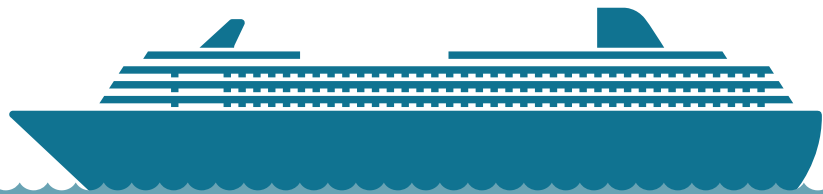
8 million tonnes

of plastic waste is dumped in the ocean each year

or

15 large garbage bags

for every metre of coastline. That number is set to double by 2025.



A moderate-sized cruise ship on a one week voyage generates 795,000 litres of sewage, 3.8 million litres of grey water, 500 litres of hazardous waste, 95,000 litres of oily bilge water, 8 tonnes of garbage

based on 2,200 passengers and 800 crew.

Source: World Wildlife Fund



Around 25 per cent of all marine species live in or around coral reefs.

to create an even bigger marine reserve in the Ross Sea off Antarctica. This reserve comprises around 1.55 million square kilometres of ocean largely untouched by humans and it will now stay that way for decades to come. Britain is protecting an 834,000 square kilometre area around the Pitcairn Islands in the Pacific, while Chile created an MPA called “Mar de Juan Fernandez” that covers 11,000 square kilometres.

Last year also saw some important advances in the decades-long effort to protect the High Seas – the deep ocean that lies beyond national boundaries and covers half the planet. UNESCO laid out for the first time a path forward for World Heritage protection of the High Seas, and identified five sites of potential outstanding universal value. At the same time, the UN General Assembly has been working on a new instrument under the United Nations Convention on the Law of the Sea to promote conservation and sustainable use in the High Seas.

In June of 2016 the world made a major stride forward in curtailing illegal fishing by bringing into force

the Port State Measures Agreement. This pact makes it harder to offload illegal catch by requiring that vessels give notice of their arrival to port and allow inspections. Illegal fishing has been estimated to be a \$23.5 billion annual trade, representing up to 20 per cent of fish caught in the ocean.

Since April 2016, an unprecedented 3.6 million square kilometres of ocean – an area larger than India – have been designated as MPAs, meaning for the first time that more than five per cent of the world’s oceans are now protected. According to recent figures released by the International Union for Conservation of Nature (IUCN) and UNEP’s World Conservation Monitoring Centre, today there are 14,859 MPAs covering 18.5 million square kilometres of ocean and sea. The global target, agreed in 2010 at the Convention for Biological Diversity meeting in Japan, is to safeguard 10 per cent of the world’s coastal and marine areas by 2020. Steps are being made in the right direction, but there is still a long road ahead. ↗

MARINE CONSERVATION IN THE UAE

Marine protection has been a concern of the UAE for nearly two decades. The country's first non-profit, marine protection organisation, the Emirates Marine Environmental Group (EMEG) was set up in 1996 to offer support and protection for a variety of marine and terrestrial issues.

Yet the Gulf region's recent 'development boom' has claimed much of its coastal areas. Although 173 marine areas have been marked as protected in the UAE, Oman, Qatar, Bahrain, Saudi Arabia, Kuwait, Iraq and Iran, many are ineffective and offer little or no protection to endangered species and habitats. At a 2015 conference on coral reefs organised by New York University – Abu Dhabi (NYUAD), scientists warned that the region's coral reefs might disappear in our lifetime unless quick action is taken.

The UAE's waters – the Arabian Gulf in the north and the Gulf of Oman and Indian Ocean in the east – are inhabited by more than 500 different species of fish. It is interesting to note that scientists believe that the Gulf waters' naturally harsh conditions make them ideal laboratories to study the effects of climate change on marine life. The extreme temperatures and high salinity levels of the region's waters make the marine life unique as well as resilient.

Following the NYUAD conference, the UAE's Ministry of Environment and Water designated five more sites as areas of global significance. The south-west waters of Abu Dhabi, the Marawah Marine Biosphere Reserve, Jebel Ali, Sir Bu Nair Island and Khor Kalba sites comprising of mangroves, seagrass beds, coral reefs and sand flats were recognised for their rich and unique biodiversity. These sites serve as the habitat or staging grounds for a variety of migratory and endangered species, joining 60 other protected areas in the UAE of which 38 are terrestrial, 21 marine, and one

coastal, according to the Convention on Biological Diversity.

Of the five sites, Marawah Marine Biosphere stands out for being the UAE's first biosphere reserve recognised by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Under the care of the Environment Agency – Abu Dhabi (EAD), Marawah hosts around 60 per cent – nearly 1,600 – of the second largest population of dugongs in the world. The island, which is situated west of Abu Dhabi's mainland, boasts a variety of ecosystems such as seagrass beds, coral reefs and mangroves. Due to its extremely sensitive ecological balance, Marawah is not open to public.

Marine conservation has an important place in the country's national agenda. The Abu Dhabi Environment Policy Agenda calls for the establishment of more protected areas to enhance biodiversity and

measures to reverse the decline of the emirate's fish stocks. EAD plans to increase the percentage of protected marine areas in the capital to 14 per cent by 2019.

Another protected area, known as the Eastern Mangrove Lagoon National Park, is the first of five national parks identified for establishment in Abu Dhabi Plan 2030. This park is open for kayak tours where visitors can spot flamingos, herons, terns, egrets, crab puffers, Egyptian geese, red foxes, bottlenose dolphins, dugongs, baby barracudas, schools of needle fish, groupers and mangrove snappers to name a few.

Sharjah's Sir Bu Nuair Island has been recognised as a wetland of international importance and is also listed as a global heritage site by UNESCO. For more than 2,000 years, various species of sea turtles have taken refuge at the pearl-shaped island where 20 types of corals and 58 reef fish species thrive.



THE M H USE LE IN BIOMEDICAL RESEARCH

Mice are the overwhelmingly dominant model organism in biomedical experimentation. Yet such intense focus on one species is limiting innovation

It is unlikely that medical testing on humans will ever be officially or legally condoned. Besides the many practical limitations, dosing humans with unapproved drugs, one hopes, will always remain an unacceptable violation of ethics.

So our understanding of disease and the expansion of knowledge to treat and cure a vast range of human afflictions rests on animal testing. Of the millions of species on Earth, the bulk of modern biomedical research is largely concentrated on just one animal – the humble mouse. Of all the different breeds, a single inbred strain of mouse

called C57 black 6 is the subject of the most study and experimentation. If you've ever had to take some form of medication, chances are that some little C57 black 6 lab mice were involved somewhere along the line.

The incredibly reductive nature of basing the majority of biomedical testing on one single determinant gives serious cause for concern. As lab mice have become the globally standardised tool of research and preclinical testing across the whole spectrum of disease, the potential for new drugs that could be found to have transformative



results when tested in other animals, is being woefully neglected. We may share over 97 per cent of our working DNA with mice, but to state the glaringly obvious, humans are very different creatures. Various drugs have cured cancer in mice, only to be utterly ineffective for humans.

There are numerous scientific breakthroughs in mice that simply don't cross over into humans. Despite their best efforts, scientists can't yet explain why something that works in mice does not work in humans. This contributes to the shocking statistic that 90 per cent of drug trials never get past the early development stages towards approval for human use. From the billions of dollars channelled into medical research, the return – in terms of real innovation – is perplexingly low.

The dependence on mice in the field of biomedicine has become so great that it is effectively a monoculture. The reason it got this way is surprisingly simple. Mice are cheap, easy to manage and manipulate, and they are amenable to the most advanced tools of genetic engineering. Plus, when one study is done and a paper published, it triggers future work that continues with the mouse as the subject to that specific line of inquiry. Ever since mice were introduced to lab testing nearly 100

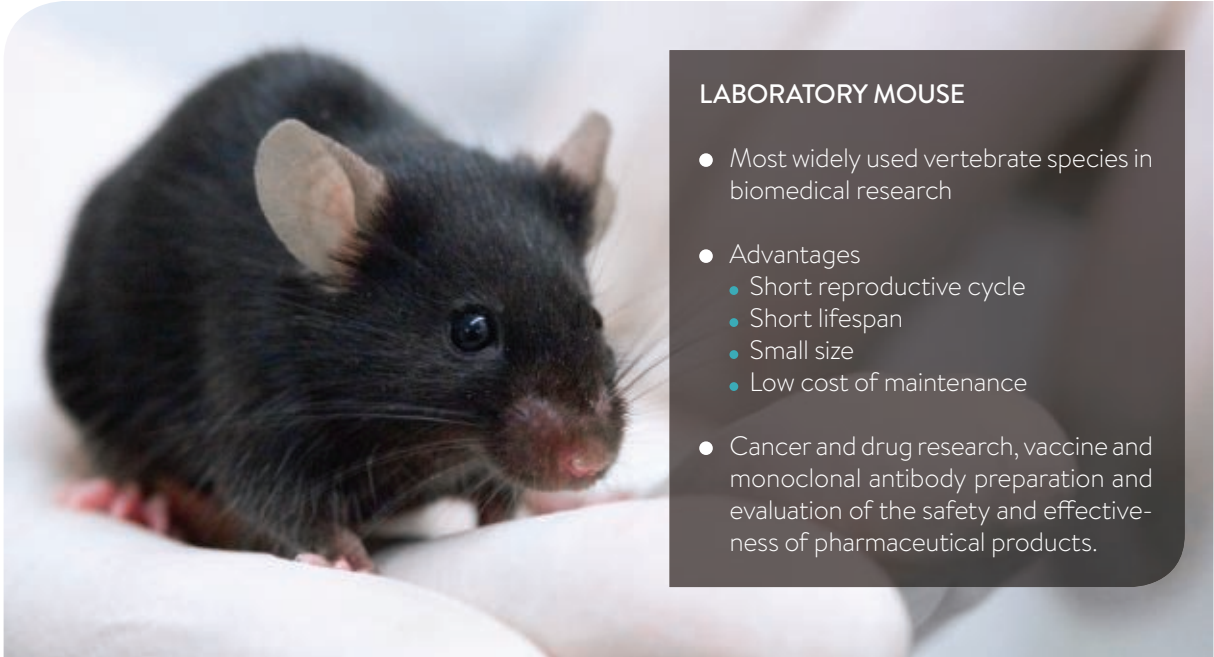
years ago by the geneticist Clarence Cook, convenience and precedent have paved the way for them to become the dominant subject upon which the majority of all research pivots.

Speaking to *Flashes* from his office in the Pain Genetics Lab at McGill University, Montreal, Dr. Jeffrey S. Mogil elaborates on how the rule of the mouse arose. “The problem is that once people start using inbred mice, especially a particular strain, then everyone uses inbred mice because everyone else uses them. So it builds on itself and it quickly becomes too late to second guess the original decision.

“The other problem with inbred mice is not so much that they're inbred but that we are using one particular strain of inbred mouse. The reason we use C57 black 6 is because it's the one that breeds the best. But the problem there is, it's like we decided to only test people from the western half of Mongolia and we're going to pretend that they are like everyone on Earth. We have settled on this particular example of mousedom and suddenly we think we can extrapolate the results from that strain to all mice. And that is absurd”.

Focusing too heavily on one strain of mouse isn't the only problem. An added element is that

Mice were introduced to lab testing by geneticist Clarence Cook.



LABORATORY MOUSE

- Most widely used vertebrate species in biomedical research
- Advantages
 - Short reproductive cycle
 - Short lifespan
 - Small size
 - Low cost of maintenance
- Cancer and drug research, vaccine and monoclonal antibody preparation and evaluation of the safety and effectiveness of pharmaceutical products.

Above: Mice account for 61 per cent of all biomedical animal research.

Below: Professor Mark Mattson identifies a number of reasons why translating findings from mice to humans are problematic.

the overwhelming majority of test mice are overweight and out of shape. Whilst it could be argued that this reflects the reality of human subjects in most industrialised societies, it is far from ideal for experimentation purposes. Test results from an unhealthy and obese mouse will differ hugely from those of a healthy specimen.

The eminent neuroscientist and National Institute of Health's Longevity Director, Mark Mattson, has propounded the claim that the worldwide use of overweight lab mice creates skewed baseline data. Mice in labs can feed themselves 'ad libitum' through pellet hoppers installed on their cages. With no interaction or exercise and nothing else to do all day, they over-eat, which makes them sick. Prompting the question – shouldn't unhealthy mice be of limited use for research?

From his lab in Baltimore, USA, Mattson summarises the core problems of what is referred to in the field as 'the mouse trap'.

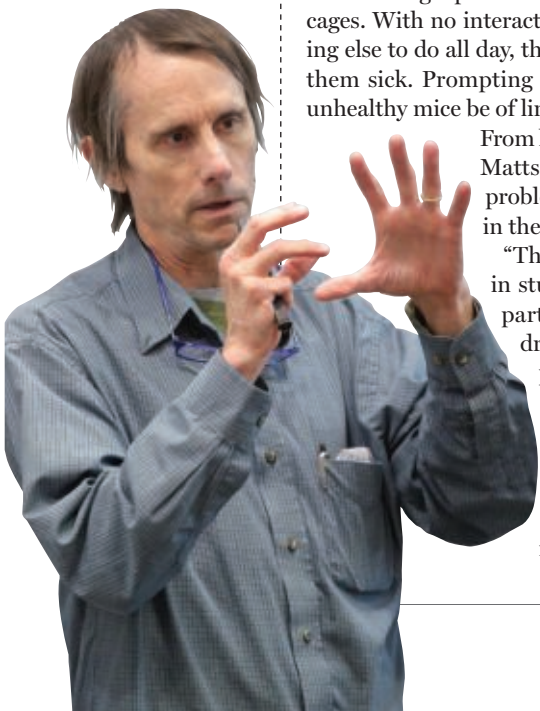
"The translation of findings in studies of mice to humans, particularly with regards to drug development, has been problematic with failure in human clinical trials of a very high percentage of drugs that are reported to be effective in mouse models of a disease. The reasons for such failures

are often not established. However, likely factors include the facts that 1) mice used for research are genetically 'pure' whereas humans are genetically highly variable; 2) 'control' mice are overfed and sedentary; and 3) some mouse models of human disease do not accurately reflect what is happening in humans."

It's clearly unwise to depend on one sole factor because if it fails there are no alternatives. As the saying goes, "the mouse that has but one hole is taken quickly". The problem is, as with many things, it comes down to money. Scientists are constricted in their work by the budgets allocated to them.

"Funding agencies could decide to give more priority than is currently the case to people who want to look for the generalizability of phenomena. Rather than only funding people who say, 'I'm going to find something that's never been found before,'" explains Dr. Mogil when asked about potential solutions. "That would mean giving people money to test things in both sexes and to test things in multiple strains and species", he adds.

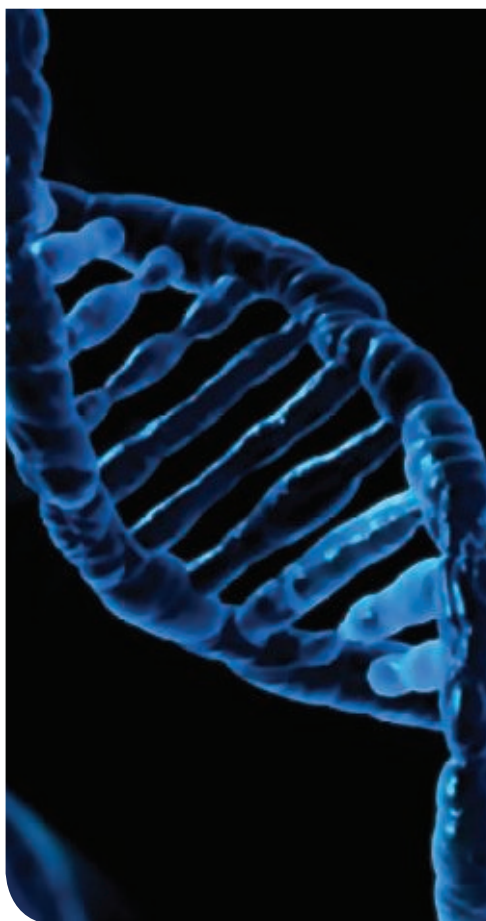
Not only is biomedical science myopically honed in on lab mice as a test subject, the focus is further narrowed by only using males. This is despite fixed sex differences in the way the biological systems operate. As with humans, males and female mice are wired very differently but scientists are less aware of the potential ramifications of this due to rarely testing female mice.





Why neglect the female of the species? Dr. Mogil explains, “The reason that we never test female mice is that everyone’s afraid they’re going to have oestrus cycles and create variability. But it’s been empirically demonstrated that the data you get from female mice is not more variable than that from male mice. What everyone is worried about simply isn’t true. That’s an empirical fact and yet the industry is such that people continue on. I would argue that this is the first thing we should change because using both sexes doesn’t cost you a dime. In fact, it saves you money because you’re breeding both sexes and you don’t have to throw half of them away.”

Reflecting on the paradoxical notion that, in the scientific field with its elevated quest for knowledge, such seemingly elementary flaws could compromise the whole system, Dr. Mogil says, “What I would remind you and everyone else is that it’s a miracle we can do this at all. Expecting a brain to understand how a brain works is like expecting a carburettor to know how a carburettor works. And yet we can do it. Slowly but surely we chip away and figure things out. Is it done optimally? No. Can we do it better? Yes. Do people make stupid decisions sometimes? Of course. But I would hate for people to get the conclusion that this is all worthless because we are making advances. People are living longer and there are therapies available that really work. It’s just that it goes slow. Because it’s really hard.” †



Above: Lab mice are often overfed which skews results.

Below: Genetically ‘pure’ mice have easily manipulated genes that aids some research.

FAZZA CHAMPIONSHIP

The first Fazza Heritage Championship was launched with much fanfare in 2001, and quickly became the biggest celebration of traditional sports in the UAE. Today, it attracts competitors of all ages, both regionally and internationally, and plays a central role in keeping the UAE's traditions alive.





Traditional Saktoun rifles, which were used for hunting, are used in the Saktoun Rifle event. However, there are also events in Plates and Clay Shooting. This year's events attracted a record number of male, female and Olympic shooters.



Around 200 hybrid and purebred Arabian salukis took part in the second Saluki Championship, which is split into amateur and professional categories. The dogs, traditionally used for hunting, run a two-kilometre course.

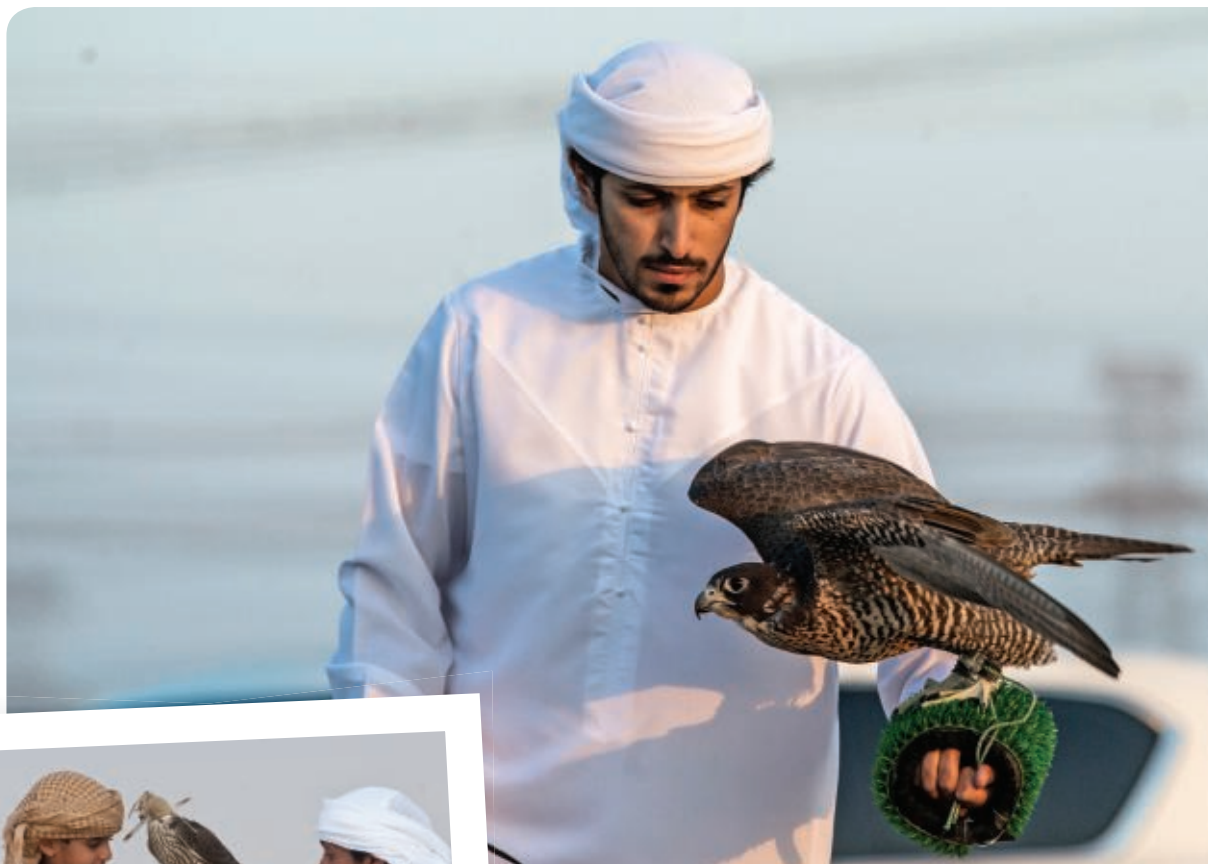


Camels were intrinsic to long journeys through the desert, thanks to their ability to go without any water for up to five days during the summer. Dubai's Camel Marathon sees riders covering a distance of 25 kilometres, with the last winning time being 80 minutes.



Pearl diving is an important part of the UAE's heritage. In order to retrieve the pearl oysters, freediving techniques were used. The Fazza Championship for Freediving celebrates this legacy, which sees contestants holding their breath in excess of 10 minutes.





Predatory birds such as falcons have been used to hunt not just in the Arabian Peninsula but all around the globe. There are numerous disciplines open to all ages, with the latest technology being used to measure the birds' speed and accuracy. It is the most popular part of the Fazza Heritage Championship.



Youlah is a male-only performance that sees each 'yaweel' (soldier) moving in time to traditional music and chanted poetry, spinning swords or guns to demonstrate prowess. It is a permanent presence at weddings, special occasions and national celebrations.

ELON MUSK ON THE FUTURE



One of the most anticipated speakers at the World Government Summit 2017 (WGS) in Dubai last month was visionary entrepreneur Elon Musk, who tackled subjects ranging from driverless cars to artificial intelligence and the idea of a “universal basic income”.

The future of transportation was a popular topic at the World Government Summit 2017, a subject central to Musk as founder and CEO of Tesla and the inventor of the Hyperloop.

“The most near term impact from a technology standpoint is autonomous cars. That is going to happen much faster than people realise and it’s going to be a great convenience,” Musk said. “Getting in a car will be like getting in an elevator. You just tell it where you want to go and it takes you there with extreme levels of safety. That will be normal. There used to be elevator operators. There was a guy moving a lever. Now you just get in and press a button and that is taken for granted.”

However, there is also a downside as Musk claims that within 10 to 20 years, up to 15 per cent of the world’s workforce will be rendered redundant by artificial intelligence.

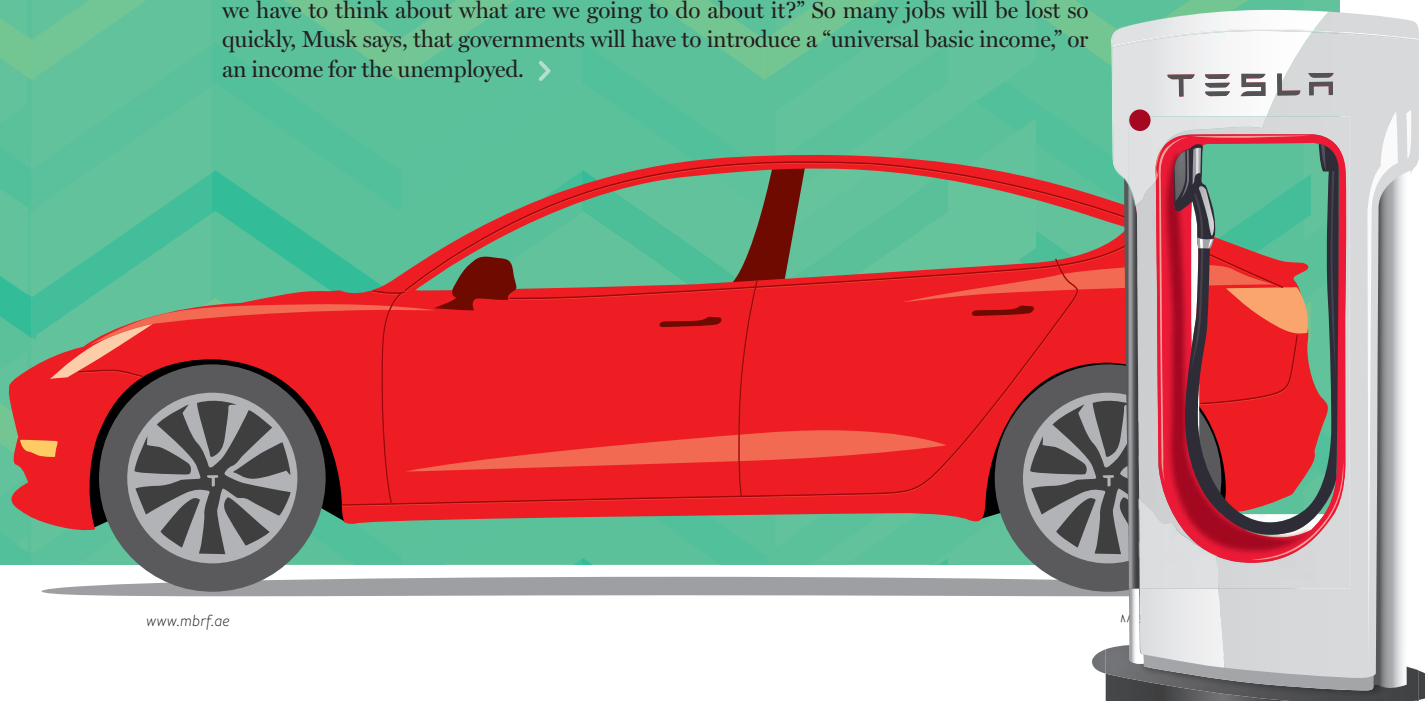
“There are many people whose jobs are to drive. In fact I think it might be the single largest employer of people – driving in various forms. So we need to figure out new roles for what do those people do, but it will be very disruptive and very quick.”

Musk is not alone in this assessment. A 2013 study by Oxford University’s Carl Frey and Michael Osborne estimates that 47 per cent of US jobs would potentially be replaced by robots and automated technology in the next 10 to 20 years. Those individuals working in transportation, logistics, office management and production are likely to be the first to lose their jobs to robots, according to the report.

In less developed countries, the potential for job loss is more severe. A 2016 analysis from the World Bank estimated that roughly two-thirds of all jobs in developing nations around the globe are susceptible to replacement by automation.

Musk further highlighted: “There will be fewer and fewer jobs that a robot cannot do better. I want to be clear. These are not things I wish will happen; these are things I think probably will happen. And if my assessment is correct and they probably will happen, then we have to think about what are we going to do about it?” So many jobs will be lost so quickly, Musk says, that governments will have to introduce a “universal basic income,” or an income for the unemployed. >

“The most near term impact from a technology standpoint is autonomous cars. That is going to happen much faster than people realise and it’s going to be a great convenience”





Top: Musk on stage with Mohammad al-Gergawi, UAE Minister of Cabinet Affairs and Future, at the World Government Summit 2017.

Above: Driverless cars will be the biggest disruptors in the next 10 to 20 years.

"I think universal basic income will be necessary, but the much harder challenge is: How will people then have meaning?" he said. "A lot of people derive meaning from their employment. If you're not needed, what is the meaning? Do you feel useless? That is a much harder problem to deal with. How do we ensure the future is a future that we want, that we still like?"

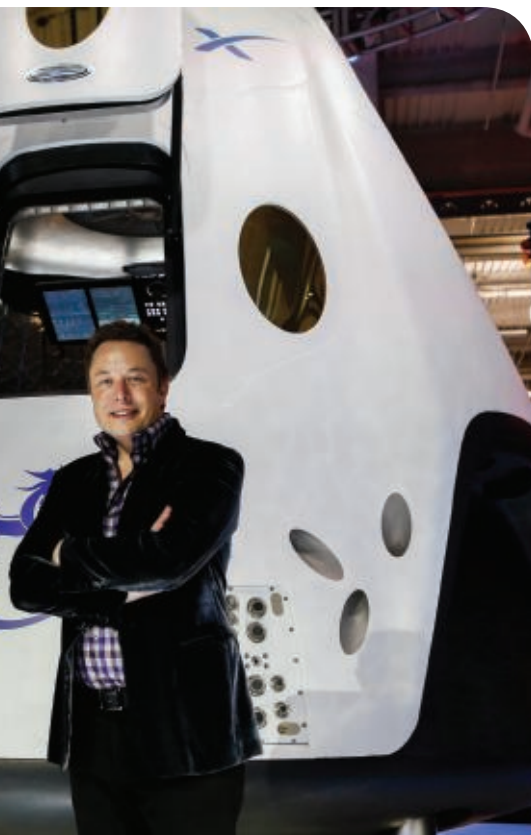
Musk identified artificial intelligence as posing another potential problem. "One of the most troubling questions is artificial intelligence. I don't mean narrow AI but deep artificial intelligence, where you can have AI that is much smarter than the smartest human on earth. This is a dangerous situation."

He warned world governments to regulate the development of AI so it would not become a threat to public safety. "Pay close attention to the development of artificial intelligence. Make sure researchers don't get carried away – scientists get so engrossed in their work they don't realise what they are doing."

However, Musk believes that AI is both a good and a bad thing. "One way to think of it is to imagine you were very confident we were going to be visited by super intelligent aliens in 10 years or 20 years at the most. Digital super intelligence will be like an alien."

One of the ways to prevent AI getting out of hand was to merge with it, Musk proposed. Although the idea seems far-fetched, in many ways this merger has already begun he said.

"To some degree we are already a cyborg – you think of all the digital tools that you have – your phone, your computer. You already have a digital tertiary layer. Think of the limbic system – the animal brain and the cortex as the thinking part of the brain, and your digital self as a third layer. Over time we will see a closer merger of biological intelligence and digital intelligence. It is all about the bandwidth of the brain."



The problem, according to Musk, is that computers can communicate at “a trillion bits per second”. Humans, on the other hand, who do most of their communication by typing on various digital devices with their fingers, are limited to around 10 bits per second.

“Output if anything is getting worse,” said Musk. “Some high bandwidth interface to the brain will be something which helps achieve symbiosis between human and machine intelligence, which solves a control and usefulness problem.”

Musk was sure to say during his speech at the Summit that forecasts about the distant future are highly unlikely to pan out just how we expect. “Any predictions we can make today about what the future will be like in 50 years will be wrong,” he insisted.

Of course, if anyone is in a position to make an educated guess, it's Elon Musk. ✨



THE MAN BEHIND THE IDEAS

Elon Musk was born in South Africa to a Canadian mother and South African father. He got his first computer at 10 and taught himself how to programme. At 12 he made his first software sale of a game he created called *Blastar*. In 1989, he moved to Canada to attend Queen's University but he left in 1992 to study business and physics at the University of Pennsylvania. He graduated with an undergraduate degree in economics and stayed for a second bachelor's degree in physics.

After leaving Penn, Elon Musk headed to Stanford University in California to pursue a Ph.D in energy physics. However, he dropped out of Stanford after just two days as his move was timed perfectly with the internet boom. Musk launched his first company, Zip2 Corporation, and this online city guide was soon providing content for the new web sites of both the *New York Times* and the *Chicago Tribune*. In 1999, a division of Compaq Computer Corporation bought Zip2 for \$307 million in cash and \$34 million in stock options.

That same year, Musk co-founded X.com, an online financial services/ payments company. An X.com acquisition the following year led to the creation of PayPal as it is known today, and in October 2002, PayPal was acquired by eBay for \$1.5 billion in stock. Before the sale, Musk owned 11 per cent of PayPal stock.

Musk now turned his attention to space and clean energy. Space Exploration Technologies Corporation, or SpaceX, was founded in 2002 with the intention of building spacecraft for commercial space travel. By 2008, NASA had awarded SpaceX a contract to resupply the International Space Station. Back on Earth, Musk founded Tesla in 2003, a company dedicated to producing affordable, mass-market electric cars, and five years later the company released its first car, the Roadster. Musk's continuing effort to promote and advance sustainable energy resulted in him acquiring SolarCity in 2016.

Another Musk idea is a concept for a new form of transportation called the “Hyperloop,” an invention that would foster commuting between major cities while severely cutting travel time. The Hyperloop would propel riders in pods through a network of low-pressure tubes at speeds reaching more than 700 mph.

According to Musk the goals of SolarCity, Tesla, and SpaceX revolve around his vision to change the world and humanity, by reducing global warming through sustainable energy production. He is also a strong proponent of making human life “interplanetary” by setting up a human colony on Mars.



THE SCIENCE OF RAIN

Masdar's latest developments in the sphere of cloud seeding have put the focus back on a technique that has been around in one form or another since 1946.

The UAE-based Masdar Institute recently filed a patent for their innovative cloud seeding material, which is based on nanotechnology. The team is being led by Dr Linda Zou, one of the first scientists in the world to explore the use of nanotechnology for cloud seeding. Nanotechnology has never been researched in this context until now and has the potential to revolutionise cloud seeding by making the process of water condensation and rain precipitation more efficient and effective.

Filing the patent holds dual significance for the UAE. It safeguards the country's intellectual property, which is a key measure of the nation's innovation drive. It is also a significant milestone towards achieving greater water security in the UAE. Rain enhancement through cloud seeding can increase rainfall by between 10 and 30 per cent. The UAE is among the world's top 10 driest countries and relies heavily on desalination to fulfill its water needs. The desert nation accounts for 14 per cent of the world's desalinated water and is the second largest producer of it. Despite the high production, desalinated water fulfils only 42 per cent of the UAE's needs with an additional 14 per cent obtained from treated waste water.

Cloud seeding can significantly solve the Emirates' water security concerns. In 2010, four days of heavy rain induced by cloud seeding produced downpours equivalent to the nine-year production of a single desalination plant. Last year, 77 seeding operations took place between January and March, which resulted in record rainfall at a cost of \$558,000. Rain triggered through cloud seeding is therefore a more viable option both economically and ecologically.

Cloud seeding in the country goes back to the late 1990s with the National Centre of Meteorology and Seismology cooperating with leading international organisations such as the National Centre for Atmospheric Research in Colorado and the US space agency, NASA. In 2015, the programme spread its reach further branching out to San Francisco, Tokyo, Seoul and Bangkok. Today the UAE has 60 automatic weather stations, an integrated radar network and six dedicated aircraft taking off 200 times a year to seed the clouds and augment rain.

Two years ago the government set up the UAE Research Programme for Rain Enhancement Science, in a bid to stimulate the next breakthrough. The programme's latest round of funding attracted 91 research proposals from 398 scientists and researchers affiliated to 180 institutes in 45 countries around the world. The

three winners were granted a total of \$5 million in funding. Dr Paul Lawson is investigating new approaches to rain enhancement that use ice production in clouds, Professor Hannele Korhonen is working on atmospheric aerosols, while Professor Giles Harrison was awarded for his work on electric properties of clouds and how they relate to rain.

WHAT IS CLOUD SEEDING?

Cloud seeding refers to the process of inducing rain from a naturally existing cloud cover. Conventionally this has been done by injecting salt crystals into cumulus clouds. Clouds are injected by planes, which go up and launch salt flares into them. The salt crystals cause the water in the clouds to condense stimulating water droplet growth. Soon the droplets grow bigger and start colliding with each other. Once they become too big and can no longer remain suspended in the cloud, the droplets come down as rain. The size of the cloud and the air pressure are important factors in determining how heavily it will rain, which can be expected usually 20 minutes after a seeding operation has been carried out.

WHEN DID IT BEGIN?

Attempts to induce rainfall can be traced back to 1946 when scientists at General Electric (GE) >

The most common chemicals used for cloud seeding include silver iodide, potassium iodide and dry ice.





Above and right: The UAE has been experimenting with cloud seeding since the late 1990s.



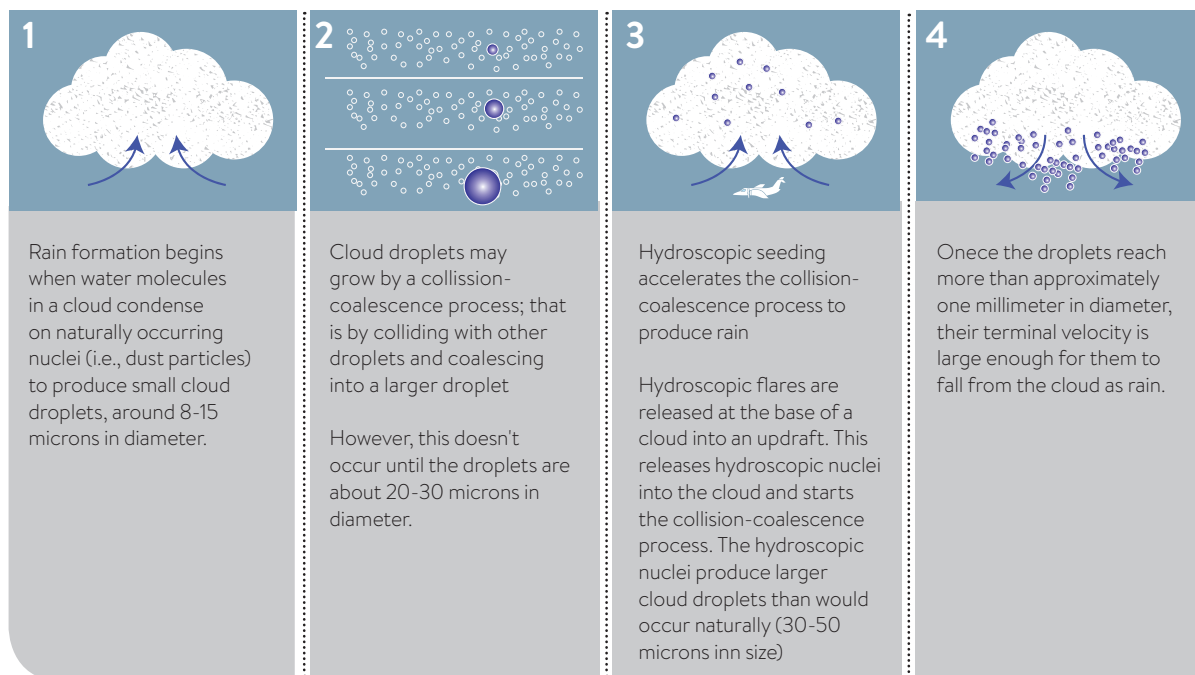
laboratories discovered that flakes of dry ice (solid carbon dioxide) could cause ice crystal formation in super cooled water. Super cooled water is simply the presence of liquid water at temperatures below its normal freezing point and is found in certain clouds. While the first sprinkling of dry ice was accidental, the GE scientists later came up with a dispenser to drop dry ice over clouds, producing the first manmade snow. After a series of

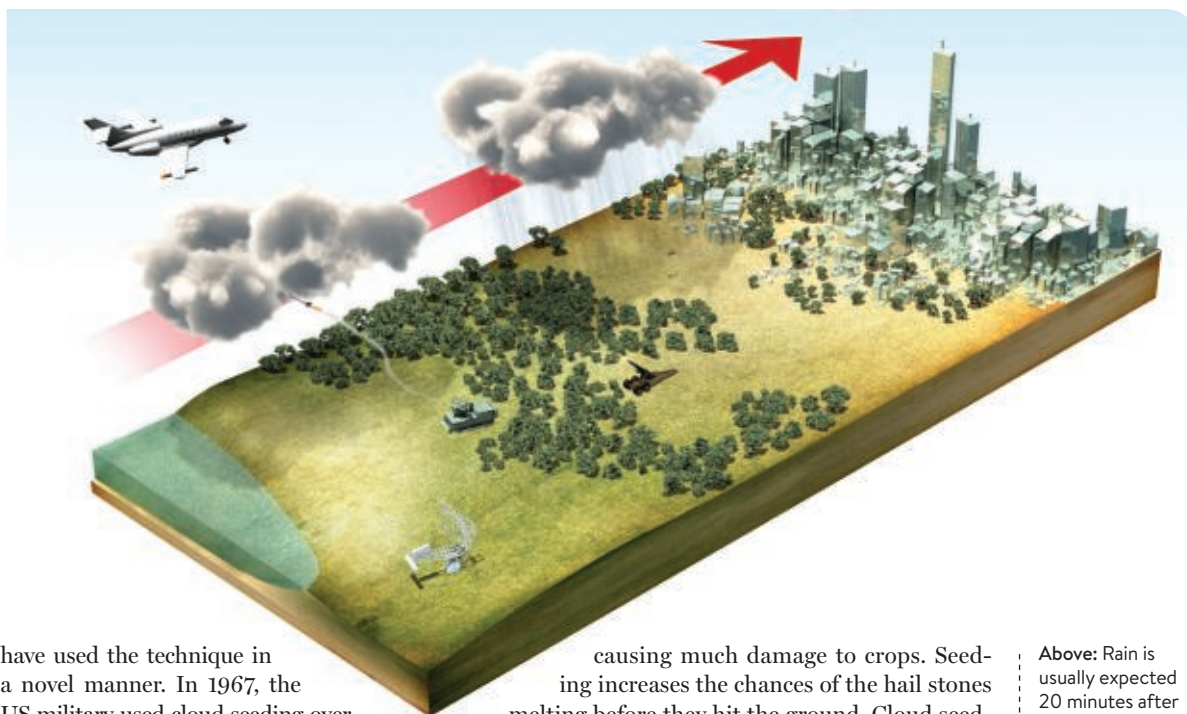
laboratory-based experiments, Bernard Vonnegaut, another GE scientist, found that silver iodide produces the same results at warmer temperatures. Vonnegaut's method is still the standard for many modern cloud seeding operations.

NOTABLE CLOUD SEEDING OPERATIONS

The sole purpose of cloud seeding is to achieve water security but there have been times governments

HYDROSCOPIC CLOUD SEEDING PROCESS





have used the technique in a novel manner. In 1967, the US military used cloud seeding over Laos in an attempt to stall the Vietnamese forces. The plan worked with the Vietnamese monsoon extending by 30–45 days. However, this didn't go down well with the global community and in 1977 the UN Environmental Modification Convention banned all forms of hostile weather control.

More recently, Chinese authorities launched 1,000 silver iodide rockets into the clouds surrounding Beijing to ensure they dropped all their rain prior to the start of the 2008 Olympic Games. The Chinese have complete faith in cloud seeding with nearly 39,000 field operators, 7,113 anti-aircraft cannons and 4,991 truck-mounted rocket launchers always ready to draw rain from the sky.

Austria uses cloud seeding to suppress hail. Hail storms are frequent in the European country

causing much damage to crops. Seeding increases the chances of the hail stones melting before they hit the ground. Cloud seeding has also been used to rain pollutants from the sky – the Russians used the technique to remove radioactive particles from the air after the Chernobyl disaster.

Eighty-five per cent of the world's population lives in the driest parts of the planet and it is predicted that by 2050, 1.8 billion people around the globe will be affected by water scarcity. With statistics like these, the science of rain enhancement is one of global interest. It is touted as one of the easiest, cheapest and most energy-efficient ways of ensuring regular water supply. Amidst concerns over the use of iodide for seeding – it is identified as a carcinogen – UAE's nanotechnology seeding technique could just be the answer the world is looking for. †

Above: Rain is usually expected 20 minutes after a cloud seeding operation has been carried out.

Below: Only certain types of clouds are successful targets for cloud seeding.



SEISMIC CHANGES FOR THE MIDDLE EAST'S

E-COMM



The Middle East may be slightly late to the e-commerce party, but it plans to enjoy it. With logistical and infrastructure challenges being overcome, the sector is booming and set to triple in value.

ERCE

First there was teleshopping – created in the USA in the late 70s it was the initial alternative to physically buying products from shops. Products were projected to millions via brash, low budget TV commercials that never seemed to end. Teleshopping's natural successor is the vast sphere of e-commerce.

Since the arrival of the internet in 1991, and in quick succession the growth of giant companies such as eBay, Amazon and PayPal, online retail has become a global phenomenon – albeit one that is concentrated predominantly in the Western world. Populations in the West are accustomed to ordering anything and everything at the click of a mouse button or the tap of a touchscreen. Be it a wedding ring, a new car or a cheese sandwich, it's 'select', 'confirm your purchase', and 'pay'.

In the Middle East, however, the adoption of this digital shopping world has taken more time to form and evolve. A tendency towards face-to-face interaction, less prevalence of the internet and mobile phone penetration, the logistical challenges of deliveries, plus widespread doubts about quality, returns and security have all played a role in the more gradual uptake of e-commerce. Now that these factors and fears have been largely allayed, the flood gates are open and online marketplaces, including both small start-ups and major players, are proliferating.

Founded in 2015, Mostawda is a fledgling business offering instant access to a range of largely

handmade products from vendors all over the Middle East. The goods of local artisans, home-based businesses, private individuals and refugees are presented to an online audience and finding great interest and traction. The Founder of Mostawda.com, Odeh Quran, is enjoying the success but recognises the ongoing difficulties ahead. "The main challenges for e-commerce in the Middle East mainly lie in the still developing infrastructure, whether it's IT or logistics. The challenge in logistics is mainly due to a lack of house addresses and a sophisticated postal service, which makes it harder to deliver packages to the doorsteps of customers" he says.

With respect to sustaining growth Quran adds, "The IT challenges lie in having suitable physical hardware, internet access and supporting infrastructure that would match the standard required for e-commerce to reach its full potential in the Middle East".

In January this year another burgeoning online retailer, Mumzworld.com, raised a multi-million-dollar round of investment. The company, which sells mother and baby products, has had to carefully manage issues relating to online payments. The founder, Mona Ataya, explains that, "Despite high smartphone penetration rates and huge potential for e-commerce across the Middle East, the preference for cash payments remains high, while a lack of post codes can often lead to delivery issues". ➤

Ronaldo Mouchawar is the founder and CEO of Souq.com, currently the Middle East's largest online retailer.

E-COMMERCE IN THE MIDDLE EAST

UAE leads the region as an **innovation hub** for **e-commerce**



Emerging markets (MENA included) are set to overtake developed market in **e-commerce growth**



Social media growth in the Middle East is among the highest in the world, presenting the perfect opportunity for a **social-commerce boom**



Women and the after hours workforce drive e-commerce growth in **the region**



Reflecting on this distinct preference for cash transactions, Ataya adds, “Many internet users in the Middle East are still uncomfortable with online payments and fear the possibility of internet fraud. Over the years we have dedicated much time to educating the consumer on the merit of e-commerce and the advanced security measures employed to protect against fraud, but some people remain apprehensive. This means we must offer a number of payment options, including cash on delivery.”

According to PayPal, their service accounts for just five per cent of online purchases in the Middle East, 15 per cent is comprised of credit and debit card sales and 80 per cent of sales are made with cash-on-delivery. From the minnows to the mammoths, the same logistical hurdles and infrastructure obstacles apply.

Intense competition is another interesting element of the e-commerce boom and soon there will be some gladiatorial battles. The current dominating force is Souk.com, which features over two million products and 300 brands across numerous categories. Operating throughout the GCC and Egypt, the site has more than 23 million monthly visitors, investments totalling \$150 million, and is valued at \$1 billion.

A formidable contender is due to enter the field though, as Noon.com is primed for launch. Projected to have as many as 20 million products on its site, the title of biggest online retailer will soon be up for grabs. Founded by the prominent Emirati businessman and Emaar Chairman, Mohamed Alabbar, the Riyadh-based company, which takes its name from the Arabic letter ‘noon’, is set to grow the online retail sector exponentially.

Insignia Worldwide, a leading branding agency headquartered in Dubai, spoke exclusively to Flashes about this looming duel.

Executive Director Rupert Diss says, “Due to Mohamed Alabbar’s extensive bricks and mortar retailing experience he understands the power of consumer trends, needs, wants, hearts and minds and is a believer in the all important ‘brand’ and storytelling behind retailing ventures. Failure is not an option and the brand’s online visibility, resources and infrastructure will create a category killer.”

Speculation is rife about how the tussle for the top position will play out. Diss states, “Will there be room for two big players? I think not. Noon will become the Amazon of the Middle East and Souq.com, who have



done an extremely good job to date with probably half the investment, will have to reinvent themselves or occupy a new white space to not compete head on”.

Regardless of how the battle for market share resolves itself, what is certain is the steady encroachment of online sales on the traditional bricks and mortar revenues from shopping malls. In certain cases, some brands may even see the cannibalization of physical mall sales with the marked drive towards online sales.

E-commerce will undoubtedly gain ground on the long held reign of the shopping mall and it will be interesting to see how this will affect the cultural significance and fiscal sustainability of the mega malls. In Dubai and Abu Dhabi alone there are 4.7 million square metres of shopping centres. The malls are not merely a functional place to purchase goods, but part of the social fabric. Yet in 2016 sales were in decline. If the trend for visiting without actual spending continues, it could spell trouble.

John Deykin, Advisor to the CEO at Insignia Worldwide, acknowledges the rise of e-commerce but doubts we will see a distinct decline in the shopping mall. "Malls are a central part of people's day-to-day lives in the UAE and will continue to flourish," he says. "We can expect to see malls further develop their entertainment products, creating better relevance in their tenant mix and branding themselves as destinations with added value."

The UAE has one of the highest numbers of shops per capita in the world and the overwhelming predominance of shopping malls is

not going to dissipate overnight, but e-commerce will be forcing the malls to up their game by any means possible as people are increasingly more willing to buy online.

A study by Network International found that 34 per cent of UAE residents make online purchases between one and five times a week. Figures on the value of the online retail market in the Middle East are varied but according to Payfort, the leading online payment service provider in the Arab world, the e-commerce market is expected to almost triple in value, from \$25 billion in 2015 to \$69 billion by 2020.

“We have reached a critical mass of high quality apps delivering on what they have promised, with travel and food ordering apps leading the way in the UAE. The entire e-commerce industry is benefiting from people’s comfort and trust in sharing their payment details online,” Devkin concludes.

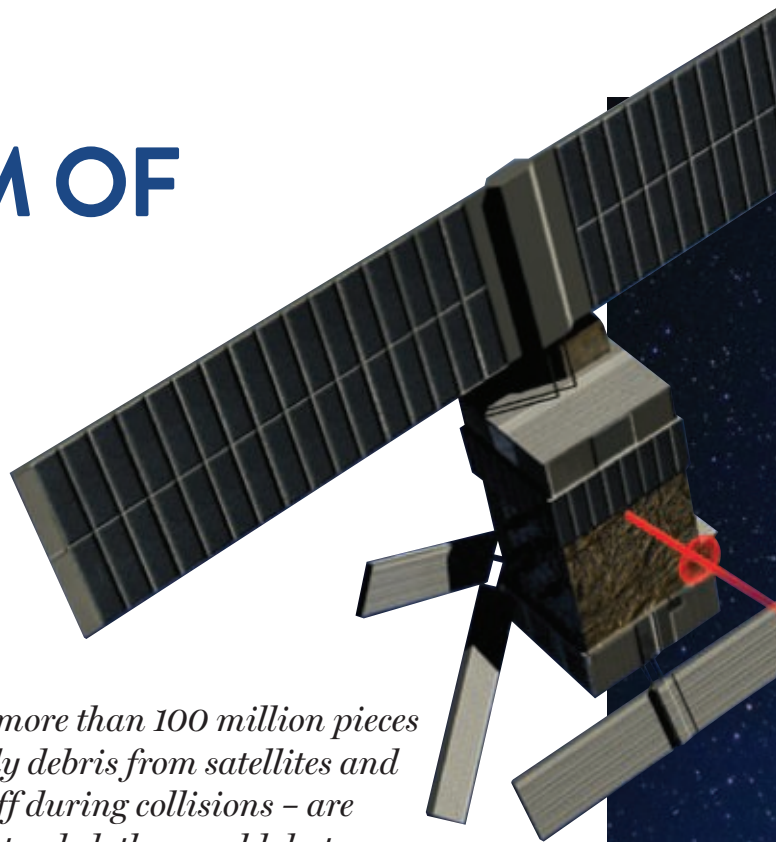
With the construction of new fulfilment infrastructures and the improvement of inadequate logistics and electronic payment methods, e-commerce will continue to rapidly expand and the effects on the physical retail ecosystem will be interesting to observe. In order to maintain ground, physical retailers in the UAE and across the Middle East must attract and connect with a generation accustomed to smartphone shopping. 

Above: Mohamed Alabbar has extensive retail experience, which bodes well for the launch of Noon.com.

Above middle and left: The UAE has one of the highest numbers of shops per capita in the world.



THE PROBLEM OF SPACE JUNK



Researchers estimate that more than 100 million pieces of rubbish – predominantly debris from satellites and rockets that have broken off during collisions – are orbiting Earth. If left unattended, they could destroy satellites worth hundreds of thousands of dollars and jeopardise further space missions.

Last month, the Indian Space Research Organisation (ISRO) set a new world record by launching 104 satellites into orbit at one go. However, soon the applause gave way to growing concern about the amount of debris these satellites would add to the existing space junk orbiting our planet.

Space junk is a problem that is increasingly plaguing galactic exploration missions and putting satellites worth hundreds of thousands of dollars at risk. Around 3,000 working satellites orbit the Earth, but NASA estimates that more than 100 million man-made objects the size of a grain of salt are orbiting the planet. About 500,000 objects that are roughly the size of a marble are also believed to be out there, as well as 23,000 objects the size of a cricket ball or larger. Smaller pieces of dead spacecraft, abandoned launch vehicle stages, mission-related debris, fragmentation debris and even flecks of paint form the majority of space junk.

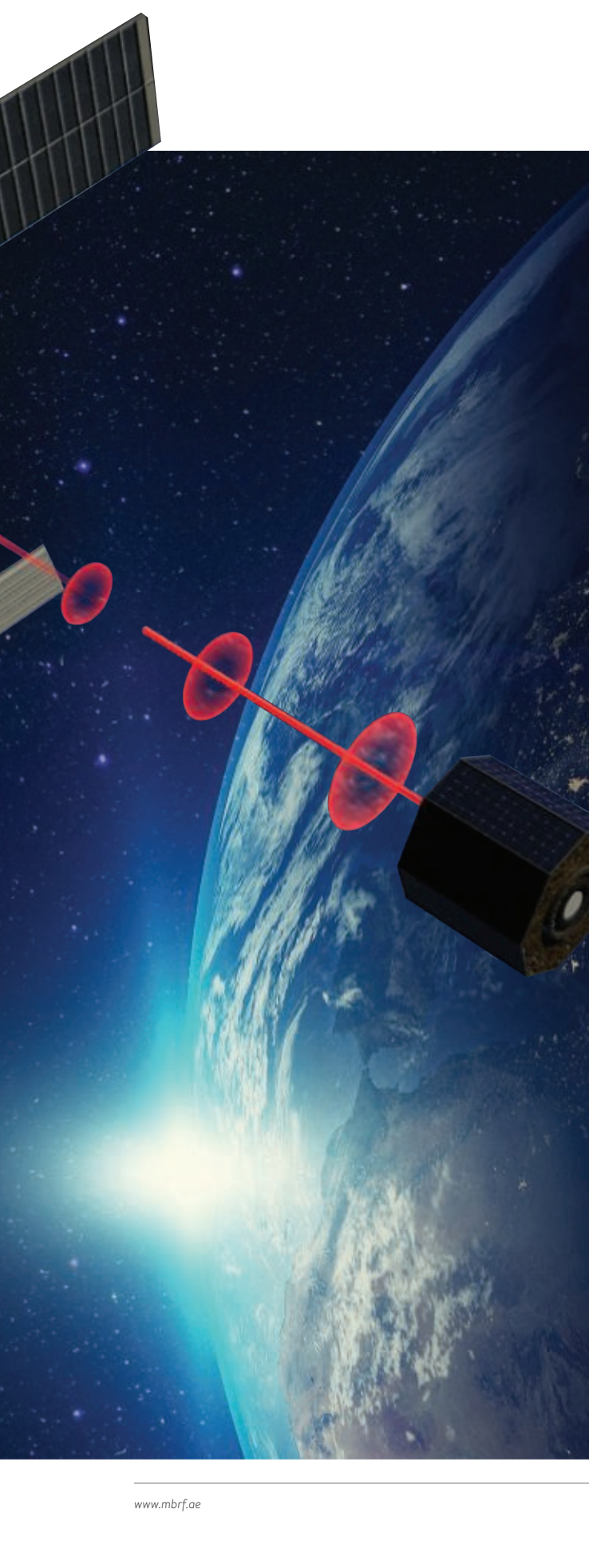
“The greatest risk to space missions comes from non-trackable debris,” says Nicholas Johnson, NASA chief scientist for orbital

debris. Non-trackable debris comprises of tiny pieces of litter that cannot be tracked by satellites. Travelling at speeds of up to 30,000km an hour, even the tiniest pieces of orbital debris turns into deadly shrapnel that can damage satellites, space shuttles, space stations and spacecraft with humans aboard. The amount of debris in low Earth orbit is so high that it has created a ‘debris’ belt rendering many orbits that functional satellites could use unusable.

Although NASA scientists say the odds of an operational satellite being disabled by space debris remain quite small, there have been instances where satellites were wrecked after being hit by man-made debris – a French satellite in 1996 and an American craft in 2009. In 2013, space debris left over from a 2007 Chinese missile test collided with a Russian satellite, and in 2012 the crew of the space station had to evacuate as a precautionary measure after a piece of debris passed close by.

Large pieces of space junk also return regularly to Earth, although calculations by >

The Space Debris Elimination System aims to use pulses of atmospheric gases to deorbit debris.



WHAT IS SPACE JUNK?

Nonfunctional, human-made materials in orbit caused by everything from spent booster stages to satellite collisions and explosions.

73% of tracked debris resides in low-Earth orbit (LEO), 1,200 miles above our planet's surface.

HOW MUCH SPACE JUNK IS THERE?

More than

23,000 objects

The amount of space debris larger than 10 centimetres in diameter in Earth's orbit being tracked by the US Space Surveillance Network.

500,000 objects

Estimated amount larger than one centimetre in diameter, or the size of a marble.

There are another tens of millions of paint chip-like pieces that measure smaller than a centimetre.

WHY IS IT A SERIOUS PROBLEM?

Travelling at such hyper velocities, any particles of space junk presents a considerable threat to spaceflight for any nation. And with more hardware flying around Earth's orbit, the potential of collisions between spacecraft and large orbital trash only continues to grow. >>



Above: The titanium motor of a Delta II rocket landed in Saudi Arabia in 2001.

Above middle: A Chinese rocket stage crashed into Myanmar last year.

Opposite page: JAXA's tactic to clean up space junk with an electrodynamic tether failed this year.



Columbia University put the highest possible risk of a dead satellite hitting a person at a 1-in-10,000 chance. Still, chunks of debris weighing two tons or more from satellites and rocket parts fall uncontrolled every three weeks or so, according to an analysis by a Harvard University astronomer who tracks satellites and space debris. According to the Centre for Orbital and Reentry Debris Studies it's likely that 50 to 200 "large" pieces of manmade space debris return to Earth every year.

NASA and other space agencies have instituted measures to crack down on space polluters, including a rule stating that anyone who sends a satellite or other object into space needs to plan on bringing it back down in 25 years. But Jer Chyi Liou, NASA's chief scientist for orbital debris, said only about half of the world's space missions today plan on bringing their spacecraft back in that period, mostly because of money.

DRIVES TO CLEAN UP SPACE

While ISRO was launching its record-setting satellites and other space missions were planning manned missions to Mars, the Japan Aerospace Exploration Agency (JAXA) was anxiously waiting to see the results of its experimental tactic to clear up space junk. Scientists at JAXA had launched an electrodynamic tether to slow the junk circling the Earth and bring it into a lower orbit. The clutter – a result of over five decades of space exploration – would burn up upon entering the Earth's atmosphere long before it had the chance to crash into the ground. Unfortunately the mission did not go as planned with the tether failing to deploy.

JAXA's experiment was part of an international effort to safeguard astronauts, space stations, satellites and other infrastructures against space debris. JAXA and ISRO are both part of the of the Inter-Agency Space Debris Coordination Committee (IADC), an international governmental

COMING BACK TO EARTH

Although most large pieces of descending space junk largely end up in the oceans, that doesn't mean we can turn a blind eye to the issue.

- In 1978 the Russian nuclear-powered Cosmos 954 came back to Earth over Northwestern Canada, spreading radioactive debris over a wide area. The Canadian government billed the Soviet Union \$6 million to cover the cost of the search and cleanup efforts; the Soviets eventually paid \$3 million.
- Parts of Skylab, America's first space station, came crashing down on Australia and into the Indian Ocean in 1979. The Australian town of Esperance charged NASA \$400 for littering.
- In 1991 the 22 ton Salyut 7 space station came back to Earth. It burned up and broke up over Argentina, with some debris scattering over a town called Capitan Bermudez.
- The titanium motor casing from a Delta II rocket, weighing 70 kg, landed in Saudi Arabia in 2001.
- In 2011, a Delta II rocket stage and a fuel tank came to Earth in Mongolia.
- WT1190F, an unidentified piece of space junk, crashed into the Indian Ocean near Sri Lanka in 2015.
- Last year an old Chinese rocket stage as big as a car hit Myanmar, shaking nearby houses.



forum that coordinates global efforts to reduce man-made and natural space debris by sharing research and identifying debris mitigation options.

In September 2016, Surrey Space Centre and aerospace company NanoRacks announced that their RemoveDebris mission would be ready to be deployed in low-Earth orbit from the International Space Station (ISS) in June this year. The 100kg satellite will demonstrate four different debris removal technologies using artificial debris. Launched in 2013, the RemoveDebris team draws on the expertise of some of Europe's most prominent space companies and institutions. The 11-member consortium comprises the European Commission; Surrey Space Centre (University of Surrey); Airbus Defence and Space (DS), the world's second largest space company; Airbus Safran Launchers (France); SSTL, a world leader in small satellites (UK); ISIS (Netherlands); CSEM (Switzerland); Inria (France); and Stellenbosch University (South Africa).

German company Astrium plans to use a harpoon to tackle space junk. An unmanned chase spacecraft will fire a barbed harpoon into the body of the debris and then use a smaller propulsion unit attached to a tether to tow it back towards the atmosphere where it will burn up safely on re-entry.

Raytheon BBN Technologies (BBN) and the University of Michigan are studying a Space Debris Elimination (SpaDE) system that will remove debris from orbit by targeting pulses of atmospheric gases into the path of targeted debris. These pulses will cause the deorbit rate to exceed the debris generation rate. The pulses themselves will fall back into the atmosphere, leaving no residual trace in orbit. Compared to other proposed methods, SpaDE seems to be the safest as it places no solid material in orbit where a malfunction could create new debris.

Right from the prevention of creation of new debris to designing satellites that can withstand impacts by small debris and predicting and avoiding collisions, space junk is a threat that is compelling aerospace companies to come up with new and innovative solutions to tackle it. ↑

FASTER THAN THE SPEED OF SOUND.

In order to remain in orbit, the fragments in space have to move along at least 20 times of the speed of sound, and can go up to almost

30,000 km/h

COLLISION & EXPLOSIONS INCREASE DEBRIS

CHINA'S ANTI-SATELLITE MISSION

In 2007, China intentionally destroyed one of their weather satellites in space, and the event led to a

900-piece

cloud of debris

THE FIRST MAJOR IMPACT

FEBRUARY 10, 2009: The 25,000 km/h collision of the private Iridium 33 satellite and Cosmos 2251, a Russian military spacecraft, left a trail of approximately

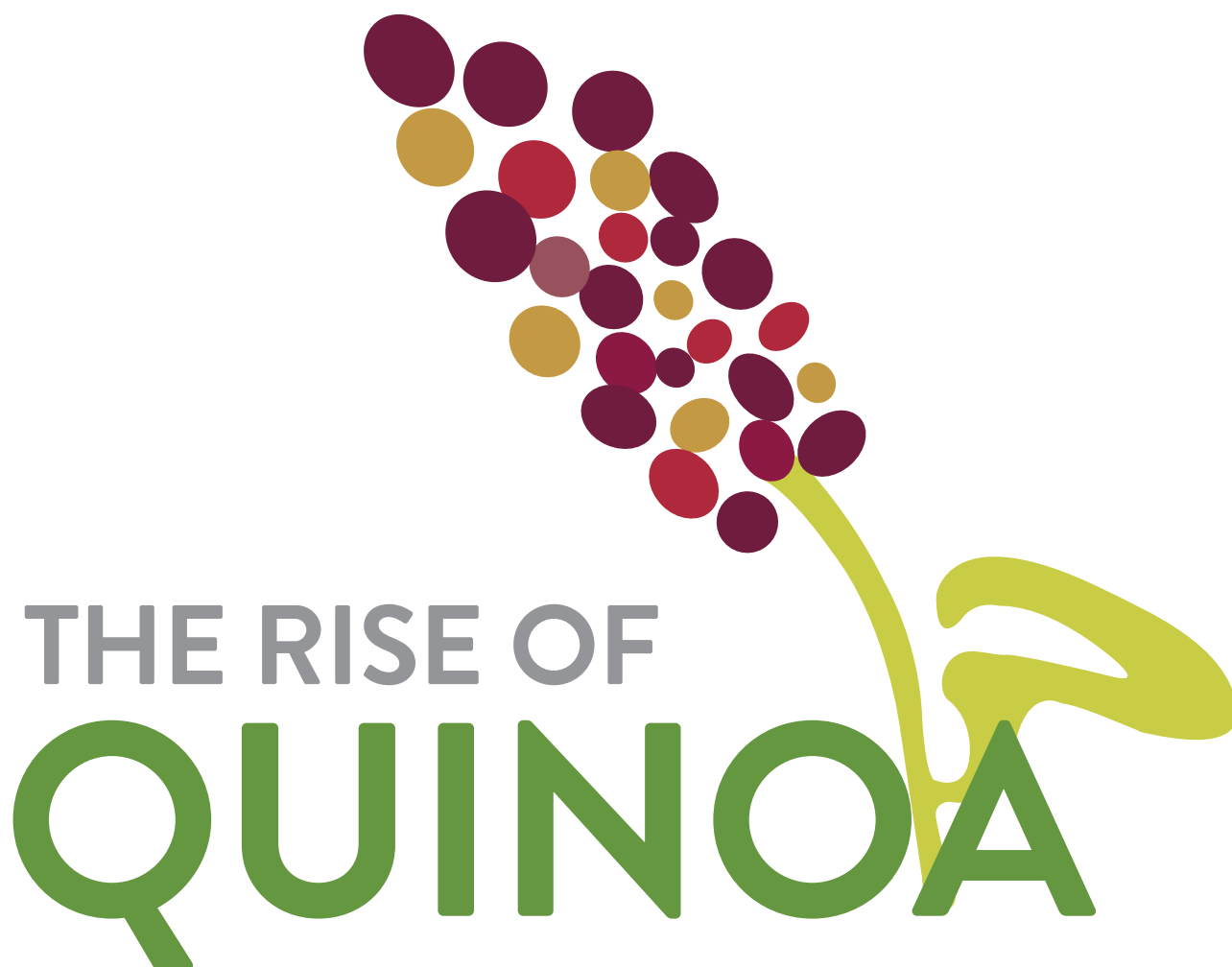
2,000 pieces

of low-Earth orbit debris.

Together, these two events combined increased the number of debris in low-Earth orbit by more than

60%





It is regarded as a 'superfood', yet quinoa production is miniscule compared to other grains. This could change thanks to the mapping of the plant's genome.

Quinoa is an enigmatic plant. It is a grain that was cultivated centuries ago by Incas in the Peruvian Andes. It thrives at any altitude up to 4,000 metres above sea level, in conditions that would leave most food plants struggling with its ability to handle -4°C during the night and up to 38°C during the day. Quinoa is classified as a pseudocereal, as it is not a grass like other cereals. In fact, it is closely related to species such as beetroot and spinach.

For centuries, poor people in the Andes were more or less the only people to grow or eat it. However, in recent years quinoa

demand has soared thanks to its designation as a 'superfood' due to its health benefits. In 1993 a study by NASA, America's space agency, stated: "While no single food can supply all the essential life-sustaining nutrients, quinoa comes as close as any other in the plant or animal kingdom." Quinoa is highly nutritious, gluten-free, and packed with essential amino acids, fibre, vitamins and minerals. It also scores lower than other crops on the glycemic index, a measure of how quickly foods raise blood sugar levels – a major concern for diabetics.

However, it took adulation from the likes of Oprah Winfrey (who in 2008 included it in her 21-day “cleanse” diet) to give the grain global appeal. This was further boosted when the United Nations branded 2013 the International Year of Quinoa.

This publicity caused a surge in demand and supply couldn’t keep pace. Between 2000 and its peak in 2014, the average price of quinoa exports from Peru and Bolivia more than tripled to \$6-7 a kilogram. This gave rise to accusations that Westerners were pricing poor Andeans out of their staple food, but figures indicate the contrary. In countries like Bangladesh, Malawi and Vietnam, sharp increases in the price of staple foods can plunge the poor into even deeper poverty, as they often spend more than a third of their income on them. But a study by Andrew Stevens at the University of California found that quinoa accounted for a mere 0.5 per cent of household spending, on average.

For farmers, meanwhile, higher prices meant higher incomes. The “Fairtrade” price of quinoa (which is meant to correspond to the minimum required to give farmers a decent standard of living) is around \$2.60 a kilogram. However, as the price of quinoa rose so did the number of people farming it, ranging from South American entrepreneurs through to large agribusinesses and European farmers. Quinoa is now grown in around 50 countries, according to James Livingstone-Wallace, founder of Quinola, a quinoa supplier.

That means a lot more supply: the combined volume of quinoa exports from Peru and Bolivia to the European Union rose by 227 per cent between 2012 and 2015. Nevertheless, Peru, Bolivia and Ecuador are still by far the main quinoa producing countries. In 2015 these three countries accounted for 94 per cent of total global quinoa production according to analyst Mercader. Global quinoa imports continue to grow, although not as fast as in the previous years. The latest trade data show that quinoa imports in the world reached a total of 75,208 tons in the year ending September 2016, which is 13 per cent more than in the previous year. Prices, naturally, have plummeted – by 40 per cent between September 2014 and August 2015 alone and have now leveled off at between \$0.94 to \$1.26 a kilogram.

However, global quinoa consumption remains incidental compared to wheat, rice, barley or corn – less than 100,000 tons per year compared to 737 million tons of wheat and 480 million tons of rice in 2015/16. This means quinoa could play an



important part in global and regional food security thanks to its high nutrition value and ability to grow in extreme conditions. First, though, some problem areas of quinoa have to be addressed.

Unlike many other domesticated crops that have been selectively bred over centuries for maximum yield and pest resistance, quinoa is still mostly wild. Its seeds are covered with a bitter layer of chemical compounds called saponins, which act as a natural defence against birds and other pests. Once harvested, quinoa has to be heated to crack the seed coating and then repeatedly washed. This process is labour intensive, uses a lot of water and potentially also washes away some of the nutrients. Another constraint is that

Peru, Bolivia and Ecuador are the world’s largest quinoa producing countries.



quinoa plants tend to have small seed heads and long stalks that can collapse in strong wind or heavy rain.

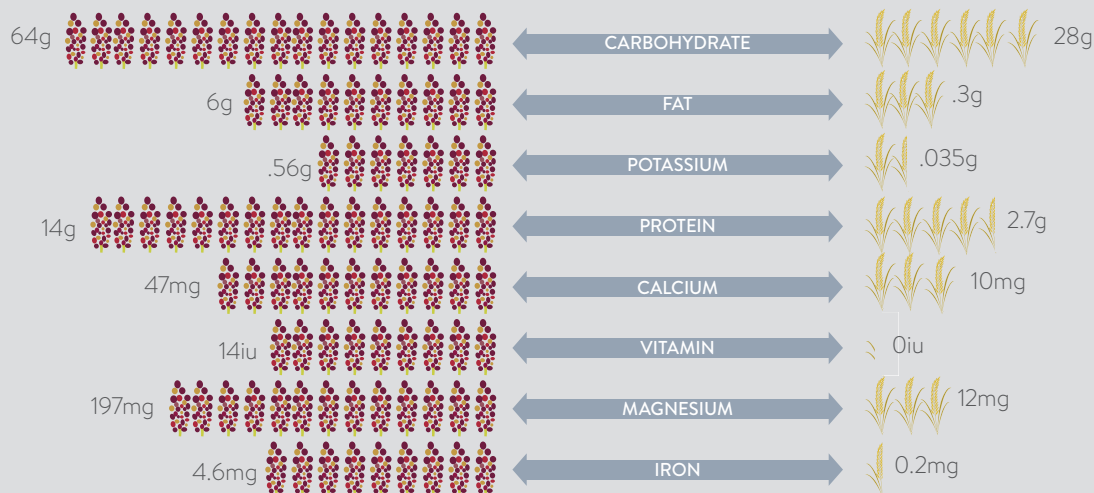
However, these problems could be overcome as scientists in February unveiled the near-complete genome of quinoa, determining that the grain has 1.3 billion nucleotides (the building blocks of DNA) spread over 18 chromosomes. The study saw 33 researchers from four continents use a combination of cutting-edge sequencing technologies and genetic mapping to piece together chromosomes.

“Quinoa is incredibly resilient, and can grow in poor or salty soils,” said Mark Tester, a professor at King Abdullah University of Science and Technology in Saudi Arabia and leader of the consortium of scholars that decoded the plant’s genome. “Its distinctive tolerance to salty soil enables farmers to grow it in harsh conditions, from the Andean highlights to the Middle East and northern Sahara.”

“It could provide a healthy, nutritious food source for the world using land and water that currently cannot be used. Despite its agronomic potential, quinoa is still an underutilised crop, with relatively few active breeding programmes,” Tester and his colleagues wrote in the journal *Nature*.

“Quinoa was the staple ‘Mother Grain’ that fuelled the ancient Andean civilisations, but the crop was marginalised when the Spanish arrived in South America and it has only recently been

QUINOA VS RICE COMPARISON CHART



revived as a new crop of global interest. This means quinoa has never been fully domesticated or bred to its full potential even though it provides a more balanced source of nutrients for humans than cereals.”

Tester’s team has already pinpointed genes, including one that controls the production of saponins, that could be altered – through breeding or gene editing – to enhance quality and yields. Similar projects with other grains have resulted in new varieties of crops in the last decade. The rice genome, for instance, was first publicly released in 2006. Last month, Chinese scientists announced that they were cultivating new varieties of insect and disease resistant rice based on studies of the rice genome.

“With this new knowledge of quinoa DNA, we can quickly and easily select plants that do not produce bitter substances in the breeding process,” said coauthor Robert van Loo, a scientist at Wageningen University and Research Centre in the Netherlands.

“The goal is to move this crop from its current status as a crop of importance in South America, and a crop of novelty in the West, to become a true commodity in the world,” said Van Loo. “I’d like to see quinoa changed into a crop that can be grown much more widely and become much cheaper. I want the price to come down by a factor of five... I want it out of the health food section.”



Left: There are three types of quinoa: red, white and black.

Below: The advantage of quinoa over other grains is that it can grow in salty soil and endure harsh conditions.



THE DARK SIDE OF A PERFECT ONLINE LIFE

If our online portraits are too far from our real selves, it can lead to stress and feelings of social isolation.

We all have a tendency to put our best face forward in social situations and on social platforms, but online networks give us the added ability to manipulate our online presence. Here, we can tailor-make a flawless image of ourselves by presenting only the positive parts, exaggerating our positive aspects, and hiding all our negative traits. Then there's also the freedom online social networks offer as we can express our feelings and views without any inhibitions. However, new research by Rachel Grieve and Jarrah Watkinson at the University of Tasmania in Hobart, Australia, shows that 'curating' our online self can be stressful and, lead to social detachment in real life.

Trying to be someone we are not carries an emotional and mental toll in the real world. The same consequence also applies to online worlds according to the researchers. The duo came to that conclusion after talking to 164 people between the ages of 18 and 55. The participants were asked to answer two personality tests – one as their true selves and one as the person they thought they presented on Facebook. According to Grieve, our 'true self' consists of fundamental aspects of our identity. "This could be something as light-hearted as confessing a secret love of unpopular music or a childhood crush," she says – or more serious confessions about panic attacks or bullying.

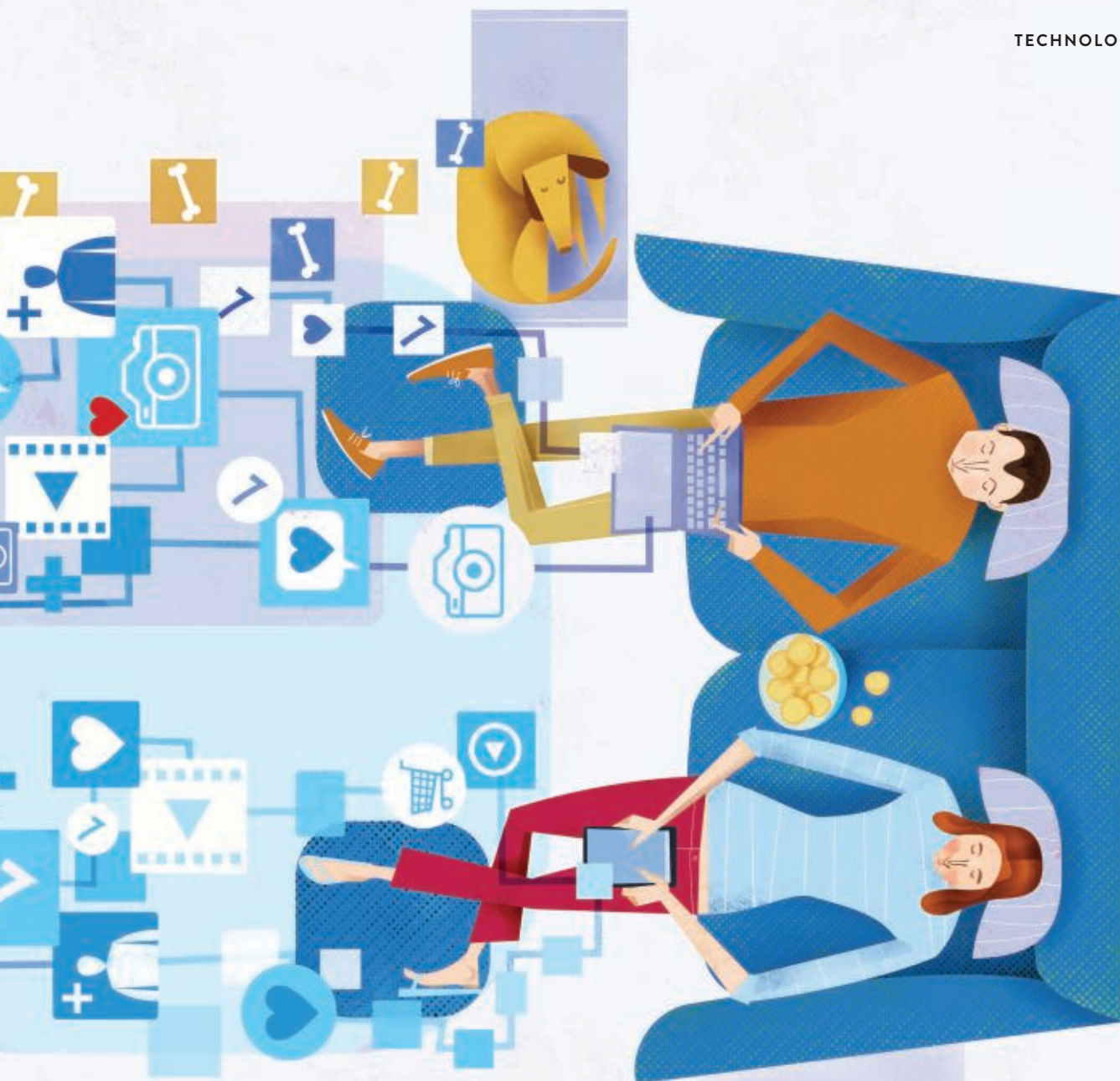
The pair found that the more people's online avatars deviated from their true feelings, likes and dislikes, the less social connectedness they felt – and the more stress. What makes the finding even more interesting is the fact that it reinforces that the established principles of psychology in the real world also apply in virtual worlds. Take for instance the theory of self-verification that says we would prefer people had an accurate view of our personalities than only a positive one. We tend to be healthier and more productive when people around us see and accept us with both our strengths and our weaknesses.

The other demoralising aspect of a false online image is that it renders us lonely. We can never earn other's validation or respect for being who we really are.



However, researchers at Yale University are wary of the new findings. They point out that the study's self-reporting nature makes it difficult to verify the accuracy of the results. The test participants' were required to exhibit very high levels of self-awareness while answering the personality tests – something they might have not possessed.

Despite its potential drawbacks, having a fake online persona may have a few advantages too. For one, a false online identity lets people express themselves without any fear of backlash. Online social networks let people of all stripes come together regardless of physical or racial boundaries. Some psychologists think the positive effects of online acceptance may spill into offline lives too. For instance, support from online communities can accelerate the acceptance of differently-abled people into mainstream society around the world. [t](#)



ONLINE IS ONLY SKIN DEEP

Other research on faux online identities say however hard we try, our true colours do shine through. In other words, our Facebook behaviour does eventually reveal our real personality. For instance, continuous updates about our fitness regime divulge a narcissistic streak. According to Michal Kosinski at Stanford University, social media is just another layer on the offline social world – it doesn't change us or our interactions in any fundamental way. Perhaps, this is what helps advertisers or researchers to glean insights into our lives from our online activities.

BROWSING FOR DEPRESSION

A 2012 study by University of Gothenburg found a 'central link' between computers and mental disorders. The study's lead author stated that high quantitative use was a central link between computer use and stress, sleep disturbances and depression. In fact, always being available on the phone or social networks was correlated to stress and guilt of not replying to messages; the feeling of never being free and difficulties separating public and private life. Even people who spent over two hours gaming daily faced greater risk of suffering from depression.

THE POWER OF KNOWLEDGE

Dr Rana Dajani is a strong believer that reading underpins free thinking and the pursuit of science.

Dr Rana Dajani was voted one of the top 20 influential Muslim female scientists in the world by *Muslim Science Magazine* in 2014, and was 13th on the list of the 100 most powerful women in the Arab World in the same year and has remained on it ever since. She is also a member of the Board of Directors of the Jordan Society for Scientific Research and has been a Visiting Scholar at both the University of Cambridge and Yale University of Medicine. However, Dr Dajani's contribution goes far beyond science, as she is also a mentor to other women and a community activist.

She obtained a Ph.D. in molecular biology from the University of Iowa, USA. A Fulbright alumnus, she is currently Associate Professor and a Former Director of the Centre of Studies at the Hashemite University, Jordan. Using genome-wide association analyses, Dr Dajani is investigating novel risk factors for cancer, cardiovascular diseases, and type 2 diabetes mellitus in the Circassian and Chechen populations in Jordan. She has created databases of anthropological, DNA, and medical records of these genetically homogeneous populations to study the evolution of diabetes.

However, research was not her first calling. "I wanted to be a physician," Dr Dajani said. "Then I decided after my freshman year at the university that it was too much responsibility. What if I made a mistake? Science was safer. Also being a scientist, I would be on the edge of a frontier."

"During later years, at the university, I enjoyed topics related to molecular biology; it was like uncovering the mysteries of the world. So it was only natural to study molecular biology."

She earned her Bachelor of Science and Master of Science at the University of Jordan. However, as there was no Ph.D. programme available, she applied and was accepted for a molecular biology programme at Cambridge University. Due to a lack of financial support she was unable to attend. A decade later, after marrying and having had four children, Dr Dajani won a Fulbright Scholarship and went to the University of Iowa to do her Ph.D.

Many would regard doing a Ph.D. while being a mother as being more difficult. In fact, she was told in her acceptance letter from Cambridge that having a child would impede her studying. "Actually my children were an asset," she said of her studies in

Iowa. “They helped each other. They depended on each other. My husband was a great support coming with me to the States to support my dream.”

Dr Dajani is a strong believer that women should not be judged on the same terms as men. “Some of the problems faced by women scientists in the Middle East are the same as those faced by women around the world. Our productivity, for instance, is measured on a male scale. The years we spend taking care of children are not calculated as part of the gross domestic product of a country. What is more important – to build physical things or to nurture a human being?”

Another common problem facing women scientists globally is a lack of mentorship. “Most women scientists everywhere have two jobs – work and home – and most will not give up home for work. They will always be worried about the children, want to be with them, and feel that the father’s presence won’t compensate for their own absence. So they don’t take time after work to have a coffee with their colleagues. There is an urgent need to take a global action to provide women with social networks to advance in their professional lives and boost their well-being.” >





Top: The We Love Reading project now operates as far afield as Uganda.

Above: Dr Dajani started reading to children in 2006.

As a result, Dr Dajani was instrumental in setting up the Three Circles of Alemat to provide female professors in the STEM fields (science, technology, engineering and mathematics) with opportunities of collaboration and collegiality through creating a mentoring model of 10x10 (mentors and mentees). The project is divided into three circles: Circle 1 (DEMN) is within Jordan, Circle 2 (BAYN) is within the Arab region, and Circle 3 (TAJAMUGH) is engaging women in the diaspora.

“The Three Circles of Alemat is an innovative approach to instill a social impact. It is based on simple networking requiring simple ways of communication in a very naturalistic setting which makes it easy to sustain, yet it addresses the female science professor in a very holistic way: professional and personal growth,” explains Dr Dajani.

She is also a strong proponent that reading is vital for personal growth. Dr Dajani grew up in a household without television where reading was fostered, and she has instilled the same in her children. However, when she returned from her studies in the US she found her children faced a lack of libraries and books in Jordan. This led her to found We Love Reading (WLR), a community-based library model for Jordan that has now spread to more than 30 countries. WLR garnered her a Synergos award for Arab social innovators in 2009, as well as a membership to the Clinton Global Initiative 2010, a place in the book *Innovation in Education: Lessons from Pioneers Around the World*, and position on the UN Women Jordan Advisory Council.

Her WLR work began in 2006, when she held weekly storytelling sessions at a community mosque for children ages 4-10. After each interactive storytelling session, Dajani allowed children to borrow books to read at home with their parents, passing the experience along from child to parent in an attempt to change attitudes towards reading.



"We realised that there are no libraries in Jordan, so we took it upon ourselves to make our own library. I started in my own house in 2006 gathering children from our neighbourhood and read to them, I wanted to create a bond between books and children. I felt an obligation and responsibility to share and benefit others with the knowledge I have gained throughout the years.

"Our project continued to grow and we felt the need to spread this in neighbouring communities and cities worldwide, in mosques, churches or even under the shade of a tree, like what is happening now in Uganda. Let us gather children and read to them out loud, reading adds to a child's personality and mental progress and imagination, and helps with their communication skills. There isn't a child that does not love to read, he just hasn't find his favourite book yet."

Dr Dajani is a firm believer that reading is essential to prepare the next generation for the future. "Great things can start from nothing," is her mantra.

"I strongly believe that an essential first step towards freeing minds from the habits of the past is to plant the love of reading in our young children. In this way, they revisit other people's experiences across time and space, learn that there are other ways of living, and develop respect for other perspectives. When children read, their horizons expand and they build the confidence to face challenges, create solutions and think without hindrance."

She also regards free and critical thinking as being intrinsic to science.

"My aim is to teach students to develop a rational methodology for assessing the natural world and to come up with their own opinions, hypotheses and theories and not to copy others. This becomes a call for new ways of thinking: a journey to pursue knowledge, which is one of the core tenets of Islam. If we succeed in that endeavour, we will contribute to the creation of a generation of Muslim scientists who are free thinkers.

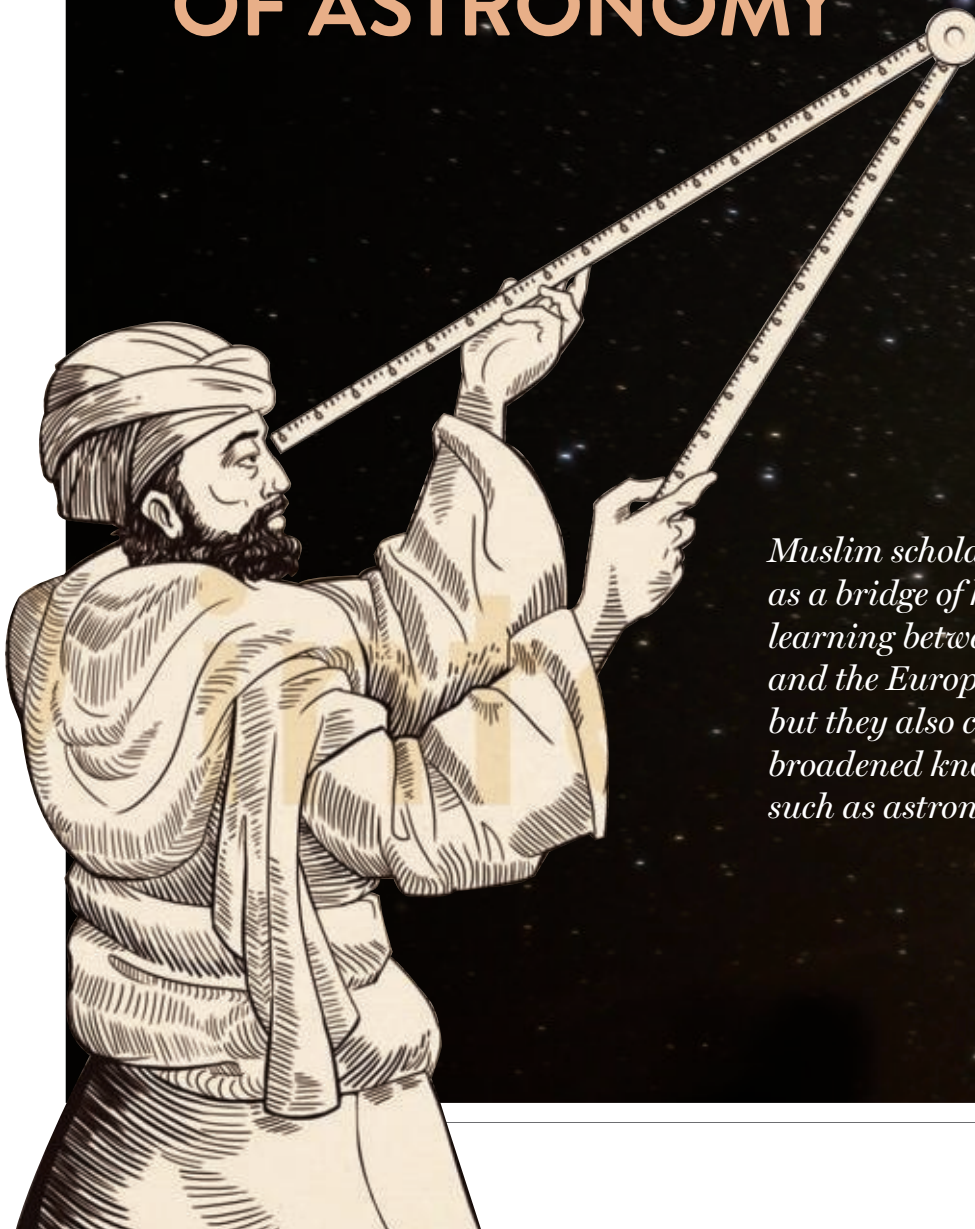
"Many students at my university have never formed an independent opinion that reflects their own original thinking. The day I got my students writing essays to express themselves was the day one student told me that he felt human, that he was 'Someone' with a capital 'S'. These are the people who will build our communities and nations, who will make a difference, who will take us into the twenty-first century with confidence and progress." ↑

Above: At the 2014 Eisenhower Fellowships Conference, Dr Dajani lead a discussion on women and success, a topic close to her heart.

Above left: We Love Reading has spread to more than 30 countries thanks to numerous volunteers.



THE GOLDEN AGE OF ASTRONOMY



Muslim scholars not only acted as a bridge of knowledge and learning between Ancient Greece and the European Renaissance, but they also considerably broadened knowledge in fields such as astronomy.

When scientists using the Hubble Space Telescope first revealed pictures of a newly discovered planet in 2008, many wondered at its name. Twenty-five light years from Earth in the constellation of Piscis Austrinus, it was the first exoplanet – a planet that orbits a star other than the sun – to be discovered purely visually.

Its name was Fomalhaut b and it orbited Fomalhaut, the brightest star in the constellation of Piscis Austrinus. Its existence had first been suggested following observations in 2005, but was not confirmed as real until 2012.

“I nearly had a heart attack at the end of May when I confirmed that Fomalhaut b orbits its parent star,” the astronomer Paul Kalas at the University of California, Berkeley, told *The Guardian* at the time. “It’s a profound and overwhelming experience to lay eyes on a planet never before seen.”

Fomalhaut – from Fam al-Hut, literally translated as the ‘Mouth of the fish’ – is an Arabic word. This may seem strange to many, but the brightest stars in the sky have Arabic names. Stars such as Achernar (from Akhir an-nahr, meaning ‘The end of the river’), Aldebaran (from Ad-Dabaran, ‘The Follower’), and Deneb (Dhanab ad-Dajajah, the ‘Tail of the fowl’). All are the most brilliant and most dazzling stars in their respective constellations.

More than 200 of the stars visible to the naked eye have names that derive from Arabic. Some are fragments of longer Arabic names – often shortened to fit on medieval astronomical measurement devices – while others have been distorted beyond recognition over time due to translation and copying errors. To the human eye, nevertheless, much of the language of our seeable universe is Arabic.

Why? The answer lies within the Islamic Golden Age, within Islam itself, and within the role played by Muslim scholars as a bridge of knowledge and learning between Ancient Greece and the European Renaissance.

The Persian scholar and polymath Abu Rayhan al-Biruni, considered one of the greatest scientists of the medieval Islamic era, attributed the roots of all the science of astronomy to Greek mathematician, astronomer and geographer Ptolemy’s *Almagest*. The *Almagest*, written in the

second century, was a mathematical and astronomical treatise detailing the motions of the stars, the sun, the moon and the five known planets at that time. It was the basis upon which all Islamic astronomy during the Golden Age was built.

When the Arabic translation movement started and the transference of Greek, Persian and Indian scientific and philosophical knowledge to the Islamic world began in 8th century Baghdad, the *Almagest* was one of the first books to be translated. Its translation – along with that of other important works – was met by the emergence of a new breed of Arab ‘falasifah’ (philosophers) and the central role of Islam in the search for knowledge.

The Arabs, of course, were already skilled at using the stars for navigation prior to the translation of the *Almagest* and the onset of the Islamic Golden Age. Bedouin traditions contained knowledge on the fixed stars and the passage of the sun and moon through the zodiacal signs and lunar mansions. This body of knowledge was refined in part because of the specific requirements of Islam.

The aim of the falasifah was to live rationally in accordance with the laws that governed the universe. They lived in a world in which wisdom was frequently prized above all other riches, and in which the application of astronomy to aspects of religious practice was of paramount importance. Time keeping, for example, was oriented towards the phases of the moon; the five Islamic prayer times – Salah – were/are based on the astronomical position of the sun; and most of the famous Islamic astronomers and geographers of the day sought to accurately gauge the direction of the Qibla from any given location.

“There is no doubt that one of the reasons for the development of Arabic and Islamic science and astronomy is God’s commandment to explore the laws of nature,” wrote Ihsan Hafez in his thesis *Abd al-Rahmān al-Sufi and His Book of the Fixed Stars: A Journey of Rediscovery*. “The idea was to admire all creations for their complexity and to cherish the Creator for his ingenuity. Holding to these beliefs, Islamic contributions to science have covered many roots of thought, including mathematics, astronomy, medicine and philosophy.”



Al-Biruni is regarded as one of the greatest scholars of the medieval Islamic era.



Above: The Islamic Golden Age lasted from the 8th to the 13th century.

Above middle: Albrecht Durer, a leading European Renaissance painter, paid homage to the great Persian astronomer Al-Sufi.

He adds: “In order to comprehend the importance of astronomical studies in the lives of Muslim scholars such as Al-Sufi we need a little background on Islamic theology. We have to understand the significance of the beliefs and rituals of this religion in order to understand the characteristics of Arabic and Islamic astronomy and the importance of astronomy to the Arabs and the Muslims. In no other religion has science – especially the science of astronomy – been a focal point of religious beliefs and practices. This is immediately reflected in almost all of the works of Arab and Islamic writers whereby they first dedicate their efforts to God and His Prophet at the beginning of their books.”

This wide-scale commitment to astronomy at a time when Europe had marginalised the study of natural science is why so many of our stars have Arabic names.

Amongst those who dedicated their work to God was the Persian astronomer Al-Sufi, who wrote arguably one of the most important medieval Arabic treatises on astronomy around 964. The *Book of the Fixed Stars* contained an extensive star catalogue, listing co-ordinates and magnitude estimates, as well as detailed star charts. Al-Sufi also added 12 degrees and 42 minutes on Ptolemy’s longitude values to allow for precession, identified the Magellanic cloud, and was the first to document the Andromeda Galaxy, describing it as a ‘nebulous smear’ and labelling it the ‘Little Cloud’. It is because of Al-Sufi that many of the stars’ Arabic names have been passed down to us.

The list of Islamic astronomers is long and impressive. They developed the astronomical tradition of treatises called ‘zij’, which were based on trigonometric and mathematical techniques. Many aspects of mathematical astronomy, as well as astrology were





included in the texts and tables of a typical *zij*, with the equation of time, planetary theory, calculations of solar and lunar eclipses, lunar and planetary visibility, and the prediction of dates for the first visibility of the lunar crescent all explored and expounded upon.

Amongst the earliest and most important of these *zij* was that written by Muhammad ibn Musa al-Khwarizmi, the founder of algebra and the writer of *Zij al-Sind hind*, a work that marked a turning point in Islamic astronomy. Prior to him, Islamic astronomers had primarily researched and translated the works of others and digested already discovered knowledge. In *Zij al-Sind hind*, al-Khwarizmi built upon that knowledge, as would others after him.

To this end the astronomers of the Islamic Golden Age built astronomical instruments such as sundials, astrolabes, quadrants, celestial globes and armillary spheres, as well as observatories such as that constructed by Abu Abdallah Mohammad

ibn Jabir ibn Sinan al-Raqqi al-Harrani al-Sabi al-Battani (better known simply as Al-Battani) in the city of Raqqa in northern Syria. The instrument maker and astronomer Abu Ishaq Ibrahim Ibn Yahya Al-Zarqali invented the equatorium, an astronomical calculating instrument that allowed astronomers to chart the movement of the sun, moon, and planets through the sky. He also devised a lunisolar computer to calculate the time of year and the phases of the moon.

Very little is known about many of the astronomers' lives, including Al-Battani's, who determined that the solar year stretched over 365 days and raised doubts regarding Ptolemy's calculations, especially in connection with the sun's apogee. Al-Biruni later disproved Ptolemy's immobile solar apogee and discussed the possibility of the Earth's rotation on its own axis – a theory proven by Galileo six centuries later.

Above: The Leo constellation as it appears in Al-Sufi's *Book of the Fixed Stars*.



Above:
Muhammad ibn Mūsā al-Khwārizmī is regarded as the father of modern algebra.

Below: Islamic astronomers greatly improved on the astrolabe.



“Scientific activities were not only in astronomy but also in algebra, chemistry, medicine and pharmacy,” says Mounib El Eid, professor of physics (theoretical astrophysics) at the American University of Beirut, when discussing the Islamic Golden Age and the astronomers who operated within it. “The only effective link between old and new science was afforded by Arab scientists. For more than 1,000 years there was not a scientific man of note except in Arabia.

“The contribution of the Arabs towards the development of modern science was twofold,” he adds. “First, discoveries of their own, and second, the transmission to Europe of the science of the ancient Greeks, India, Persia and China. Ibn Al Haytham was a pioneer of modern scientific method rather similar to Galileo in Italy, and in astronomy more accurate observations were done, for example by increasing the size of the astrolabe. They were able to calculate the radius of the Earth when in Europe the Earth was still considered flat.”

In his *Configuration of the World*, Al Haytham presented

a detailed description of the physical structure of Earth. He believed that Ptolemy’s ideas of planetary motion were wrong and argued that the true principles governing their motion were yet to be discovered. His work – as well as the work of others before him – was built upon by a continuous stream of learned astronomers up until the destruction of Baghdad by the Mongols in 1258 and the end of the Islamic Golden Age.

“Islam was a driving force for developing science in general and astronomy in particular,” says El Eid. “The Prophet Mohammed (PBUH) in his speech used to say ‘acquire science even if you go to China.’

“One can say that Arab scientists laid the foundation of modern science. The Arabic names of the stars indicate the interest in astronomy, and that astronomy did not reach the level we have today is due only to the lack of instrumentation. The first telescope was constructed about 400 years ago. Nobody knew, for example, what the surface of the sun looked like.”

Much of the Arab contribution to astronomy from the 8th to the 13th century was done with religion in mind, and if you look into the night sky you can see the legacy of their work.

That legacy endures. Both the lunar crater Azophi and the minor planet 12621 Alsufi are named after Al-Sufi, while newly-discovered planets such as Fomalhaut b will continue to remind us of the Islamic world’s contribution to the field of astronomy. †



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