

# JM

Celebrating  
200 Years  
of Inspiring  
Science



**Johnson Matthey**  
Inspiring science, enhancing life



**1817–  
2017**

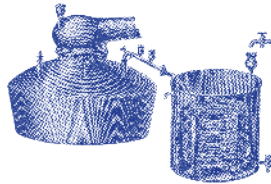
2017 marks the 200th anniversary of Johnson Matthey. Back in 1817 we began as assayers, testing the purity of precious metals, and the business quickly expanded thanks to the vision and determination of our founders.

But the world moved on. And so did we.

Today, our science and research touches some of the most pressing challenges faced by the world as we help to reduce pollution, relieve pain, make the most efficient use of the planet's natural resources and even help to restore hearing.

Our technologies are making the world a cleaner, healthier place and improving people's lives across every continent.

## 200 Years of Inspiring Science



This book is a celebration of our first 200 years in business. It showcases our journey from pioneers in the applications of precious metals to a global leader in science for a cleaner, healthier world.

It's an inspiring story, and it's one we'd like to share with you.

# 1817– 1899

P.04–11

## Pioneering Metallurgy

### Building a Reputation for Quality and Integrity

In 1817, Percival Norton Johnson set up his gold assaying business in London with just £150 of capital – that's the equivalent of £15,000 today. From these humble beginnings, the business grew rapidly. Within just a few years the company had become official assayers to the Bank of England, and was responsible for the manufacturing of the first ever standard metre and kilogramme in a platinum iridium alloy. These standards are still in use today.

# 1900– 1969

P.12–19

## Expansion into New Areas

### Establishing Expertise in Platinum Group Metals

To build on its successes, the company appointed its first ever Research Scientist in 1918. Now, Johnson Matthey has 1,450 people working in R&D, that's 12% of our global workforce. During this period the company also expanded into North America and Asia, and began to supply electrocatalysts to the NASA space programme.



# 1970- 1999

P.20-27

## Chemistry and Catalysis Improving Air Quality and Health

After the Clean Air Acts of 1956, 1968 and 1970 Johnson Matthey produced the first emission control catalyst, enabling car companies to cut exhaust emissions. The company also began the commercial production of platinum based anticancer drugs, marking the start of pharmaceutical applications for Johnson Matthey's science.

# 2000- 2017

P.28-35

## Expansion and Sustainability Continued Investment in Science

Johnson Matthey broadened its offering across sectors and geographies, with expansion into China and several acquisitions to build its business. In a world where environmental concerns are ever more pressing, we also launched Sustainability 2017, setting in stone our commitment to developing sustainable technologies and a sustainable business.

# 2017 and Beyond

P.36-40

## Creating a Cleaner, Healthier World

With a global population of over 7.5 billion, the world faces some unprecedented challenges. In the years ahead we will help to meet them, driving innovations such as low and zero emission transport, highly efficient use of the planet's natural resources and life changing medications. Our science will help to create a cleaner and healthier world.

# Pioneering Metallurgy

## Building a Reputation for Quality and Integrity

The 1st of January 1817 was a life changing day for Percival Norton Johnson, in more ways than one. Not only did he get married, he also founded a gold assaying business to test the purity of precious metals – on the very same day.

Thanks to the quality and accuracy of Johnson's work, his reputation quickly grew. By 1852 his business was appointed assayers and refiners to the Bank of England and it would go on to lead the world in developing applications for precious metals.

# 1817



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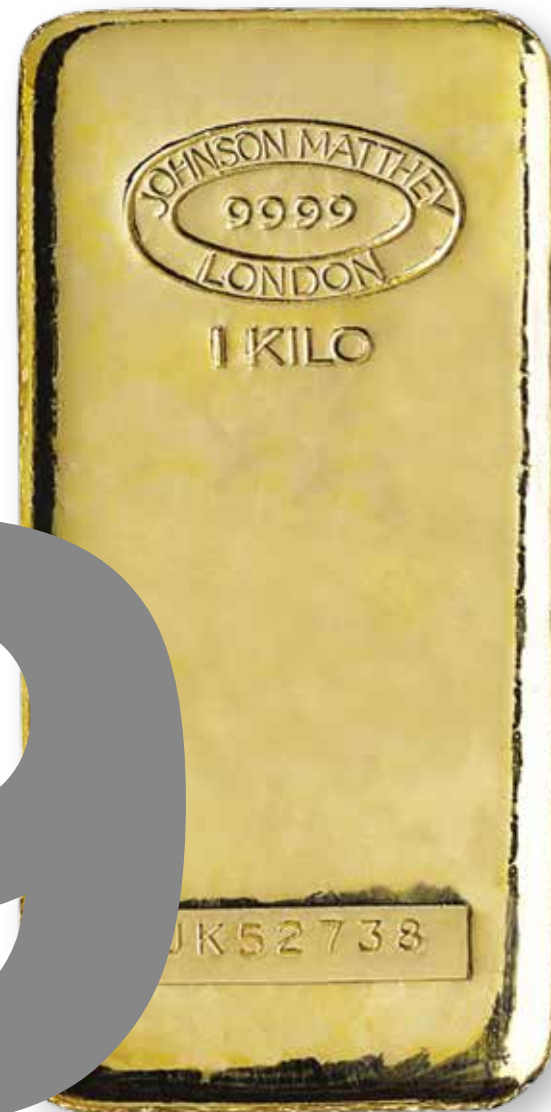
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“

These alloys with some valuable practical hints have been furnished by Mr. Johnson, No. 79 Hatton Garden; the report of the forgers is that the steel works better under the hammer than any they have before used, and likewise hardens in a much superior manner.”

Green Pickslay and Co.

899



1817–  
1899

# A Partnership of Pioneers

Percival Norton Johnson



Percival Norton Johnson was never one to miss an opportunity. When his business began assaying bullion, dealers protested that his greater accuracy was eating into their margins. Johnson responded by offering to buy any gold based on his assays, demonstrating once and for all the quality of his work.

Thanks to quick thinking like this, Johnson's business began to flourish. When the company started refining impure imported Brazilian gold, the refining process led to stockpiles of the byproduct palladium. Johnson seized the chance to promote new uses for the metal, including dental applications and lighthouse reflectors. He even presented a large chain made of palladium to King George III.

### A Talented Family

The business was originally a family affair, with Percival's younger brother John Frederick acting as his assistant. However, in 1822 Johnson joined forces with George Stokes, another expert assayer. When Stokes passed away in 1835, Johnson enlisted the talents of William John Cock, the son of Johnson's brother-in-law.

William was articled to be a solicitor, but had a natural flair for the physical sciences. He used his skills to devise a new way to increase the malleability of platinum and also published one of the first ever papers of the Chemical Society.

### From Apprentice to Partner

In 1838, the young George Matthey joined the company as an apprentice. George was just 13 years old but was soon demonstrating a keen head for business. In 1851, he persuaded Johnson to exhibit some of their precious metal products at the Great Exhibition and also managed to secure supplies of platinum from Russia.

Johnson rewarded Matthey's hard work by taking him into partnership. That year, the company changed its name to Johnson and Matthey. Or JM as we know it today.



George Matthey became apprentice to Percival Norton Johnson in 1838, at the age of 13, and began to experiment in metallurgical science.



### History in Context

#### 1789

Lavoisier published his elementary treatise of chemistry, a prototype of the Periodic Table. It contained just 23 elements, including 'caloric', an elastic fluid associated with heat.

#### 1817

The year JM began, there were no practical electric lights, no telegraph and no universal vote. However, the year did see the construction of the first ever bicycle.

#### 1827

The botanist Robert Brown first observed the random movement of particles, subsequently called Brownian motion.

### Did You Know?

In the same year that Johnson first set up in business, Humphry Davy showed that a platinum wire acted as a catalyst for the combination of oxygen and hydrogen. The platinum for the experiment was almost certainly provided by Johnson. Towards the end of the 19th Century the company was also the likely source for the aluminium used to cast the sculpture popularly known as Eros in Piccadilly Circus!

1817–  
1899

### Precious Discoveries

Under George Matthey's careful eye, the company started to up the ante in platinum refining. George's expertise meant JM produced ever larger, sounder and more malleable ingots of platinum. Soon the company was supplying platinum wire and foil to the eminent scientist Michael Faraday, helping him carry out groundbreaking research into magnetism.

### Making a Name for Himself

It's not what you know, but who knows you. Faraday was very impressed by the work of JM, and urged listeners at one of his lectures to "Go to the workshop of Mr Matthey and see them hammering and welding away." In 1846 Faraday and other members sponsored Johnson to become a Fellow of The Royal Society. Our founding fathers were now moving in very eminent circles.



## New Recruits and New Horizons

In the 1850s the firm expanded. Johnson called on the services of his brother-in-law, Captain Sellon, who invested capital in the business, while his son, John Scudamore Sellon, joined as an apprentice. John Scudamore was a natural showman, dazzling his audiences with his ideas for new uses for precious metals.

## It's All Growing Well

JM was quickly outgrowing 79 Hatton Garden and the company snapped up the leases of adjacent properties. JM soon stretched along Hatton Garden and across to nearby Leather Lane, occupying a large rectangular block of land. The whole area was a hive of activity, with employees refining gold and platinum, assayers working in the back offices and pioneering chemical engineers toiling in the laboratory.

## The Bank of England Comes Calling

In 1852 JM was appointed assayers to the Bank of England – the very highest of accolades. Johnson was asked to make plates for the Trial of the Pyx, the annual event that tests the weight and fineness of gold and silver coins issued by The Royal Mint. In just 35 years, the company had found its place at the heart of the establishment.

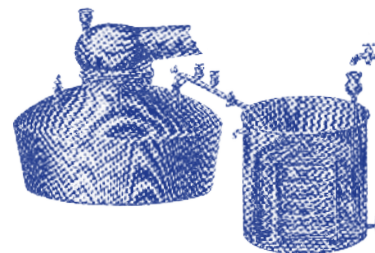
## Experts and Exhibitions

By the late 1800s JM was leading the way in boilers for manufacturing and concentrating sulphuric acid, creating entire vessels from single large sheets of platinum. George Matthey had a natural understanding of the market, creating a groundbreaking boiler that could be operated continuously.

It was a major breakthrough and JM exhibited the new boiler at the Paris Exhibition of 1855. The company went one better at the next Paris Exhibition, exhibiting a staggering 15,000 ounces of platinum, including two large boilers. At this exhibition, the next chapter of the company's work began.



The company showcased its expertise in platinum at the Paris Exhibition.



From 1855 until well into the 20th Century one of the major uses of platinum was for the construction of boilers to concentrate weak sulphuric acid. George Matthey was primarily responsible for the growth of this activity.

### History in Context

#### 1842

W. R. Grove devised the first fuel cell, using platinum foil coated with spongy platinum for the electrodes. His first fuel cell can still be seen at the Science Museum in London.

#### 1863

There were still only 56 known elements. Now there are 118 in the modern day periodic table and JM uses around half of them!

#### 1874

George Johnstone Stoney published his thesis on the concept of the electron. JM now uses electrons to probe the fundamental properties of our materials.

### Did You Know?

With the original workshops at Hatton Garden, the company also took on the lease of an adjacent Primitive Methodist Chapel. Old employees used to tell how they could hear the congregation singing while they worked in the yard.

1817-  
1899



# Setting the International Standards

Visiting the Paris Exhibition was Russian scientist Moritz Hermann Jacobi. He was on a mission, looking to create an international standard for metric measures and weights. Received wisdom said that the best material to use would be platinum, alloyed with iridium, due to its extreme strength and stability.

JM was the obvious choice for the job. The International Metric Commission tasked the company to forge a vast ingot of 250kg. A number of metre standards could then be forged and extruded from this single block.

## Rising to the Challenges

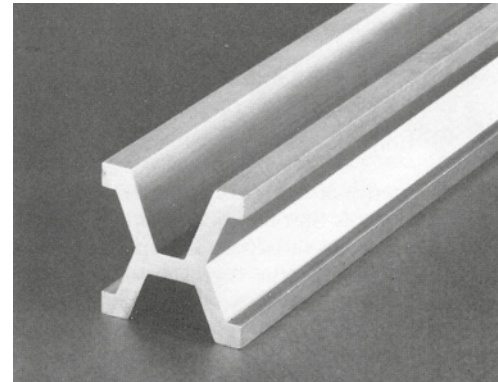
It was a huge undertaking. The largest platinum iridium ingot produced to date had been just 100kg. Under the watchful eyes of the Commission, JM's master craftsmen, led by George Matthey himself, successfully created the ingot, then cut and drew 27 special metre standards.

When the committee decided to make metre standards of an even purer quality they turned to JM once more. In 1878 the company made two extremely pure standards, along with three iridium platinum cylinders to act as kilogramme standards.

## Long Lasting Expertise

The company was soon providing standard metres and kilogrammes for countries around the world. One of the original kilogramme standards still remains as the ultimate world standard today, an incredible testament to George Matthey's craftsmanship.

The standard kilogramme.



Each of the metre rules was designed in an X-shape, for extra rigidity.

## History in Context

### 1878

Joseph Wilson Swann unveiled his incandescent lamp. The lamp's carbon filament was held between two platinum contacts. Thomas Edison went on to use a very similar design.

### 1892

The first manmade fibre was created, using wood pulp. The process was dependent on a spinning jet, which needed to be extremely robust during the process. Platinum was the obvious material to use.

## Did You Know?

On 11th April 1891 the firm became a limited company, Johnson, Matthey & Company, Limited. In the same year, company accounts show an expenditure of over £84 on electric light. JM was one of the very first London businesses to use electricity.

# Expansion into New Areas

## Establishing Expertise in Platinum Group Metals

The motorcar, electricity, telegraphy: the new century would usher in unprecedented change. JM wanted to be right at the forefront of the innovation and recruited one of the first ever research scientists.

Pure research was such a new concept that it took a while to become fully established within the company, but it would go on to take JM's thinking right around the world – and even into space.

“

The formation of a research department did not appear to be wholeheartedly welcome at the beginning; nobody seemed to know why it was started and very few problems were passed to it.”

**Alan Powell**  
Research Scientist

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# Inventions and Innovations





In the early 1900s, the development of the motorcar created a new and urgent need for JM's services. Motorcars depended on electrical and magneto contacts, which in turn needed platinum. The new world was evolving fast.

JM employed Alan Powell (above) in 1918 as its first ever research scientist. At first Powell worked solely on the extraction of materials from ores, and his presence in the company remained one of its best kept secrets.

Yet Alan was determined to make a difference, and pressed for the chance to work on X-ray screens in 1920. His vision and expertise led to some remarkable breakthroughs during his 36 years with the company.

### Protecting the Nation

During the First World War, metals and raw materials were almost impossible to get hold of, yet the country urgently needed new goods and supplies. Yet again, JM was to take centre stage in the nation's history.

Explosives were vital for the war effort. Platinum was a key catalyst in the production of TNT and the Ministry of Munitions needed a reliable and high quality supply. The Ministry turned to JM, appointing the company sole agents and distributors of platinum during the war years.

Ever resourceful, JM managed to secure enough supplies from Russia and from scrap to process an incredible 1.3 tonnes of platinum during the war. Every TNT explosive used by the British army in World War I was dependent on the work of JM.



British men and women working in a storage shed for large shells in a munitions factory.

### Conquering New Markets

The board of JM knew that the company couldn't afford to stand still. To stay ahead of the competition they had to expand and win new markets across the globe.

In 1927, the company purchased a small shareholding in J Bishop & Co, a platinum refiner and chemical engineering works based in Philadelphia, USA. The company had been set up by Joaquim Bishop, a jeweller who had supplied instruments to make one of the world's first ever cameras. JM went on to purchase 90% of the business' stock in 1933.

#### History in Context

##### 1904

JJ Thomson proposed his 'plum pudding' model of the atom, in which he stated that "the atoms of the elements consist of a number of negatively electrified corpuscles enclosed in a sphere of uniform positive electrification." Five years later, the nucleus was discovered by Geiger and Marsden, while working with Rutherford.

##### 1914

The structure of the atom was largely defined by Niels Bohr in 1914. By this time this was the eighth atomic model that had been proposed!

#### Did You Know?

During the war, JM lost a number of men to national conscription. The company approached Bedford College to find female scientists to fill the gap. Nora M Denny was the first woman to be employed in a technical role, staying with the company until retirement.

1900–  
1969

### A Global Competition

In the mid to late 1920s, mining prospectors discovered huge deposits of platinum bearing rocks stretching across the Transvaal in South Africa in the area known as the Merensky Reef. The platinum was of an extremely high concentration, but sulphides in this ore meant that extraction would be difficult, if not impossible.

South African mining companies sent samples of this ore to refiners around the world, including JM. Knowing they faced some stiff competition, Alan Powell and his Research Laboratory team in Hatton Garden set to work.

### Better than the Rest

Within just a few months, Powell and his team had discovered a unique process to ensure that the ore from the massive Merensky Reef deposits would yield up its platinum and other valuable metals. No other refiner could meet the challenge. JM thinking didn't just lead the world, the company also earned the right to become the sole refiner for Rustenburg Platinum Mines, which was to become the world's largest producer of platinum.

The refining method was known as the Powell-Deering process, named after the two masterminds behind it, and JM patented it in 1928. The process enabled JM to handle over 50,000 ounces of South African platinum until refining methods changed again in the 1930s.



JM's refinery in Brimsdown, UK.

## Suppliers for Victory

Just as it had done a generation before, JM played a key part in the war effort during the years 1939 to 1945. The company supplied a vast amount of materials for use in factories at home and by troops in action, including:

- Over 15,000 pieces of platinum laboratory apparatus for munitions factories
- Components for protecting electrical and radio apparatus at sea
- Silver nitrate for use in desalination kits, so survivors of torpedoed ships could generate drinkable water
- Millions of miles of fine wire, used for electrical resistance, creating fuses and weaving inside airmen's suits to create electrically heated jackets.

Even the enamels that the company produced contributed to the war effort. The enamel printing process was used to create long lasting markings on instrument dials and the company was also a leading producer of hypodermic needles that saved thousands of lives during the war.



World War II radio operator.

## Expanding into Asia

After the war, JM was determined to gain and keep positions in overseas markets. In 1946, the company set up an Export Division and started to do more and more business with India, particularly with a company owned by the Arora family.

In 1964, JM went into partnership with the Arora brothers, taking a 49% minority shareholding in Arora Matthey Ltd. This joint venture company was set up in Calcutta, with JM supplying specially adapted plant and machinery. The project was a great success and JM went on to train technicians to develop the business.

### History in Context

#### 1917

There were still only 86 known elements. Knowledge expanded rapidly over the next two decades until in 1945 scientists confirmed the first ever synthesis of promethium, filling in the last 'gap' in the periodic table.

#### 1932

James Chadwick discovered the neutron. JM now uses neutrons to predict improved ways to make catalysts, characterise their structure and understand how they work.

### Did You Know?

During World War II, President Franklin D Roosevelt paid indirect tribute to JM when he praised the British 'sparking' plugs fitted in American aircraft. The spark plugs contained platinum refined and fabricated by JM.

1900-  
1969



Giant Leaps  
Forward



Image courtesy of NASA.

## Helping to Power NASA

Platinum acts as a catalyst in a range of crucial scientific applications. Up until the 1950s, most of JM's catalysis expertise focused on oxidising ammonia and creating nitrogen based fertilisers. But in the late 1950s, the company's research and development team started looking at innovative applications in the petroleum industry.

Their timing was perfect. By the 1950s, the space race meant that scientists were looking for high performance fuels. Thanks to JM's presence in the USA and relationships with major oil producers and plant constructors, the company hit the ground running. JM's expert technicians started investigating the properties of platinum as a catalyst for making high octane fuels.

The science was so cutting edge that NASA came calling. In the early 1960s, JM supplied a range of electrocatalysts for fuel cell systems used in the US space programme. The fuel cells provided electricity and water on board missions carried out by the NASA space programme. Proving that JM's innovative thinking was literally out of this world.



I remember my first day at JM. It was 1965 and I joined as an engineering apprentice at Hatton Garden, just like George Matthey. One of the first people I encountered on that day was another George Matthey – the great grandson of Mr Matthey himself. I couldn't believe that we were refining precious metals right in the heart of London. Since then I've had the opportunity to work in many parts of the company and on many great technologies of which our founders would be proud. It's wonderful to be part of JM as it celebrates 200 years of inspiring science."

**Barry Connelly**

Current JM employee

## History in Context

**1953**

James Watson and Francis Crick outlined their proposed structure of DNA.



## Did You Know?

ICI filed a patent for the first low pressure methanol process, a revolutionary technology to make this vital chemical building block. The technology became part of JM's portfolio with its acquisition of ICI's Syntex Catalyst Division in 2002 and is used around the world today.

# Chemistry and Catalysis

## Improving Air Quality and Health

By the end of the century, the world was changing yet again. Now industries wanted more from less – not just to keep costs down, but also to ensure less waste and to be more sustainable. Catalysis would be instrumental in doing this and yet again, JM drove the innovation forward, thanks to its strong position in catalysis.



The problems of air pollution are increasingly the subject of public attention. Pressures, and ultimately legislation by governments, will undoubtedly result in a rapid increase in demand for effective low cost catalytic pollution control systems."

**JB Hunter**  
Platinum Metals Review



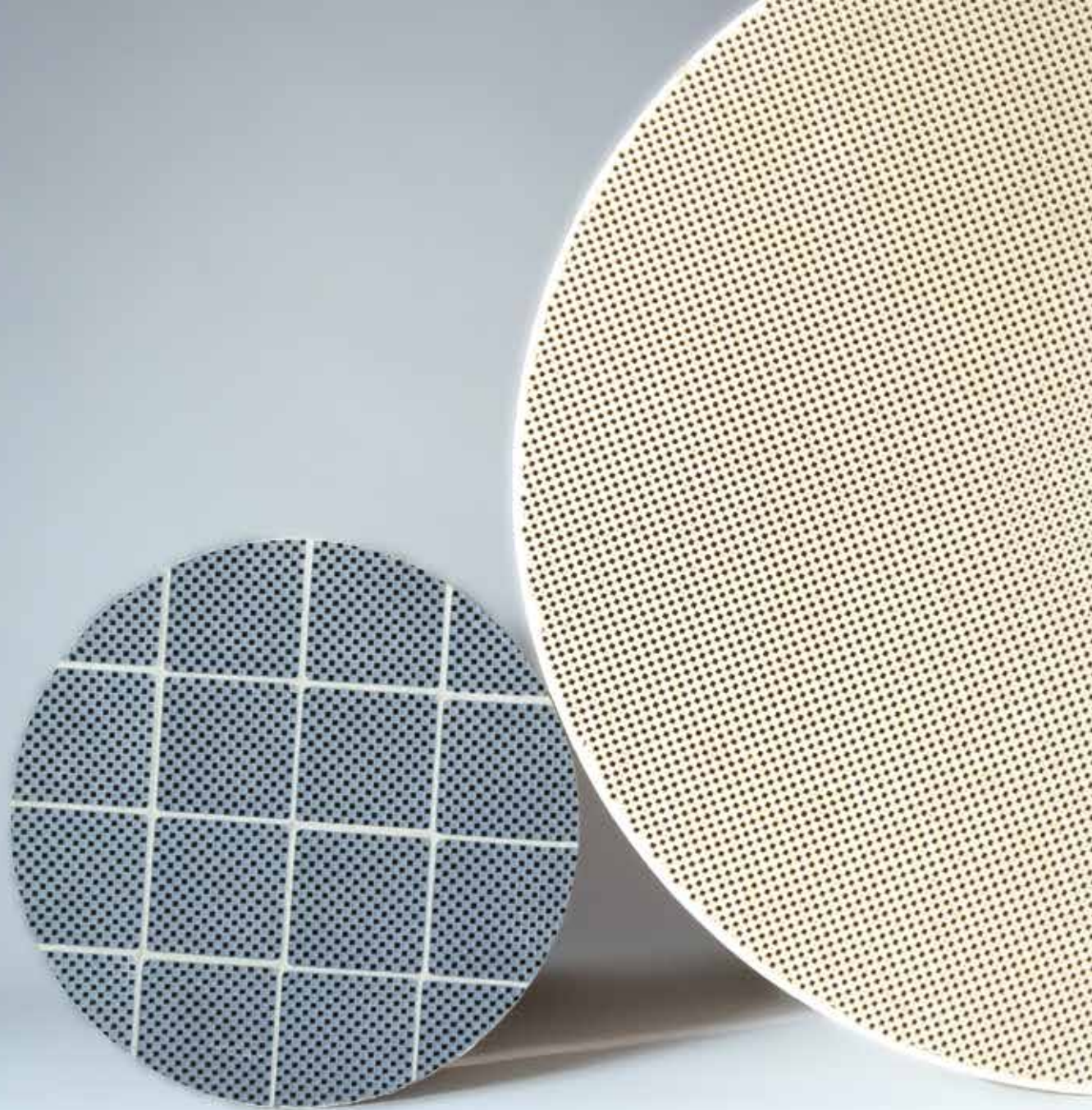
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**1970–  
1999**

Ever since Henry Ford started mass producing his Model T in the 1920s, cars had started to become more and more affordable. The boom years of the 1960s meant that more and more people were enjoying the freedom of the open road.

That brought with it the problems of environmental pollution. The US Congress decided to take action, introducing the Clean Air Act in 1970, and, over the years, much of the world followed suit. With ever more stringent legislation, the automotive industry had to ensure it had pollution under control.

# Pollution Solution





## The Very First Catalytic Converter

JM was ideally placed to help, thanks to its expertise in catalysis. We had originally developed the Matthey-Bishop THT catalyst to counteract pollutants such as nitrogen oxide fumes. And by harnessing this expertise, JM researchers were able to develop an emission control catalyst that would cut automobile pollution.

In 1974, JM's first ever emission control catalyst rolled off the production line in Royston, UK. This technology made a world changing difference. For instance, a test in 1989 pitted a standard Golf GTi against the same car fitted with a JM emission control catalyst. The non-catalyst car produced six times more nitrogen oxide, 11 times more hydrocarbons and 35 times more carbon monoxide.



A plaque that can still be seen today at JM's facility in Royston, UK.



## Cleaner and Greener

Nowadays one in every three new cars carries an emission control catalyst from JM. Our catalysts stop around 20 million tonnes of pollutants in their tracks every year – a breath of fresh air for people all over the world.

## Award Winning Thinking

In 1938, the scientist Otto Roelen discovered hydroformylation, a chemical process that forms an aldehyde. Aldehydes are chemical building blocks used to make other every day products like plastics, detergents, solvents and lubricants. However, Roelen's process used cobalt as a catalyst, which was costly and sometimes unreliable.

JM worked with Professor Geoffrey Wilkinson's Group at Imperial College, London to develop a much less costly alternative. Our scientists found that by using rhodium, hydroformylation could generate a lot more product for a lot less cost. In fact, the breakthrough we helped to develop could save a large commercial plant up to US \$6 million every single year.

We worked with Dow and the Power Gas Corporation to get the technology to market. This groundbreaking work led to JM and partners winning the 1977 Kirkpatrick Chemical Engineering Achievement Award.

## History in Context

### 1976

CERN'S Super Proton Synchrotron, a vast particle accelerator, first went into operation. It was nearly 7km long and was designed to test the very nature of matter.

### 1977

The spacecraft Voyager 1 and Voyager 2 were launched, with the remit of exploring the further reaches of our Solar System.

## Did You Know?

In 1980 JM won the MacRobert Award, the UK's top engineering distinction, for our work controlling car emissions. The company also won a second MacRobert Award in 2000 for its Continuously Regenerating Trap technology for controlling emissions from heavy duty diesel engines.

1970-  
1999



# Life Saving Technology

From standard setter to world leader, JM was now about to become a life saver. A happy accident in a medical experiment led to a new use for platinum and a whole new industry for JM.

In 1965, Professor Barnett Rosenberg of Michigan State University was investigating cell division in the laboratory. When he tested his equipment on a bacteria sample, he got a result that was completely unexpected.

On investigation, Professor Rosenberg realised that the platinum electrodes he was using were causing cells to behave in a way that could be useful in cancer drug applications.

## Suppliers to the Researchers

JM supplied the platinum to aid the Professor's research. The work was instrumental in developing the first ever platinum based anticancer drug, Cisplatin. We also provided a research scientist, Dr Michael Cleare, who helped develop a second generation version of the drug, known as Carboplatin.

Carboplatin proceeded rapidly through clinical trials and was first given to patients in 1986, to treat ovarian cancer.

The Carboplatin team in 1986. Back row, left to right: Chris Barnard, Brian Theobald, Andy Brunning, Andy Tipping. Front row, left to right: Martin Allwright, Brian Moore, Meta Mitchell, Andy Smith, Neil Edwards.



The work on Carboplatin was acknowledged with the Queen's Award for technology in 1991.

## History in Context

### 1980s

Research into Tamoxifen showed that the drug could prevent breast cancer returning after surgery. The development would go on to save thousands of lives.

### 1985

The first domain names were registered on the internet. Three years later, the inventor Tim Berners Lee started to talk about the idea of a 'world wide web' with his colleagues at CERN.



## Did You Know?

In 1989, JM's US emission control catalyst manufacturing operations celebrated the production of its 100 millionth autocatalyst.

1970-  
1999



## Life Changing Treatments

The success of the anticancer drugs Cisplatin and Carboplatin inspired JM to investigate other life saving applications for its technologies. In the 1990s the newly formed Biomedical Technology Department started looking into ways to help improve the quality of life for patients with kidney failure.

Chronic kidney disease can cause a patient to have too much phosphate in their blood. This can lead to cardiovascular or bone disease, ultimately proving fatal. Our scientists and researchers joined forces with academics at the University of Surrey to investigate a compound that could help control phosphates and eliminate the risks for patients.

The result was Fosrenol, a drug that has since helped improve the quality of life of thousands of renal patients around the world.



## A Royal Welcome

On 10th December 1990, JM was delighted to welcome a very special guest. During a visit to Belgium Her Royal Highness The Princess of Wales came to look round Johnson Matthey's emission control catalyst plant.

The Princess met a number of employees at JM and also saw a display showcasing emission control catalysts. While she was at the factory, Her Royal Highness unveiled a commemorative plaque to mark her visit and received a gift of two rhodium-plated replicas of Aston Martin cars for her two sons, Princes William and Harry.

### History in Context

#### 1990

The Human Genome Project began; an international research project aiming to map the sequence of human DNA.

#### 1996

Google started indexing the World Wide Web.

### Did You Know?

When India celebrated its 50th anniversary of independence, leading British businesses assembled in New Delhi to showcase scientific links between our countries. JM was proud to be one of 80 companies taking part.

# Expansion and Sustainability

## Continued Investment in Science

The world hasn't stood still, and neither has JM. Our ever expanding interests and expertise have taken us into new applications and new markets. Since the start of the 21st Century we have diversified our interests through strong growth and through the acquisition of some of the world's cutting edge companies.

# 20

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This is a very special year for all of us at Johnson Matthey as we celebrate our 200th anniversary. This extraordinary achievement belongs to my colleagues worldwide and to our predecessors.”

**Robert MacLeod**

Chief Executive of Johnson Matthey

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2000-  
2017





### Stronger and More Sustainable

In the early 21st Century there was a shift of focus. JM was already playing a leading role in cutting exhaust emissions. A number of acquisitions enabled the business to bolster its expertise, add new skills to its portfolio and build on its position in sustainable technologies.

In 2001 the company acquired MacFarlan Smith, a groundbreaking chemicals company that dated back even further than JM. MacFarlan Smith produced the morphine that was used in the first ever hypodermic injection of a human, back in 1854. The knowledge and expertise within the company were a natural fit for JM and further enhanced our contribution to improving human health.

Shortly after, JM strengthened its offering to the chemical industry with the acquisition of ICI's Catalysts Division and Davy Process Technologies, a process design and technology licensing business. Both acquisitions helped us broaden our portfolio of technologies that enable the more efficient use of natural resources.

The acquisition from ICI brought us the technology to help customers make important building blocks like methanol. And the acquisition of Davy brought us the knowledge to help design chemical plants for our customers and help them optimise their processes.

The acquisitions provided JM with access to a range of exciting new markets and technologies, including base metal catalysis, which complemented JM's pgm catalysis expertise.

In 2007 JM divested its Ceramics Division, enabling the business to focus further on its core expertise and on sustainable technologies.

### A Vision for the Future

In 2007 JM launched Sustainability 2017 to build a sustainable future for the company. The programme included two objectives. The first was to become more efficient with the resources we used as a business and the second focused on designing new products to help our customers be more sustainable and competitive.

Sustainability 2017 set some stretching targets, including achieving zero waste to landfill and halving our key resources used per unit of output. From turning off lights and printing on two sides of paper, right through to having more efficient furnaces and redesigning our products, employees across the whole business made a contribution.

Thanks to our forward thinking and proactive approach, in 2017 JM is a more sustainable and efficient business, working to make the world cleaner and healthier and investing in sustainable technologies to improve the lives of future generations.

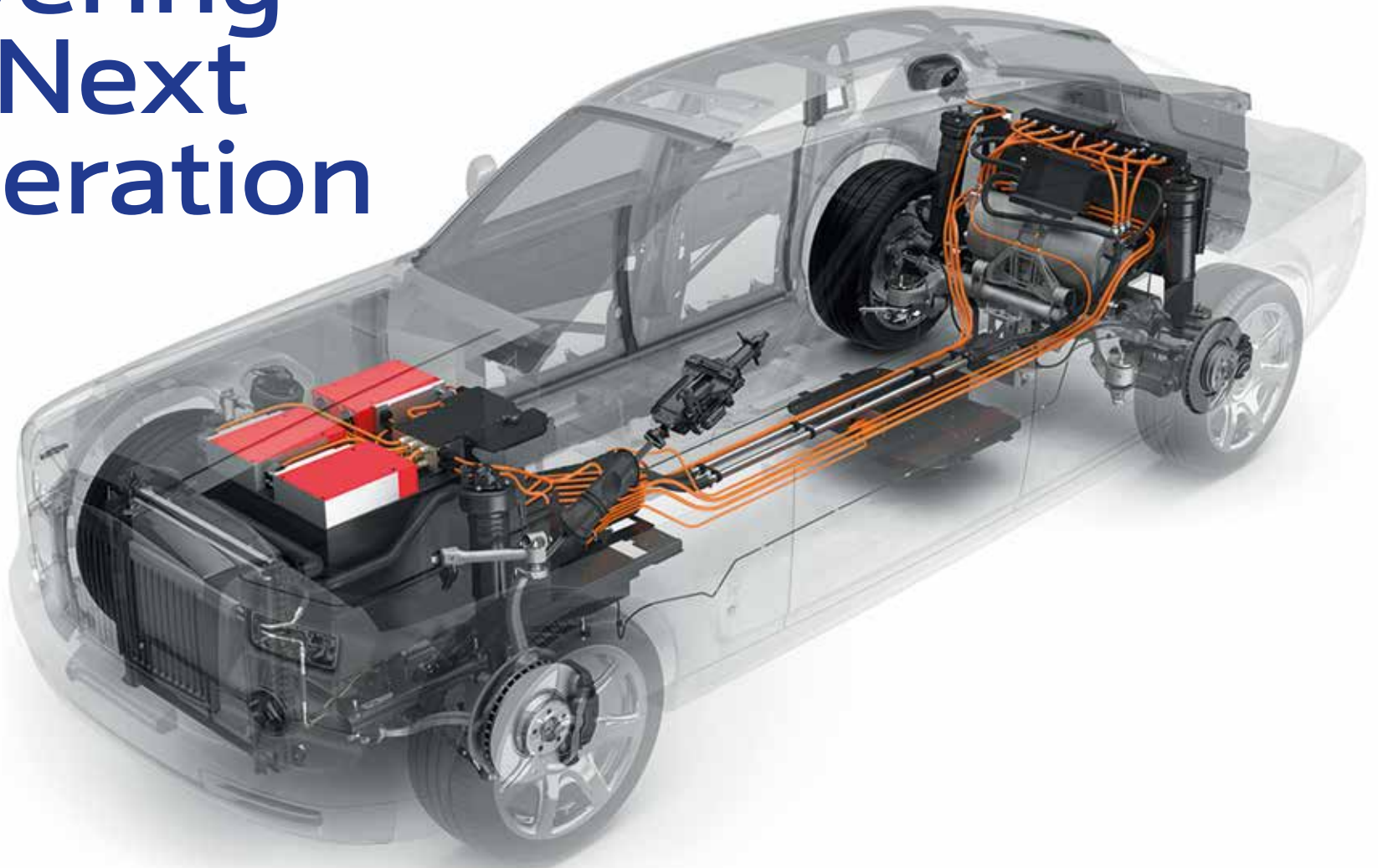


#### Did You Know?

JM supplies Bitrex; the world's bitterest substance. It is added to household products to prevent children from swallowing their harmful contents. It is so bitter tasting that it would be possible to taste a single teaspoon of Bitrex in the water of an Olympic-sized swimming pool.

2000–  
2017

# Powering the Next Generation





### Driving Change Worldwide

Building on our expertise in catalysis, we invested early in research and development into emission control catalysts for larger vehicles. So by the early 2000s, when legislation came into force requiring catalysts to control emissions from heavy duty diesel vehicles such as lorries and buses, we were ahead of the curve.

Our forward thinking approach meant we were ideally placed to help customers comply with the new legislation. The market for truck and bus emission control catalysts is now a huge one worldwide and legislation is continuing to tighten.

### The Science Behind a Better Battery

The move to cleaner and renewable technologies means that batteries are going to play more and more of a role in all our lives. JM started working in battery technology in the 1990s, partnering with the company SAFT to develop a faster acting battery charge and discharge model.

Now we've entered the battery market again. We've made a number of acquisitions and are investing in research. There's huge potential in the battery vehicle and electric car market, and we are using our science to enable this greener and more sustainable technology.



#### Did You Know?

In 2001 JM opened its first manufacturing operation in China. Today, JM has seven facilities in the country and employs approximately 1,000 people.

2000–  
2017

Separating platinum group metal species  
– essential in the recycling of platinum  
group metals.



### Recycling Rare Elements

They're not called precious metals for nothing. Platinum group metals, or pgms, are a valuable natural resource, and their applications are numerous. You'll find them in autocatalysts, jewellery and electronics.

The more pgms we can reuse, the less we need to take from the earth. So we've developed highly advanced processes for extracting and separating pgms from products – so advanced that we can recycle platinum, for example, to a purity of 99.999%.

In fact, we recycle enough platinum and palladium in a year to make millions of catalytic converters.

### Breaking the Silence

Cochlear implants can change deaf people's lives in the most profound way, by providing them with a sense of hearing. The implant consists of vital platinum components; these are made of high-grade platinum, which is biocompatible, has high electrical conductivity, and strength. JM produces the component by melting grains of platinum into an ingot or rod, which is then drawn or rolled, into wire or strip form.

Last year alone, thousands of men, women and children have been able to hear for the first time by using cochlear implants containing our platinum strips and wire.

### Continued Commitment

One of the major factors behind JM's success has been our ongoing investment in research and development over the years. We are still committed to investing in vital research work, and invested some £200 million in R&D in 2016/17 alone.



Image courtesy of Cochlear Limited.

#### Did You Know?

JM is the world's largest recycler of platinum and platinum group metals.

# Creating a Cleaner, Healthier World

JM's history shows that, as our knowledge and understanding of materials increase, so does our ability to design them to create life changing technology. The next 100 years will see us gain even more control over our materials, and develop ways to design and construct materials on a scale we can only begin to imagine. But let's have a try...



For two centuries Johnson Matthey has been at the forefront of inspiring science. Much of the important work that we do is not visible to the naked eye but the impact of our science is global and profound. This year we renew our mission to make the world a cleaner and healthier place for everyone."

**Robert MacLeod**  
Chief Executive of Johnson Matthey

# 2017

**and Beyond**

### **Making More from Less**

Populations are growing all over the world, placing ever greater demands on food production and the manufacture of agricultural products such as fertilisers. With pgm and base metal catalysts developed by JM, chemical companies will be able to produce more fertiliser using fewer materials and less energy.

We design our catalysts to cleverly maximise their atomic level surface area, greatly accelerating the reactions that produce ammonia and nitric acid while only using a minimum of energy and raw materials.

With JM technology, our customers produce fertilisers that help cultivate millions of tonnes of produce every year.



### **An Ambassador for Change**

JM started championing sustainability relatively early and the company has made great strides in integrating it into the way we operate and manage our business. We are now developing goals associated with our supply chains and with social and community activities. In the years ahead we can drive change through our partnerships and our influence.

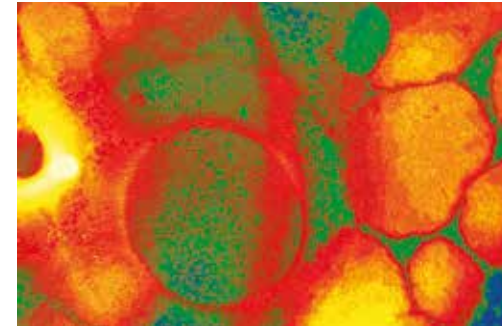


## Charging Forward

Electric vehicles are well on their way and we're developing advanced new materials for battery cells used in hybrid and full electric cars. Cathodes are the key. We're engaged in the cutting edge science needed to understand how different cathode materials can reduce the time a battery takes to charge and extend the distance a fully charged electric vehicle can travel.

Our materials are already helping to reduce CO<sub>2</sub> emissions from cars. It's a long journey to pollution-free roads, but we're getting there.

With air quality a major global issue, there will be more and more demand for new and more complex catalysts and materials to help meet tightening regulations. JM will be at the forefront of the new technology.



## The Journey Continues

When our ten year vision, Sustainability 2017, was first launched, the iPhone was less than six months old and Beijing was preparing to host the Olympics. In the face of the global recession JM stuck to its objective to do more with less. As the programme came to a close, we had achieved a lot. We had improved our health and safety performance, making it a priority in our business to drive further progress. As we move forward, we have more than doubled our underlying earnings per share while halving our carbon intensity and almost halving our use of key resources, namely electricity, natural gas and water, relative to sales. And at the same time we've delivered over £140 million in savings.

In the next ten years we will continue to progress towards ever greater targets, making sure sustainability is at the heart of everything we do.

### Did You Know?

Today, over 90% of our sales come from products and services that are contributing to a cleaner, healthier world.

**2017**  
and Beyond

### **Here's to the Next 200 Years**

In 2017 JM is involved in technologies around the world – and even beyond – as well as in science at every scale. From the manipulation of materials at the atomic level through to technologies used in world scale applications, we will continue to be at the forefront of technological breakthroughs, finding ways to make life cleaner, healthier and more efficient.



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