

Science uncovers the hidden secrets of worldfamous paintings

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(PhysOrg.com) -- The hidden secrets of some of the world's most famous paintings have been revealed thanks to a partnership between EPSRC (Engineering and Physical Sciences Research Council) and the UK National Gallery.

Culminating in the first major exhibition of its kind in summer 2010, scientists at the Gallery have been using the latest equipment to shed new light on the history behind some of the Gallery's priceless works of art.



A state-of-the-art, EPSRC-funded gas-chromatography-massspectrometer (GC-MS) has helped specialists in the National Gallery's scientific department study the <u>organic chemistry</u> of old master <u>paintings</u> to understand how paintings were made and how they have changed over time. In painstaking investigations, the scientists used GC-MS to study the characterisation and composition of paint binding media, additions to paint media such as resins, and the composition of old varnishes.

The results of this work have raised complex questions of disputed authorship and authenticity, such as period copies or modern forgeries, and shed light on the original colour balance of paintings.

One example is <u>The Virgin and Child with an Angel</u>, which was originally attributed to the Renaissance painter-goldsmith Francesco Francia and dated about 1490. The painting's authenticity was queried in 1954 when another version appeared on the market and years of uncertainty ensued. Finally in 2009 a renewed campaign of scientific examination and comparative testing, including GC-MS testing on the paint media and varnish, proved beyond a shadow of doubt that the gallery's painting was indeed a fake that was painted in the 19th century.

As well as needing a meticulous approach, working on highly valuable paintings is also technically demanding.

Ashok Roy, Director of Science at the National Gallery explains: "Firstly only tiny quantities of material are available for analysis as samples, plus the organic content can be very complex. In addition, these materials have generally changed over time so that analysis may be of degraded materials the results of which have to be translated into assessments of the original chemical composition when the painting was first produced."

All these analyses are challenging in the sense that every picture presents



new problems and subtle variations of chemistry and GC-MS is the ideal way of exploring these problems."

Roy describes uncovering something that no one else has seen for perhaps hundreds of years as "both fascinating and exhilarating".

Close Examination explores the pioneering work of the National Gallery's Scientific Department by presenting the varied and fascinating stories behind more than 40 paintings in the National Gallery's collection. The exhibition is arranged over six rooms, representing some of the major challenges faced by Gallery experts: Deception and Deceit; Transformations and Modifications; Mistakes; Secrets and Conundrums; Redemption and Recovery; and a special focus room relating to Botticelli. The exhibition features works by Raphael, Dürer, Gossaert, Rembrandt and others.

The partnership between the National Gallery and EPSRC has highlighted the contribution that science and scientists make in the world of art and shows the intellectual value that emerges when scientific and artistic traditions come together. EPSRC, together with Arts and Humanities Research Council, funds a Science and Heritage Programme which aims to increase knowledge and the resilience of our cultural heritage in the face of twenty first century challenges.

David Willetts, Minister for Universities and Science said: "People come from throughout the country and all over the globe to enjoy the National Gallery's sublime collection of paintings. This unique partnership with the UK's world-leading research base is prising open art's hidden secrets, illustrating the vital contribution science brings to our everyday lives."

Gas-chromatography linked to mass-spectrometry is the core technique for these types of microanalyses of paint samples, and the techniques of analysis were developed first in the National Gallery laboratory, which



remains a world leader in the study of the materials and techniques of Old Master paintings.

Paint binding media includes drying oils used in paintings, such as linseed oil, walnut oil and poppy seed oil. Analysis shows, for example, whether the oil was pre-treated by 'heat-bodying' (or thickening) before use by the painter. Added resins and other materials can also be identified and the state of degradation of the binder can be assessed. Paintings in other media, such as egg tempera can be identified, as well as complex combinations of media.

The National Gallery's Scientific Department was founded in 1934 and has become a world leader in the study of the materials and techniques of Western European paintings. Today, the department works ever more closely with curators and conservators to investigate the physical characteristics of works in the collection and to protect paintings for the future. Modern scientific methods, including infrared imaging, X-ray images, electron microscopy and mass spectrometry can provide fascinating insights into the materials used by artists, studio practice and the ways paintings can change over time.

Provided by Engineering and Physical Sciences Research Council

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