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The power of x2 a botanical collaboration

Rob Kesseler

Collaborations between artists and scientists might suggest outcomes resulting in a hybrid fusion of cultures with unrealistic expectations of super progeny. However, in reality the outcomes are more subtle, far more diverse, and more widely dispersed than might be imagined - analogous in fact to pollen or seeds, the subjects of my recent collaborations with scientists.

(left) Fig. 1. Hackelia sp. Stickseed – seed 3.5mm long.
(above) Fig. 2. Silene dioica – Red campion. Pollen grain [SEM x 2000] (30 microns in size) and flower.

There is a long and illustrious history of artists working with flowers and plants for inspiration. Their forms of expression, from minimal to exotic, are as varied and numerous as the species portrayed. Through artistic intervention and interpretation, artists have created powerful symbols that carry many messages; markers with which we retain contact with the natural world. It is hard to imagine a part of our lives that they do not touch upon.

The development of the microscope by Robert Hooke in the mid 17th Century opened up new territory for examining a world too small to be seen unaided. Among the earliest enthusiasts of the microscope, the polyglot Nehemiah Grew found he was able to study details of plants far beyond what was visible with the naked eye. In his pioneering publication *The Anatomy of Flowers, prosecuted with the bare eye, and with the microscope,* Grew executed in explicit detail the intimacies of plant genitalia, acknowledging the sexual role of pollen by his reference to spermatic *globulets.* After this, it was not until the latter half of the 19th Century that really significant advances were to be made in the development of microscope lenses. Nevertheless, the advances in lens technology had made considerable progress since Hooke's day and by the early 19th century the botanist Franz Bauer was able to record details of pollen structure with a remarkable degree of accuracy. Bauer was also an excellent botanical artist and was granted a lifetime annuity from Sir Joseph Banks to record the rapidly expanding collection of living plants being brought into cultivation at the Botanical Garden in Kew.

Scientists were quick to realise that the advances made in lens technology during the late 19th Century and the recent invention of photography had great potential if the two technologies were combined; microphotography was born. This was a pivotal moment for the portrayal of microscopic imagery, but ironically this technology would have far reaching consequences. By the early 20th Century the hand-drawn revelation of the minute complexities of the natural world which delighted the Victorian middle classes, would be increasingly confined to the photographic archives in specialist laboratories. Microphotography proved to be a gatekeeper, controlling who had access to this material.

There is a line of thought, although not one to which I subscribe, which considers botanical illustration to have very little to do with art, belonging rather to the realm of botanical science where aesthetic considerations follow a restricted set of conventions and beauty is a pleasant but scientifically irrelevant side effect. Apart from doing a great disservice to the artists involved, this view fails to recognise that these fabulous works have been responsible for creating, inspiring and informing new audiences, as well as reflecting the ideals and aspirations of the societies in which they were created.

Fig. 3. Hieracium pilosella – Mouse-ear hawkweed, Pollen grain [SEM x 2000] (40 microns in size) and flower.

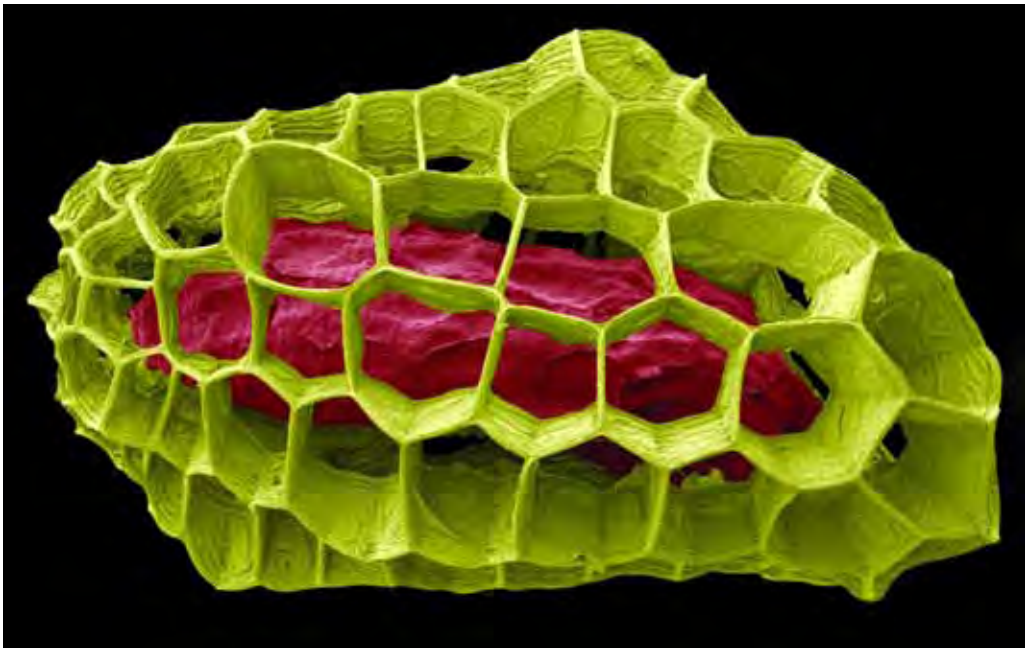

Fig. 4. Lamourouxia viscosa – seed 1.2mm long.

Opportunities for access to and artistic translation of the wealth of microscopic imagery, was all but eliminated as microphotography became ever more sophisticated, and the equipment used to generate the images prohibitively expensive. The images accumulated, enclosed within the archives of professional communities for scientific research. The possibility of it being selectively re-appraised for its potential public interest, were limited by differing attitudes, as well as time. In the past, great works of botanical artistry were reliant on the fusion between scientific understanding and artistic creativity, whereas the rapidly emerging technologies of microscopy and photography effectively shut the door on artists.

When I was a child I had a beautiful Victorian microscope and was aware of the world beneath the lens. Having worked with plants most of my creative life it was inevitable that at some point the two worlds would collide. While light microscopy, and later electron microscopy combined with camera technology, had closed the doors between art and science for so long, now it is the emergent digital technologies shared between all walks of life that have enabled artists and scientists to engage in meaningful collaboration. Specialisation in any discipline can be isolating, and a growing awareness of the need to communicate across boundaries has lead to a number of Sci-Art initiatives during the 1990's, with support coming from organisations

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such as the Wellcome Trust and NESTA (National Endowment for Science, Technology, and the Arts).

Recognising the creative potential within plant science, I approached Kew Gardens in 1999 to enquire if I could speak to one of the botanists about a possible collaboration. Fortunately my enquiry drew an enthusiastic response from Dr Madeline Harley, who was at that time head of Palynology in the Herbarium. With a former career as an interior designer she had an appreciation for the visual aspects of her work and had long held a passion to extend her subject to a wider audience. I was immediately struck by the staggering diversity of forms I was shown, and under Madeline's expert guidance I was soon producing my own specimens.

From the beginning it was clear that different selection methods came into play. Madeline would carefully prepare pollen specimens, to present them in a scientifically acceptable manner so that key details could be observed among her colleagues who would attend scientific conferences and read her articles in professional journals. For me there were no such professional limitations. I could take a more 'warts and all' approach, working from untreated freshly mounted specimens, initially randomly photographing as an aesthetically instinctive response to their forms, rather than for any scientific reason. However, working together we realised that our respective disciplines did have some things in common – the language used to describe the pollen was very familiar. Pollen surfaces are described in terms of their 'ornamentation' and 'sculptural' qualities, while the structure of the pollen wall is referred to as 'architecture'.

As a result of a number of projects on which we had collaborated, I was awarded a fellowship from NESTA. This allowed me funding for three years to extend my work at Kew. I was keen to shift the perception of being an 'artist in residence' to one of an 'artist researcher', working with equal integrity and commitment, using contemporary scientific knowledge to explore the plant world at a microscopic level.

Madeline and I shared a belief that the power of the spectacular images of pollen we were creating would ensure an eager audience beyond the scientific community. With this passion we set out to create a book that would fuse the scientific and artistic, to enlighten and enrapture. We approached many publishers and their response was typical of what we had prepared ourselves to expect. The book was not intended to fit in any conventional publishers' category - it was neither simply 'art' nor was it simply 'science'. When confronted with

Fig. 7. Polygala arenaria – Sand milkwort – seed 2.2mm long.

(above left) Fig. 5. Arenaria franklinii – Franklin's sandwort – seed 1.3mm diameter.
(below left) Fig. 6. Ariocarpus retusus – living rock cactus – flower and seed 1.5mmm long.

(Above) Fig. 8. Pseudotsuga menziesii – Douglas Fir Pollen grain in expanded condition [SEM x 2000], (40 microns in size).
(Below) Fig. 9. Silene nutans – Nottingham catchfly. Pollen grain [SEM x 1500] (40 microns in size) and flower.

(Above) Fig. 10. Tolmiea menziesii – seed 0.6mm diameter.
(Below) Fig. 11. Nigella damascena – Love-in-a-mist - seed 2.6mm long and inflated capsule.

Seeds are larger and more familiar to us than pollen, but at a microscopic level, they too reveal an astonishing range of forms and structures of which most people are completely unaware.

something that had not existed before, they could not see beyond the conventional market. Fortunately for us, this was not the case with Andreas and Alex Papadakis (Papadakis Publishers), who with a distinguished imprint dominated by contemporary architecture, immediately realised the potential. Eighteen months later *Pollen, the hidden sexuality of flowers* was published. Its impact was such that it was featured with multi-page publicity splashes across a wide range of publications; including scientific journals, nature magazines, art and design magazines, colour supplements and tabloid newspapers. Our belief that the subject would have widespread appeal was confirmed.

Throughout our collaboration both Madeline and I took great care to ensure that our work should meet the highest standards pertaining to our respective professions. We have felt hugely satisfied by the worldwide enthusiasm, respect, and acknowledgement that the book has received, both within the scientific community and throughout the art world.

Recognising the potential for collaboration, I was subsequently approached by Dr Wolfgang Stuppy, a seed morphologist working at Kew's Millennium Seed Bank in Sussex, UK. Wolfgang is a botanist with an extensive knowledge and consuming passion for his subject. Seeds are larger and more familiar to us than pollen, but at a microscopic level, they too reveal an astonishing range of forms and structures of which most people are completely unaware. Together Wolfgang and I set out to reveal this diversity. Working from the huge diversity of seed stored in the Millennium Seed Bank, as well as others we had collected from across Europe and South Africa, each session using the scanning electron microscope revealed a dazzling variety of forms and structures. It was hard to curb our enthusiasm as each specimen we examined provoked a response akin to watching fireworks explode. In a very short space of time we had built up a rich collection which was to form the basis of *Seeds, time capsules of life*. With this material we worked alongside designer Alexandra Papadakis, in a three-way partnership that ensured a harmonious balance between scientific text and superb imagery.

As it is a question which is often asked, I should say something about how the images are created and my use of colour. The images were taken with a scanning electron microscope, the pollen on a Hitachi S2400 SEM and the seeds on a Hitachi S-4700 Digital SEM. Scientifically these images are usually recorded black and white and although the increasing sophistication of the software enables colour emulation, I prefer the added sophistication of being in total control of this myself. Using Adobe Photoshop CS, many hours are spent in retouching the black and white images to remove all background distraction. With samples that have particularly delicate or feathery profiles this can sometimes take several days for one image. The contrast is adjusted to ensure that the full three dimensionality of the form is apparent. Colour is first introduced by changing the format to a duotone or tritone before changing the format again into RGB (red-green-blue). Subtleties and complexities of colour are developed at this stage by duplicating numerous layers, the colours of which are individually changed. By erasing selected areas, the different hues and tones are revealed within the one image.

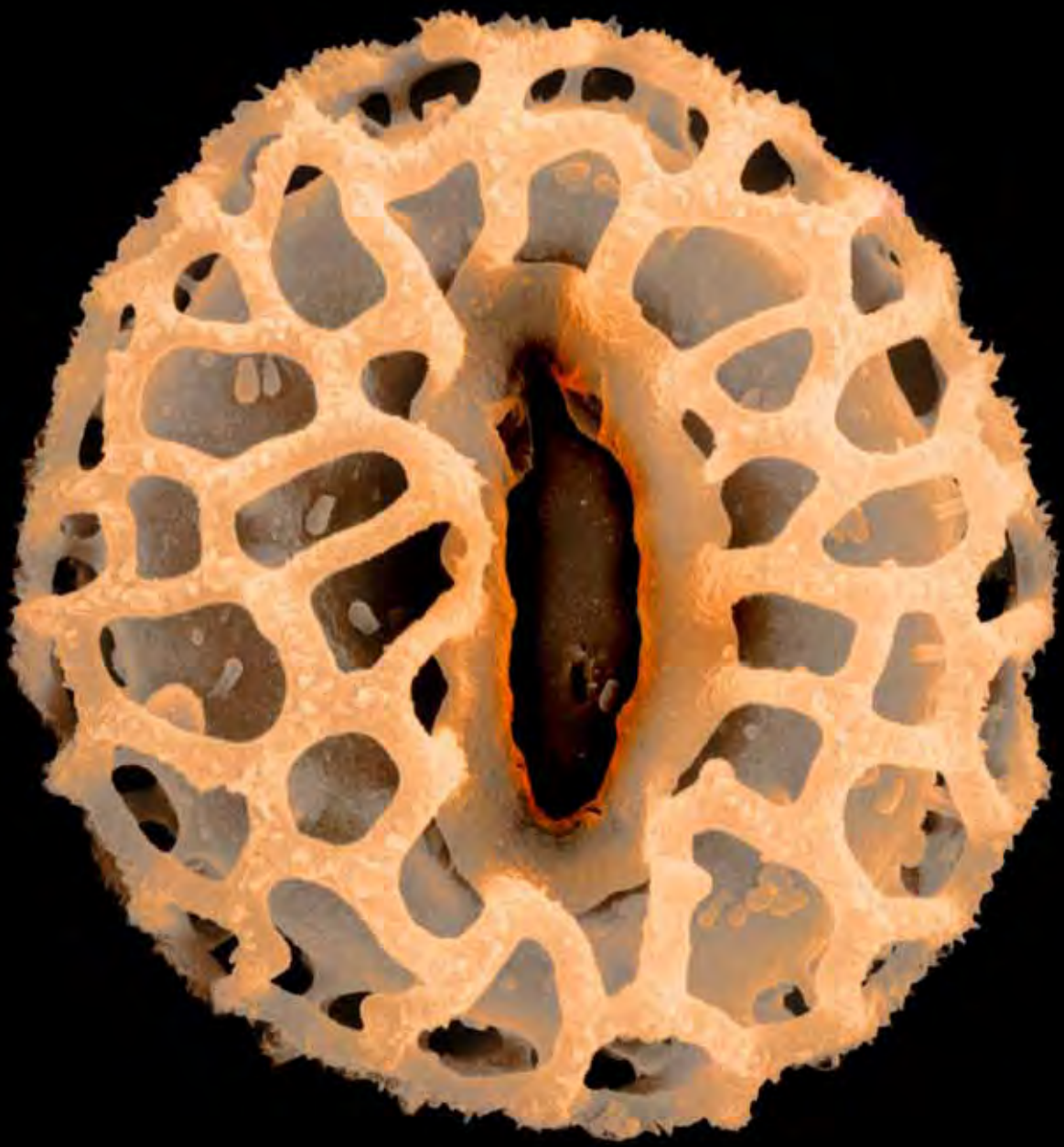
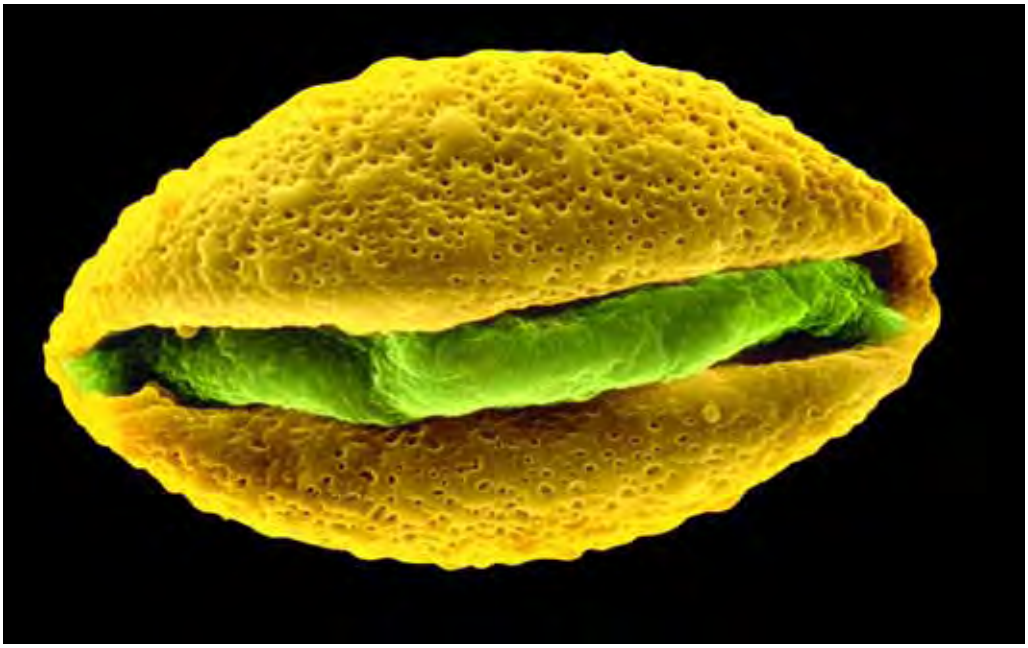


Fig. 12. Nenga gajah – Pinang palm Pollen grain [SEM x2000 acetolysed], (50 microns in size).

The colours chosen are frequently derived from the natural colours of the flowers from which the pollen or seeds were collected.

There is an assumption that new push button, digital technologies do everything for you, but for me this transformative colouration process is a *hand-crafted* operation and differs very little from using a sable brush with watercolour. It is my dexterity with the tools I use and intuitive sensitivity to the colours I choose that makes the images unique. The colours chosen are frequently derived from the natural colours of the flowers from which the pollen or seeds were collected. Colour in nature has many functions. Flowers have evolved complex strategies to ensure they attract the appropriate pollinators, for example odour, morphological mimicry, ultra-violet colour guides, and other patterning. Most insects have greater sensitivity to colours at the blue end of the spectrum and are able to detect ultra-violet colours, revealing patterns that direct the insect to the pollen bearing parts of the flower, like an aircraft guided to a safe landing by runway lights at night. As an artist, I too employ diverse strategies to ensure that my images attract as many 'visitors' as possible - colours guide the eye, moisten enquiry and stimulate the imagination.

Throughout the past seven years I have not only been trying to create remarkable images through my work, but also to contribute to a movement that seeks to break down monocultures and effect greater communication and understanding across disciplines. Artists and scientists have much to learn and gain from each other - through collaboration, by re-invigorating their own practice, and extending their knowledge and enthusiasm to a much wider audience.



(left) Fig. 13. Stellaria pungens – Prickly starwort – seed 1.5mm diameter.
(above) Fig. 14. Liriodendron tulipifera – Tulip Tree Pollen grain, dehydrated [SEM x 1500], (60 microns in size).

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Rob Kesseler is a visual artist and Professor of Ceramic Art & Design at Central Saint Martins College of Art & Design. His work inhabits a territory where Design, Fine Art and Applied Art overlap. Within a very diverse range of outputs, his work examines the natural world and its place within contemporary society through the interrelationship between the Arts and Sciences.

In 2001 he was awarded a three year fellowship from NESTA (National Endowment for Science, Technology and the Arts), to work with microscopic plant material in the herbarium at Kew.

His work has been exhibited widely, with recent solo exhibitions at the Victoria & Albert Museum London, The City Museum and Art Gallery Stoke, and in group exhibitions across the UK and Europe. Recent public commissions include an award winning park landscaping project in the London Borough of Barking and a series of sculptures for Sustrans, the UK Cycle network along the route between Dover and Folkestone.

His belief in the power of art to engage popular interest in the sciences was confirmed by the diverse press coverage following the publication of *Pollen, the hidden sexuality of flowers,* written with Dr Madeline Harley from Kew. The book has featured in wildlife magazines, gardening magazines, beekeepers journals, arts magazines, national and international press and on two BBC websites. Building on this interest he has recently lectured at The Royal Institution, The Linnaean Society, Manchester City Art Gallery and Kew Gardens.

(above) Fig. 15. Morina longifolia
Pollen grain [SEM x 4800 –acetolysed], (170 microns in size).
(above right) Fig. 16. Nemesia versicolor – seed 2.4mm diameter.
(below right) Fig. 17. Ornithogalum dubium – Yellow star-of-Bethlehem – seed 1.1mm long.

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