The biomedical properties of ancient Egyptian black eye makeup

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Few people would be unfamiliar with the iconic eye make-up of the ancient Egyptians. Modern perceptions that the Egyptians used the substance known as *kohl* for purely cosmetic purposes are not correct. Data from recent studies provide a profound insight into this previously little understood aspect of Egyptian cosmetics and their preparation. Various scientific studies have produced detailed analysis of the chemical constitution of the eye compounds, and concluded that the ancient Egyptians utilized sound empirical science.

Ancient Egyptian manuscripts[1] list many remedies for bodily ailments, and of particular interest here are those for eye conditions. Although specific quantities are not mentioned it is reasonable to assume that an Egyptian eye-doctor knew the composition of each type of prescription. Set out in figure 1 is one such prescription from the papyrus Ebers (pEbers) with its modern translation.[2]

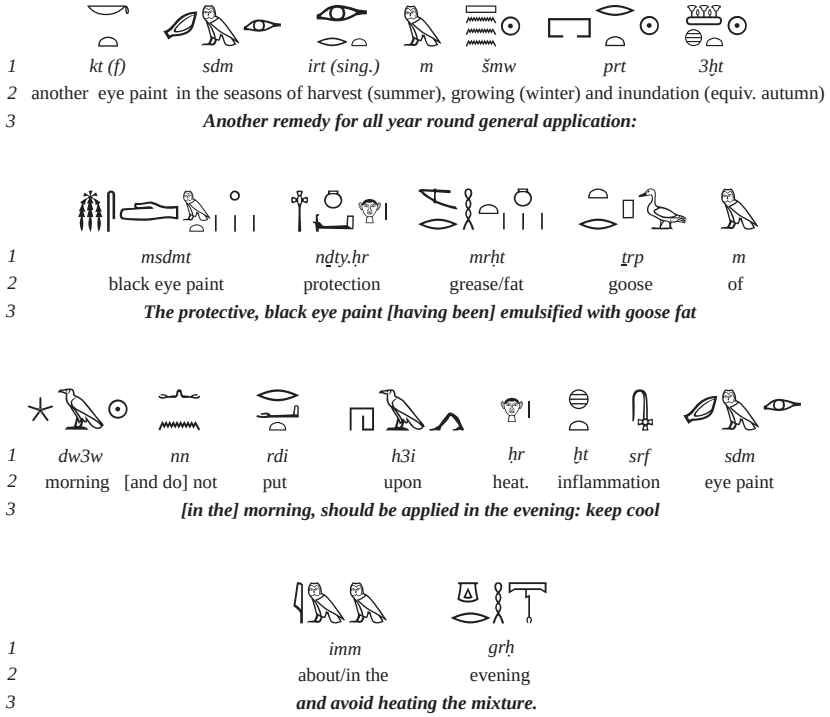

Figure 1. Paprus Ebers (Column 61, Lines 6–8). Key: 1) Translation of hieroglyphs, 2) Literal Translation, 3) Translation into modern English.

The method of manufacture ancient and modern

Tests on the contents of Egyptian cosmetic artefacts held at the Louvre Museum indicated that the material was in very good condition.[3] Using Powder X-ray Diffraction at the European Synchrotron Radiation Facility (ESRF), the mineral constituents of the Egyptian cosmetics were deciphered. Altogether 49 samples were analyzed revealing the presence of four lead species: galena (PbS) for blackish gloss and three white species: cerussite ($PbCO_3$), phosgenite ($Pb_2Cl_2CO_3$), and laurionite (Pb(OH)Cl). The first two compounds occur naturally and were bound in an emulsion made from animal fats (see figure 1), but what surprised the scientists was the presence of two very rare naturally occurring compounds, laurionite and phosgenite.

It is faintly possible that these two compounds may have formed by chemical alteration if they came into contact with carbonated and chlorinated waters. There are, however, no indications that such alterations took place and the logical conclusion is that the Egyptians deliberately manufactured both compounds using a simple yet very delicate wet chemistry.[4]

A simplified explanation of the method nevertheless indicates a high level of competency by the Egyptians. Lead oxide was ground into a fine powder. This was mixed with water, sodium chloride, and sometimes natron (Na_2CO_3). Close attention to pH levels was essential if production of unwanted lead hydroxides was to be avoided: this involved frequent filtration and changing of supernatant with fresh water and NaCl. It is thought that the process could take up to 30 days after which the litharge was expended and a white residue remained. A team of scientists exactly replicated this method in the laboratory and observed that the precipitation of lead chlorides did indeed occur.[5] The researchers noted in their experiment that when the lead oxide was vigorously mixed with rock salt (1) (and also natron (2) in other tests), in warm water they obtained the following results:

$$PbO + H_2O + NaCL \rightarrow Pb(OH)Cl + NaOH \quad (1)$$

$$PbO + H_2O + NaCL + 1/2\ Na_2CO_3 \rightarrow 1/2\ Pb_2Cl_2CO_3 + 2\ NaOH \quad (2)$$

The resulting precipitants were then incorporated into a wide range of therapeutic products by mixing these compounds with various emulsion agents such as animal fats or vegetable oils; a practice not dissimilar to modern pharmaceutical processes.

How the eye preparations work

Studies in immunological responses to bacterial infection have shown that nitric oxide (NO) operates

as a vital messenger in the non-specific immune system. NO signals infection to a variety of immune cells including macrophages[6] and promotes increased capillary blood flow which significantly increases phagocyte numbers. One litre of human blood contains about six billion phagocytes;[7] compelling evidence of intelligent design by a caring Creator. Using ultramicroelectrodes to monitor stress responses of keratinocytes (skin cells), it was discovered that submicromolar concentrations of Pb^{2+} ions were sufficient to obtain specific oxidative stress responses. The moment a submicromolar solution of lead acetate was introduced around a keratinocyte, the cell released an oxidative response lasting approximately thirty minutes. The most significant effect noted was the overproduction of NO by as much as 240% when laurionite was present.

Due to the variability of the cells, the kinetic features of the release did vary although the study[5] concluded that response increased in direct proportion to the Pb^{2+} concentration:

> "It was observed that Pb^{2+} did not induce any significant change in the normal production of superoxide ion but that it led to an increased (~240% for 0.2 μM Pb^{2+}) and longer lasting production of NO^{o}."[5–8]

The ancients were intelligent

The general view that human intelligence (as opposed to technological advance, which relies on the transmission and accumulation of discoveries) has evolved upwards leads to a tendency to downplay the achievements of the ancients.

This seems to have been at play with the scientists featured in the *Analytical Chemistry* article. They wrote that:

> "[the] laurionite component was real and effective, despite the fact that its 'magic' implications seemed a priori totally irreconcilable with our modern scientific views …"[9]

Image courtesy of www.catchpenny.org/race.html

Figure 2. Faience tiles from the time of Ramesses III. L–R: Libyan, Nubian, Syrian, Shasu Bedouin and Hittite.

For 'our modern scientific views' read 'evolutionary science and materialism/naturalism'. Ancient Egyptians would have disputed the idea that the natural realm is all there is: in their worldview the natural and spiritual realms were not only real, they were mutually co-existent and co-dependent. Also:

> "One cannot evidently go as far as to propose that laurionite was purposely introduced into the composition of the makeup because of any recognized antibacterial properties."

The obvious question is, 'Why not?' Whether they knew of the existence of germs as a cause for disease or not, why should they not have understood that these compounds, from empirical clinical observations, had a therapeutic effect on certain conditions? This reflects another serious and common error; the attempt to impose 21st century cultural ideas on cultures millennia removed from the present. The world-view of the ancients was very different to that of modern man. The Egyptians were generally a prudent people and these compounds appear very early in the archaeological record without any developmental steps.

Belief in evolution is again seen to have the potential to hinder our understanding in this area of historical science. The evidence in general indicates that ancient man was at least as intelligent as his modern counterpart. The Egyptians were competent in technologies across the cultural spectrum. These included metal technologies, paint pigment micronisation, fabric weaving so thin and fine as to be virtually transparent and, of course, construction technologies (e.g. the pyramids).

Was the Egyptian eye make-up technology limited to the Kemet (Egypt)? Apparently not. From the royal palace of Ramesses III at Medinet Habu, Luxor, there are faience tiles showing some of Ramesses' enemies in their traditional costumes (figure 2). Note the attention to detail employed by Egyptian artists—all five individuals are rendered correctly in their national dress. What is particularly interesting is that all of these figures, representatives of peoples spread across the Ancient Near East and south into Africa, wear black eye-make-up just like their Egyptian counterparts. This suggests that this technology was more widespread than previously thought.

From the creationist point of view Adam was created perfect, and by the

second generation his descendants were engaged in technologies such as metallurgy and musical instrument production Genesis 4:21–22. Such technologies required a high level of intelligence. In certain fields and cultures, archaeology has shown there to have been a loss, not gain, in technology.[10] The science behind Egyptian eye make-up preparation and application, accords well with the biblical record of mankind's origins.

References

1. Only one of these manuscripts is cited here; the pEbers. Regarding the age of the pEbers, there are some important pointers to the text's antiquity. Columns 103–110, which were written on the reverse, are in a different style of language compared to the rest of the papyrus. Whilst the handwriting is the same, different dialects are detectable. Although the writing style appears to be dated no earlier than 1600 BC by the Conventional Chronology, idiomatic usage indicates that the text belongs to an older period and some sections of pEbers can be traced back to the earliest Pharaonic dynasties.
2. Immediately before this prescription on the pEbers there is a more complex recipe and remedy for conjunctivitis.
3. European Synchrotron Radiation Facility (ESRF), *Newsletter*, April 1999, p. 10.
4. Walter, P. *et al.*, Making make-up in Ancient Egypt, *Nature* **397**:483–484, 11 February 1999.
5. Tapsoba, I., Arbault, S., Walter, P. and Amatore, C., Finding out Egyptian gods' secret using analytical chemistry: biomedical properties of Egyptian black makeup revealed by amperometry at single cells, *Analytical Chemistry* **82**(2):457–460, 15 January 2010; p. 458.
6. These large cells 'eat' invading organisms by engulfing them. From Greek *macro* (large) and *cytos* (cell). They are only one type of immune cell which does this, including monocytes, neutrophils, tissue dendritic cells and mast cells. All are collectively called phagocytes, from the Greek *phagein* (eat).
7. Hoffbrand, A., Pettit, J.E. and Moss, P.A.H., *Essential Haematology,* 4th ed., Blackwell Science, London, p. 331, 2001.
8. Supporting information for Tapsoba *et al.*, ref. 5 available f.o.c. from: pubs.acs.org/doi/suppl/10.1021/ac902348g/suppl_file/ac902348g_si_001.pdf .
9. Tapsoba *et al.*, ref. 5, p. 460.
10. For references, see Wieland, C., Modern 'Stone Age' reconsidered, *Creation* **15**(4):51, 1993; creation.com/tech-loss, and also creation.com/culture-clash.

PRDM9: a link between meiotic ecombination hot spots and the origin of species

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Creationists accept that changes occur within created kinds.[1] In fact, it has been pointed out that many times these changes can occur quite rapidly, surprising evolutionists who believe in only gradual changes over long periods of time.[2] However, the underlying causes for these changes, including those that can result in new species, have been unknown. Rapid changes may be either genetic or epigenetic.[3] Recent research suggests the gene PRDM9 is one factor that can be involved in rapid genetic changes.

What is PRDM9?

PR domain-containing 9 (PRDM9) is "a meiosis-specific histone H3 methyltransferase with a C-terminal tandem-repeat C2H2 zinc finger".[4] This means that PRDM9 is active during meiosis, or gamete formation. Histones are proteins associated with DNA that are important for proper packing and unpacking of DNA so it can be stored or used as needed. PRDM9 methylates a specific amino acid in histone H3 early in meiosis.[5] It plays an essential role in meiosis; mice lacking a functional *PRDM9* gene are sterile in both sexes due to severe impairment of the double-stranded break repair pathway and inadequate pairing of homologous and sex chromosomes.[6]

The zinc fingers at the end of this protein are predicted to bind DNA. A C2H2 zinc finger is a special structural motif where two cysteine (C) and two histidine (H) residues appear in an arrangement where they bind a zinc atom which helps to stabilize the structure (figure 1). One study in humans found that the number of zinc fingers varied from 8 to 18 in the over two dozen alleles examined.[4] It is this portion of the molecule that appears to play an important role in meiotic recombination by binding certain mini-satellite motifs in DNA.

Meiotic recombination hot spots

During meiosis, chromosomes pair up near the center of the cell, an event known as synapsis. During synapsis most, or all, chromosomes will undergo homologous recombination, or crossing over (figure 2). Portions of the matching chromosomes are swapped. This complex process begins with double-stranded breaks and, following a series of well-controlled protein-mediated steps, ends with the repair of those breaks. Important enzymes have been identified which are involved in the various steps.[7] Thus, crossing over is a complex, designed process that helps shuffle alleles between homologous chromosomes, allowing for greater genetic variation among the offspring.

Crossing over tends to occur most frequently at locations known as hot spots. Variation in PRDM9 appears to greatly influence hot spot activity. The previously mentioned study in humans shows that minor variation within the zinc finger domain can have profound effects. Alleles differing by a single amino acid can enhance hot spot activity, fail to activate hot spots, or even trigger the appearance of new hot spots.[4]

There was an interesting conundrum uncovered by this research. Some of the variants were not predicted to influence DNA binding, yet they had an impact on hot spot activity. Additionally, hot spot promoting alleles could activate hot spots that had no obvious corresponding binding motif. Uncovering further the details of PRDM9 activity in recombination should be a challenging and fascinating venture.

Unequal crossing over and genomic rearrangements

Hot spots are also associated with rearrangements. Unequal crossing over is one mechanism for changing