

KEYNOTE LECTURE-LECTIO MAGISTRALIS

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INTRODUCTION

Arthur Aufderheide (1922-2013) and I came from clinical disciplines; he from pathology and I from neurology; but here the comparison ends. He became my teacher, I his pupil; he provided tissues and I analyzed those with the help of numerous collaborators and by using new techniques as they became available, we made slow progress in the study of human mummified remains. Here I focus on paleoneurology which I define as the reconstruction of ancient neurological diseases in the absence of a living nervous system.

MATERIAL AND METHODS

We found that:

1. Peptides in the peripheral nervous system (PNS) are preserved for millennia.
2. True portraits can be found before van Eyck (1390-1441) who was regarded as the first human portraitist. Facial palsy, congenital ptosis and deviation of the eyes' visual axis from the normal parallel state are portrayed in mummy portraits dating from Roman Egypt ~AD 120-140.

3. Faces in portraits command attention and allow for clinical neurology without the presence of a nervous system.
4. Hydrogen isotope ratios in hair reveal biologic rhythms and evidence of neurodegenerations.
5. Mummified human brain tissue can reveal ancient infections.

RESULTS

Histology and statistical analyses

We found that autonomic rhythms (a function of the autonomic nervous system) in the growth lines of human and extinct archosaurus teeth are preserved. [1]

Any repeat measures along growing tissues, such as hydrogen isotopes or growth lines in hairs are suitable for this statistical analysis. A comparison of normal human hairs from a number of sites shows a normal statistical pattern with low frequency and high frequency peaks, except in a patient with PAF (Progressive Autonomic Failure) a disease of the autonomic nervous system in which there is no frequency change in the statistical pattern derived from power spectral analysis. Analysis of mammoth hair shows that even millions of years after death the biologic rhythms are preserved in archived hairs.

Immunohistochemistry

The sural nerve is a purely sensory nerve in the foot; it can be biopsied for diagnostic purposes without causing paralysis of the foot. Sural nerves from Egyptian feet, ~4000 years old, held at the Smithsonian Institution in Washington DC, USA were biopsied. Immunohistochemistry of this material showed the presence of Nitric Oxide Synthase. The presence of this enzyme in the sural nerve and in the paravertebral sympathetic chain was first noted in such ancient specimens. [2]

Human faces

In the 19th century, a treasure trove of gold masks was found in Greece. These masks were made by hammering a thin sheet of gold over the face of the dead so they reflected accurately the features of the deceased. The normal features of the faces were perfectly symmetrical. However, in one mask the features were asymmetrical the left corner of the mouth being lower than the right, the hall

mark of a lower motor 7th cranial nerve palsy (Bell's palsy, possibly due to ancient viral infection). Agamemnon, if indeed this was his gold mask, had a left Bell's palsy. [3]

The eye lids are normally symmetrical but on occasions a droopy eye lid can be seen on one side of the face. This is called a congenital ptosis- a harmless facial asymmetry. Some historical figures with congenital ptosis attest to the genetic underpinnings of this condition because it tends to run in families (*J. History Neurosc.* (2004); 13: 668-373).

The eyes demand attention

We examined at the British Museum in London and in a book edited by Susan Walker, *Ancient Faces, Mummy portraits from Roman Egypt* published by The Metropolitan Museum of Art, New York, Routledge, New York, mummy portraits held by the British Museum.

We found that the eye captures the viewer's attention! Normally there is perfect symmetry of the eyes but some mummy portraits show various conditions of neurological interest; exotropia, the eye turns outwards; exophthalmia the eye bulges out; esotropia the eye turns inwards; corectopia displacement of the pupil from its normal central position.

Additional disorders gleaned from attention to the eye are Horner's syndrome, paralysis of the iris muscle causing a small pupil. In a live person there is unilateral loss of sweating of the forehead and a droopy eye lid with slight enophthalmos-a retraction of the eye into the orbit. [4]

Inspection of the human face

Parry-Romberg syndrome or progressive hemifacial atrophy (PHA) consists of:

1. Localized atrophy of skin, subcutaneous tissues and underlying bony structures.
2. Ipsilateral smallness of orbital height & width (on X-rays of the skull).
3. Larger infraorbital foramen; asymmetry of facial bones (on X-rays of the skull).
4. Lack of gyral impressions-paucity of sulci in ipsilateral cortex (on 3-D CT scan of the head).

This condition occurred in ancient times too. We found a mummy portrait with (PHA) dating from AD ~70-120.

DISCUSSION

Claude Bernard, the eminent Neurophysiologist coined the aphorism: "ART IS I; SCIENCE IS WE".

I interpret this to mean that science is considered to discover whereas art is to create.

Nowadays it is impossible to do science without the help and collaboration of many investigators. But, more importantly, Claude Bernard was also the father of autonomic physiology that is the science of oscillating biologic systems. All such living systems oscillate around a set point and these system oscillations are maintained by the autonomic nervous system. Once oscillations stop these systems reach a "tipping point" from which no recovery is possible and death ensues. The autonomic nervous system maintains the set point throughout life until death or the tipping point is reached. [5] Collaborative research and advances in scientific methods and techniques are likely to present new opportunities for research and will further illuminate paleoneurology.

Study limitations

The results are limited to the study materials and periods examined.

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Conflict of interest statement

The author declares no conflict of interest.

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