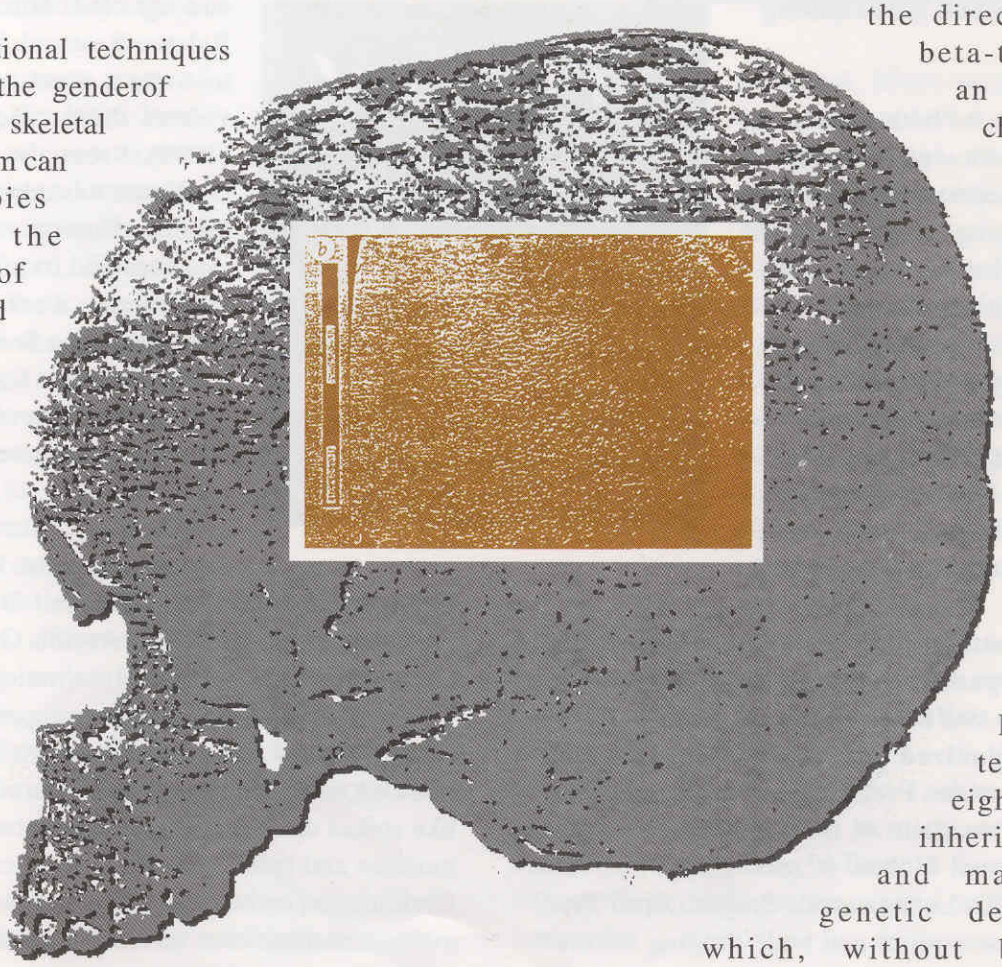
RESEARCH NOTES: DNA Windows on the Past

Despite technical difficulties, recent successes in using the polymerase chain reaction (PCR) to replicate many copies of minute samples of ancient DNA have opened many new avenues for exploring the past at the molecular level. In a landmark series of investigations, published in such prestigious journals as *Nature* (Genetics) and *Gene*, Prof. Ariella Oppenheim and her colleagues have refined and advanced molecular genetic techniques to peer into Israel's past.

For example, conventional techniques often fail to identify the genderof immature or incomplete skeletal remains. Prof. Oppenheim can create numerous copies of (amplify) the amelogenin gene of ancient samples and detect a small portion of that gene which appears only in the X chromosome but not in the, male only, Y chromosome. Their first study succeeded in determining the sex of 18 individuals living 200 to 800 years ago (out of 22 examined). Chelex purification of the DNA from minute samples of powdered teeth and cranial and long cortical bones (but not ribs) gave the best results.



The team then proved the archaeological importance of their methods in a study of Roman era infanticide in Ashkelon. There bones from over a hundred 1-2 day old infants were found haphazardly mixed with animal bones and potsherds in the sewer of a Roman bathhouse in use from roughly 300-600 C.E. None of the infants displayed skeletal abnormalities and their casual disposal contrasted strongly with the careful jar burial of another infant 200 yards away.

Archaeologists had hypothesized that the remai represented unwanted female babies. Prof. Oppenheim's team extracted the DNA from 44 left femurs avoid counting any child twice) and successfully identified the sex of 19 (43%) of them. In dramatic contradiction to prior predictions, 14 (74%) of the discarded infan were male! This raises new questions about the social basis of Roman infanticide.

Another landmark study involved the direct identification of beta-thalassemia major, an inheritable disease characterized by severe anemia and extensive bone pathology, in bone fragments from an Ottoman child (c. 1500-1800 C.E.) buried at Akhziv. The skull (shown) displays the pitting typical of this disease (see magnified insert), which is caused by mutations in the beta-globin gene. Prof. Oppenheim's team showed that the eight year old child had inherited similar paternal and maternal "beta null" genetic defects, a condition which, without blood transfusions usually results in death in early infancy. T team attributed the child's relative longevity to another mutation they found, a rare 2C➔T polymorphism one which is linked to elevated levels of feta hemoglobin.

This constitutes the first direct evidence for a geneti disease in a past society. Many ancient Israeli skeletons display symptoms of thalassemia. This may represent an ancient adaptation to the spread of malaria that may have accompanied the shift from hunting to agriculture in the Neolithic era.