Since 2010, *Yersinia pestis*, the pathogen currently causing plague, was confirmed by phylogenetic studies to have also been the causative agent of the pandemics of the past. Notwithstanding, several questions concerning the routes and modalities of dissemination from rodents to humans and from human to human remained open. With the project MedPlag (ERC-AdG MedPlag, grant agreement no. 324249, PI, BB), we aimed to address these questions by combining ancient DNA, ecological, historical and epidemiological studies. Using high-throughput methods to generate *Y. pestis* ancient genomes, we explored the phylogeny of the bacterium on its historical background (Namouchi et al. 2018, Guellil et al., in prep.). The results appear to be in support of the theory of plague having been introduced from time to time into Western Europe from Eurasia, and re-circulating among humans on trade routes – a theory which is also sustained by a climate study and a study on the Third Pandemic (1894-1940s) in Europe. The latter study proposes also that the current absence of plague from Europe is due to improved and effective hygienic and sanitation measures. This finding is consistent with different studies of MedPlag demonstrating that human ectoparasites may have played a major rule in sustaining re-circulation of plague among humans. An additional indirect confirmation of the diffusion of human ectoparasites in past Europe was the recovery of *Borrelia recurrentis* (causing louse-borne relapsing fever) in a 15th century skeleton from Norway. This project testify that an integrative approach to the study of infectious diseases which involves ancient DNA analyses may be of great importance to better understand the mechanisms underlying epidemic-prone infectious diseases of the past.

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Archaeogenomics in Caravate and Cittiglio (Lombardy): from the excavation of ancient human bones to the study of DNA

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A novel discipline, called archaeogenomics, studies ancient remains through the combined analysis of archaeological/anthropological and genomic data. Italy is particularly rich in ancient human remains dating to different eras and civilizations, in a chronological sequence that is unique worldwide. This national treasure is almost unexplored due to the scarcity of ancient DNA laboratories in Italy and the difficulty of establishing interdisciplinary efforts. The present study merges the expertise of two research groups: 1) the population genomics team at the University of Pavia, which recently set up an ancient DNA Facility 2) the Research Center of Osteoarchaeology and Paleopathology at the University of Insubria, which focuses on anthropological analyses of archaeological excavations in Lombardy.

This pilot project will have a local/national impact by developing a new model to enhance regional and national archaeological resources. Our model is based on an interdisciplinary approach by combining both studies of history/archaeology and technological innovation in life science. Major goals are: (a) excavation interventions, anthropological study of human finds and archaeological restoration; (b) genomic survey of excavated human bone remains. In details, the research program is performing genomic analyses of remains excavated at the archeological sites of Cittiglio and Caravate (Varese, Lombardy). Forty bones have been selected by the research team based on the following criteria: petrous bones, when available, were selected as preferential DNA sources, followed by teeth and long bones; individuals with peculiar anthropological features were primarily selected.

Molecular analyses will be carried out in the ancient DNA Facility at the University of Pavia. DNA will be extracted minimizing contamination risks and genomic libraries for the Next Generation (NG) sequencing will be obtained as in Bioinformatic tools will be applied to the initial outcome of the sequencing (row reads) to check the presence of endogenous DNA and to obtain shot-gun low-resolution genomes. Finally, these ancient genomes will be compared each other and to a world wide dataset of available genomic data from

Italy, Europe, the Middle East and North Africa in order to highlight genetic affinities and/or peculiarities and to reconstruct the ancestry and genetic affinities of the buried individuals.

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Health condition and social status in the Roman Imperial Age

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Enamel hypoplasia is a developmental defect occurring during dental crown formation and represents episodes of arrested growth in infancy or childhood while the tooth is still developing. Examination of Linear Enamel Hypoplasia (LEH) received significant attention in the paleopathological literature for its relationship with malnutrition and diseases. Analysis of hypoplastic lesions in skeletal remains provides an excellent index to evaluate the health and living conditions in ancient populations.

In this research, the prevalence and distribution of LEH were investigated in the skeletal remains from two large necropolises in Rome (Italy, 1st- 3rd century AD) with the aim to evaluate the relation between social status, health, and nutritional conditions of the Romans during the Imperial Age. Both necropolises, Collatina and Casal Bertone, are located near the ancient centre of Rome and the presence of different typologies of graves, with monumental mausoleums and simple tombs, testifies the presence of stratified social classes.

The skeletal remains of 177 individuals were selected on the basis of their grave typologies and funerary equipment and assigned to low social class or medium-upper social class. LEH was detected in 3,105 permanent teeth and differences were found between anterior and posterior teeth, male and female samples, upper and lower social classes.

Developmental defects were significant more frequent in teeth and in individuals from the lower than the upper class, in both sexes and ages. The mean number of stress episodes for individual and the mean number of lines for tooth were also higher in the lower class.

The age of onset of the stressful events that caused the defect was determined on the basis of the localization of hypoplastic lines on the dental crown. The chronological distribution of the age shows differences among the two social classes and might be related to the different social conditions involved in LEH occurrence. Comparison among the dental categories revealed that the anterior teeth are more affected than the posterior, and canines are more sensitive in terms of registration of defects.

Examination of LEH as stressful indicator, in two subsamples with different subsistence patterns, allowed us to detect differences related to the social status, indicating that the socially advantaged group enjoyed better health in the Roman population during the Imperial Age.

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Funerary rite and body treatment in the ancient town of Adulis, Eritrea

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