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# Laboratory of 3D Imaging and Analytical Methods

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## Offer

- High resolution scanning of any object, human skull or other part of the human body
- Expertise in virtual anthropology, i.e., acquisition, analysis of different types of 3D data (sets of points, curves, surface and volume models), statistical analyses, documentation and interpretation of results
- Expertise in human growth and development with an overlap into biomedicine (e.g., comparison of the human body's morphology with respect to therapy, development of standards of human body development)
- Expertise in forensics and bioarchaeology (estimation of demographic indicators such as age, sex and height, reconstruction of missing bone parts, facial reconstruction using the skull, analysis of tooth microstructure and diet reconstruction of historic populations)
- Whole body composition analysis (bioelectrical impedance analysis)

## Know-how & Technologies

### Scanning with Surface Scanners

- Laser scanning
- Structured-light scanning
- Scanning of living or non-living objects

### Post-processing

- Acquisition, processing, interpretation of results of landmark, curvature, surface and volumetric data
- Data analysis (landmark, curvature, surface, volumetric data) with geometric morphometric methods

### Analysis of Body Composition of Living Humans

- Measuring body composition using bioelectrical impedance analysis

## Content of Research

### Human morphology and variability

- Morphological comparison of the human body, its parts in time and geographical horizons, norms and pathologies
- Research in facial morphology in orofacial cleft disorders and rare syndromes
- Monitoring ontogenetic development of the face, including senescence changes and facial asymmetry
- Development of prediction systems for aging or rejuvenating the face for the purposes of forensic science

### Biological Profile of an Individual

- Analysis of the human skeleton (most frequently the pelvis and skull) for determining sex
- Analysis of 3D models of articulation surfaces for estimating age
- Estimation of body mass using long bones
- Virtual reconstructions of fossil skeletal material for use in bioarchaeology and forensic anthropology

## Key Research Equipment

Our fully equipped and modern laboratory uses a wide range of software and hardware. We have several surface scanners for digitizing different surface types.

### Full-body/facial Scanners and Suitable for Nonliving Objects

- 3dMDface System
- Scanner Vectra 3D
- HP 3D Structured light scanner PRO S3
- Laser scanner Breuckmann smartSCAN
- Roland Picza 3D Laser Scanner LPX-1200DS and LPX250

- Contact scanner MicroScribe G2X

## Other Equipment

- Morphome3cs  
- Rapidform  
- Amira  
- Rhinoceros  
- InBody 230

## Partnerships & Collaborations

### Academic Partners

Faculty of Mathematics and Physics at Charles University | Second Faculty of Medicine at Charles University | Czech Technical University in Prague | Institute of Archaeology of the Czech Academy of Science | National Museum, Prague | University of Coimbra | University of Bordeaux | Paul Sabatier University – Toulouse III | University of Aix-Marseille II (Méditerranée) | University of Geneva | Autonomous University of Madrid | University of the Basque Country | Adam Mickiewicz University Poznań | Comenius university, Bratislava | Slovak national museum, Bratislava

### Private and Public Sector

Plastic Surgery Clinic, Third Medical Faculty and Faculty Hospital Královské Vinohrady

## Main Projects

- **2018–2020:** “Classification of sex using skulls, soft tissue depth and craniofacial senescence: 3D modelling in virtual anthropology”  
- **2018–2020:** “Using 3D models of the articular surfaces of pelvic bones to estimate age at death in a skeleton”  
- **2017–2019:** “Lifestyle and identity of the Great Moravian nobility: archaeological and bioarchaeological analysis of the evidence of Mikulčice’s uppermost elites”  
- **2017–2019:** “Reconstruction of fossil hominin pelvises from the Late Pleistocene: palaeobiological and functional interpretations”  
- **2016–2018:** “Human diet in the early medieval period: synthesis of stable isotope analysis and dental microstructure and its relationship to social stratification”  
- **2016–2018:** “Forensic identification and progression/reversion of age in children and juvenile individuals using 3D facial modelling of surface data: complex and *per partes* method”

## Achievements

- Procured devices and software equipment for 3D data imaging and analysis  
- Created an extended and unique database of (1) surface scans of faces of the Czech population, including selected facial expressions (transversal and longitudinal data), (2) virtual models of human palates and faces of patients with craniofacial malformations, (3) CT scans of heads and other bones of the contemporary population, (4) virtual models of fossils or skulls and bones of different prehistoric and historic periods  
- Proposed and created the software Morphome3cs II in collaboration with the Faculty of Mathematics and Physics at Charles University. This software processes landmark and curvature data as well as whole surfaces of models  
- Multidisciplinary collaboration to introduce neonatal cheiloplasty as the preferred surgery for patients with orofacial clefts  
- Developed standards for the Department of Biology and Medical Genetics, 2nd Faculty of Medicine, Charles University and Motol University Hospital  
- Developed standards for the Plastic Surgery Clinic, 3rd Medical Faculty and Faculty Hospital Královské Vinohrady  
- Created prediction models for estimating sex and age based on dentition  
- Published articles in high impact international journals on anthropological, forensic and biomedical topics (e.g., American Journal of Physical Anthropology, Forensic Science International, International Journal of Legal Medicine, PLOS One, American Journal of Human Biology, International Journal of Pediatric Otorhinolaryngology, Legal Medicine)

## Are you interested in this expertise?

Please contact CPPT UK

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## Experts and their department

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