BIRTH

Births, mothers and babies:

Prehistoric fertility in the Balkans between 10000-5000 cal BC

BioSense INSTITUTE

BIRTH

Births, mothers and babies:

Prehistoric fertility in the Balkans between 10000-5000 cal BC

The current world population of c. seven billion people is the living testimony that the human race paradoxically thrived despite the complexities of birthing. In fact, our species managed to achieve an increase in fertility already in the prehistory, thousands of years before the modern technologies. Although this major demographic shift, known as the **Neolithic Demographic Transition**, was fundamental for the human survival and further development of the civilization, it still remains unknown how it happened.

This important paradox of our species - **that humans managed to achieve an increase in fertility in prehistory, despite the evident difficulties and risks accompanying parturition,** is investigated by the BIRTH project.

The BIRTH project develops an integrative framework for **understanding biological and cultural mechanisms which affected the prehistoric fertility**, and investigate skeletal, nutritional, and cultural effects on fertility rates between 10000-5000 BC in the Central Balkans.

BIRTH is the first project supported by the European Research Council in Serbia and hosted by the BioSense Institute in Novi Sad, the first European Centre of Excellence outside the EU. Principal investigator of the BIRTH project is Sofija Stefanović, the professor of physical anthropology and leader of the bioarchaeology group at the BioSense Institute.

Cover page photo:
Neolithic figurine with baby,
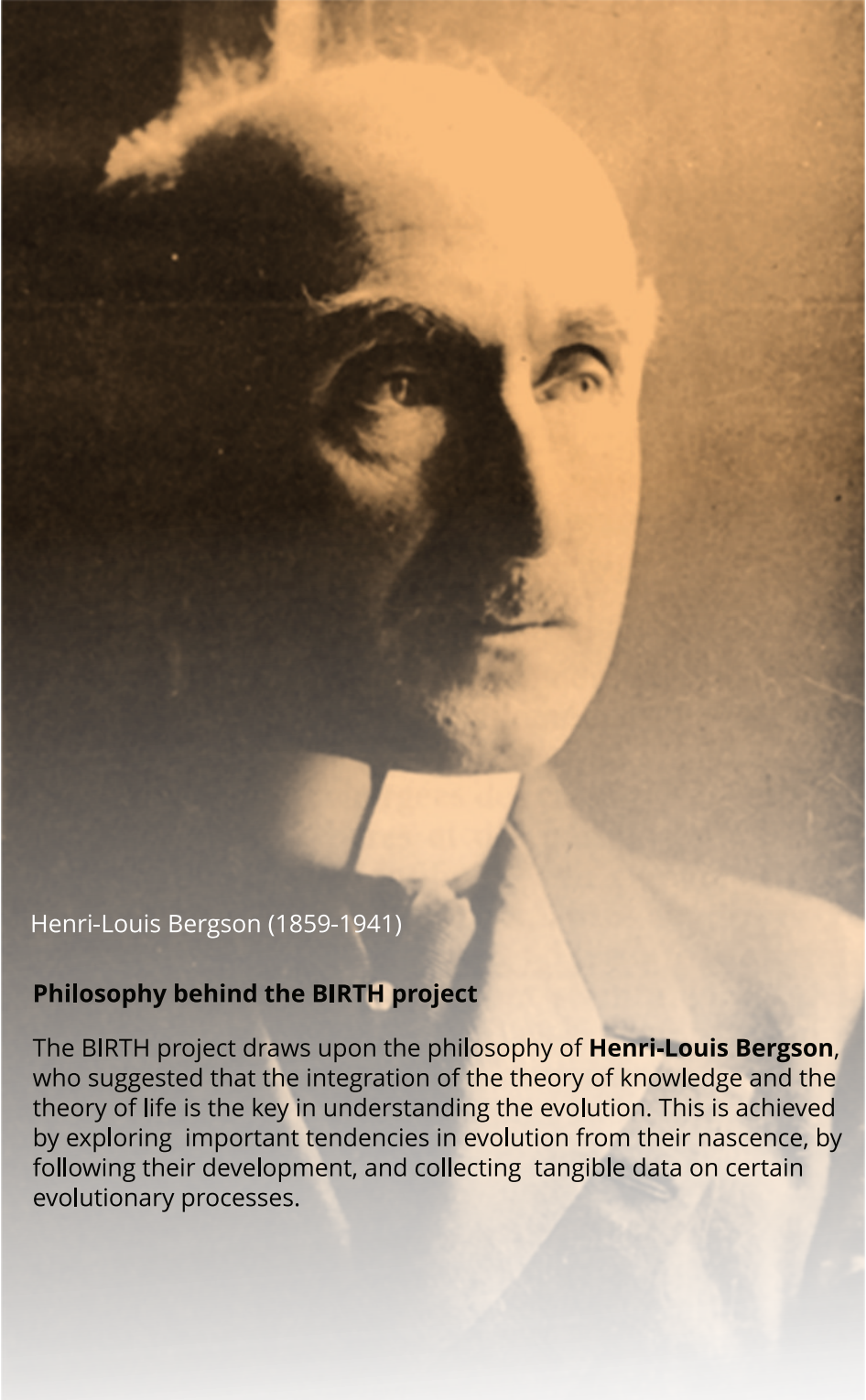*Regional museum of Jagodina, Serbia*

Sculpture named *Vulva* was placed near the hearth of the house at Lepenski Vir, and was described as a "womb before giving birth". (National museum, Belgrade.)
Photo: A. Radoman

Henri-Louis Bergson (1859-1941)

Philosophy behind the BIRTH project

The BIRTH project draws upon the philosophy of **Henri-Louis Bergson**, who suggested that the integration of the theory of knowledge and the theory of life is the key in understanding the evolution. This is achieved by exploring important tendencies in evolution from their nascence, by following their development, and collecting tangible data on certain evolutionary processes.

The BIRTH project sees the complexities of birthing as some of the main issues in the human evolution because the things that make us human - bipedalism and a large brain are the ones ensuring that from the beginning of the human evolution the birthing process is extremely difficult and risky for both mothers and babies.

The BIRTH project is investigating this issue and collecting biocultural data about it during one of the most important periods in human evolution, the period in which the demographic increase occurs for the very first time. Presuming that similar biological and cultural mechanisms affected fertility rates throughout the course of human evolution, the study of these mechanisms is of crucial importance for the understanding of both ancient and modern fertility.

The main aims of the project BIRTH project are:

1. To establish the pattern of birth rates between 10000–5000 BC in the Balkans

2. To investigate micro and macronutritional values of prehistoric foodstuffs

3. To simulate possible scenarios of fertility increase during the Neolithic

4. To explore the role of prehistoric culture in fertility increase

The BIRTH project has 4 work packages and human, animal, plant, and archaeological remains studied come from around 400 Mesolithic and Neolithic sites in Serbia.

European Research Council and BIRTH

Although the births, mothers, and babies present key pillars in human survival, their role has not been adequately studied either by physical anthropology or archaeology. It is important to note that ERC recognized importance of the birthing topic which will help to move the ancient mothers and babies from the margins of contemporary science into the limelight.

Being 'investigator-driven', the ERC approach (https://erc.europa.eu) allows the BIRTH project to develop new research field - bioarchaeology of fertility. BIRTH results will represent the first direct data on number of pregnancies and duration of reproductive period of prehistoric females, and create novel pathways for the study of ancient fertility.

Until today, ERC supported 5000 excellent projects, but only few of them from the Balkans, and the BIRTH project as well as the BioSense institute are devoted to improving this situation, as both are active participants in various local and EU efforts in this direction.

The host of the BIRTH project, the BioSense Institute (https://biosense.rs) is an internationally recognized multidisciplinary research institute and the most successful participant in FP7 and H2020 projects from Serbia. Research and innovation excellence of the BioSense Institute is recently confirmed when ANTARES project, led by professor Vesna Crnojević Bengin, ranked first in the most competitive European Teaming H2020 call and provided 28 million Euros as an investment in Serbian science.

BioSense is focused on development, introduction, and promotion of advanced ICT solutions and dedicated to understanding the diversity, variability, and functioning of various biosystems. Considering that BIRTH project is focused on ancient biosystems, such as human, animal, and plant remains, in 2016 BioSense established new **bioarchaeology research group**.

The aim of the bioarchaeology group is to investigate the ancient biosystems in order to understand the phenomena relevant for the modern populations - i.e. fertility, fetal development, and the effects of (micro)nutrients on health and pregnancy. Ancient biomaterials await on this new horizon as a vast unread library and as a priceless biological heritage of past humans.

BIOLOGY OF FERTILITY

This part of the project investigates skeletal indicators of pregnancy and paleoobstetric traits of females and neonates, as well as the health and nutritive status of the population as a whole.

Skeletal evidence of fertility: investigation of the variability in the pattern of birth rates (number of pregnancies, interval(s) between them, and the duration of the reproductive period) through histological analysis of irregularities in tooth cementum.

Body, health and micronutrition: analysis of pelvis and neonatal skeletons will determine whether the Neolithic saw a change in body proportions that could have had a positive effect on birth success. Micronutrients are of particular importance for babies, pregnant, and lactating women and our aim is to determine the concentrations of elements (Iron, Zinc and Calcium) which are vital for growth, development, and fertility.

PREHISTORIC MACRO AND MICRONUTRITION

The aim of this segment of the project is to determine the macro and micro nutritive potential of diet, and to correlate obtained results with data on human health, body proportions, and fertility.

Evidence from animal bones: existing and newly obtained archaeozoological data from Early-Middle Holocene sites will be integrated in order to reconstruct macro and micro nutritive values of animal products used in human diet. The project will establish chronology of animal domestication, i.e. introduction of milk and dairy which probably have had consequences on human biology.

Archaeobotanical micro-remains: although the shift towards diet rich in carbohydrates is often cited as one of the key causes of NDT, data on the introduction and availability of carbohydrates in the Early Neolithic is scarce. The project will analyze micro-archaeobotanical remains from dental calculus and artefacts used in food preparation and consumption in order to understand the outset of plant cultivation and consumption.

BIRTH
Births, mothers and babies:

SIMULATION AND MODELING

Summed radiocarbon probability distributions: simultaneously with estimates of individual fertility, we will reconstruct population dynamics, by using the method of summed radiocarbon probability distributions. The existing database of 380 Early Neolithic sites will be employed in order to define a spatial/chronological unbiased sample of 300 new radiocarbon dates.

Testing hypotheses on the interaction of demographic and cultural processes: the project encompasses a wide range of methodological approaches at various levels and we will use computer simulation and modelling as instruments for testing complex hypotheses regarding the interaction between demographic and cultural processes.

ARCHAEOLOGY OF BIRTHING

The attitudes of the community towards pregnancy, birth, and neonatal care could have played a key role in the success of the birthing process. BIRTH will construct a methodological framework for the research on the archaeology of birthing by investigating the artefacts connected to birthing, motherhood, and childcare.

House as the new birthing arena: the appearance of the first dwellings in Neolithic and giving birth in a sheltered, warm, and lighted place, could have been a significant factor in the newborn survival rates. Analysis of the thermal characteristics of prehistoric houses will provide information about thermal conditions for birthing.

Neonate burials: Assuming that burial practices connected with neonates reflect the concern of the community for the babies, and assuming that communal concern is the foundation for the success of birthing process, neonate burials will be analyzed.

Figurines: in order to explore the extent to which the topic of birthing was present we will analyze the Early Neolithic figurines - their formal attributes, context of deposition, and use will shed more light on their association with fertility or lack thereof.
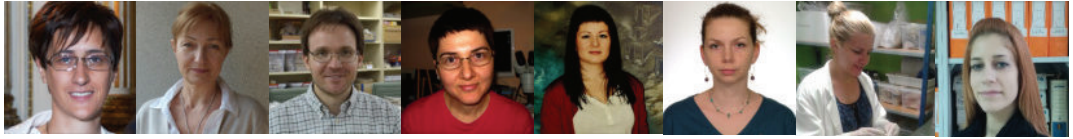
TEAM

Dr Sofija Stefanović, Professor, ERC BIRTH Principal investigator

Physical anthropologist coordinates the project and investigates the skeletal paleoobstetric evidences, neonatal growth and development, and the role of macro and micro nutrients in reproductive success and health. Also she is exploring possible archaeological indicators of prehistoric community concern for birthing and baby care.

Dr Vesna Dimitrijević, Professor, Senior ERC Researcher

Archaeozoologist, coordinates analysis of animal remains and investigates different aspects of the significance of animals for human communities during the early stages of animal domestication.

Dr Marko Porčić, Associate Professor, Senior ERC Researcher

Archaeologist, coordinates the reconstruction of population dynamics and develops methods for reconstruction of demographic aspects of *prehistoric* populations based on skeletal and other kinds of archaeological evidences.

Dr Dragana Filipović, Senior ERC Researcher

Archaeobotanist, investigates the use of **plants,** their role in the diet and economy, and the scale and intensity of crop cultivation at the time of the emergence and spread of agriculture.

Ivana Živaljević, ERC Researcher

Macro and micronutritive potential of diet, specially the role and effects of aquatic diet on human health and fertility.

BIRTH
Births, mothers and babies:

Kristina Penezić, ERC Researcher

Skeletal evidence of fertility through the analysis of irregularities in the tooth cementum which occurs in pregnancy, namely in the width and the degree of mineralization of incremental lines.

Jelena Jovanović, ERC Researcher

Skeletal evidence of health and nutrition and paleoobstetric data through the analysis of the pelvic and neonatal bones by using geometric morphometrics.

Tamara Blagojević, ERC Researcher

Reconstruction of population dynamics by using the method of summed radiocarbon probability distributions.

Ttrapezoid house at Lepenski Vir (around 6200 Bc), one of the sites investigatet in BIRTH project

BIRTH

BIRTH project is not only about the past. Lessons about the prehistoric fertility could be important for the modern humans as well, because the mechanisms of human fertility are the same from the beginning of our evolution until today.

Sofija Stefanovic, Pi of the ERC BIRTH project

BioSense Institute
University of Novi Sad

http://biosens.rs
sofija.stefanovic@biosense.rs

BioSense INSTITUTE