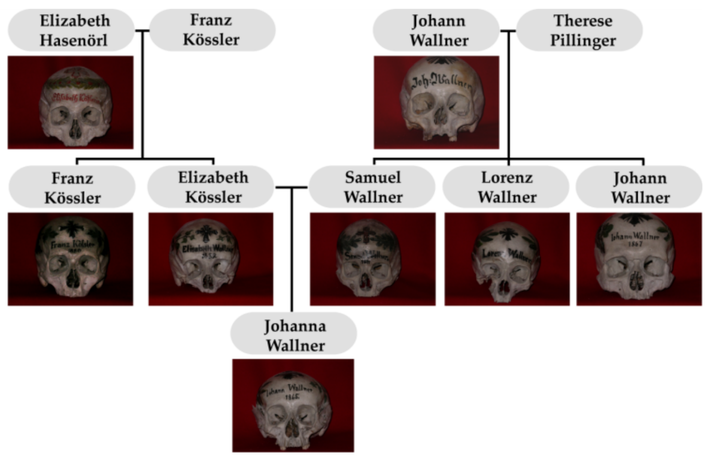

A comparison between heritabilities of life history and morphological traits in human populations

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INTRODUCTION

Life history traits, closely associated to fitness than morphological traits, and heavily influenced by environmental factors, should be under stronger selection. Therefore, life history traits should show lower additive genetic variance (heritability) than morphological ones, although it could be significant.

Our goal in this work is to compare the heritability (additive genetic variance) of morphological and life history traits in the population of Hallstatt (Austria).

THE POPULATION

Hallstatt, one of the oldest settlements in Austria, is placed at about 75 km south-east from Salzburg, in the province of Upper Austria, on Hallstatt lake (Fig. 1). The main economical activity since 1300 B.C. and during the analyzed period was salt minery.

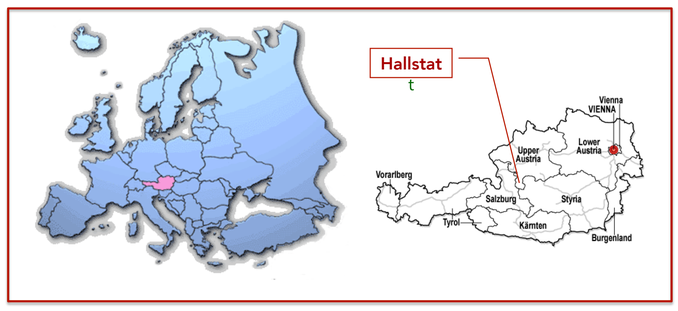

Fig 1. Location of Hallstatt

MATERIAL AND METHODS

• **Life history traits:**

We reconstructed the genealogies of the population of Hallstatt from the Catholic parish records of births, deaths and marriages from 1602 to 1900. We have analysed a total of 18134 individuals. We calculated Lifetime reproductive success as a measure of fitness, and we obtained four life-history traits: fertility, age at first child, age at last child and reproductive span.

• **Morphological traits:**

We analysed a sample of 353 adult skulls of both sexes from the Hallstatt decorated skulls collection. We recorded 65 anatomical landmarks on each skull with a 3D digitizer and we estimated 8 distances.

• **Heritabilities:**

We used maximum-likelihood methods to estimate variance components and heritabilities of all measures with the SOLAR software package.

RESULTS

Variables			Covariates	
Trait	h^2	*p*	Variance explained	Significant covariates
Morphological traits				
Facial height	0.34	0.002	0.15	sex
Facial lenght	0.32	0.001	0.14	sex
Facial breadth	0.28	0.008	0.43	sex, year of birth
Neurocranial height	0.24	0.016	0.18	sex, deformation
Neurocranial lenght	0.31	0.002	0.18	sex
Neurocranial breadth	0.36	0.002	0.17	sex, year of birth
basicranial length	0.24	0.003	0.17	sex
basicranial breadth	0.29	0.005	0.20	sex
Life history traits				
LRS	0.03	0.1	0.21	year of birth
Fertility	0.14	0.01	0.28	year of birth
Age at first child	0.36	0.09	0.17	year of birth
Age at last child	0.00	0.5	0.24	sex, year of birth
Reproductive span	0.10	0.15	0.18	sex, year of birth

CONCLUSIONS

• The heritability values observed on life-history traits for our population are clearly lower than those observed for morphological traits, confirming classical evolutionary theories predictions.

• Fitness measures present very low heritabilities in Hallstatt's pretransitional population. This might be due to the expression of cultural and environmental factors.

• Age at first child is the only life history trait with an appreciable heritability.

• Year of birth is the most important covariate included, reflecting the effect of the temporal span and its environmental variation in the life history of individuals.

• Cultural, economical and other environmental factors seem to have a great influence in the life histories of Hallstatt inhabitants. Thus, our aim for future studies is to obtain social data of the inhabitants like social status, religion, etc. that we can fit in the study as fixed effects.

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