



# Expression of Sexual Dimorphism Among the German, Irish, and Italian Ancestry Groups in the Huntington Collection

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## Introduction

Sexual dimorphism in humans is expressed in the difference in stature and robusticity between males and females. The degree of sexual dimorphism varies from population to population. However, various articles suggest that environmental factors have an impact on the expression of sexual dimorphism in a population<sup>8,9,10,11</sup>. One of these environmental factors is nutrition. The access of nutrition, in industrial societies, is often correlated to social economic status. Tanner claims that "in industrialized society height is clearly linked with upward social mobility"<sup>10</sup>. Migration waves are a perfect exemplar of social mobility and stratification.

The migration waves to America during the late 1800's early 1900's, brought various European groups such as the Germans, Irish, and Italians. These consecutive waves of immigrants provided upper mobility to the older immigrants, while the newer immigrants became marginalized.

The Huntington collection was assembled by George S. Huntington, a professor of anatomy at Columbia University<sup>3</sup>. The collection is composed of unclaimed immigrant bodies from 1893-1921<sup>6</sup>. The individuals in the collection are of known age, sex, and ancestry<sup>3</sup>.

## Materials and Methods

Femora and humeri were selected for this study because of the femora's contribution to height and the humeri's usefulness for sex estimation<sup>11</sup>. These elements would therefore be good indicators for sexual dimorphism. Measurements of the femora and humeri were taken with an osteometric board and digital sliding calipers, following Ubelaker and Ruff<sup>2,7</sup> (Figure 2 and 3).

The sample size was a total of 252 individuals: German females (28), German males (50), Irish females (50), Irish males (50), Italian females (24), Italian males (50). The left elements were preferred for measurements, but if not present then the right would be measured. Individuals were excluded from the study due to: neither humerus and femur were present, elements contained pathological conditions that would obscure the site of measurements, and/or the elements were severely deteriorated.

The data collected from the measurements were analyzed using the programs *R* and *PRISM*. Sexual dimorphism in terms of robusticity was assessed by regressing robustness-related variables such as femoral head diameter or humeral epicondylar breadth against bone length, using sex as a factor. In these regressions, the magnitude of sexual dimorphism is measured by the difference in intercept between the male and female regression lines (Figures:4,5,6,7,8,9,10,11). In order to test if dimorphism differed across ancestry groups, we added terms that allowed for sex by ancestry interaction. If sexual dimorphism differs substantially across ancestry groups, then interactional terms should be significant and the model with interactions should be a substantial improvement over the simpler model.

## Results

Clear and significant sexual dimorphism was detected in the three populations (Figures:5,6,7,9,10,11). However, the magnitudes of sexual dimorphism were similar across ancestry groups; interactions terms were all non-significant and overall, the model that allowed dimorphism to vary across groups did not result in significant improvement in model fit ( $F = 0.42, df = 4, P = 0.79$  for humerus;  $F = 0.521, df = 4, P = 0.72$  for femur).

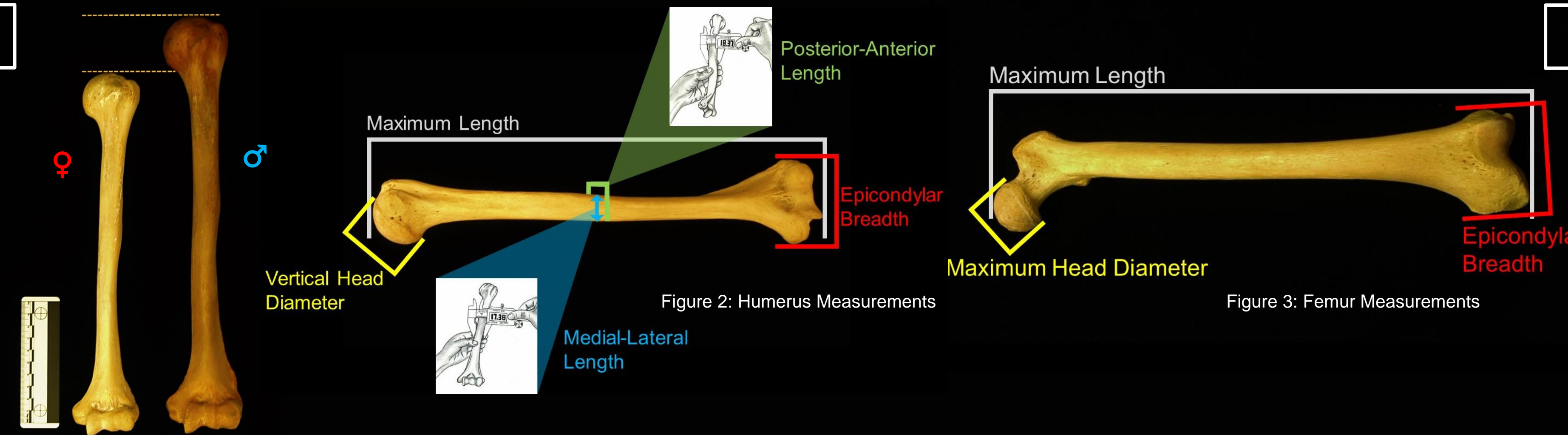


Figure 1: Left humeri of German female vs. German male

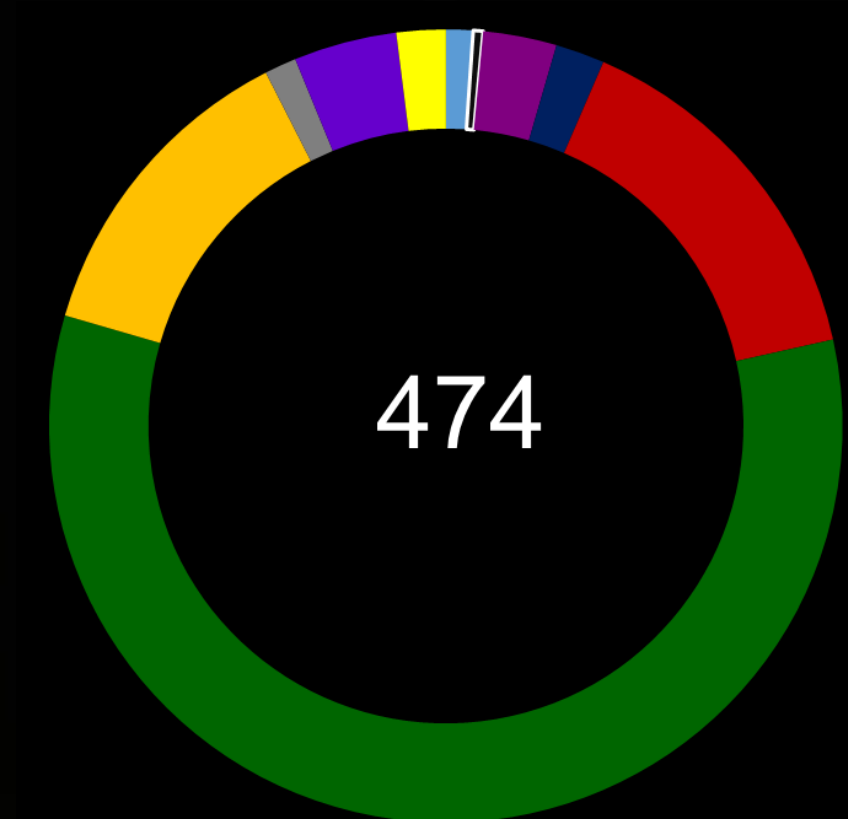
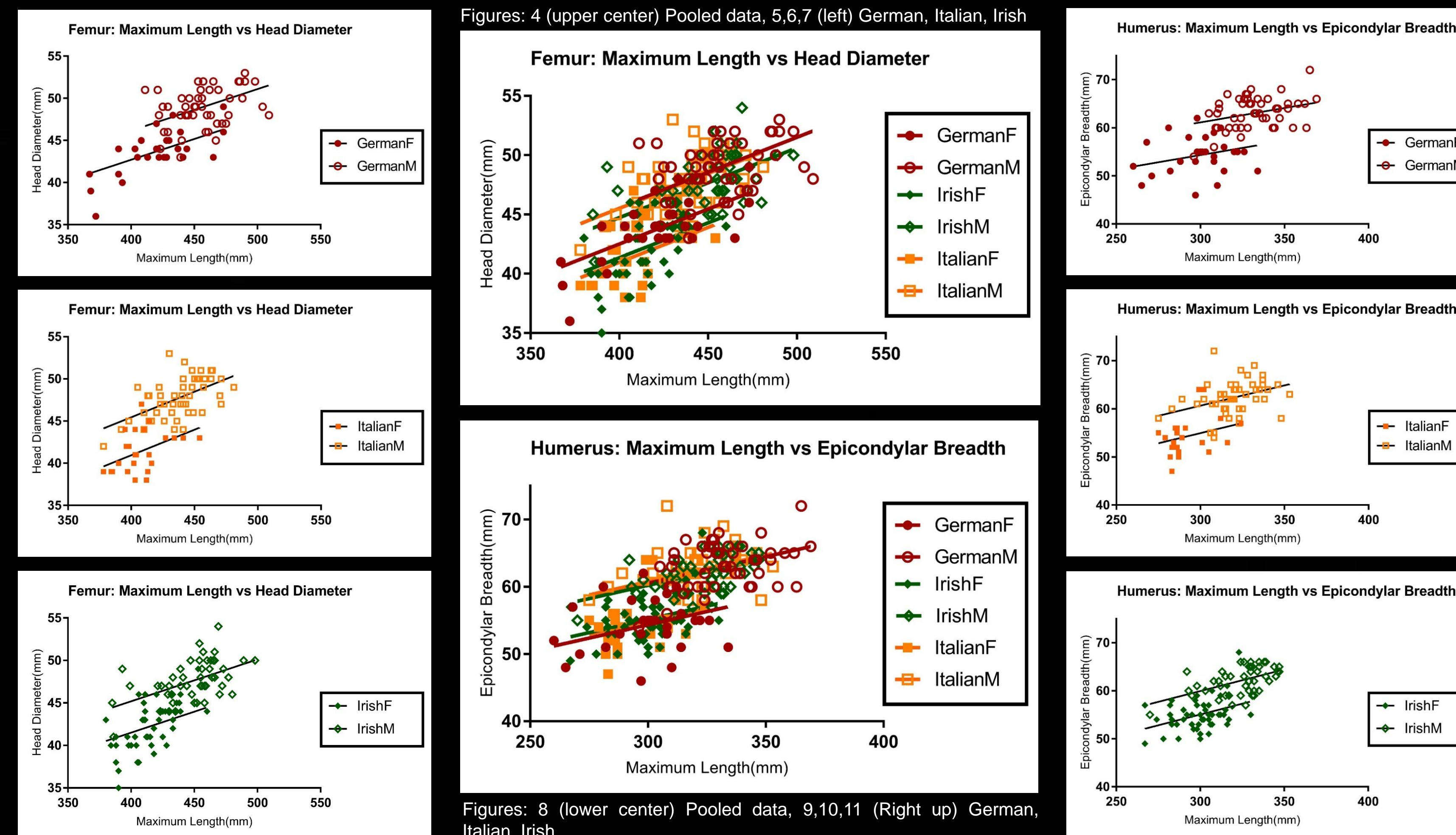


Figure 12: Female distribution in collection

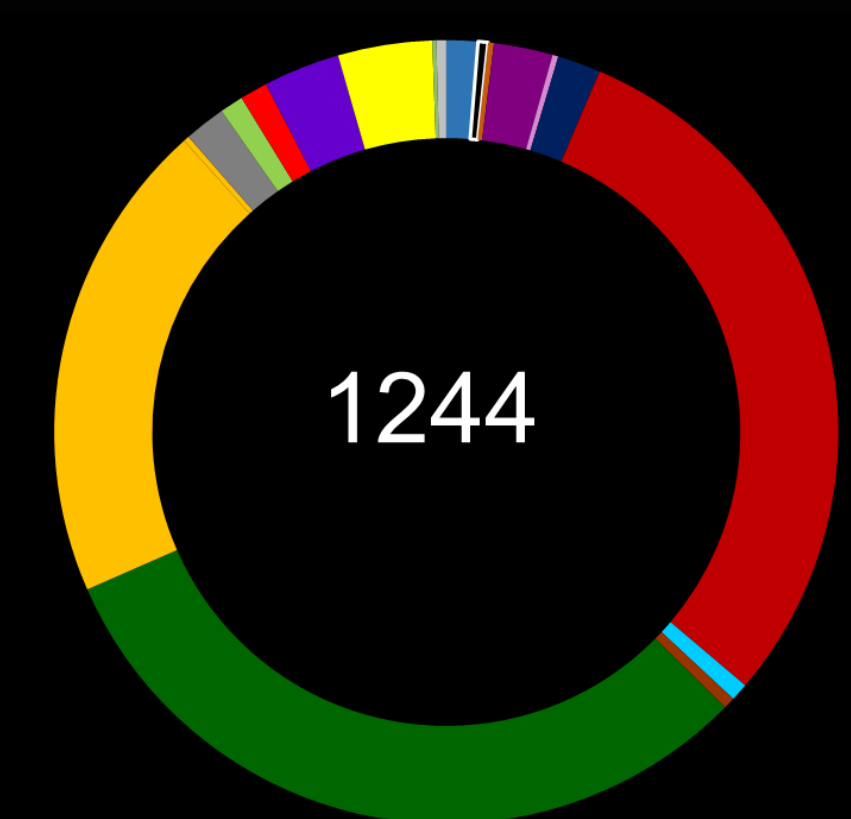


Figure 13: Male distribution in collection

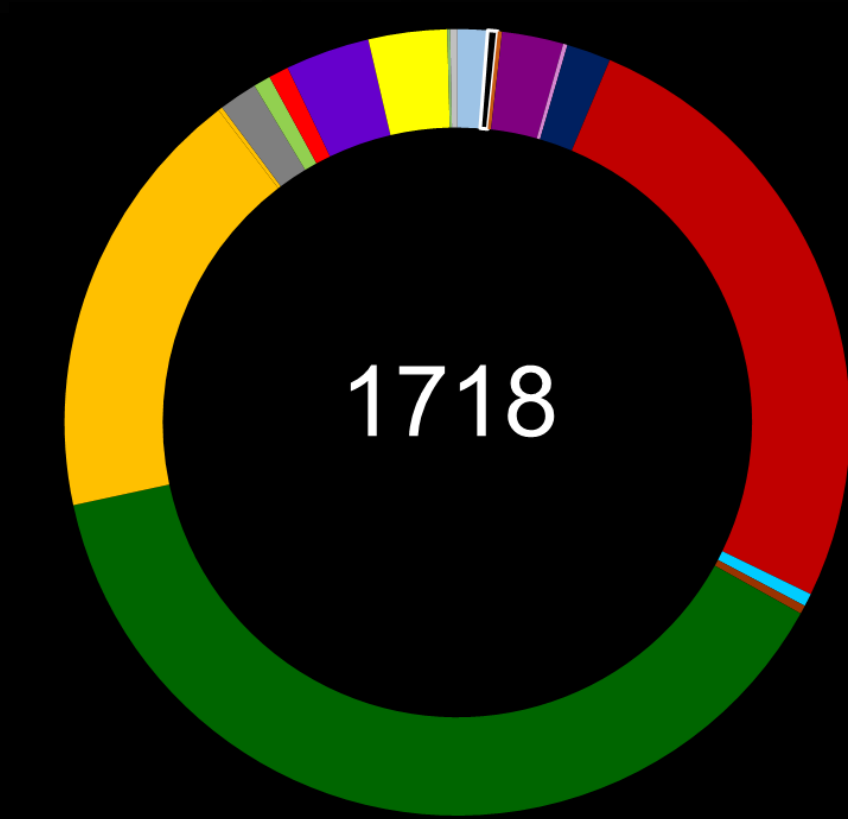


Figure 14: Total distribution in collection

## Discussion

We did not detect significant differences in sexual dimorphism among the three ancestry groups. The lack of significance may be partly a result of low statistical power caused by the low sample size of German and Italian females present in the collection. It may also be attributed to some inaccurately sexed individuals in the collection and/or the commingling of remains.

Despite the statistical results, the distribution of the Huntington collection reflects the activities and demographics of these immigrant groups (Figures:12,13,14), since the collection was assembled through the use of unclaimed bodies. These bodies were often from lower economic status individuals whose kin were absent or could not afford to pay for the burial cost. Among these lower economic groups were the Irish and Italians.

The Germans were one of the first immigrant groups to arrive to America and quickly assimilated into American society and improved their economic status. The Irish were the second largest group to migrate to America. They came during the potato famine which resulted in the death of one million people and diseases such as typhus and cholera spread among the remaining population<sup>6</sup>. In order to reduce the spread of disease, landlords began to clear their estate by paying for their tenants to immigrate to another country<sup>4,5,6</sup>. The Irish were forced out of their country in order to escape famine and disease. The Italians were also afflicted by famine due to the grape vine blight and migrated to America in search of economic opportunity. However, the arriving Italians "participated in remigration [...] and had only temporary plans to work before returning to Europe"<sup>8</sup>. Only 2 million out of the 4.5 million Italians who migrated to America permanently stayed in America<sup>1,6</sup>.

The lack of Italian individuals in the collection is explained by their migratory activity. Meanwhile, the large portion of Irish in the collection reflects their social economic status and their permanence in the U.S. The Germans also composes a small portion of the collection due to their overall high economic status in society.

## Future Research

Further research in this area would be to acquire a larger sample size of German and Italian females in order to ensure if there is sexual dimorphism expressed within these three ancestry populations. In addition, collecting data on first generation German, Irish, and Italians would be interesting in order to compare the respective immigrant groups in order to observe secular change.

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