ADVANCED ENVIRONMENTAL SCIENCE

The human journey

from the Esri GeoInquiries™ collection for Environmental Science

Audience – Advanced environmental science **Time required – 12 minutes**

Activity	This activity follows the path of human migration from Africa to the far reaches of the globe.
Science Standards	**APES III. B.1.** Human population dynamics (historical population sizes; distribution)
Learning Outcomes	• Students will use genetic factors, such as blood type or a simplified version of genetic markers, to explain where human characteristics originated.

Map URL: http://esriurl.com/enviroGeoinquiry14

Engage

How did humans come to dominate the planet?

– Post Darwin's "On the Origin of Species," scientists worked to put organisms into classes. First attempts to organize humans sought continental similarities between people.

→ Click the map URL above to open the map.

→ With the Details pane visible, click the button, Show Contents of Map.

→ Click the map notes near each of the continents.

? What traits could be used to differentiate people from different continents? *[Answers may include hair color and texture, height, skin color, and facial bone structure.]*

? What has been happening to these distinctions over the past 200 years? *[Global migrations are increasing the variety of features seen in local populations but blurring regional patterns in traits.]*

→ Turn off the layer, Continental people Groups

Explore

What do blood-type distributions tell us?

– Blood types, discovered in 1901, predict who can share blood without clotting and killing the recipient. Within 20 years, A, B, and O patterns were determined globally.

→ Turn three layers on and off as needed for the following questions: Type O Blood Distribution, Type A Blood Distribution, Type B Blood Distribution.

? What blood type is most prevalent? *[O blood type]*

? Would this give evidence to which blood type was the founder and others the mutations? *[Not conclusively, but it supports a theory of Type O being the original blood type.]*

Explain

How did blood get us closer to the heart of the matter?

? What patterns occur in blood types? *[Type A is concentrated in Europe, B in Asia, and O in Americas.]*

? Where is Type A blood likely to be found? *[Europe, Australia, and northern Alaska/Canada.]*

? Could any of these areas be explained by recent historic migrations of A blood types moving in? *[Australia and the eastern/central U.S. could be a legacy of European blood types due to recent immigrations. Northern Canada could have possibly been influenced by arctic nomadic populations that also settled near Scandinavia.]*

more ▶

Elaborate

Why do those living in the Americas have such similar blood types?

– Mitochondrial DNA mutates at rates higher than DNA from the cell nucleus. This leaves recognizable patterns in how long populations have been separated.

→ Turn on the layers, Human Migration from Africa and Austronesian Expansion.

? Does the blood type distribution of the Americas match where these populations originated? *[No, but a small set of related individuals from these areas might, as Type O is still the dominant blood type in Asia.]*

? What might explain why Native Americans have such an overwhelming prevalence of O blood types? *[The founder effect with a high percentage of O blood types; O populations in Europe, Asia, and Australia faced selective elimination due to disease allowing A and B types in Eurasia to become more prevalent.]*

Evaluate

What other blood types variations could be added to the map?

? What other old-world disease information can you find to look for spatial relationships to these blood types? *[O blood types have been shown to be more susceptible to diseases like Cholera, gut bacterial infections (E. coli or H. pylori in ulcers), malaria, the plague, or smallpox.]*

IDENTIFY A MAP FEATURE

- Click any feature on the map, and a pop-up window will open with information.
- Links and images in the window are often clickable.
- An arrow icon in the upper-right of the window indicates that multiple features have been selected. Click the button to scroll through the features.

TURN A MAP LAYER ON AND OFF

- Make sure that the Details pane is pushed, and click the button, Show Contents Of Map.
- To show individual map layers, select the check boxes next to the layer names. If a map layer name is light gray, zoom in or out on the map until the layer name is black. The layer can now be turned on.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at http://www.esri.com/schools.

THEN TRY THIS...

- The *Columbian Exchange* GeoInquiry from the U.S. History collection and the *Slowing Malaria* GeoInquiry from the Advanced Environmental Science collection show diseases and the genetic response. For more information, visit http://esri.com/geoinquiries.
- Learn more about *The Age of Humans* with a story map at http://esriurl.com/Geo5172.

TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these texts.

- *Evolution and Biodiversity by Miller — Chapter 5*
- *Patterns of Inheritance by Campbell — Chapter 9*
- *Evolution of Biodiversity by Friedland/Relyea — Chapter 5*

Version Q3 2019. Send feedback: http://esriurl.com/GeoInquiryFeedback

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