

Open Schools Journal for Open Science

Vol 3, No 10 (2020)



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doi: [10.12681/osj.24897](https://doi.org/10.12681/osj.24897)

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To cite this article:

Mumelaš, S. (2020). Fingerprints – are they unique human’s codes?. *Open Schools Journal for Open Science*, 3(10). <https://doi.org/10.12681/osj.24897>

Fingerprints – are they unique human's codes?

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Abstract

Have you ever looked carefully at your fingertips? What do you see? You can see many bumps and bridges on your fingertips. Those patterns are called dermatoglyphs. Dactyloscopy is a discipline that uses papillary lines. Fingerprints can be used in solving crimes, like key or password to open the phone or tablets. They are formed before the birth and they are permanent and unique. There are three main patterns in fingerprints: arch, loop and whorl. Are there any similarities between human fingerprints? We decided to test are the human fingerprints inherited. We took fingerprint patterns among members of the same family and as well among group of students in the class. After the investigation we confirm that there are some similarities in fingerprints among the members among the same family.

Keywords

Fingerprints; dermatoglyphs; dactyloscopy; patterns on fingertips

¹ Six students from 7th and 8th grade



Introduction

In order to provoke the curiosity students watched two videos³ *Where Do Fingerprints Come From?*⁴ and *How Do My Fingerprints Form?*⁵

Video presents the formation of prints on fingers in 24th week inside the uterine during pregnancy. After that after they only grows but shape of prints stays the same. Fingerprints are unique for each individual from the cradle to the grave. Not even identical twins have the same prints.

Even though fingerprints were used for signatures in 200 BC in criminal investigation they have only just begun to be used from 19th century.

The main pattern is a product of our genes. Three common fingerprint patterns are loops, whorls, and arches (Fig_1). They usually often run in families since they are ruled by genes. But, the role of minutiae (non- genetic factor) vary from person to person, even within families. "Minutiae" can be influenced

by position in uterine, environmental factors, density of amniotic fluid...



Fig_1_ Fingerprints patterns.jpg⁶

Students did the research task during the COVID-19 pandemic in Croatia while the school were closed due to lock down.

³ Students are suggested to use settings to translate the video to their mother tongue.

⁴ <https://www.youtube.com/watch?v=qX6hFXHDmk4> (duration 2:30 min.)

⁵ <https://www.youtube.com/watch?v=WZL7OpFq0fw> (duration 3:03 min)

⁶ https://uh.edu/engines/fingerprint_classifications_level1.jpg



During that time students teaching was online through different applications. In our school, we used Microsoft Teams. Microsoft Teams – chat was used for individual communication with students. The students with inclusive education (individualized approach) done this research task. Further investigation was done in follow up activity - Pioneer of dactiloscopy.

Scientific question, hypothesis and prediction

The scientific question: Are fingerprint pattern types inherited?

Hypothesis: Fingerprint pattern are inherited.

Prediction: Fingerprint pattern among the family members are inherited.

Methods

Students followed the steps (detailed explanation of the investigation procedure – step by step)

In order to investigate are fingerprint pattern types inherited, students did research among the members of their family and among themselves.

First, they collected the fingerprints of their family members at home.

Afterwards in school, students worked in group and then take the fingerprints of the students within the group.

They will use stamp pad soaked in ink, magnifier, wet wipes and fingerprint cardboard (table 1, table 2)

Task:

1. Determine the types of fingerprint patterns of family members and compare it (do they match or not)

Table 1 - fingerprints of their family members

2. Determine the types of fingerprint patterns of group members and compare it (do they match or not)

Table 2 - fingerprints of group members

The results were presented in table 1 and table 2.⁷

Their work was admitted in PowerPoint presentation.

⁷ The detailed instructions about the investigation - <https://hr.izzi.digital/DOS/1593/3393.html>



The second task was done online where we organized group video call using Microsoft Teams. I shared the screen with students results - fingerprints of their family members.

Table 1 - fingerprints of their family members

family members	1 st finger	2 nd finger	3 rd finger	4 th finger	5 th finger	Match type fingerprint patterns YES / NO
Name: _____ Relation: _____						
Name: _____ Relation: _____						

Table 2 - fingerprints of group members

Name:					
1 st finger	2 nd finger	3 rd finger	4 th finger	5 th finger	

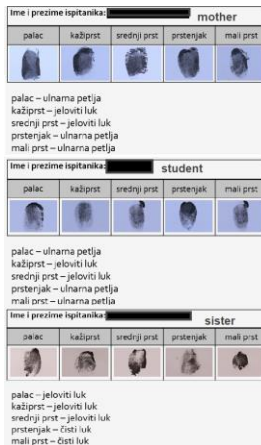
Results

There are more or less similarities between the members of the same family (Fig_2 – Fig_7) due to the genes we inherited from our parents (relatives). The differences between the pattern on fingerprints among the members of the same family arise from non- genetic factor, called minutiae.

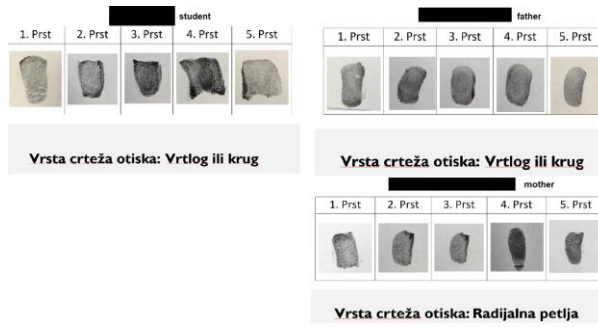
When students compare the patterns of fingerprints among the group members (students who did the research – adaptation to task due to online school) they noticed just some similarities (much less then among the members of the same family) between. The results showed that the



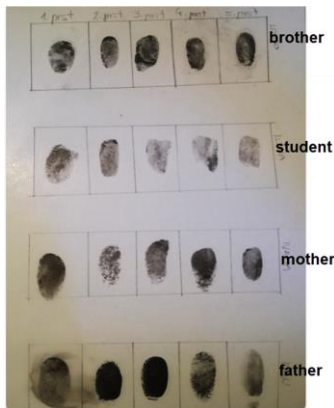
the types of fingerprint drawings are inherited.



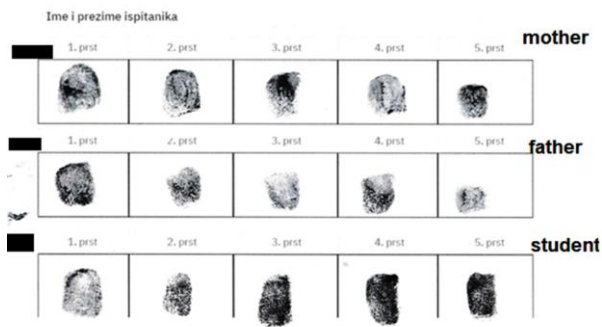
Fig_2_DL.png



Fig_3_IŠ.png



Fig_4_LD.png

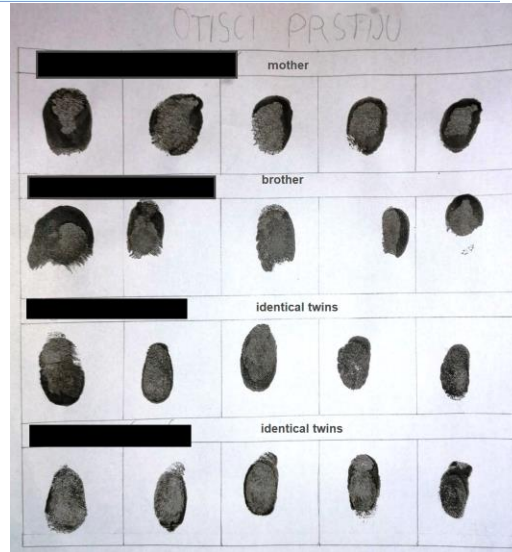


Fig_5_ND.png



Fig_6_NS.png





Fig_7_O&L -identical twins.png⁸

Conclusion

Our hypothesis was confirmed. Members of the same family have some similarities in their fingerprints. Even identical twins do not have identical fingerprints although they show more similarities between them. The human fingerprints are unique and permanent.

Follow up activity

Pioneer of dactiloscropy



Among the pioneers of dactyloscopy is Ivan Vučetić from Hvar, Croatia. He introduced the first complete ten-finger dactyloscopic card in Argentina in 1891. (Fig_7).

Fig_8_dactilonom.png⁹

⁸ Fig_6_O&L represent the work from identical twins (boys) that are both students with individualized approach – inclusive education

⁹ https://croatia.hr/sites/default/files/styles/image_text/public/2020-02/5%29-DACTILONOMO-CREADO-POR-J.-VUCETICH-1080x608.jpg?itok=n2hAJI8

