International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 8, Issue 7
July, 2021
Pages: 293-302

Scientific Evidences of the "Prostration Effect" on the Forehead of Some Prayer

Mohammad Sharifi[1]; Abasalt Hosseinzadeh Colagar[2]; Homayoon Yazdanshenas[2]; Maryam Gorji[3]; Sayed Hossein Hosseini Karnami[4]

[1] Faculty of Theology and Islamic Studies, University of Mazandaran, Babolsar, Iran

[2] Department of Molecular and Cell Biology, Faculty of Basic Sciences, University of Mazandaran, Babolsar, Iran

[3] Department of Education, Babolsar, Mazandaran, Iran

[4] Department of Islamic Studies, Mazandaran University of Medical Sciences, Sari, Iran

Corresponding author: A. H. Colagar (ahcolagar@umz.ac.ir)

http://dx.doi.org/10.18415/ijmmu.v8i7.2772

Abstract

Prostration, putting forehead on the ground or clay-tablet, has many medical benefits. But some reports showed on the forehead of a few prayers it causes prostration effect/PE or clay-tablet effect/CTE, as a skin-callosity, on his/her forehead. This effect, which in Persian language is named Mohr-e-Pishani, has always been a curious question for researchers. Observation of the PE raises many questions in mind, which is not limited to the present time. For example; in old books 'Ali Ibn Al Husayn, Zainul Abedeen (PBUH), the fourth Imam of the Shia, has been nicknamed " Dhu Althafanat" for having the CTE on his forehead which in the Arabic language means "the owner of skin-callosity". The main purpose of this study was to uncover the scientific evidence of the PE on the forehead of some prayers. The results showed that several factors would result the development of PE, including physiological factors such as skin structure and its keratin content; allergens of the ground and soil as an external factor including chemical elements, acidity, macromolecules, and microorganisms. Physical factors, such as the way and duration of prostration, head weight concentration on the ground, soil or clay-tablet are also effective. These findings can answer some of the questions, curiosities, and possible doubts related to the phenomenon of PE or CTE on the forehead as a phenotype for other researches.

Keywords: *Soil; Clay-Tablet; Geosmin; Skin-Callosity; Allergens*

Introduction

People are daily exposed to many electrostatic charges from different electromagnetic radiation sources. There are three main sources of electromagnetic radiation that are used in remote sensing including solar radiation, in other words, natural radiation that originates from the sun; terrestrial radiation - natural radiation emitted by the surface of the ground - and artificial radiation originating from a remote

sensing system (Irmak, 2014). This radiation can affect the central nervous systems (CNS) and supersaturat it can also be very harmful to soft tissues (Elbashir, Alfalih, Elbendary et al., 2014). One has to rid themselves of these extra charges, otherwise, they may have headaches, neckaches, muscle spasms, etc. The best way to get rid of these extra electrostatic charges is to discharge them from the body by connecting it physically to the ground. By lying forehead on the ground, one can dissipate the extra electrostatic charges from the brain and CNS to the ground. Therefore, one will receive peace of mind and body (Irmak, 2014). Discharging the body is one of the most important benefits of prostration (putting forehead on an object) on the ground, soil or clay-tablet. Prostration has medical benefits for mind and body but in a few of people causes skin-callosity or PE on the forehead (Figure 1).

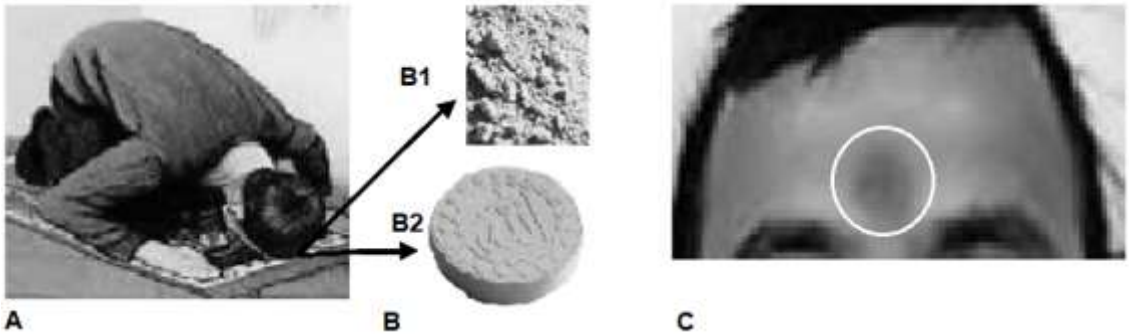

Fig 1. Prostration of a Muslim on the ground or clay-tablet and skin-callosity (A). A Muslim, who is lying prostrate on the ground towards Kaaba in Mecca; (B) The forehead of a prayer after a long and frequent prostrating on the ground: soil or carped (B1) or clay-tablet (B2); The skin-callosity or PE on the forehead of a prayer, which is showed by a white circle.

The effect of the clay-tablet on the forehead of some prayers, ignoring the marginal aspects, is a remarkable issue and has created a taste for research and curiosity in people who are interested. This topic has always attracted the attention of researchers and enthusiasts from the distant past. For example, some scholars reported that Imam Sajjad (PBUH), the fourth Imam of the Shia, had been nicknamed as " Dhu Althafanat", which in the Arabic language means “the owner of CTE” (Maroof al-Hasani, 1991). On the other hand, most of the previous studies concerning this topic are about social and behavioral aspects, with the aim of creating or eliminating doubts. However, a small number of articles examined the reasons for the development of PE on the forehead of some prayers in the last decades, which are more concerned with the physical causes (external factors) and the role of the experimental sciences has been diminished. In total, a short number of analyses were made on the role of the individual physiology factors in the occurrence of the Skin-callosity on the forehead. Obviously, with the satisfaction of these limited researches, many questions such as the following encounter unreliable answers or remain unanswered: Why does PE appear on some people’s foreheads, not all of them? What mechanisms of the human body can influence this issue? Is the nature of the ground or the soil used in the clay tablet associated with the Skin-callosity? Therefore, the purpose of this study was to investigate the causes of the occurrence of the skin-callosity on the forehead of some prayers.

Results and Discussion

The results of this study show that there are many factors associated with the development of the skin-callosity, which can be divided into physiological factors such as skin structure and keratin levels, external factors such as soil allergens and physical factors each of which is described below.

Physiological Factors Associated with Skin Structure and Its Keratin Levels

Skin is a part of our bodies coating system. Other parts of this system include hair, nails, and mucous membranes. The skin with a surface of about 2 square meters is one of the largest organs in the body. Skin is also the first protective barrier between the outside and inside of the body (Proksch, Brandner, & Jensen, 2008). Hair and nails originate from the skin and provide additional protection. The appearance of the skin changes a lot; this change is not only due to factors such as age but also reflects emotional fluctuations and general health (Kolarsick et al., 2011). The main task of the skin is to cover the surface of the body and protect the internal organs and other systems from infection or damage. It also has other tasks such as fat storage, synthesis of vitamin D, playing a role in disposing of the body and helping out the function of some sensory receptors (Brodell & Rosenthal, 2008). Generally, human skin consists of three main layers. They are commonly known as (from the outside to inside of the body) epidermis, dermis, and hypodermis. Each layer can be divided into several layers (Wicket & Visscher, 2006). The interior layer of the skin is called hypodermis, which consists of fat storage cells and sensory receptors and neural cells. The middle part, dermis, is more likely to have loose connective tissue cells and receptors. The hair-creating structures are also often found in this layer. Both layers have blood vessels, but the diameter of the blood vessels of the hypodermis is greater than dermis. The outer layer of the epidermis is called stratum corneum, and sometimes it is also referred to as "horny layer (s)". This layer consists of dead cells and protein, called keratin, containing cells known as keratinocytes. Usually, if the amount of keratin in a cell is high, that cell dies. Eliminated cells are replaced from the underlying layers. Dead cells increase the thickness and the keratin level of the horny layer (s) (Brodell & Rosenthal, 2008; Wicket & Visscher, 2006).

Contrary to the beliefs of some people, skin is not only a hard shield! it is made of different cells. Therefore, internal and external factors have a lot of influence on its appearance and function. These factors can alter the behavior of the skin cells by altering the expression of their genes, particularly by altering the expression of the keratin coding genes (Gu & Chen, 2016). Therefore, in some cases, the skin can't be exposed to external factors. For example, when the concentration of environmental pollutants is exceeded, or the individual's genetic potential is low in contamination with the contaminant, so-called skin-sensitive person, the skin can't have an acceptable physiological function. On the other hand, one of the ways to resist the external factors in sensitive skins is to increase the amount of keratin. Most of its cells are located in the outer skin epidermis, which is called stratum corneum (Deo & Deshmukh, 2018). Keratins are a relatively large and diverse group of skeletal proteins called cellophane tubules or intermediate fibers, which can be found in different parts of the body of eukaryotic organisms (organisms with a specific nucleus), from yeast to human. In humans, keratin can be found in horny layers of the skin, nails, and hair. And some researchers call them hard keratin because they are seen in hair, nails, and horns, and some of them are called soft keratin because they are seen inside the cell (Cooper & Hausman, 2016). Keratins are often hydrophobic molecules, as a result, they decrease the skin humidity and, to some extent, cause skin dryness and make it bitter (Santoro & Gaudino, 2005; Gu & Chen, 2016; Jin, Wang, Chu et al., 2016; Deo & Deshmukh, 2018).

Just like all other proteins, keratins are codified and made from their genes. In humans, there are about 54 genes codifying keratin, and cell keratinization in the skin surface is largely dependent on the expression and activity of these genes (Deo & Deshmukh, 2017). The expression of these genes can be changed by the interference of environmental factors (Olden, Freudenberg, Dowd et al., 2011). If the expression of these genes increases for any reason, cells will have more keratin, in other words, they will be more "keratinized". As keratinized cells increase, the amount of keratin in the area also increases (Santoro & Gaudino, 2005; Deo & Deshmukh, 2018). Previous studies have shown that the environment has not only a significant effect on the expression of genes but also can affect the behavior and function of the genetic contents of the cell and ultimately the cell itself (Deo & Deshmukh, 2018). The other factor is the role of the combination of actin and keratin in the cell, which makes it possible to create an

anchorage connection of cell with cells and cells with a specific membrane in the skin (Cooper & Hausman, 2016). Among these anchor connections, cellular connections of the cell to the membrane of the cell, which are known as desmosome or hemidesmosome connections, can be described. This leads to the attachment of epithelial cells to each other or to the underlying membrane, respectively (Cooper & Hausman, 2016). They prevent mechanical strokes and stretches to the cell (Walko, Castañón, & Wiche, 2015). Therefore, these types of connections play an important role in connecting skin cells and skin cells to the base membrane. This kind of cellular connective tissue is produced by a group of proteins known as desmoplakin, with keratin fibers, which is a type of cellular skeletal proteins (Vasileva and Citi 2018). According to the recent studies, in addition to genetic factors, various environmental factors, including continuous contact with hard objects, can affect these connections, and like the effect on the rise of keratin, cause various skin problems. One of these problems is the simple butterfly genetic disease (EBS) (simple epidermolysis bullosa simplex), which is caused by a disorder of 5 and 14 keratins and plektin genes (Cooper & Hausman, 2016). Environmental damage such as foot bristle due to the friction of inappropriate shoes, which is caused by friction and rubbing bolts with legs inside the shoes, and burns caused by liquids, which are caused by degradation hemidesmosome bonding from the base membrane are also caused by a disorder of 5 and 14 keratins and plektin genes. Of course, this type of friction and release causes dark, dry and rusty skin spots that might look like what is commonly known as skin-callosity (Zillikens, 1999; Chidgey, 2011).

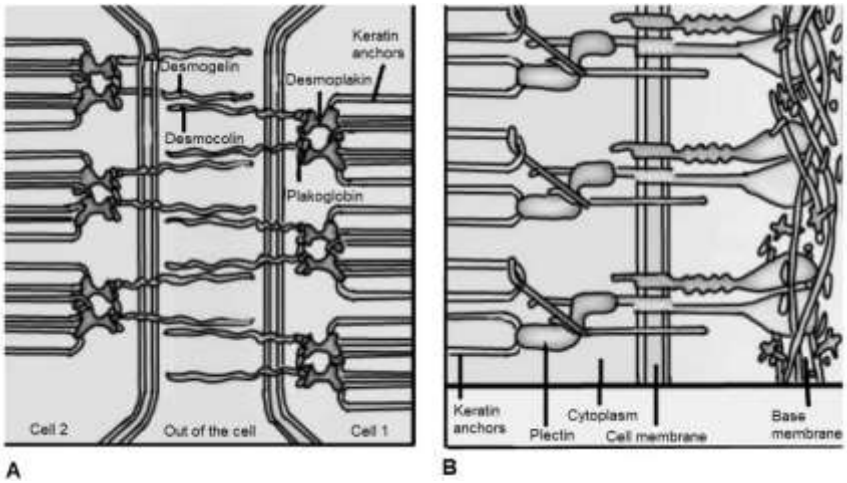

Fig 2. A schematic of desmosome and hemidesmosome connections: (A) Desmosome bonding; (B) Hemi-Desmosome bonding; In both cases, the skeleton protein chain called keratin was shown as an anchor, which is intermediate-mediated several proteins are bound to the space between the two cells or the base membrane (Adapted from Cooper & Hausman, 2016).

It can be concluded that continuous contact between the prayer's forehead and a hard surface of the ground, carpet, soil or clay tablet, as an environmental factor, can lead to the expression of some of the encoding genes of the proteins involved in the desmosome and hemidesmosome connections, and also, even the expression of keratin in some keratinocytes in different people. Increasing the expression of keratin also causes the accumulation of keratin in the outer and superficial parts of the skin, as the skin macrophage cells induce the destruction of excess skin keratin, resulting in skin dryness and roughness. On the other hand, macrophage cells struggle against the strike or possible inflammatory factors. This phenomenon can cause skin-callosity, which is also associated with some changes in color, and it is one of the main factors associated with skin-callosity on the forehead.

External Factors

Soil Allergens

Allergy is the immune system's response to an external agent called Allergen. This response usually causes many unwanted distresses (Rietschel et al., 2007; Nicholson, 2016). Generally, there is no limit to the nature of allergens. Several allergens exist in the soil or among the yarns of a carpet. These allergens can include various chemical elements, mineral compounds, organic macromolecules, pollen grains, microorganisms and so on. These allergens may cause allergic problems in many people with different age groups and lifestyles (Brew et al., 2018; Nicholson 2016). Geology studies show the presence of several elements and compounds in the soil (Table 1), some of which can be allergic to some people (dos Anjos Leal, Dick, Lombardi et al., 2014).

Table 1 The amount and percentage of elements and compounds in a sample of standard soil *

Elements	Amount (g/kg-1)	Compounds	Percentage
Calcium	21.2	Molecular Carbon	46.56
Magnesium	4	Molecular Nitrogen	1.03
potassium	5.2	Fixed Carbon	7.62
Phosphorus	0.73	Ashes	8.22
Sulfur	0.53	Volatile compounds	84.16

Adapted from (dos Anjos et al., 2014; Dick et al., 2014)

Some of the elements and compounds of the soil and yarns can easily penetrate through the pores of the skin in water-soluble form (Mahapatra, 2008). Also, the presence of blood vessels and white blood cells can increase the immune response. Therefore, allergens can trigger the response of the immune system after their entry (Fonacier et al., 2010). The main reason for the onset of allergy is a genetic issue. Many studies have shown that the incidence or absence of allergy to an allergen type, and even how it responds to it, varies from person to person. An allergen may cause an allergic reaction in one person, but it might be ineffective on the other person (Huang et al., 2017). Soil is a rich microbiome in addition to organic and inorganic compounds (Schindlbacher et al., 2015), most of which are bacteria (Table 2). In addition, a certain group of these microorganisms is known as actinobacteria (soil bacteria) (Bhattarai et al., 2015).

Table 2 Amounts of different microorganisms in a thickness of 15 cm from soil *

Microorganisms	Number/ gram of soil	Biomass (g/m2)
Bacteria	108-109	40-500
Actinobacteria (Actinomysets)	107-108	40-500
Fungi	105-106	100-1500
Algae and Mosses	104-105	1-50
Protozoa	103-104	various
Worms	102-103	various

* Adapted from Bhattarai et al., 2015

Actinobacteria in their various metabolic pathways make a substance called geosmin for the purpose of energy storage. In fact, actinobacteria bring energy from their nutrition to various molecules such as geosmin to use it when needed. In the event of the death of these bacteria, geosmin disperses in their habitat (Zaitlin & Watson, 2006; Guttman & Rijn, 2012). As can be seen from its molecular form, geosmin is an organic, aromatic and two-ring compound (Figure 3). This compound has a special smell.

The amount of geosmin is not equal in different soils of different regions. The human's nose is susceptible to this composition and the major part of the smell of soil is caused by it (Dionigi et al., 1991). Based on researches and studies, this compound has the ability to penetrate through the skin of many marines including fish. This compound, in the body of these creatures, creates serious problems and in some cases, the infected fish loses its nutritional value for humans (Howgate, 2004; Guttman & Rijn, 2012). Also, in other studies, it was found that the reason for the smell and taste of drinking water in some areas is the high amount of geosmin in the soil. High levels of geosmin in drinking water are problematic for its consumers. We can assume that the geosmin of the soil used in the clay tablet can cause allergic responses in some people, and have negative effects on the forehead skin, which is likely to affect the appearance of skin-callosity (Srinivasan & Sorial, 2010).

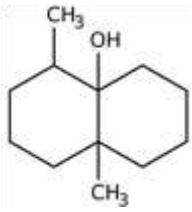

Fig 3. Molecular structure of geosmin: the IUPAC name is 4 and 8 dimethyl octahydronaphthalene 4-ol, it has an alcoholic group and two methyl groups. It's an aromatic compound, and it has a special smell.

Another remarkable fact of table 2 is the significant presence of fungi in the soil. fungi are systematically complex organisms with many species. One of the common features among most of these species is the production of Spores reproduction. The species found in the soil are mostly microsporidia, a group of spore-forming unicellular mushrooms, which are simpler than other mushrooms but they nevertheless produce spore for reproduction (Guarro et al., 1999).

Spores are small microorganisms that are not easily visible. They also have a lot of dispersal power. Environmental factors spread spores rapidly throughout the entire environment around their sources (Damialis et al., 2017). Spores are resistant to factors such as heat, cold and chemicals, so they can exist in the soil or among the yarns of a carpet used in clay tablet. According to previous studies, spores are potential allergens, and their presence may stimulate the immune system which causes respiratory problems, or if it is in contact with the eyes, tears, itching, and burning. Since the stimulation of the immune system can be due to the intensification of allergic responses to other substances (Damialis et al., 2017). Therefore, the presence caused by spores can also be considered as a major contributor to allergic responses to the PE on the forehead.

Soil Acidity

One of the factors considered as an indicator for soil is the acidity (or pH) of the soil. Accordingly, soils are classified into groups such as alkali, acid, and neutral soils. The soil of different regions is different in acidity levels; for example, the soil around a city may be with acidic pH, while the soil around another city, with a few kilometers distance, has an alkaline pH (Mahapatra, 2008). The effect of acidity on the allergen aspect of the soil is that it has an effect on the growth of microorganisms in the soil, and also the effect on the penetration of the materials into the skin and, consequently, the sensitivity of the individual is significant. As already mentioned, the soil has many types of microorganisms, of which two groups called actinobacteria and fungi are very important in terms of allergen production. For

example, Brock et al studies Showed that both groups of these organisms, particularly actinobacteria, have better growth and reproduction in Soils with neutral pH, which can be a factor in increasing soil allergens (Madigan et al., 2018). On the other hand, Saba and Yosipovitch's studies of dermatology showed that the human skin at birth has a relatively neutral pH, but over time and aging, the skin will have acidic pH to prevent the growth of microorganisms on its surface and any factor that promotes the pH of the skin, neutralizing or alkalizing it, increases the skin's sensitivity to external factors. Hence, the researchers inferred that constant skin contact with neutral or alkaline soils could cause skin irritation to allergenic agents (Saba & Yosipovitch, 2013).

Physical Factors

Physical factors facilitate or accelerate the development of physiological or internal factors. One of the most important physical factors is the way of prostration. For example, some people squeeze their forehead when they prostrate, or when they rise from their prostrations, which affects the roughness of the skin and provides the means for keratinization. Some other people pray when they perform ablutions with a wet face, which will dissolve some allergens and accelerates their penetration into the skin. Such issues can be an introduction to allergies. Externally, despite the lack of a high scientific level, external factors are closely related to internal factors, because human skin and other living organisms are affected by the direct relationship with the environment to a great extent and show changes.

Conclusion

Genes are the source of individual differences between individuals. Therefore, the physiology of the skin structure or having allergies is related to the genders of the worshiper. Yarns of a carpet or Soil have different allergens, including different microorganisms, combinations and different chemical elements of pH which are either directly allergenic or accelerate the effect of other allergens. Sensitivity to one or more allergens on the soil that causes the reaction or responses of a person's immune system can lead to the placement of PE on the forehead of some worshipers. On the other hand, a group of physical agents can cause or exacerbate the onset of internal factors in the onset of the pancreas in the person's forehead.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Author Contribution

All of the authors contribute to this work, from writing to summiting and published.

Acknowledgments

The authors are grateful to Zobeydeh Ramesh (Zeinab (PBUH) Hospital in Babolsar, Mazandaran University of Medical Sciences), Who generously helped us in writing this manuscript.

References

Ali, S. M., & Yosipovitch, G. 2013. "Skin pH: from basic science to basic skin care." *Acta Dermato-venereologica, 93(3), 261-269*. doi:10.2340/00015555-1531

Bhattarai, A., Bhattarai, B., & Pandey, S. 2015. "Variation of soil microbial population in different soil horizons." *Journal of Microbiology & Experimentation, 2(2), 00044*. doi:10.15406/jmen.2015. 02.00044

Brew, B. K., Söderberg, J., Lundholm, C., Holmberg, K., & Almqvist, C. 2018. "Academic achievement of adolescents with asthma and atopic diseases. In Allergy." *European Journal of Allergy and Clinical Immunology, 73 (Suppl. 105), 313-313*. doi:10.1111/cea.13371

Brodell, L. A., & Rosenthal, K. S. 2008. "Skin structure and function: the body's primary defense against infection." *Infectious Diseases in Clinical Practice, 16(2), 113-117*. doi:10.1097%2FIPC .0b013e3181660bf4

Cooper, G. M., & Hausman, R. E. 2016 The Cell: A Molecular Approach (7th ed.)., *Sinauer Associates is an imprint of Oxford University Press; 7 eds, PP 832*.

Cortés-Malagón, E. M., Palacios-Reyes, C., Romero-Cordoba, S., Mendoza-Villanueva, D., Escobar-Herrera, J., Verdejo-Torres, O., ... & Hidalgo-Miranda, A. 2017. "The PDZ-binding motif of HPV16-E6 oncoprotein modulates the keratinization and stemness transcriptional profile in vivo." *BioMed Research International, 2017*. doi:10.1155/2017/7868645

Damialis, A., Kaimakamis, E., Konoglou, M., Akritidis, I., Traidl-Hoffmann, C., & Gioulekas, D. 2017. "Estimating the abundance of airborne pollen and fungal spores at variable elevations using an aircraft: how high can they fly?" *Scientific Rreports, 7, 44535*. doi:10.1038/srep44535

Deo, P. N., & Deshmukh, R. 2018. "Pathophysiology of keratinization." *Journal of Oral and Maxillofacial Pathology, 22(1), 86*. doi:10.4103/jomfp.JOMFP_195_16

Dionigi, C. P., Millie, D. F., & Johnsen, P. B. 1991. "Effects of farnesol and the off-flavor derivative geosmin on Streptomyces tendae." *Applied and Environmental Microbiology, 57(12), 3429-3432*.

Dos Anjos Leal, O., Dick, D. P., Lombardi, K. C., Maciel, V. G., González-Pérez, J. A., & Knicker, H. 2015. "Soil chemical properties and organic matter composition of a subtropical Cambisol after charcoal fine residues incorporation." *Journal of Soils and Sediments, 15(4), 805-815*. doi:10.1007/s11368-014-1040-z

Elbashir, A. M., Alfalih, A., Elbendary, A., & Mohamed, S. 2014. "The health effects of electrostatic charge in the biosphere at Al-Sulyil city, KSA." *Academic Research International, 5(2), 52*.

Fonacier, L. S., Dreskin, S. C., & Leung, D. Y. 2010. "Allergic skin diseases." *Journal of Allergy and Clinical Immunology, 125(2), S138-S149*. doi:10.1016/j.jaci.2009.05.039

Goldsby, R. A., Kindt, T. J., Kuby, J., Osborne, B. A. 2003 Immunology (5th ed.). W. H. Freeman.

Guarro, J., Gené, J., & Stchigel, A. M. 1999. "Developments in fungal taxonomy." *Clinical Microbiology Reviews, 12(3), 454-500*. doi:10.1128/CMR.12.3.454

Guttman, L., & van Rijn, J. 2012. "Isolation of bacteria capable of growth with 2- methylisoborneol and geosmin as the sole carbon and energy sources." *Applied and Environmental Microbiology, 78(2), 363-370*. doi:10.1128/AEM.06333-11

Howgate, P. 2004. "Tainting of farmed fish by geosmin and 2-methyl-iso-borneol: a review of sensory aspects and of uptake/depuration." *Aquaculture, 234(1-4), 155-181*. doi:10.1016/j.aquaculture.2003 .09.032

Huang, Y. J., Marsland, B. J., Bunyavanich, S., O'mahony, L., Leung, D. Y., Muraro, A., & Fleisher, T. A. 2017. "The microbiome in allergic disease: current understanding and future opportunities-2017 PRACTALL document of the American Academy of Allergy, Asthma & Immunology and the European Academy of Allergy and Clinical Immunology." *Journal of Allergy and Clinical Immunology, 139(4), 1099-1110*. doi:10.1016/j.jaci.2017.02.007

Irmak, M. K. 2014. "Medical aspects of ablution and prayer." *Journal of Experimental and Integrative Medicine, J Exp Integr Med 2014, 4(2):147-149)*. doi:10.5455/jeim.291213.hp.010

Jin, M., Wang, J., Chu, M. X., Piao, J., Piao, J. A., & Zhao, F. Q. 2016. "The study on biological function of keratin 26, a novel member of liaoning cashmere goat keratin gene family." *PloS One, 11(12), e0168015*. doi:10.1371/journal.pone.0168015

Kolarsick, P. A., Kolarsick, M. A., & Goodwin, C. 2011. "Anatomy and physiology of the skin." *Journal of the Dermatology Nurses' Association, 3(4) 203-213*. doi:10.1097/JDN.0b013e31823cccbe

Li, L., Chen, X., & Gu, H. 2016. "The signaling involved in autophagy machinery in keratinocytes and therapeutic approaches for skin diseases." *Oncotarget, 7(31), 50682*. doi:10.18632/oncotarget.9330

Madigan, M. T., Martinko, J. M., Bender, K. S., Buckley, D. H., Stahl, D. A., Brock, T. 2018. "Brock Biology of Microorganisms." *Pearson*.

Madison, K. C. 2003. "Barrier function of the skin:"la raison d'etre" of the epidermis." *Journal of Investigative Dermatology, 121(2), 231-24*1. doi:10.1046/j.1523-1747.2003.12359.x

Mahaparta, G. B. 2008. "A Textbook of Geology." *CBS Publishers & Distributers.*

Maroof al-Hasani H. 1991. Seerat 12 Imam (a.s.), translate: Drakhshandeh M., *Amirkabir Publication. Tehran, Iran. PP. 614*.

Nicholson, L. B. 2016. "The immune system." *Essays in Biochemistry, 60(3), 275-301*.

Olden, K., Freudenberg, N., Dowd, J., & Shields, A. E. 2011. "Discovering how environmental exposures alter genes could lead to new treatments for chronic illnesses." *Health Affairs, 30(5), 833-841*. doi:10.1377/hlthaff.2011.0078

Proksch, E., Brandner, J. M., & Jensen, J. M. 2008. "The skin: an indispensable barrier." *Experimental Dermatology, 17(12), 1063-1072.*

Rietschel, R. L., Warshaw, E. M., Sasseville, D., Fowler Jr, J. F., Deleo, V. A., Belsito, D. V., ... & Marks Jr, J. G. 2007. "Common contact allergens associated with eyelid dermatitis: data from the North American Contact Dermatitis Group 2003-2004 study period." *Dermatitis, 18(2), 78-81*. doi:10.2310/6620.2007.06041

Santoro, M. M., & Gaudino, G. 2005. "Cellular and molecular facets of keratinocyte reepithelization during wound healing." *Experimental Cell Research, 304(1), 274-286.* doi:10.1016/j.yexcr.2004.10.033

Schindlbacher, A., Schnecker, J., Takriti, M., Borken, W., & Wanek, W. 2015. "Microbial physiology and soil CO_2 efflux after 9 years of soil warming in a temperate forest-no indications for thermal adaptations." *Global Change Biology, 21(11), 4265-4277.* doi:10.1111/gcb.12996

Shimizu, H. 2007. Shimizu's textbook of dermatology (pp. 42-48). Hokkaido University.

Srinivasan, R., & Sorial, G. A. 2011. "Treatment of taste and odor causing compounds 2-methyl isoborneol and geosmin in drinking water: A critical review." *Journal of Environmental Sciences, 23(1), 1-13.* doi:10.1016/s1001-0742(10)60367-1

Thornton, M. J. 2002. "The biological actions of estrogens on skin." *Experimental Dermatology, 11(6), 487-502.* doi:10.1034/j.1600-0625.2002.110601.x

Vasileva, E., & Citi, S. 2018. "The role of microtubules in the regulation of epithelial junctions." *Tissue Barriers, 1-20.* doi:10.1080/21688370.2018.1539596

Walko, G., Castañón, M. J., & Wiche, G. 2015. "Molecular architecture and function of the hemidesmosome." *Cell and Tissue Research, 360(3), 529-544.* doi:10.1007/s00441-015-2216-6

Wickett, R. R., & Visscher, M. O. 2006. "Structure and function of the epidermal barrier." *American Journal of Infection Control, 34(10), S98-S110.*

Zaitlin, B., & Watson, S. B. 2006. "Actinomycetes in relation to taste and odour in drinking water: myths, tenets and truths. Water Research", 40(9), 1741-1753. doi:10.1016/j.watres.2006.02.024

Zillikens, D. 1999. "Acquired skin disease of hemidesmosomes." *Journal of Dermatological Science, 20(2), 134-154.* doi:10.1016/S0923-1811(99)00019-5

Żukiewicz-Sobczak, W. A. 2013. "The role of fungi in allergic diseases." *Advances in Dermatology and Allergology, 30(1), 42.* doi:10.5114%2Fpdia.2013.33377

Copyrights