Jagua Publication

Journal of Applied Health Sciences and Medicine , 6(3):22–25, 2026. DOI: 10.58614/jahsm634

Journal of Applied Health Sciences and Medicine

Journal homepage: https://jpub.org/journal-details.php?journal-id=39

ISSN (E): 2583-1887
Journal of Applied Health Sciences and Medicine

Review Article

Blood's function in cell communication: From hormone signaling to Oxygen transport

Marwa Ahmed Meri [1*], Nabaa. K. Alqurashi[2] and Hawraa Ayad Khudhair[1]

[1] *Ministry of Education / Directorate of Education of Al-Najaf Governorate.*
[2] *Ministry of Education, Najaf Education Directorate, Open Educational College.*
[*] *Corresponding author: marwaahmedmeri@gmail.com*

Article Info

Keywords: *Hemodynamics, Cell Communication, Hormonal Signals.*

Received: *01.02.2026;*
Accepted: *05.03.2026;*
Published: *13.03.2026*

Abstract

A wide array of factors facilitates vital communication between cells in the body. The characterization, regulation, functions, and mechanisms of these factors have been the subject of extensive research in this field. Most of the detailed descriptions of cell-to-cell communication molecules that have been identified over the years include proteins, small peptides, amino acids or their derivatives, ions, lipid metabolites, and steroids. In addition, hormones participate in many vital functions in the body, most importantly growth, development, metabolism, mood, and immune responses. These essential processes depend on the hormone's ability to reach its target tissue. Hormones travel through the bloodstream, passing through the vascular endothelium and performing various biological processes within the body.

1. Introduction

One of the body's essential connective tissue fluids is blood. Its function goes beyond merely carrying nutrients and oxygen; it also serves as the main channel for cellular communication amongst the body's organs. This vital fluid acts as a complex communication network connecting all the body's systems, transporting not only nutrients and gases. But also the biochemical information that regulates physiological functions [1]. This vital network consists of cellular components (red blood cells, white blood cells, platelets) and non-cellular components (plasma and soluble factors) that work in amazing harmony.

Blood enables chemical signaling between cells and tissues through four categories of transmitted factors including growth factors and cytokines and chemokines and classical hormones along with extracellular vesicular (exosomes) information transport [2]. Research conducted recently shows that blood functions as a sophisticated integrated communication network superior to past assumptions [3].

The evaluation presented in this document examines blood's cellular signaling function through an investigation of biological transmission patterns and physiological signal integration processes. The paper examines scientific proofs showing blood transforms from simple transport fluid into an active communication network capable of engaging every bodily tissue.

How To Cite: M.A. Meri, N.K. Alqurashi, H.A. Khudhair. Blood's function in cell communication: From hormone signaling to Oxygen transport. *Journal of Applied Health Sciences and Medicine*, 6(3):22–26, 2026. https://doi.org/10.58614/jahsm634

2. Blood as a Multi-Level Communication System

2.1. Functional Structure of Blood

About 45% of blood's volume is made up of cellular components, with the remaining 55% being plasma, which contains over 3,000 different proteins, many of which have signaling functions [4]. According to proteomic analyses, plasma proteins are involved in complex signaling networks, where a single molecule, like albumin, can bind to multiple growth factors and hormones, thereby regulating their bioavailability [5].

2.2. Hemodynamics and Signal Distribution

In order to ensure that chemical messages reach all tissues in a matter of seconds, the heart pumps about 5 liters of blood per minute. Blood's great distribution efficiency makes it perfect for sending long-lasting signals like thyroid hormones as well as quick ones like adrenaline [6]. Research indicates that certain signaling molecules, such IL-6, can effectively accumulate in target tissues minutes after being secreted [7].

2.3. Selective Barriers

All tissues are impacted by blood, but specific processes control how signaling molecules enter target tissues. According to [8], barriers like the blood-brain barrier function as selective gates that let only specific molecules through. For the body's chemical signals to remain balanced, this spatial uniqueness is crucial.

3. Mechanisms of Cell Communication Through the Blood

3.1. Direct Transport of Signaling Molecules

Most hormones travel through the blood in various forms:

- Free (such as adrenaline)
- Bound to carrier proteins (such as thyroid hormones bound to the TBG protein)
- Contained in vesicles (such as exosomes containing microRNAs) [9]

3.2. Interactions between blood components

Soluble factors are secreted by blood cells to interact with one another. For instance, during clotting, platelets release about 300 distinct signaling proteins [10]. Hypoxia also causes red blood cells to produce ATP, which promotes vasodilation [11].

3.3. Dynamic Message Modifications

Blood is a dynamic medium that uses complex methods to control the chemical messages it conveys in order to deliver and modulate critical signals [12]. Among these mechanisms are:

- **First:** A delicate hormonal balance is maintained in the body by the selective activation or deactivation of hormones by plasma enzymes such the angiotensin-converting enzyme (ACE). Both blood pressure and the volume of fluid in the blood arteries are controlled by this system.
- **Second:** Antibodies are essential for attaching to signaling molecules like growth factors and hormones, changing their efficacy, or deactivating them entirely. This is a component of the immunological surveillance system of the body.
- **Third:** This process is aided by coagulation systems, which release signaling peptides like thrombin, which serves as a signaling molecule in addition to its clot-forming activity [12]. These peptides control the inflammatory response and wound healing.

According to [12], these processes work in a delicate integration, whereby signaling molecules and blood components interact by:

- Modifying the biological activity of hormones
- Changing the duration of signaling molecules' presence in the bloodstream
- Controlling the delivery of these molecules to the body's target tissues

This integrated system ensures a proportionate and time-specific physiological response to various physiological and pathological variables.

3.4. Oxygen and Carbon Dioxide Transport: Physiological Basis

The primary function of red blood cells (erythrocytes) is to transport oxygen from the lungs to the tissues and return carbon dioxide from the cells to the lungs for excretion.

This transport relies on the hemoglobin molecule, which reversibly binds to oxygen [13]. However, the role of blood is not limited to gaseous transport; red blood cells also release signaling molecules such as ATP and nitric oxide (NO), which regulate blood flow and pressure [11].

3.5. Blood as a Carrier of Hormonal Signals

Transporting hormones from endocrine glands to target cells is a critical function of plasma, the liquid component of blood. In order to affect metabolism, development, and the stress response, hormones like insulin, glucagon, and cortisol are released into the bloodstream and travel great distances [14].

For example:

- **Insulin:** Secreted by the pancreas and regulates glucose uptake into cells.
- **Cortisol:** The adrenal gland releases this hormone in reaction to stress, and it affects the immune system and the metabolism of carbohydrates.

Research has indicated that some hormones attach to plasma-bound carrier proteins, like sex hormone-binding globulin (SHBG), enhancing their stability and regulating their release into target cells [15].

3.6. Immune and inflammatory signals through the blood

Immune cells known as white blood cells exist together with signaling chemicals such as interferons and cytokines that aid in immune response coordination that occur in blood. The immune cells release TNF-α and interleukin-6 (IL-6) to spread inflammatory signals after infection based on [16]. Wound repair occurs through platelet secretion of platelet-derived growth factor (PDGF) and other growth factors according to [10].

3.7. Blood as a carrier of neuroendocrine signals

The hypothalamic-pituitary-adrenal (HPA) axis lets blood link to neurological operations. Two examples of nerve signals known as Corticotropin and CRH help the blood activate hormone production [17]. Blood functions as a transmission pathway between endocrine glands and neurological components when this process occurs.

4. Conclusion

Blood functions beyond transportation because it works as a unified communication system which requires all immunological and neurological and hormonal signals to travel between body tissues. Disease treatment development becomes possible for diabetes and hormone imbalance diseases and inflammatory conditions by studying how cells transmit signals through blood.

Article Information

Acknowledgments: The authors would like to express their sincere gratitude to all researchers and scholars whose valuable scientific contributions and published works have significantly enriched this article and supported the scientific concepts discussed in this study.

Author Contributions: Marwa Ahmed Meri – Conceptualization, Data curation, Writing – review & editing; Nabaa. K. Alqurashi – Methodology, Writing – original draft; Hawraa Ayad Khudhair – Formal analysis, Supervision.

Funding / Financial Support: The authors did not receive any external funding for this work.

Conflict of Interest: The author declares no competing interests.

Ethical Approval: Not applicable.

Informed Consent: Not applicable.

Data Availability Statement: Data sharing is not applicable to this article as no new datasets were generated or analyzed.

Clinical Trial Registration: Not applicable.

Reporting Guidelines Statement: Not applicable.

Disclaimer (Artificial Intelligence): The author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.), and text-to-image generators have been used during writing or editing of manuscripts.

References

[1] B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, and P. Walter. *Molecular biology of the cell*. Garland Science, 7th edition, 2019.

[2] R. N. Pittman. *Regulation of tissue oxygenation*. Morgan Claypool Life Sciences, 2011.

[3] G. Raposo and W. Stoorvogel. Extracellular vesicles: Exosomes, microvesicles, and friends. *Journal of Cell Biology*, 200(4):373–383, 2013.

[4] N. L. Anderson and N. G. Anderson. The human plasma proteome: History, character, and diagnostic prospects. *Molecular Cellular Proteomics*, 1(11):845–867, 2002.

[5] R. L. Gundry, M. Y. White, J. Nogee, I. Tchernyshyov, and J. E. Van Eyk. Assessment of albumin removal from an immunoaffinity spin column: Critical implications for proteomic examination of the albuminome and albumin-depleted samples. *Proteomics*, 9(4): 868–881, 2009.

[6] J. R. Levick. *An introduction to cardiovascular physiology*. CRC Press, 5th edition, 2013.

[7] M. A. Febbraio and B. K. Pedersen. Muscle-derived interleukin-6: Mechanisms for activation and possible biological roles. *The FASEB Journal*, 16(11):1335–1346, 2002.

[8] R. Daneman and A. Prat. The blood-brain barrier. *Cold Spring Harbor Perspectives in Biology*, 7(1):a020412, 2015.

[9] A. Turchinovich, O. Drapkina, and A. Tonevitsky. Transcriptome of extracellular vesicles: State-of-the-art. *Nature Communications*, 10(1):1–10, 2019.

[10] E. M. Golebiewska and A. W. Poole. Platelet secretion: From haemostasis to wound healing and beyond. *Journal of Thrombosis and Haemostasis*, 13(10):1763–1775, 2015.

[11] M. L. Ellsworth, C. G. Ellis, and R. S. Sprague. Role of erythrocyte-released ATP in the regulation of microvascular oxygen supply. *Microcirculation*, 24(3):e12356, 2017.

[12] J. E. Hall. *Guyton and Hall textbook of medical physiology*. Elsevier, 14th edition, 2021.

[13] D. P. Kaufman and Y. Deng. Physiology, oxyhemoglobin dissociation curve. In *StatPearls*. StatPearls Publishing, 2021.

[14] L. Sherwood. *Human physiology: From cells to systems*. Cengage, Learning, 10th edition, 2021.

[15] S. R. Hammes, E. R. Levin, and M. Gannon. Steroid hormone receptors and signal transduction processes. *Endocrine Reviews*, 41(4): 539–565, 2020.

[16] C. A. Janeway, P. Travers, M. Walport, and M. J. Shlomchik. *Immunobiology: The immune system in health and disease*. Garland Science, 9th edition, 2018.

[17] S. M. Smith and W. W. Vale. The role of the hypothalamic-pituitary-adrenal axis in neuroendocrine responses to stress. *Dialogues in Clinical Neuroscience*, 8(4):383–395, 2021.