Tego

Mechanisms for Decentralized Thyroid Research and Development

White Paper v 0.1

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Introduction

Overview

Tego is a decentralized project for research and development relating to thyroid disease. The project will focus on building decentralized protocols on Ethereum to facilitate funding for research and innovation relating to thyroid diseases. Tego aims to become a full-scale biotechnology project, operating research, development, and production.

This is important because a global and decentralized biotechnology project has a lot more flexibility and thus capability to innovate because it increases access to capital and jurisdictions with favorable innovation policy. This also provides a direct bridge between Web 3 and the real world. Focusing primarily on thyroid research is also significant because there is a significant need for more research and development in this area. This White Paper introduces the preliminary ideas behind Tego, including the solution, substance of the project, and intended governance methods.

Problem

The problem is that there is no opportunity for open source research focused on thyroid disease. However, thyroid disease is ubiquitous and it is estimated approximately 200 million people worldwide have thyroid disease.[1] Thyroid treatments have hardly improved over the past sixty years. For example, Hypothyroidism is still treated by the same oral levothyroxine (LT4) method that was introduced in the 1970s.[2] This treatment has many drawbacks and limitations.

While thyroid research opportunities exist within institutions, there are many problems with institutional research. First, institutional access and opportunities are largely arbitrary and alienate a significant portion of the research community. Second, institutional research has no focus on solving real problems in the field or innovating in treatments. The problem is ultimately that institutional researchers are incentivized to make incremental contributions to maximize funding, while minimizing risk and work. While this research structure works well for institutions, it fails to help patients, innovation, and global opportunities.

Solution

The solution is to create decentralized rewards and funding mechanisms for open source research focused on thyroid disease. This will create an ecosystem for thyroid innovation to flourish. By creating a research protocol focused on problem oriented research, research incentives will be aligned with innovation. In other words, the research protocol will be focused on supporting research in response to real problems and proposing solid solutions. This stands to significantly increase care for patients, innovation, and global opportunity.

For example, there is a significant need for research relating to combination therapy with triiodothyronine and thyroxine. Additionally, there is significant need for research for biomedical devices to aid in drug delivery. Tego launched a digital asset on Ethereum to facilitate funding for thyroid research and development.

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[1] Xuexue Zhang, et al., Prevalence and Trends of Thyroid Disease Among Adults, 1999 – 2018, Endocrine Practice (2023).

[2] George J. Kahaly, Therapeutic Use of Levothyroxine: A Historical Perspective (March 12, 2021).

Research and Development

Open Source

The project will operate on principles of open source development, which allow for public production of research and innovation. In general, most research funding for healthcare and biotechnology comes from pharmaceutical companies, governments, and universities. However, access to this funding is extremely limited, highly political, and dependent on relationships rather than results. This is a major problem insofar as the incentives do not promote progress, but rather stagnation.

Moreover, to gain access to these institutions and associated funding takes years. As such, researchers lose valuable time that could be directed to solving real problems if they want to research professionally. Moreover, this also forces researchers into extreme poverty because their options are essentially working for free for for-profit companies until they are hired or working for free to solve real problems in the field. Neither one of these paths provides an opportunity to keep a roof over their heads or food on the table.

So, the solution is to allow researchers to earn funding through open source research. This way they can focus on solving real problems, making their work open, and fostering innovation. Given recent developments in artificial intelligence, there is little value to keeping research proprietary because any technology can be easily reverse engineered given sufficient resources.

Thyroid Disease

Thyroid diseases are the second most ubiquitous endocrine disorders worldwide.[3] Although thyroid diseases may be life threatening, they are considered treatable. But such diseases also have significant side effects even with current treatments. Still there is a high demand for new research in this field. There are three main research needs.

First, there is a need for research relating to combination therapy – where patients take both triiodothyronine (T3) and thyroxine (T4). One problem with current treatment options is they only include T_4. However, recent research shows that the thyroid produces both T4 and T3.[4] Most of the thyroid hormone production is T4, but there is some T3 produced as well. In fact, treating patients with both T4 and T3 at the right ratio would help with treatment effectiveness. For example, T3 supplementation may help with depression.[5]

Second, research in biomedical devices for treating hypothyroidism is essentially non-existent. There are many problems with oral medicine and daily regiments relating to the digestion of the medication. While there have been considerable developments in drug delivery

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[3] Elske Theresia Massolt, Translational Studies Toward Understanding Clinical Effects of Thyroid Hormone, 9 (2017).

[4] Cristiane Gomes-Lima, Can Reverse T3 Assay Be Employed to Guide T4 vs. T4/T3 Therapy in Hypothyroidism?, Front. Endocrinol., Sec. Thyroid Endocrinology, (11 December 2019), https://doi.org/10.3389/fendo.2019.00856. ("In humans, a normal thyroid gland produces ~85 mcg of T4 and 6.5 mcg of T3 daily (1). Thus, the ratio of T4:T3 that is directly secreted from the thyroid gland is around 13:1.")

[5] Kenneth Ain, M.D., and M. Sara Rosenthal, PH.D., The Complete Thyroid Book, 262 (2011).

devices for purposes relating to diabetes and birth control,[6] there are no such devices for thyroid hormone control.

Third, the relationship between thyroid disease and the rest of the body has much room for new research and knowledge development. For example, thyroid hormones exert profound effects on the central nervous system, influencing cognitive function, mood regulation, and neurodevelopment. Investigations into the neuroendocrine interactions between the thyroid gland and the brain offer promising avenues for understanding the pathophysiology of neuropsychiatric disorders, such as depression, anxiety, and cognitive impairment. By delving deeper into the intricate mechanisms governing thyroid physiology and pathology, researchers can pave the way for novel diagnostic approaches, therapeutic interventions, and preventive strategies aimed at optimizing thyroid health and improving patient outcomes.

The exploration of the thyroid's role in human health represents a frontier of scientific inquiry ripe for exploration. By embracing interdisciplinary collaboration and leveraging cutting-edge research methodologies, we can unlock new insights into the complexities of thyroid function and its implications for overall well-being. The thyroid and its role in the human condition are still poorly understood in relation to what is possible. While these three main research needs will be the project's primary focus, over time Tego may support research in other healthcare or biotechnology domains.

Mechanism

The goal for Tego is to create mechanisms for funding research and development relating to thyroid disease. A main component for this mission is to provide funding opportunities for researchers and professionals. To achieve that end, Tego will build a decentralized governance software on the Ethereum blockchain. The governance software will provide a mechanism for TEGO token holders to vote on allocations of TEGO tokens for the purpose of supporting and rewarding researchers and developers.

Network participants and stakeholders will be able to vote on research proposals relating to Thyroid disease to effectively make grant awards. The outcome of the voting process will result in grant awards being disbursed to researchers and developers whose proposals receive sufficient support from the Tego community. These grants will provide financial support to fund various aspects of thyroid research and development efforts, including but not limited to laboratory expenses, equipment acquisition, personnel salaries, and project-related expenses.

One distinguishing feature of Tego's funding mechanism is its exclusive focus on supporting research and development initiatives related to thyroid disease. While many blockchain projects incentivize research in blockchain technology itself, Tego prioritizes funding projects aimed at advancing knowledge and innovation in the field of thyroid health. This strategic focus underscores Tego's commitment to addressing critical healthcare challenges and driving tangible outcomes in medical research.

[6] Patent Publication No. 2011/0319861 AI to Wild, Medical Device Mechanical Pump (Dec. 29, 2011). *See also* China Patent Publication CN 102665619B, Contraceptive Device, Bayer Pharmaceuticals Corp (May 5, 2015).

Governance

Risks

Decentralized development comes with significant risk, such as cybersecurity, regulation by enforcement, and academic validity. However, given the severity in the lack of funding for thyroid disease and prominence of thyroid disease, the risks are outweighed by a need for new solutions in treatment, the knowledge leading thereto. Tego strives to reduce risk through proactive planning, yet high risk in this project is inherent across a spectrum of exposure.

The main risk for all decentralized software projects is security. To reduce security risk Tego will rely on the Parsimony Principle in development, ensuring simplicity in design and architecture.[7] By utilizing only simple software, hacks will be much more difficult. Second, Tego will provide a security audit of any software used before any Ethereum main network launch. This will ensure the code has been properly reviewed for security prior to launch.

Second, a unique risk for Tego is the need to achieve academic and professional validity in the healthcare and biotechnology space. By far the most difficult space to startup a new project or company is biotechnology because it is a highly regulated field with high knowledge and professional certification barriers. Tego will seek to collaborate with established medical professionals, researchers, and institutions to ensure the project earns credibility from an academic and professional standpoint. While criticism is certainly a part of building something new, Tego will focus on growing at an appropriate pace and with appropriate support from a personnel perspective.

Finally, a main risk for all decentralized projects is regulation by enforcement. Regulation by enforcement is a process where regulators aggrandize agency authority through illegal practices and litigation. This is a real risk for all decentralized projects operating in the United States, as the federal agencies therein, such as the SEC regularly deploy regulation by enforcement strategies against decentralized projects. To respond to this risk, Tego will employ automated mechanisms for compliance optimization as detailed in the following section.

Compliance

The project will take steps to ensure compliance with applicable laws over time. Specifically, the project will deploy software for compliance automation focusing on legal informatics. Legal informatics is an information-based approach to law that uses information technology to optimize cost-efficiency in results.

As part of its initial efforts, Tego will focus on structuring the project such that the TEGO token is solely a utility token for governance. Given the current regulatory climate in the United States, Tego will not operate in, nor be available in the United States. As part of Tego's terms and conditions, Tego will exclude United States users. Over time, the goal is for Tego to be able to operate safely in the United States in full compliance with all applicable laws.

Ultimately, compliance is a process, and the goal is minimizing errors. As the project grows and the needs of the project expand, Tego will likely pursue the advice of legal counsel to further support its compliance efforts.

[7] Oxford Reference, Principle of Parsimony (2022).

Voting

A core part of the stimulating mechanism for research will be voting with TEGO to approve funding for research proposals. For example, blockchain voting systems are usually more secure than centralized voting systems, which most often are vulnerable to corruption, slow in processing, and unable to produce verifiable results.[8] As such, voting technology is Ethereum well in development.

TEGO token holders, comprising a diverse array of stakeholders including researchers, healthcare professionals, and community members, are invited to participate in the voting process. Through their engagement with the platform, stakeholders can shape the direction of research initiatives, influence funding allocations, and contribute to the advancement of thyroid disease research and development.

The voting process commences with the submission of research proposals by members of the Tego community. These proposals outline specific research projects, objectives, methodologies, and anticipated outcomes, providing stakeholders with comprehensive insights into the proposed initiatives. The voting process is conducted transparently on the Ethereum blockchain, ensuring the integrity and immutability of the decision-making process. Stakeholders are provided with access to relevant information pertaining to each proposal, enabling informed decision-making based on the merits of the research initiatives.

The voting mechanism within Tego's decentralized governance framework is designed to evolve iteratively in response to community feedback, technological advancements, and changing research priorities. Continuous improvement efforts aim to enhance the efficiency, transparency, and effectiveness of the voting process, ensuring that Tego remains responsive to the needs and aspirations of its stakeholders.

The voting mechanism for Tego research will be an Ethereum layer 2[9] technology. By allowing network participants to vote on proposals, it will help ensure that better proposals are approved improving the quality of research and aiding in support of academic validity. The core Tego voting technology will be built on Ethereum.

Conclusion

The purpose for this White Paper is to provide a roadmap forward and the foundational principles on which Tego is built. Over time, as the project grows, plans and purpose may change. However, the core focus will be directing funding toward open source research and development for thyroid and other health related diseases.

[8] Vitalik Buterin, Notes on Blockchain Governance (2017).

[9] Layer 2 should be a mechanism for decentralization, creating opportunity, and inventing incentive systems for a more equitable economy. Inventing new incentive systems that create opportunity to earn economic income through providing products and services is critical.