Concepts

of

Ranking of Scientists in the Field of Longevity & 4P Medicine

and

The Rating of Longevity technologies,

and

Longevity & P4 Medicine Companies Ranking Codex

Abstract.

More and more scientists are engaged in the struggle against aging and the amount of financial resources invested in this sphere is growing every year. This note presents a methodology for creating a rating of scientists in the field of anti-aging.

The purpose of this rating is to select the most promising companies / groups of scientists in the field of anti-aging, whose medical technologies are worth investing in.

The rating will include scientists, experts who in their scientific development adhere to the P4 Medicine approach (Predictive, Preventive, Personalized and Participatory).

Objectives of the project:

1) Creation of a methodology for ranking experts in the field of longevity (LongevityRanking***) based on* P4 Medicine** approach;

2) Preparation of documentation for the implementation of the Longevity technologies Ranking (LongevityRanking Codex);

3) Building of clusters of scientists for medical and related scientific fields;

4) Description of conditions and rules for interaction with LongevityRating experts.

Methodology of the Longevity Scientists Ranking

When developing the methodology for the Longevity Rating, the experience of previous studies of ***scientific communities*** will be taken into account. In most studies, the basis for ranking is the calculation of the number of publications in high-ranking peer-reviewed journals and their citation. In this project, we propose to expand the composition of indicators, based on which the candidates' score will be calculated.

The candidates' score is calculated based on:

•The productivity and citation impact of the publications of a scientist (Hirsch index);

•The number of visitors to personal websites;

• The number of followers on the candidate's social media channels. The social channels analyzed include Linkedin, Twitter, YouTube, and Medium.;

• The number of mentions on specialized sites;

• The number of mentions in mainstream technology publications (social graph);

• The number of search engine results.

Data

The following sources of information will be used to gather data on experts:

- Meta.science
- Sci-Hub
- Crossref
- Web of Science
- Derwent World Patents Index (DWPI)
- Derwent Innovation and Derwent Patents Citations Index (DPCI)

The methodology for building the Ranking of Longevity Scientists will include also the following indicators:

• Number of venture deals in the expert industry

• Countries of expert activities

The more countries he is known the higher is the probability of investing in this expert. Ideally, if his service is in demand all over the world.

1. Long list of candidates

In building the rating of scientists, we will utilize the social network analysis (with the use of R programming language package).

When selecting scientists for long-list of future Ranking of scientist, the experience of previous studies of *scientific communities* will be taken into account. In most studies, the basis for ranking is the calculation of the number of publications in high-ranking peer-reviewed journals and their citation.

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- The number of followers on the candidate's social media channels (social graph);
- The number of mentions on specialized sites;
- The number of visitors to personal website or his account on professional site;
- The number of mentions in mainstream technology publications.

2. Election of the DAYS Blockchain Panel

The election of the LIF Blockchain Scientific Panel from top 300 selected global experts in the field of life extension and P4 Medicine

The election will be performed by the LIF sites contributors, users of the site www.liforum.org contributing to scientific researches.

3. Voting of the DAYS Scientific Blockchain Panel

The Scientific Blockchain Panel voting mechanism is like an ordinary Internet voting, but the results of each member of Scientific Blockchain Panel voting will be encrypted and stored changeless, on the decentralized mode.

Utilizing the Blockchain principle for voting will ensure the transparency of expert voting, since one will be able to check the initial weights of voters.

For the expert voting we'll utilize Blockchain voting panel that is like an ordinary Internet voting, but taking into account the rating of the voter. The identity management protocols in blockchain and the authentication protocols make it impossible to change. This way we assure that scientific process will be more sustainable and responsible.

This voting will be permanent. For the first time, LIF is leveraging linkable ring signatures in the scientific researches process. Each vote will be stored using blockchain solution: hash-chain time stamping and proof-of-work algorithm.

For the expert voting we'll utilize Blockchain technology taking into account the ranking of the voter. That is, the expert votes are weighted based on his ranking weights.

Utilizing the Blockchain principle for voting will ensure the transparency of expert voting, since one will be able to check the initial weights of voters.

Rating of longevity technologies procedure.

The stage of the DAYS project after call for papers for LIF is to make a rating of the most effective technologies in the sphere of longevity.

The rating will include medical technologies that can extend healthy life span and have already shown their effectiveness.

<u>Policy for DAYS Scientific Blockchain Panel's decisions</u>

(1) General provisions

Except for those decisions that must be taken in a particular way as indicated in section 4, decisions of the members of the DAYS Scientific Blockchain Panel may be taken either by vote at a general meeting as provided in sub-clause (2) of this clause or by written resolution as provided in sub-clause (3) of this clause.

(2) Taking ordinary decisions by vote of DAYS Scientific Blockchain Panel's electors

Any decision of the members of the DAYS Scientific Blockchain Panel may be taken by means of a resolution at a general meeting. Such a resolution may be passed by a simple majority of votes cast at the meeting (including votes cast by email ballot, and blockchain votes).

(3) Taking ordinary decisions by written resolution without a general meeting on blockchain panel:

a resolution in writing agreed by a simple majority of all the members who would have been entitled to vote upon it had it been proposed at a general meeting shall be effective, provided that:

(i) a copy of the proposed resolution has been sent via LIF blockchain system to all the members eligible to vote; and

(ii) a simple majority of members has signified its agreement to the resolution in a document or documents which are received at the principal office within the period of 7 days

Rating methodology is based on: I.Stambler, Potential criteria for feasibility verification of R&D for anti-aging diagnostics and therapies (in the form of computational algorithms)

Based on: Stambler I. Recognizing degenerative aging as a treatable medical condition: methodology and policy. Aging and Disease, 8(5), 583-589 2017,

http://www.aginganddisease.org/EN/10.14336/AD.2017.0130

Main classes of criteria:

I. Clarity of definitions.

II. Minimization of confounding factors.

III. Informative value.

IV. Practical utility (cost-effectiveness).

I. Clarity of definitions.

1) Clarity of basic terms and definitions.

Are the basic terms and premises defined clearly? For example, is "degenerative aging" understood as a process or as a state?

Potential measure: Degree of clarity

Work tasks: Develop a set of desirable basic definitions.

2) Definition of clinical benefits.

Are clinical endpoints and benefits defined clearly?

There is a need to precisely define measurable clinical end points, demonstrating evidential clinical benefits, especially for the reduction of age-related multimorbidity, including not only biomarkers, but also functional parameters.

Potential measure: Number and quality of endpoints. Degree of clarity

Work tasks: Define exemplary sets of endpoints.

II. Minimization of confounding factors.

1) Relevance to human patients.

How is the present research model relevant/close to apply to humans generally or to individual humans particularly?

The aim is to eliminate or improve R&D that may be unlikely to apply to humans.

Measure: Closeness of range by biological level of organization, type of animal model, predictive value of in-silico models.

Work tasks: Define the closeness of range.

2) Focus on older persons.

What is the relevance for actual aging patients?

The clinical benefits need to be evaluated in the primary target population – the older frail and multi-morbid persons, rather than the younger and healthier ones who may exhibit entirely different biological responses. Or at least the relevance must be shown to the aging process and aging subjects.

Potential measure: Closeness of relevance.

Work tasks: Defining criteria for closeness of relevance.

3) Long term consideration.

Have the long-term effects been evaluated (measured or at least predicted)?

The clinical criteria and biomarkers, as well as resources available to the organism, need to be considered for the long term. Thanks to long-term evaluation it may be possible to control for effects of over-stimulation, as well as rule out transient compensatory and psychosomatic effects and seeming short-term benefits that may arrive at the expense of long-term deterioration. In particular, seeming short-term "rejuvenation effects" may increase mortality and shorten the actual lifespan.

Potential measure: Level of evidence for long-term effects

Work tasks: Define levels of evidence for long-term effects

III. Informative value.

1) Predictive value.

Are the biomarkers and intervention effects predictive?

As almost any age-related biological parameter may be considered a “biomarker of aging,” and almost any physiological intervention can in some way affect the aging process, there is a need to select the most predictive biomarkers and intervention effects, for the population as well as for individuals, with reference to the aging process and aging-related diseases.

Potential measure: Mutual information (strength of non-linear correlation)

Work tasks: Develop algorithms for predictive values, possibly using information theory.

2) Safety vs. efficacy.

How is the efficacy related to safety (actual or potential)?

For any potential intervention, there is a need to weigh potential benefits against

potential risks. Hence the degree of potential efficacy must always be weighed against

potential safety (these values are often antagonistic).

Potential measure: Degree of efficacy vs. degree of safety.

Work tasks: Develop a balance relation between efficacy and safety.

3) Strength of Integration.

Is the diagnostic or treatment integrative?

The organism reacts as a whole, in an integrated and interrelated manner. Individual

biomarkers and interventions may not be indicative of the process or state of degeneration or general therapeutic effect. Therefore they must be considered in combinations, or ideally in a systemic balanced way – otherwise interventions on particular biomarkers and pathways may exacerbate other biomarkers and pathways, and disrupt the system as a whole.

Possible measure: Strength of integration

Work tasks: Define strength of integration, possibly using algorithms from set theory

and information theory.

IV. Practical utility.

1) Standardization.

Particular batteries of assays and interventions are usually related (and potentially biased) to particular theories, research agendas, academic schools and commercial interests. There is an apparent need to allow pluralism of investigation, discovery and application, while maintaining standards of the scientific method. Consensus standards often emerge as a result of data-sharing, which may become a practical challenge of its own.

Possible measures: perceived bias, compliance with standards (where available).

Work tasks: Defining agreeable compliance standards.

2) Cost-effectiveness.

Will the interventions be cost effective?

This is the most complex set of criteria to develop. As the goal of healthspan care is not just to produce profit for the providers, but to improve actual healthspan for as many people as possible, the considerations of cost-effectiveness should involve not only profitability, but also affordability for the population and the non-monetary improvement of well being, while still providing a return on investment.

Possible measure: Cost-effectiveness and potential return on investment.

Work tasks: Evaluate cost-effectiveness of existing and prospective diagnostics and treatments, possibly using expected value of sample information algorithms.