

# 金太郎セルズパワーの社会的使命と SDGs への取り組み

## 家族や社会、地球環境に負担をかけない、健やかな人生を実現するために

Kintaro Cells Power's Social Mission in line with SDGs Initiatives

To realize good health throughout the lives of people without burdening families, society and the global environment

### 背景：地球環境問題と人類文明、人口増加・少子高齢化との関係

地球史における「人新世」とも称されるようになった生物種としての人類の「繁栄」の時代、特に産業革命期以降の爆発的な人口増加に伴う、化学工業の発達や、化石エネルギーや原子力の利用による産業活動の地球環境への負荷は、地球環境が持つ自然の回復力の限度を超えつつある。漁獲・狩猟のような食糧・スポーツ・商業目的としての野生動植物の略奪的採取や殺傷に加えて、大気、水圏、地表等の生物圏全域に渡る合成化合物・人工物による汚染と、温室効果ガスの増加による地球温暖化により、生物圏・生態系に甚大な影響・被害が蓄積してきており、人類文明が原因で多数の生物種が絶滅しているだけでなく、人類自身の生存や人類文明そのものの存続にも危機が迫りつつある。2015年の国連総会での2030アジェンダの採択により、その中で謳われたSDGsの具体的な目標が提言され、世界各国の政府、企業、市民が一丸となつての地球温暖化抑制や地球環境回復への取り組みが要請され、漸く具体的な対策が本格化しつつある。

### Background: Relationship of global environmental problems with human civilization, population growth, declining birthrate and aging population,

In the era of 'prosperity' of human beings as an animal species that has come to be called 'Anthropocene' in the history of the earth, along the explosive population growth especially since Industrial Revolution, the burden of industrial activities on the global environment due to the development of chemical industries and the use of fossil energy, nuclear power is exceeding the limit of the natural resilience of the global environment. In addition to the predatory collection and killing of wild animals and plants for foods, sports, and commercial purposes such as fishing and hunting, pollution by synthetic compounds and man-made substances throughout the biosphere such as the atmosphere, hydrosphere, and surface soils, due to the global warming caused by the increase in greenhouse gases, enormous impacts and damages have been accumulated in the biosphere and ecosystems, there have been lots of extinct species due to human civilization, and also we perceive imminent crisis even for the survival of human beings and human civilization. The adoption of the 2030 Agenda at the United Nations General Assembly in 2015 proposed the specific goals of the SDGs set forth in it, and governments, companies, and citizens from around the world need to work together to curb global warming and recover the global environment, and concrete measures are finally being recognized for the implementation of needed actions.

ライフサイエンス、特に生物学・医学の視点から、産業革命以降の人類文明の「進歩」の負の側面を一言で言うと、自分たち自身を自己家畜化した人類が、地球環境に負荷を与え過ぎないような適正な人口のコントロールと、人類自身の社会や文明にとっての好ましい年齢構成比の人口ピラミッドの形状(様々な議論があろうが、有限の資源や化石燃料、食糧の条件に応じた「長方形に限りなく近い台形の人口構成」が望ましいとも言える)となるように、適切に人口動態を管理できなかった事が、地球環境破壊の根本的原因の1つとなっていると言える。世界の人口は2020年の時点で78億人に達し、2011年の70億人から僅か10年で10%以上の8億人も増加しており、肉食/雑食性の大型哺乳動物としては、地球

生命史上でも類を觀ない異常に大きい個体数となっている(皮肉にも、科学や文明を持たない野生生物の生態系においては、食物連鎖の頂点を占める大型肉食/雑食動物は増え過ぎないように絶妙にバランスされている。)。人口が増えた原因・条件は幾つか有るが、その最大の原因は、食糧の増産体制の確立と、公衆衛生(特に、上下水道の整備、石鹼の発明・普及等々)のと医学(特に抗生物質やワクチンの発明による主要な感染症の克服)の進歩・向上による乳幼児の死亡率の低下と寿命の延長である。

From the perspective of life science, especially biology and medicine, the negative aspects of the 'progress' of human civilization since the industrial revolution are summarized that human beings who have domesticized themselves impose huge burdens on the global environment without doing proper population control to optimize the shape of the population pyramid with a age composition desirable for human society and civilization themselves. Although there are various arguments, the shape should be trapezoid close to rectangle under the conditions of limited resources, fossil fuels and foods. It can be said that one of the root causes of the destruction of the global environment is the failure to properly manage the desirable population demographics. The world's population reached to 7.8 billion in 2020, an increase of more than 800 million (10%), in only 10 years from 7 billion in 2011. It has an unusually large population as a large carnivores / omnivores mammal that is unprecedented in the natural history of Earth (Ironically, in wildlife ecosystems without science or civilization, the numbers of large carnivores / omnivores animals that occupy the top of the food chain pyramid have been exquisitely balanced to other animal species and their foods.). There are several causes and conditions for the increase in population, but the biggest causes are the establishment of systems and technologies to increase food production and collection and the advancement of public health (especially the maintenance of water and sewage, the invention and spread of soap, etc.) and medicine (overcoming major infectious diseases especially by inventing antibiotics and vaccines) for the reduction of infant mortality and the prolongation of lifespan.

一方、先進国においては、社会や経済システムの発達、技術の進歩によるライフスタイルの変化は、少子高齢化をもたらした。少子高齢化は、家族や社会への負担と労働人口の減少に直結し、労働力の供給のための移民増加は、各国の社会の民族構成を変え、文化の地域性や独自性への脅威や、民族間の宗教・思想の対立の要因ともなっている。また、経済のグローバル化や日常生活の利便性の追求は、国境を越えた物資・旅客輸送技術の進歩とIT技術の急速な発展や、行き過ぎた資本主義や拝金主義的な経済的利益追求至上主義とも相まって、経済格差による貧富の差が拡大し、社会の分断化を促進しており、地球環境問題と異なる次元での、社会・経済・政治の混乱による人類文明への重大なリスクとなっている。2019年末に outbreak し、長期化が懸念されている、COVID-19の pandemicにより、このような社会・経済の混乱と政情の不安定化の傾向がさらに加速していると考えられる。

On the other hand, in developed countries, lifestyle changes due to the development of social and economic systems and technological advances have brought about a declining birthrate and an aging population. The declining birthrate and aging population are directly linked to the burden on families and society and the decrease in the working population, and the increase in immigrants to supply the labor force changes the ethnic composition of each country's society and threatens the regionality and uniqueness of culture. It is also a factor in the conflict of religions and ideas between ethnic groups. In addition, the pursuit of economic globalization and convenience of daily life, coupled with the advancement of cross-border goods and passenger transportation technologies, the rapid development of

IT technologies, and the utmost pursuit of excessive capitalism and money-based economic benefits has been generating the gap between the rich and the poor due to economic disparity is widening, promoting the division of society, and it becomes a serious risk to human civilization due to social, economic and political turmoil in a dimension different from global environmental problems. The COVID-19 pandemic, the outbreak of which has been reported in the end of 2019 and is feared to be prolonged, is thought to further accelerate the tendency for such social and economic turmoil and political instability.

### 少子高齢化から考える金太郎セルズパワー(KCP)のSDGsへの貢献のための対策： 健康寿命延長と高齢者QOLの向上 - 「ピンピンコロリ」の実現を目指して

一般に、農業による食糧自給率が高い発展途上国では人口が増加中で、公衆衛生や医療システムの水準が低い事から平均寿命が短いため、人口ピラミッドの年齢構成比は高齢者<若年者である。そのような社会では、急激な経済発展と工業化による温室効果ガス排出や環境汚染・公害、森林開発等による生態系破壊が深刻な問題であり、都市圏への人口集中が商業を発展させるが、同時に貧富の差を増大させる原因となる。SDGs実現には、先進国の犯した過去の過ちを繰り返さないような、国家・超国家単位での、環境負荷、貧富の差を大きくしないような産業・経済活動のためのルール作りや、環境技術の早期導入、地球環境・生態系保全のための教育・啓蒙活動が必須であり、これには該当国や地域の政治や経済の影響が大きい。

一方、少子高齢化が進んでいる先進各国においては、人口ピラミッドの形状を変えるには何世代にも渡る政策的な取り組みが必要であり、人権や個人の自由意思の尊重との両立も難しく、社会のルールや教育、ライフスタイルに関わる課題と言える。少子高齢化が進んでいる国や社会において、運動機能が低下したり、認知症の傾向が有る、労働が困難な高齢者や「寝たきり老人」は、医療・介護依存性が非常に高く、家族や友人、地域社会に負担をかけ、自身のみではなく社会全体の労働人口や医療経済に大きなマイナスの要因となっている。また、高齢者自身のQOLが低下すると、家族や周囲へも心理的・精神的な負担やストレスとなり、社会全体の健康状態にマイナスの効果になりかねない。

このような少子高齢化社会において、SDGsの観点から医療や医学に何が望まれるかを考えてみると、「ピンピンコロリ」を実現する事こそが最重要であると考えられる。「ピンピンコロリ」とは、理想的な老後を比喩的に表現する日本の言葉であるが、これは、「人生を終える最後の瞬間まで、元気で活力に満ちた意欲的な生活を楽しめる」ような、高いQOLの人生を象徴する言葉である。日本企業であるKCPは、この言葉どおりの高いQOLの個人と社会を理想とし、その実現こそがSDGsにも適った社会的使命であると考えている。すなわち、高齢になっても自分で生活できるだけの身体の機能の健全性を維持し、低下した機能を回復・再生させるための治療手段の有効・安全な選択肢として、金太郎細胞をより多くの人々に安価な価格で提供できる事業体制や事業モデルを実現したいと考えている。

栄養バランスの悪い食生活、睡眠不足、運動不足やストレスは早期の老化や生活習慣病(心血管障害、動脈硬化、高血圧、糖尿病、癌等)を招き易く、その多くは、慢性的な炎症を伴い、部分的または全身的な組織・細胞の老化とダメージの蓄積が加速し、恒常性の維持機能が徐々に失われて、未病の段階から疾病が顕在化し、運動機能も低下していく。更に、内分泌や免疫能のアンバランスや機能低下により、感染症や癌への自然な抵抗力も低下してQOLが失われていく。このような疾病の症状が深刻化してから治療行為を行っても、早期回復が困難が治療不可能で、治療のためのコストや医療従事者や家族の負担がより大きくなる。それに対して、未病の段階や現れた症状が軽微な段階から、健康状態を理解・

把握して対処する早期治療や予防的な治療の方が、経済的・社会的な負担が軽くなる事が、疫学的・医療経済学的にも証明されている。

KCPは、後述するAIロボットによる高効率自動培養装置を開発して、金太郎細胞の単位製造コストを劇的に下げることで、現在は富裕層クライアントが中心であるビジネスモデルから、中間層を含むより広い層のクライアントを対象にしたビジネスモデルへの移行を目指している。これによって、社会全体のQOL改善・向上に貢献し、介護や医療への精神的・経済的な負担を減らして、健康な労働人口を維持する事で、直接・間接にSDGsに貢献できると考えている。言い方を変えると、KCPは、人口ピラミッドの形である年齢構成比は変えられないが、その質・内容である健康寿命を改善し、健康な労働人口を維持するアプローチでSDGsに貢献する。

金太郎細胞は骨髄に由来する間葉系幹細胞の一種であるが、間葉系幹細胞には老化・損傷した組織や細胞の修復・再生、亢進した炎症や免疫の暴走を適切に調節する機能が有り、骨髄由来間葉系幹細胞のこのような機能は、国内外で頻用されている吸引した脂肪組織に由来する間葉系幹細胞よりも強く、静脈から投与した場合の(脳梗塞や肺梗塞等の致命的な事故につながる)血栓誘導リスクも小さい。骨髄由来間葉系幹細胞は生理的にも体の恒常性維持、特に炎症の調節や組織の修復・再生の役割を担う事が明らかにされつつあり、金太郎細胞は健康寿命の改善に最適な治療手段となる。

#### **Measures for Kintaro Cells Power (KCP) to contribute to SDGs from the perspective of declining birthrate and aging population: Extending healthy life expectancy and improving QOL for the elderly-Aiming to realize 'Pin Pin Korori'-**

In general, in developing countries where the food self-sufficiency rate by agriculture is high, the population is increasing and the average life expectancy is short due to the low level of public health and medical systems, so the age composition ratio of the population pyramid is 'elderly < young'. In such a society, greenhouse gas emissions due to rapid economic development and industrialization, environmental pollution and ecosystem destruction due to deforestation for economic growth and so on are serious problems. The biased population concentration in urban areas develops commerce, but at the same time, it causes an increase in the gap between the rich and the poor. In order to realize SDGs, it is necessary to create rules on a national / super-national basis for industrial and economic activities that can limit the increase in the environmental load and the gap between the rich and the poor, so as not to repeat the past mistakes made by developed countries in terms of the environmental protection. Early introduction of environmental technologies and education and enlightenment activities for the conservation of the global environment and ecosystem are indispensable, but it will be largely influenced by the political decisions and the economical conditions of the relevant countries and regions.

On the other hand, in developed countries where the birthrate is declining and the population is aging, it is necessary to continue policy efforts for generations to change the shape of the population pyramid, and it is difficult to balance such efforts with human rights and respect for individual free will. It can be said that it is an issue related to social rules, education, and lifestyle. In countries and societies with a declining birthrate and an aging population, elderly people who have difficulty in working, e.g. have a tendency of dementia or have decreased locomotive function, are highly dependent on long-term medical care and nursing care by medical specialists as well as their families. It puts stresses on families and local communities, and is a major negative factor not only for themselves but also for the working population and medical economy of society as a whole. In addition, if the QOL of the elderly themselves declines, it causes psychological and mental burdens

and stress on their families and surroundings, which have a negative impact on the health condition of society as a whole.

Considering what is desired for medical care and medicine from the perspective of SDGs in such an aging society with a declining birthrate, the realization of 'Pin Pin Korori' should be the most important. 'Pin Pin Korori' is a Japanese word that metaphorically expresses an ideal old age, meaning "enjoy a lively, energetic and ambitious life until the last moment of your life." It is a word that symbolizes a life with a high QOL. KCP as a Japanese company, idealizes individuals and society with high QOL as the word says, and believes that its realization is a social mission suitable for SDGs. In other words, more people should use Kintaro Cells as an effective and safe option for therapeutic means to maintain the soundness of physical functions that allow them to live on their own even as they become older, and to recover and regenerate their deteriorated functions. KCP desires to realize a business structure and a business model that can offer Kintaro Cells for a reasonable price.

Poor nutritional diet, lack of good sleep, lack of proper exercise and stress are likely to lead to premature aging and lifestyle-related diseases (cardiovascular disorders, arteriosclerosis, hypertension, diabetes, cancer, etc.), many of which are accompanied with chronic inflammation. Along with this, partial or systemic tissue / cell aging and the accumulation of damages are accelerated, the function of maintaining homeostasis is gradually lost, the disease becomes apparent from the pre-illness stage, and the motor functions also decline in parallel. In addition, due to endocrine and immune imbalances or functional decline, the natural resistance to infectious diseases and cancer are weakened, resulting in serious loss of QOL. Even if treatment is performed after the symptoms of such a disease have become serious, early recovery is difficult or untreatable, and the cost for treatment and the burden on medical staff and family members will increase. On the other hand, early treatment and preventive treatment based on the good understanding of the health condition from the stage of non-illness or the stage where the manifested symptoms are minor will significantly reduce the financial and social burden, which has been well proven epidemiologically and in terms of medical economy.

KCP has been planning to develop a high-efficiency automatic culture device using AI-operated robots, which will be described later and is expected to dramatically reduce the unit manufacturing cost of Kintaro Cells. We are aiming to shift to a business model that targets a wider range of clients. By doing so, we believe that we can contribute directly and indirectly to the SDGs by improving the QOL of society as a whole, reducing the mental and economic burden on long-term care and medical care, and maintaining a healthy working population. In other words, KCP contributes to the SDGs with an approach that improves the quality and content of healthy life expectancy and maintains a healthy working population, although the age composition ratio, i.e. the shape of the population pyramid, cannot be changed.

Kintaro Cells are a type of mesenchymal stem cells (MSC) derived from bone marrow, and MSC has the function of appropriately regulating aging / damaged tissue and cell repair / regeneration, enhanced inflammation, and immune runaway. Such functions of bone marrow-derived mesenchymal stem cells (BMMSC) is stronger than those of adipose-derived mesenchymal stem cells (AdMSC), which are collected from aspirated adipose tissues and are more frequently used in Japan and oversea but have higher risks of clot induction (leading to fatal accidents such as cerebral infarction, pulmonary infarction, etc.)

when administered intravenously while BMMSC has much lower risks of clot. It is becoming clear that BMMSC plays a central role in maintaining body homeostasis, especially in regulating inflammation and repairing / regenerating tissues, and Kintaro Cells are optimal for improving healthy life expectancy as a proper alternative therapy for better QOL.

### 金太郎細胞の製造体制における SDGs への取り組みの具体例

1) 従来の多くの細胞培養系においては、人工的な化学合成・製造が難しい、細胞の増殖に必須な生理活性物質を含む培地添加物として、ウシ胎児血清 (FBS) が使われているが、FBS は妊娠牛の胎児の血液を全採血して作られ、大量の飼料が飼育に必要な食肉用家畜を無駄に殺傷するばかりでなく、動物倫理 animal welfare にも大きく反している。KCP の主力製品である金太郎細胞の培養系においては、FBS を使わず、ヒトの疾患治療の目的で供血者から得られた成分輸血用血小板濃縮液のうち、何らかの理由で使用期限が過ぎて廃棄処分とされてしまうものを原材料として活用した、「血小板溶解物」製品を培地添加物として使っており、SDGs の観点でも環境負荷が極めて小さい。

2) 従来から KCP では、培養液組成と培養形態・方法の両方に独自の工夫を凝らしており、効率的な細胞培養系を構築している。これにより、他社の場合よりも培地の使用量やコストが小さく、また、使い捨てにされるプラスチック製培養器具の使用量も小さい。すなわち、細胞製品の製造のための工程で用いる材料の効率的な使用により、環境負荷を小さくしている。今後はさらに、AI 化ロボットを導入・開発しながら、培養条件の更なる改良を行う事で、単位製造量当たりの環境負荷を減らす工夫と改良を継続する計画であり、環境負荷の軽減と利益性の向上の両立を目指している。

3) 金太郎細胞の製造で用いられた培養液には、金太郎細胞の産生した様々な生理活性物質が含まれており、皮膚組織の老化や損傷を回復・再生させる働きが認められており、増やした金太郎細胞の遠心分離機による回収後の培養上清液は、皮膚科領域での再生医療や化粧品原料として利用できる。すなわち、細胞製造の副産物が有効活用でき、廃棄するものを最小化できる。

4) 金太郎細胞の製造に用いる AI 化ロボットによる高効率自動培養装置の運転に必要な電力は、再生可能エネルギーで賄い、計画中の細胞医療産業化開発センター操業開始時に ZEB ready ~ nearly ZEB、将来的には ZEB な細胞製造工場を実現する。

1) ~ 4) の取り組みは、これまでの KCP のビジネスプランや方針と全く矛盾せず、無理なく自然に SDGs に貢献できるものと考えている。

### Specific examples of SDGs initiatives in the Kintaro Cell manufacturing system

1) In many conventional cell culture systems, fetal bovine serum (FBS) is used as a supplement of cell culture medium containing biologically active substances essential for cell proliferation, which are difficult to artificially synthesize and produce. FBS is made by collecting all the fetal blood in pregnant cows, which not only wastefully kills the meat livestock requiring a large amount of feed for breeding, but also greatly violates animal welfare. In the culture system of Kintaro Cells, which is KCP's main product, KCP uses 'human platelet lysate (hPL)' product instead of FBS, manufactured from expired human platelet concentrates obtained from healthy donors originally collected for blood component transfusion into patients, which have expired for some reasons and are to be discarded. Thus the environmental load can be significantly reduced by choosing hPL from the viewpoint of SDGs.

2) Conventionally, KCP has devised its own ingenuity in both the recipe of culture medium and the culture method for an efficient culture system of Kintaro Cells. As a result, the amount of medium used and the cost are smaller than those of other companies, and the

amount of disposable plastic culture equipment used is also small. Thus, the total environmental load is reduced by efficiently using the materials used in the process for manufacturing cell products. In the future, we will continue to reduce the environmental load per unit production volume by further improving the culture conditions by introducing and developing AI robots. We are aiming at realizing both the reduction of environmental load and the business profits.

3) The culture medium used for the production of Kintaro Cells contains various physiologically active substances produced by Kintaro Cells themselves, and has been found to have a function of recovering and regenerating skin tissues from aging and damages. The culture supernatant after the collection of Kintaro Cells by centrifuge can be used as a raw material for regenerative medicine and cosmetics in the field of dermatology. That is, the by-products of Kintaro Cells production can be effectively utilized, and the waste can be minimized.

4) Renewable energy is planned to be used to supply the power for the operation of the high-efficiency automatic culture system by the AI-robot used to manufacture Kintaro cells, and ZEB ready or nearly ZEB will be realized at the start of the planned operation of Development Center for Industrialization of Cell Therapy. In the future, we will realize a ZEB cell manufacturing factory.

We believe that the efforts 1) to 4) are completely consistent with the KCP business plans and policies, and can contribute to the SDGs naturally and reasonably.