

## PAINLESS "HUNGER-DEATH" IS A MYTH

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### ABSTRACT

*Since at present A.D. 2015 around one billion people are exposed to hunger (< 200 kcal/caput/day) -among them around 7 million children (aged < 5 years) and around 4 million neonatal deaths- we will discuss the important question "Do we have pain during starvation resulting in a hunger death?" Because of the total physiological and biochemical degeneration during a hunger death, we can assume it will be accompanied with tremendous pain which can be relieved by treatment anodyne medicine like morphine, which are not available for these one billion people in the underdeveloped world. When agriculturist don't succeed to meet the feeding demands of the  $\approx 10$  billion people who will live at planet Earth at the midst of this century a tremendous disaster and hunger pandemic will strike planet Earth. Food is so integral to human wellbeing and there is such a close relation between energy, food, nutritional quality and health on a global scale at our planet that it not only opens the discussion about the ethics that at present on a global scale the neglected  $\approx$ one billion people are dying a cruel hunger death, but also suggest a smart innovative perspectives "to ban the hunger", and over a period of three decades gradually make the transition gradually from a fossil energy driven economy towards a seaweed based economy meeting the 8 millenium goals.*

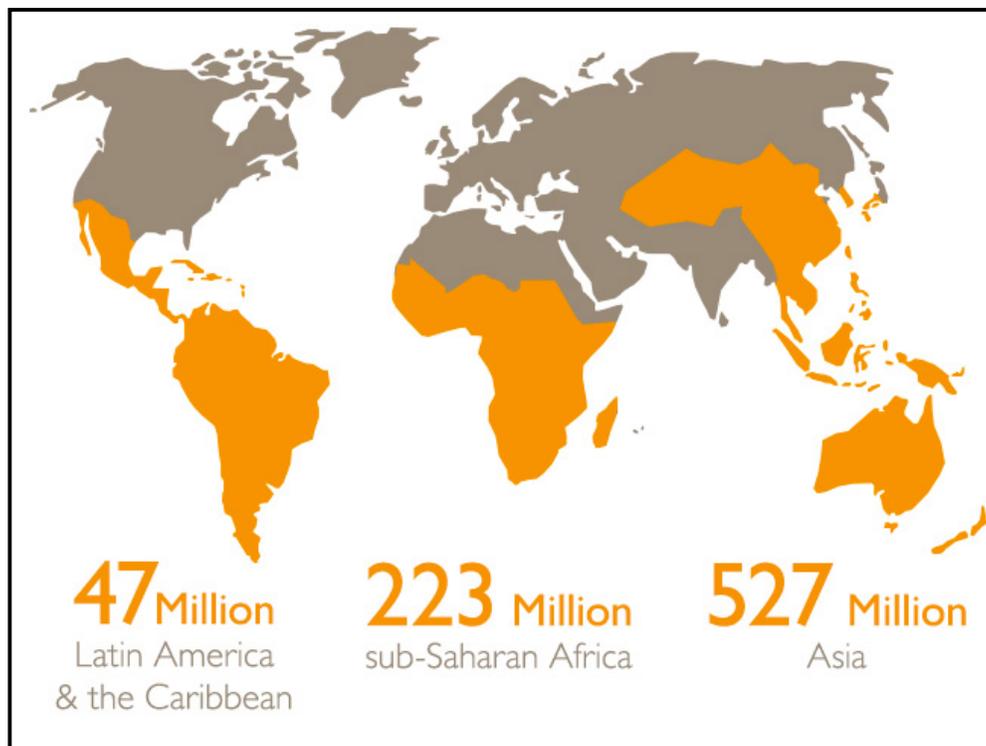
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### INTRODUCTION

We will first start this manuscript with some classical historical doubts of one of the most important natural philosophers ever existed in human history. Charles Darwin (1859), who could boast with the release of "*On the Origin of Species*" as a masterwork in the scientific world of natural philosophers and evolutionary biologists and its influence on society today still continues to be unabated. During that time "natural philosophy" graded subtle and intermingled with "natural theology", a pious school that considered the wonders of nature as evidence for the omnipotence and benevolence of God. In this societal context and personal belief Charles Darwin completely accepted the (cruel) evolutionary laws of "natural

selection" and "the struggle for life" without any doubt of a merciful God as Charles Darwin wrote in his famous book: ***"That each –individual- at some period of his life, during some season of the year, during each generation or at intervals, has to struggle for life and to suffer great destruction. When we reflect on this struggle, we may console ourselves with the full belief, that the war of nature is not incessant, that no fear is felt, that death is generally prompt, and that the vigorous, the healthy, and the happy survive and multiply"*** [Charles Darwin (1859). "On the Origin of Species"; Chapter III: "Struggle for Existence"]. But solely one year later after having studied the tremendously cruel symbioses between parasite wasp and its caterpillar prey he wrote to his American colleague Asa Grey in a rather bewildered and riveting way his personal "struggle" to accept such cruelty in nature created by an omnipotent good God: ***"There seems to me too much misery in the world. I cannot persuade myself that a beneficent & omnipotent God would have designedly created the Ichneumonidae (≈parasite wasp) with the express intention of their feeding within the living bodies of caterpillars..."***. (Charles Darwin (1860), Letter to Asa Gray, May 22). Coming to the major issue of this [Perspectives:] Painless "Hunger" death is a Myth. While the issue "Hunger in the World", has earlier been reviewed from mainly physiological- and biochemical- point of view van Ginneken (2011). But the most important question "Do we have pain during starvation resulting in a hunger death?" will remained unanswered. This remains an undissolved question probably because the question blends many research areas like philosophy, psychology & neuroscience. What we hope to achieve –and is the major mission of our blue-green technologies foundation- that from moral, ethical and empathy for every human citizen on our globe we will not accept towards the 10 billion people at A.D. 2050, hunger has been there and always will be there. Based on the photosynthetic efficiency of C3- and C4- crops in combination with a Maximal Solar Irradiance (MSI) like in the Sahara desert of 2800 ( $\mu\text{mol}/\text{m}^2/\text{sec}$ ) the calculation of Larkum (2010) made clear that on a global scale sufficient food could be produced for the world population of  $\approx 7,2$  billion people on an agricultural surface area like a country with the size of Egypt or Columbia. However, we live in a dispersed world with a hunger-obesity paradox (van Ginneken 2011) which combination hinders to produce sufficient food for the whole world population In our earlier review we outlined –based on the classical but –as later considered grueling study of Adam Keys (1950) - in the so called "Minnesota Starvation Experiment" which delivered a standard work "The Biology of Human Starvation". The "volunteers", received the first 3 months 3200 kcal/caput/day followed by 6 months of "semi-starvation" at 1800 kcal/caput/day. During this semi-starvation period most of the participants lost > 25% of their body weight. The final three months were a nutritional rehabilitation period (Kalm & Sebens 2005). In general this starvation period was considered by most "volunteers" as psychological traumatically with a tremendous impact during the rest of their lives. Because of the results of Keys (1950), it is now generally recognized that starvation alters personality and that nutrition directly and predictably affects mind as well as body (Kalm & Semba 2005; reviewed van Ginneken). Despite these scientific facts we live in a dispersed "Hunger-Obesity"-world and although since the 1990's hunger has

diminished the people in the developed countries seems to be untouched because it is far away from the Industrialized Western World (IWW) (Notice that in the IWW there is also  $\approx 1.6\%$  hunger). We shall argue that systematic public action can eradicate the terrible and resilient problems of starvation and hunger in the world in which we live. The character of the appeal of the  $\approx 800$  million people in the Developing countries (Figure 1), human nature reveals just how pervasive the “charity view” of most people in the IWW is. We think that although it would be nice of us to assist the starving, none of us is morally required to assist them—that we have done nothing (very) wrong if we ignore those strangers in need. Indeed, most people assume that if we help, then we are moral heroes. The most familiar ground for claiming that we have a strong duty to assist is simply that, if we can alleviate people’s suffering or prevent their dying at little personal cost, then we morally ought to do it. This seems especially plausible when those in need are in no way responsible for their own plight. Since the overwhelming majority of those who are seriously undernourished are children -who are paradigmatically innocent and vulnerable- then their need would arguably demand our assistance. In this world we are mutually dependent. We live in the conditions which constitute the “circumstances of justice” (reviewed: LaFolette 2003).



**Figure 1.** “Hunger in the World” The highest mortality is in S.E. Asia –where more than half of the world population lives, followed by Sub-Saharan Africa. (Source: FAO (2013): data for the period 2011-2013).

Coming to the present world A.D. 2014 where in principle terrestrial agriculture can provide according to Millenium goal 1 "The right for food", with the acquired  $\approx 3000$  kcal caput/day still  $\approx 800$  million people have acute hunger stress ( $< 200$  kcal/caput/day). Although 82 countries are listed to cope with starvation and undernourishment, the "Hunger Problem" seemed to be far away from the industrialized Western world. To oversee and understand the enormous impact of the problem some facts will be mentioned. Related to hunger  $\approx 800$  million people across the world are hungry (while nearly one-two billion individuals are undernourished worldwide (van Ginneken 2011). As a paradox (see Figure 1), in the developed countries  $\approx$  one billion people have nutritional health problems related to obesity (BMI $>30$ ) and its very costly "burden" of Chronic Degenerative diseases (CD's) which already  $\approx 30$  years strikes the US as an epidemic plague (van Ginneken & de Vries 2015).



**Figure 2.** The present Hunger-Obesity paradox.

According to FAO (2005) data in order to feed the world with its still unfettered growing population mainly in the developing countries and estimated by the UN (2008) at  $\approx 9.4$  billion citizens around 2050 will cost for the developed countries an annual investment of  $\approx 83$  US\$ while for the developing countries these costs are nearly 50% higher at an estimated  $\approx 142$  US\$. These numbers are extremely low in comparison the US paid in 2012 at its national problem obesity and its "burden" of CD's of  $\approx 15$  trillion US\$ (Fineberg 2012), just below its GDP (data Worldbank) of  $\approx 16,245$  trillion US\$.

Black et al. (2003) gave an impressive and shocking review in 'the Lancet' entitled: "*Where and why are 10 million children dying every year?*"

Some facts from this review: **a).** At 2005, about 10.1 million children died before they reached their fifth birthday. About 41% of child deaths occurred in sub-Saharan Africa and another 34% in south Asia; **b).** To get an impression of these "nothing saying" numbers: every day, almost 16,000 children die from hunger-related causes, nearly one child every 5 seconds (reviewed: van Ginneken 2011).

In fact, as described in the review of van Ginneken (2011) an acute chronic hunger death -lasting at maximal 10 days due to acute chronic starvation  $\approx 0$  kcal/caput/day- is the most inhumane and cruel death a human can dye. It is so genius and perfectly organized in its cruelty with perfectly organized physiological

and biochemical pathways “the so called crosstalk”, with the liver as central operator in order to provide the human brain of the starving person continuously and instantaneously of fuel like glucose, ketone bodies, until the last amino acid is burned from the remaining bones of a five years old totter (figure 2) which results that the Body Mass Index (BMI) -an antropometric parameter which is a global index to define underweight, overweight or obese- dwindles. This is an index of a person’s weight in relation to height; determined by dividing the weight (in kilograms) by the square of the height (in meters) and will drop in case of starvation (< 200 kcal/caput/day) below some standard of acceptable weight during starvation and acute chronic hungering. In males the threshold of a hunger death is a BMI of 13 with a coefficient of variation (CV) of 8.7% while these figures are for females 11 with a CV of 14%. This is mainly caused by a loss of fat and muscle combined with a tremendous shrinkage of the organs and loss of body mass -which cannot be denied- a complete physiological degeneration of which we **can** assume it will be accompanied with tremendous pain which we luckily in the developed world –in most cases for the elderly- can relieve by treatment anodyne medicine like morphine.

But for these ≈10 million children of Black et al (2003) in the desert even “the developed world” is not willing to spend any UN money to supply at this protracted crises moment for humanity, the 21<sup>st</sup> century. Furthermore, it can be disputed if a “hunger death” is at present the most humane death (≈passive euthanasia). Medical Sciences can offer an incurable patient also an active euthanasia protocol but the first “method” is preferred because of the following rooted outdated medical perception believes and assumptions which are nearly not investigated and thus consequently have no firm grounds.

**1).** At first due to food abstinence the patient slowly becomes lethargic because whole metabolism, expressed in the Basal Metabolic Rate (BMR) slows down; but is this beyond the awareness of pain?

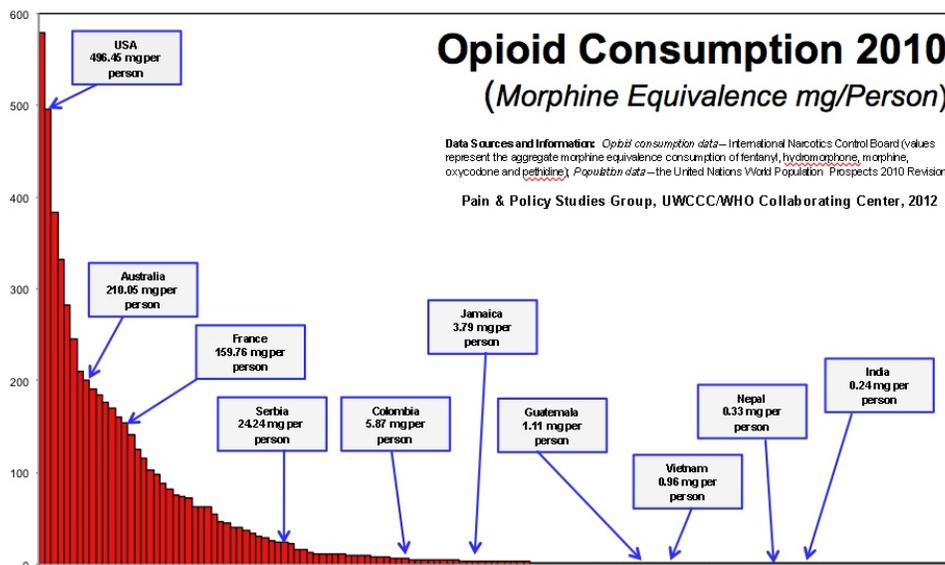
**2).** Next stage, the patient slowly further reaches a kind of stage of dormancy comparable to a deep painless sleep. Also, the disputed publication of Margulus (1979) is quoted in Medical Sciences, which describes the phenomenon that under extreme harsh and adverse life conditions like famine by the autonomic nervous system natural pain releasers like  $\beta$ -endorphins and endoloxone are released in order to conserve further any energy stores in the body under these extreme situations. Taking in consideration the tremendous amount of morphine which is used as anodyne medicine in the developed world and speaking with geriatric physicians and nursery personal working in the developed world at elderly institutions were -“medical passive abstinence policy of food” is a common practice- they all acknowledge nearly almost all patients are complaining about tremendous pain and ask themselves -if capable- for pain diminishing medicines (anodyne medicines) like morphine. In the developed world it is broadly used but in the underdeveloped world it is nearly not applied in Medicine from which we can make at present the following assertions:

**a).** Morphine is nearly not available due a nearly undeveloped health-care system in the underdeveloped countries;

b). Lower- and middle- class of these societies in the underdeveloped world can not afford the expensive morphine themselves.

c). From Figure 2 –which are the official medical registered and documented datasets from the national statistics organizations in five underdeveloped countries – we can conclude that the opioid consumption in expressed in [Morphine Equivalence mg/Person] – is nearly not applied in the official medical institutions.

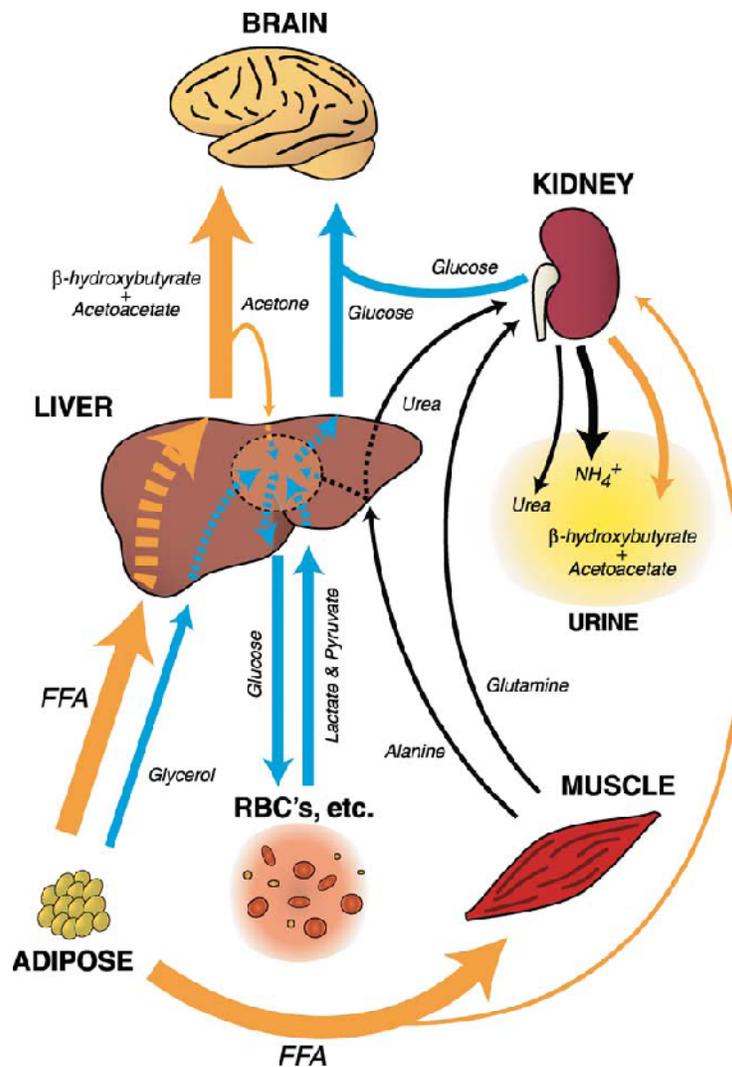
=> So what about the field situation and the option that morphine is used as anodyne medicine in the underdeveloped world? We can make the statement that it is not available nor applied in the field situation where 10 million children < 5 years old (Black et al 2003) die this inhumane and cruel hunger death (van Ginneken 2011).



**Figure 3.** Morphine usage in developed and underdeveloped countries in Medical Society (Courtesy: UWCC/WHO Collaborating Center 2010).

It is really beyond all medical ethical & moral standards that published assertions like the 3 decades ago published work Margulus (1979) are still educated but in practice when they have to treat their first incurable patient that “a hunger death without pain”, is a myth. Finally, at the last stage of this by acute chronic hunger (Depth of Hunger < 200 kcal/caput/day) induced mortality process the patient loses consciousness and slowly faiths away. Is this according to common moral and ethical values for a highly developed civilized world just a fact and unabated issue? Emphatics on a global scale seems to be dampened by a globalization where the individual doesn't count. Presently whole human populations: ≈one billion obese and ≈one billion dying a hungry death are not according to Darwinian thought of “survival of the fittest” where he defined in the “Origin of Species” “...where the rate and manner of natural selection of the inhabitants of this world where according to his believes the natural selection will

always act very slowly, often at long intervals of time, and generally on only a very few of the same region at the same time.” [Charles Darwin, On the Origin of Species 1859; Chapter IV: “Natural Selection”]. At present we postulate this perception needs to be revised if we stipulate as Blue-Green technology foundation “The State of the World A.D. 2014”: where **a)** Natural selection is tremendously rapidly in one-three generations; **b)** Rapidly all problems since the start of the Industrial Era has to be dissolved in nearly three decades; **c)** Where on a global scale billions of people are involved; **d)** Yet we can conclude the 21<sup>st</sup> century the world is in a protracted crises.



**Figure 3.** Overall scheme of starvation fuel metabolism. Liver derives its major energy by partial oxidation of FFA to  $\beta$ -hydroxybutyrate and acetoacetate; muscle and kidney by complete oxidation of FFA to  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . Brain utilizes both  $\beta$ -hydroxybutyrate and acetoacetate and glucose. FFA, free fatty acids; RBCs, red blood cells (Source: van Ginneken et al 2011).

The global nutritional (figure 3) and health status of its inhabitants are major research issues of the recently started Blue-Green technologies foundation ([www.bluegreentechnologies.nl](http://www.bluegreentechnologies.nl)).

When agriculturist don't succeed to meet the feeding demands of the  $\approx 10$  billion people who will live at planet Earth at the midst of this century a tremendous disaster and hunger pandemic will strike planet Earth. Our solution "*Towards a Seaweed based Economy*" (van Ginneken & de Vries 2015), requires low technology and input factors (seaweeds, maximal solar irradiance, desert and oceanic water), is very are simple and will reach the poorest in the remote areas of our planet and can per region implemented (Wahlqvist et al 2007). At present, legislation about ending life of an incurable patient are strictly ruled and protected by law. In the modern westernized World before the hunger dying person is incapacitated, the patient's wishes about care should be clarified, and financial and legal arrangements (e.g. durable power of attorney, durable power of attorney for health care) should be made. When these documents are signed, the patient's capacity should be evaluated, and evaluation results recorded decisions about artificial feeding and treatment of acute disorders are best made before the need develops. However, in practice Western help organizations are only directed to get as much of food in the areas of famine and "official" legislation about moral and ethical issues about the patient willingness for medical treatment or to die are only luxury legislation for the developed rich countries. What is at present not even available during an advanced state of chronic hunger deprivation are palliative measures like pain-diminishing drugs non-available in the underdeveloped countries (Figure 2). The fact that at present  $\approx$ one billion people are dying a cruel hunger without palliative measures should stimulate the UN the need to redouble efforts to address hunger, which continues to affect so many people. Therefore, the food system must become sustainable and there is also need to redouble efforts to address hunger. Following solely a terrestrial based food production system in the most positive case -clearly defined by the arithmetical experts of the FAO and WHO- it is unlikely that hunger will be eradicated by 2030. In order to prevent scarcity of green biomass production at planet Earth it has according to two independent research groups FAO (2005; Foresight 2011) to grow with 70% in order to avoid a tremendous catastrophe for humanity.

Our new smart innovative blue-green technologies foundation [www.bluegreentechnologies.nl](http://www.bluegreentechnologies.nl) hopes by catalyzing on a global scale seaweed culture in our nearly unexploited oceans to increase the estimated efficiency of photosynthesis, at present on a global scale estimated at the low overall efficiency value of  $\approx 7\%$  (which is in principle the only general primary motor for economic growth). An increase of this solar energy efficiency of  $\approx 7\%$  by photosynthesis (Larkum 2010 and references therein). So presently  $\approx 7$  billion people are for primary needs including food production dependent on these 7% overall efficiency of primary production yielding on a global scale  $\approx 56.4$  billion ton Carbon terrestrial and in the oceans  $\approx 48.5$  billion ton Carbon (Field et al 1998).

In two ways we can produce the amount fixed Carbon for food: **a)**. By smart innovative blue-green technologies solutions these will work synergistically and deliver totally new agricultural food chains like a sustainable, affordable and environmentally friendly global protein platform (van Ginneken et al 2015, in press); **b)**. By increasing the primary production of our planet -1% corresponds to one billion people more- e.g. with the unforeseen crop of the future the seaweeds. In this context we can only stipulate and are personally convinced that in the nowadays perspectives for the 21<sup>st</sup>, a seaweed based economy can **assist** the failing terrestrial agricultural food production system. Therefore the *a priori* described global status of our planet and the nutritional and health status of its inhabitants are major research issues of the Blue-Green technology foundation as outlined in the introduction paragraph "Towards a Seaweed Based Economy", (van Ginneken & de Vries 2015; www.bluegreentechnologies.nl.). At present an epidemiological registration system is applied in the developing countries which are atypical for specific risk regions in a country without any individual resilience. A credible method is needed for generating valid estimates for predicting the distribution of under-five deaths by cause in the developing countries (Morris et al 2003). A solution could be a Medical Systems Biology approach targeting for specific "hunger biomarkers" following a *Lipidomics* based approach. We succeeded before the millennium using advanced LC-MS techniques to find in a starvation mouse model a rare unique biomarker a 49-4-TG with an odd number of C atoms (van Ginneken et al 2007). This unique biomarker has all the characteristics of a biomarker for starvation and will make a "personalized medical treatment" possible. The process to find a proper biomarker is underestimated and has to follow the next route:

**A)**. The Discovery phase (like in our starvation mouse model discovery of a 49-4-TG) (van Ginneken et al 2007).

**B)**. Qualification phase one, which encompasses:

1. Identification of the biomarker,
2. Validation analysis,
3. Proof of the biomarker in a new study,

**C)**. Qualification phase two, which encompasses:

1. Study precision,
2. Study robustness,
3. Study limitation,
4. Test biomarker in a wider population,

**D)**. Finally, the application phase in the population is reached (van Ginneken 2011 and references therein).

A "Seaweed based Economy" is at present the only real option: **1)**. To revitalize economic moves to end hunger; **2)**. To feed at the midst of the 21<sup>st</sup> century around 10 billion people which we address as "The Global Ten Billion People Issue"; **3)**. Seaweeds can be cultured at the remote areas of our globe where the poorest of the poorest people will live -"coastal zone explosion"- and give a new imperative perspective to their lives.

Food is so integral to human wellbeing and there is such a close relation between energy, food, nutritional quality and health on a global scale at our planet that the Bluegreen technologies foundation -giving following a multidisciplinary total new smart blue-green approach- not only opens the discussion about the ethics that at present on a global scale the neglected ≈one billion people are dying a cruel hunger death, but also suggest a smart innovative perspectives “to ban the hunger”, and over a period of three decades gradually make the transition gradually from a fossil energy driven economy towards a seaweed based economy meeting the 8 millenium goals as given in Figure 4.



**Figure 4.** The eight Millenium Goals

Since the compelling and urgent research work of (Morris et al 2003), with their “cry” for a vital under-five deaths prediction system situation has improved in 2012 and 2015 by sponsored work of the Bill & Melinda Gates Foundation. Information about the distribution of causes of and time trends for child mortality should be periodically updated. A team of researchers reported recently (Liu et al 2012), the latest estimates of causes of child mortality in 2010 with time trends since 2000. Of ≈7,95 million deaths in children younger than 5 years in 2010, 64.0% (4,879 million) were attributable to infectious causes and 40.3% (3,072 million) occurred in neonates. Child survival strategies should direct resources toward the leading causes of child mortality, with attention focusing on infectious and neonatal causes (Liu et al 2012). More rapid decreases from 2010-15 will need accelerated reduction for the most common causes of death, notably pneumonia and preterm birth complications. Continued efforts to gather high-quality data and enhance estimation methods are essential for the improvement of future estimates.

Very recent work out of 2015 also funded by the Bill & Melinda Gates Foundation gave similar figures. Liu et al (2015) estimated the distributions of causes of child mortality separately for neonates and children aged 1-59 months. To generate cause-specific mortality fractions, the researchers included new vital registration and verbal autopsy data. Of the 6,3 million children who died before age 5 years in 2013, 51.8% (3,257 million) died of infectious causes and 44% (2,761 million) died in the neonatal period. The three leading causes are: **a).** preterm birth complications (0,965 million  $\approx$ 15.4%); **b).** pneumonia (0,935 million  $\approx$ 14.9%) and **c).** *intra-partum* related complications (0,662 million  $\approx$  10.5%). Reductions in pneumonia, diarrhoea, and measles collectively were responsible for half of the 3,6 million fewer deaths recorded in 2013 versus 2000. Causes with the slowest progress were congenital, preterm, neonatal sepsis, injury, and other causes. If present trends continue, 4,4 million children younger than 5 years will still die in 2030. Furthermore, sub-Saharan Africa will have 33% of the births and 60% of the deaths in 2030, compared with 25% and 50% in 2013, respectively Liu et al (2015).

Furthermore in an earlier study of Lawn et al (2006) estimations gave the tremendous amount of 4 million neonatal deaths in the year 2000 (Lawn et al 2006). These mortality data of around 6-7 million "totters" < 5 years old are shocking and might contribute to an understanding and give us the following information why the world is more shocked by the death of  $\approx$ 6-7 million < 5 years children (Liu et al 2014, 2015), in comparison to an also extremely nearly number of comparable deaths of  $\approx$ 4 million neonatal deaths in the year 2000 (Lawn et al 2000). The following provoked statement from the utilitarian philosopher Jeremy Bentham (I warn its shocking but it directly stipulates the core of our criteria of empathy). He states: "A full grown horse or a dog is beyond comparison a more rational, as well as a more conversible animal than an infant of a day, or a week or even a month old. But suppose they were otherwise, what would it avail? The question is not, Can they reason? Can they talk? But also can they *suffer*?" (Bentham 1798). The reasons for this statement are implicit in the theory of consciousness Dennet (1991) has developed. Suffering is not a matter of being visited by some ineffable but intrinsically awful state, but of having one life hopes, life plans, thwarting one's intentions –whatever they are. It follows that the capacity to suffer is a function of the capacity to have articulated, wide-ranging, highly discriminative desires, expectations, and other mental states. As long as the people in the developed world are not convinced their contemporaries (equal brothers/sisters)  $\approx$  800 million-are projected to hunger or stroke by famine in the developing countries, a hunger death will remain painful (Dennet 1991).

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