"altitude." This we find pivotal because the organism of high altitude residents going down to sea level, has to adapt to the "relative hyperoxic environment." It is wrongly assumed that for high altitude residents, going to a lower altitude where there is more oxygen pressure, as a result of a higher barometric pressure, is beneficial. We strongly question this, as high altitude residents, being born, developed, and carrying out normal lives in the mountain cities of the world living in perfect harmony with our environment. We, as Andean high altitude residents, have higher hematocrit and hemoglobin values, as the fundamental compensating biological response. All living beings, humans, animals and plants and presumably other microscopic organisms suffer biologic changes on barometric pressure changes. In other words, physical changes in the environment, induce biological changes. The rules governing physics are imbedded within biology.

The formula of adaptation is not only useful for high altitude adaptation, but rather can be used for any type of adaptation, where the organism in order to survive, needs to find the most energy efficient, fastest rebuild or healing process of the organic systems. An example can be found with a wound in the skin. When the two borders are sutured, the healing process takes around 1 week. This would be:

$$\text{healing adaptation} = \text{time/tissue.}$$

This formula changes in time if the tissue is skin or bone, the later requiring a longer time of a few months. This formula also varies with age, taking longer for the older people:

$$\text{Adaptation to healing} = \text{time/age.}$$

It should be well understood, that the healthier the subject, the better the adaptation. But it also applies to allergic reactions to mosquito bites in those not habituated to them in comparison to those living in those areas. Likewise, a viral aggression like flu, has a latent period of immunity that follows the same rule:

$$\text{Adaptation to viral aggression} = \text{time/type of viral agent.}$$

This formula has other additional variables like nutrition, stress and aggressiveness of the viral agent. Furthermore it also applies to adaptation to smell. When a new perfume is smelled for the first time it is very strong, but persistent use of it changes the capacity of sensing it:

$$\text{Adaptation to smell} = \text{time/scent.}$$

Muscle adaptation to exercise also follows the same formula:

$$\text{Adaptation to exercise} = \text{time/exercise } \Delta.$$

The more exercise, the greater the hypertrophy of the muscles and vice-versa.

In conclusion the Adaptation Formula is a fundamental formula that applies to all biological adaptation processes in the multiple survival mechanisms of all living beings, and can be generalized as:

$$\text{Adaptation} = \text{time/change.}$$

Neural Mechanisms Involved in Autonomic and Respiratory Changes in Rats, Submitted to Short-Term Sustained Hypoxia

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Humans ascending to high altitudes are submitted to sustained hypoxia (SH), activating peripheral chemoreflex with several autonomic and respiratory responses. We analyzed the effect of short-term SH (24 hours, F_{iO_2} 10%) on the cardiovascular parameters in non-anesthetized rats and on the processing of cardiovascular and respiratory reflexes using *in situ* and *in vitro* preparations. SH produced hypertension in awake rats and increased the basal sympathetic activity in an *in situ* preparation and these effects may be related to changes in respiratory-sympathetic coupling. SH increased both the sympatho-inhibitory and bradycardiac components of baroreflex and the sympathetic and respiratory responses of peripheral chemoreflex. Electrophysiological properties and synaptic transmission in the *nucleus tractus solitarius* (NTS) neurons, the first synaptic station of afferents of baro- and chemoreflex, were also evaluated using brainstem slices (*in vitro* studies). The second-order NTS neurons were identified by previous application of fluorescent tracer onto carotid body for chemoreceptor afferents or onto aortic depressor nerve for baroreceptor afferents. SH increased the intrinsic excitability of NTS neurons. Delayed excitation, caused by A-type potassium current (IK_A) was observed in most of NTS neurons from control rats. The IK_A amplitude was higher in identified second-order NTS neurons from control than in

SH rats. SH also blunted the astrocytic inhibition of IK_A in NTS neurons and increased the synaptic transmission in response to afferent fibers stimulation. The reduction of glial cell density was also observed after SH protocol. Therefore, short-term SH produces changes in structural and functional integrity of glial cells, which are essential for neuronal activity and may contribute to the increase in cardiovascular reflex sensitivity (baro- and chemoreflex) and the development of hypertension in awake rats. Financial support: FAPESP, CAPES and CNPq.

Prospective Validation of Framingham Criteria for Congestive Heart Failure Diagnosis in a High-Altitude Population

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Purpose.—To determine the validity of Framingham criteria for heart failure diagnosis in a high-altitude population.

Material and Methods.—This is a prospective, observational, descriptive, and transversal study. The study population was comprised of 97 inpatients hospitalized at Internal Medicine Service at Hospital Nacional del Centro - EsSalud Huancayo, located at an altitude of 3240 m above sea level. Patients included presented with dyspnea on exertion or at least one major Framingham criterion. Echocardiograms were performed with a Sonos 1000 echocardiographer, with color Doppler, B-mode and M-mode techniques. Dichotomous variables were analyzed by Mantel - Haenszel chi square test. A $p < 0.05$ was considered significant.

Results.—Most patients were male (51.6%). Subject age was $69.5 \pm [SD 14.647]$ (20–90) years (mean $\pm$ SD with range). A total of 73.2% of patients were elderly ($n=71$). The most frequent major criteria found were: cardiomegaly (88.9%), hepatojugular reflux (79.2%) and jugular engorgement (69.4%). The most important minor criteria were: exertional dyspnea (91.7%), pleural effusion (69.4%) and lower limb edema (58.3%). Framingham diagnostic criteria were present in 98.6% of patients with heart failure but had a specificity of only 12%. The specificity rose to 76% by using 4 major criteria and to 100% when using 5 criteria. Unfortunately, the sensitivity fell at the same time to 62.5% and 31.9%, respectively.

Conclusions.—Framingham criteria are highly sensitive but nonspecific for the diagnosis of heart failure in high-altitude populations.

Development and Validation of New Sepsis Criteria at High-Altitude

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Introduction.—Current sepsis diagnostic criteria lose precision at high altitude due to physiological variation in vital functions. Because of that, it is necessary to elaborate new sepsis diagnostic criteria, especially designed for its use at populations living at 2000 m above sea level or higher altitudes.

Methods.—This is a prospective, longitudinal and observational study, that took place at EsSalud Regional Hospital at Huancayo. Two cohorts were studied: a derivation cohort (394 patients) and a validation cohort (123 patients). A total of 147 adult patients with sepsis diagnosis and 247 healthy controls were included in the derivation cohort. Sepsis was confirmed with cultures, and diagnosis of infection was made according to CDC and McGeer criteria, in patients admitted to Intensive and Intermediate Care Unit from January 2007 to April 2008. Each case was followed up to discharge or death. With the obtained data, new diagnostic models were devised. A validation cohort of 72 patients with sepsis, 51 hospitalized patients without sepsis and 120 nonhospitalized normal subjects was developed (validation cohort) with patients admitted to Internal Medicina Seervice from January 2012 to December 2013. Diagnostic criteria were evaluated with 2x2 tables, and specificity, sensitivity, negative and positive predictive values, as well as ROC AUC values were determined. Relative risk values and 95% confidence intervals are presented.

Results.—A total of 10 physiological variables were obtained to develop the new criteria. Three of them were selected: respiratory rate > 23 , temperature $> 37.8^\circ\text{C}$ or 37.5°C , and heart rate > 85 beats/minute. More specific alternative

diagnostic criteria selected were: Criterion 10 (ALT10) characterized by a RR > 23, HR > 85, T > 37.5°C and Leukocytes > 10000 or < 4000 or bands > 5% or neutrophils > 0=70%; Criterion 22 (ALT 22): RR > 23, HR > 85, T > 37.8°C, Leukocytes > 10000 or < 4000 or bands > 5% or neutrophils > 0=70%. ALT10 and ALT 22 sensitivity were superior to that of classical criteria: 100% and 99.3% versus 95.1%, respectively. Validation in hospitalized patients without sepsis revealed similar results, with ALT10 and ALT22 reaching 100% sensitivity. Specificity remained around 83.7 to 84.8% when using the two alternative criteria in the derivation cohorts, while it was 72% when using classical criteria.

Conclusions.—Current sepsis criteria have limited specificity for diagnosis at high – altitude populations. The use of the new diagnostic criteria may decrease the rate of nondiagnosed patients from 5 to 0%, while increasing specificity from 72 to 84.8%.

Cerebrovascular CO₂ Reactivity: A Potential Tool for Prevention of High Altitude Brain Edema

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In Rotterdam in 1996 with invasive neurological monitoring systems, such as brain tissue oxygen monitoring (PbtO₂), jugular bulb oxygen catheters (SavO₂), intracranial pressure (ICP), exhaled CO₂, and arterial blood gases in patients with severe cranial lesions, we designed a test to measure the CO₂ reactivity. This test produced moderate hyperventilation, CO₂ decreased from 35±2 mm Hg to 31±3 mm Hg. Since hyperventilation is a common therapeutic routine in severe head trauma, which decreases ICP, it is actually a controversial maneuver since that hyperventilation decreases CBF and oxygen delivery. CO₂ reactivity is a physiological mechanism that allows for blood flow regulation in the brain according to metabolic requirements. For each mmHg of CO₂ change, the blood flow is modified by 4 mL. Hyperventilation results in vasoconstriction, while hypoventilation causes vasodilation. This auto regulation mechanism acts in the adaptation or failure to adapt to high altitude, and therefore can cause consciousness alterations when adaptation periods are too short. During hyperventilation at high altitude, P_aCO₂ resulted in decreased brain oxygenation. It was more accentuated in later days than in the earlier ones. Near-infrared spectroscopy (NIRS) a noninvasive technique, measures the relationship between oxygen consumption and delivery from a mix of arterial and venous oxygen. The light passes through the skin, the skull, the cerebral parenchyma and makes it 4 to 5 cm into the dura mater with values of about 65 to 70% and the extreme values is less than 20%. The Zubietas published tables to calculate changes in CO₂ as environmental O₂ decreases at increasing heights above sea level. These tables are quite useful; however, we do not have measurements determining the changes in brain blood flow inferred through studies of noninvasive multiparametric monitoring of oxygen, or other techniques such as bispectral index (BIS), let alone changes in blood flow following hyper- and hypoventilation at high altitude. We also lack data comparing healthy unadapted patients to native and adapted patients at different altitudes above sea level, nor do we have comparisons between adapted and unadapted patients at great heights exhibiting pathologies in which the relationship between supply and consumption of O₂ is crucial. CO₂ reactivity is the last mechanism lost in traumatic brain injury resulting in a dramatic outcome. Investigating this approach in noninvasive monitoring could be useful in HACE or HAPE cerebral edema and other pathologies presented by patients who either ascent to high altitude or descend from them abruptly, because CO₂ reactivity could be used to prevent further damage.

Patients living at high altitudes have a CO₂ autoregulation which is adapted to a certain level of O₂ supply and consumption which therefore allows the patient to carry out multiple activities without manifesting clinical alterations. On the other hand, when unadapted individuals are abruptly exposed to high altitude, compensation between cerebral blood flow and CO₂ levels is not regulated properly, which may result in abrupt changes in blood flow, which, depending on susceptibility, may in turn result in clinical manifestation that could be picked up by monitoring systems. Last year, in Cuzco (3200 m above sea level), we compared hyperventilation during 3 to 5 minutes between locals and unadapted foreigners. We measured exhaled CO₂ levels up to 16 mm Hg without inducing clinical or NIRS manifestations in those who were adapted to the height. In comparison, not being adapted to such heights, I presented signs of drowsiness and voice tone changes. It is with this antecedent that we have decided to present the same workshop in this symposium with different altitudes. We will have three objectives:

1. To demonstrate the reliability of our monitoring systems.
2. To describe the physiological changes measured with different monitoring systems—BIS, NIRS and exhaled CO₂—and their correlations in locals and foreigners adapted to different altitudes.
3. To invite you to partake in a research project with this protocol, in which industries, universities or tourism could provide substantial support given the benefits they would obtain from the applications of these measurements.

Vihangam Yoga Helps in High Altitude Chronic Hypoxia

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The basic biochemical reaction for energy production in the body depends on oxygen. A minimum level of oxygen is essential at tissue level to sustain that basic metabolic reaction at the required rate. If oxygen falls below the critical level, the body system switches to an anaerobic process which cannot sustain life for long. This deficiency at tissue level is known as hypoxia. How can Vihangam yoga help in high altitude hypoxia? There are two options: either we maintain the supply or we decrease the oxygen demand: 1) Oxygen transport to supply at the required consumption; 2) Acclimatizing by increasing the hemoglobin concentration of the blood; 3) The way in which yoga can help is by reducing the demand by practicing yoga at level of life force (Prana), we can regulate our basic metabolic rate, hence we are reducing the demand. According to the Vihangam Yoga teachings, there are ten pranas (life forces) in our body, each one having its designated function as and when needed. Hence our basal metabolic rate (BMR) will be reduced, thus reducing the demand of oxygen needed to sustain life. It is not possible by other forms of yoga which only work at the level of the body. The age-old Vihangam yoga was rediscovered by HH Shri Sadguru Sadafaldeo ji and this has presently been propagated by HH Shri Sadguru Swatantradeo ji across the globe. It teaches us and trains us to use this method of meditation based on the intimate relationship between “Mind” and “Prana.” By practicing it, our mind can be fully tamed and thereby, control over “Pranas” increases, which helps us in controlling and regulating our basal metabolic rate as discussed above, thus protecting us even from high altitude chronic hypoxia.

Media and Mountain Medicine: A Commitment: Role and Impact of Media on Society and with Special Reference to Newspapers’ Role in Public Awareness

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Media is dynamic and plays an important and significant role in our society today. Media is all round us 24/7 and 365 days, in newspapers daily, weekly, or monthly; magazines, books, journals and periodicals; the television channels show news and programs on varied subjects be it education, agriculture, sports, science and technology, health and fitness, or entertainment. The radio broadcasts music, news, and public awareness programs on FM/MW/SW Radio stations. The new age of media includes the Internet and other social media: Twitter, Instagram, Facebook, and others. Media is a window to the world, without which people and the society would be ignorant and isolated from what is happening around them and in the world, including the highest human habitats like those in the cities of La Paz (3100 m to 4100 m) and El Alto (4100 m). Media is present even on the summit of Mt Everest (8842 m), the highest point in the world.

Mountains—Law—Ethics

KVR Tagore

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“Don’t look up at the mountain, climb it.” Thus said Swami Vivekananda. Climb the mountain we can see the world, not so world can see us. When a goal matters enough to a person, that person will find a way to accomplish what first seemed impossible. Mountains therefore instigate us to make an adventurous attempt which has enormous environmental, socioeconomic and cultural value comprising vitally important resources and functions that benefit society both directly and indirectly: as regulators of climate and water resources; containing important water reserves and providing us with fuel as sanctuaries of a large diversities ecosystems, with unique and exclusive species and an extraordinary variety of landscapes, communities, languages, and cultures, as studying grounds for disciplines such as geology and biology and as ideal settings to develop