WELL-KNOWN HEALTH-IMPROVING EFFECTS OF COLD SWIMMING:

- Promotes **activation of the somatic energy state of the body**.
- Activates **energy metabolism based on brown fat** which is releases the large quantities of energy and convert it into heat.
- Active production of **orexin and energy group of hormones – dopamine, serotonin, norepinephrine**, which switches the body to a powerful mobilization, confidence and readiness to master the situation.
- Increases **blood supply and functional heart activity**. Due to swimming in cold water, the ability of the myocardium and electrical activity increases, the left ventricle begins to fill better and the cardiac cycle is debugged [дибАгд].
- **Heart rate variability** control. **HRV** defines the interval between the beginning of one heart cycle and the beginning of the next one. It is established that the higher the indicator of variability, the better it is for the body.
- Producing of **Neuronal stem cells** in the hypothalamus. Stem cells enter the frontal lobes of the prefrontal area and renew it.

There are a lot of well-known health-improving and healing effects of cold swimming. But we are going to talk about two fundamentally different states of the body during cold swimming helping us to understand empathic effector contact, as overcoming the boundaries of disability.
These two states are STRESSFUL LIFE IN VISCERAL HOMEOSTATIC BALANCE and ACTIVITY AND OVERCOMING IN A SOMATIC STATE OF ALLOSTASIS
First one is the state of balance of the body, the habitual mode of life when the external influence and the body's response are more or less balanced. This is **HOMEOSTASIS** (from Greek means "identical, similar" + "standing").
The second, fundamentally opposite state, is associated with overcoming, with orientation in unpredictable circumstances that require the mobilization of the body. This is **ALLOSTASIS** - from Greek. ‘Allo’, which means "changing";

In any situation the person is faced with a choice: either take a passive stress strategy, trying to escape from a stressful situation or accept it, or take an active stress strategy.
For our body, the fundamental importance is not cold water itself (as a stress factor), but the way, the mechanism of processing the stress effect on the body. It is no coincidence that swimming in cold water is increasingly used in the fight against depression, stress, and fears. During swimming, we train the body's resources that allow us to cope with stress.
Thus, entering the cold water in the first fraction of seconds, a person is faced with a choice – to overcome or be afraid, to swim or run out of the water.

Either the person says "That's great!" or "I'm cold! I cannot do it! That is not for me."

The James-Lange Theory by William James and Carl Lange is a hypothesis about emotions. It is one of the earliest theories of emotion.
The basic idea of the theory is that physiological arousal triggers the experience of a specific emotion. The theory is that the physiological change is primary, and emotion is caused by the information from the body's nervous system.
“Most people think that a person sees a bear and becomes scared. In fact, a person first has somatic physiological reactions to a bear, such as trembling, and then he becomes afraid”
(W. James)

Antonio Damasio, a Portuguese-American neuroscientist formulated the somatic marker hypothesis, a theory about how emotions and their biological underpinnings are involved in decision-making (both positively and negatively, and often non-consciously)
Emotions provide the scaffolding for the construction of social cognition and are required for the self-processes which undergird consciousness.
Damasio provides a contemporary scientific validation of the linkage between feelings and the body by highlighting the connection between mind and nerve cells this personalized embodiment of mind.

In stressful situations, the body begins to raise the temperature of internal organs.
It feels like an internal irritation, it's the same shiver, a mini-fever from stress, from norepinephrine.
Cold water, which burns your legs, body, fingers. Contacting with the skin cold water powerfully activates skin receptors.
Very soon we begin to feel that the coolness remains only on the surface of the skin, and inside it becomes warmer and warmer. The effect of the "thermos" occurs due to the fact that the blood vessels are compressed by cold water, and thermogenesis begins to go in a fundamentally different way - not through the circulatory system, but through the brown adipose tissue, which triggers the oxidative process inside the cells as a result of the activity of the energy hypothalamus. Brown fat begins to burn energy (instead of storing it), releasing heat. Very active at this moment are orexin, energy hormones – dopamine, serotonin, norepinephrine, which switches the body to energy metabolism.

In cold water conditions, when the blood vessels are pinched and thermogenesis cannot proceed in the usual way, through the circulatory system the sympathetic pathway activates brown fat, triggering thermogenesis.
As a result, the skin temperature increases. At the same time, the hypothalamus gives the body a neuroendocrine response: a whole palette of stress energy hormones is released! A powerful release of norepinephrine stimulates the oxidative process inside the cells of brown adipose tissue. And when cells are oxidized, a lot of heat is generated, as the temperature rises at this point.
Hence you are swimming in cold water, and the feeling that the skin is warm.

HOW TO CONTROL THE STRESS MECHANISM WITH COLD SWIMMING?
Entering cold water is always a burn on the skin, it is a stress for the body. But "stress is not what happened to you, but HOW you perceive it" (Hans Selye).
So, let’s see two possible options of stress conversion:

1. Marked with the black arrow on the picture. Through the spinal cord and ACTH Adrenocorticotropic Hormones generated in Hypothalamus to Autonomous System, which leads to unvoluntary reaction of shivering. And according to James-Lange Theory as a result – fear. We are running out of the cold water. In other situations, we are ready to escape from the circumstances.
2. Through the ACTH Hormones generated within the skin which allow to take reactions and emotions under the conscious voluntary control of Somatic pathway.

Entering the water, we can give a command in advance to keep the ACTH reaction on the skin and thereby avoid Shivering pathway.

Stress became the source of the energy activity of hypothalamus and producing of orexin, dopamine, norepinephrine and serotonin. Let’s have a closer look at serotonin.

THE AMAZING ROLE OF SEROTONIN

Serotonin is rightly called the "happiness hormone". But it is important to note we you need to fight for happiness. This is not a metaphor, but a physiological fact.

Serotonin has a dual function. Actively produced in the red nucleus from exposure to cold water, from the bright sun, serotonin molecules are introduced into the amygdala (the part of Subcortical Visual defense system). Serotonin activates the connection of the red nucleus with the amygdala.

On the one hand amygdala integrates serotonin, increasing the feeling of anxiety through various associations: "I'm cold…", “What if I will drown?..", etc.

But on the other hand, serotonin is energetically linked to dopamine, norepinephrine, and orexin in the hypothalamus and it acts as an energy hormone – the "hormone of happiness” and blocks the defense reaction of amygdala.

Being engaged in cold swimming for several years, we are convinced of the importance of sunny weather. In Sunny weather eyes are constantly exposed to the sun rays, receiving a portion of serotOnin. And during swimming in cool water, the hypothalamus powerfully triggers the work of energy hormones, which activates energy state of the entire body. Swimming in sunny weather increases the feeling of cheerfulness.

There are approximately 220 sunny days per year in Georgia.

Can you imagine the possibilities to get a lot of "hormone of happiness” during the swimming in the sea?

A.D. Craig, in “Evolution of Nervous Systems” (2007) revealed that

The human pain pathway evolved from an afferent representation of the physiological condition of the body, present in all vertebrates, that provides spinal and brainstem regions involved in homeostatic integration and autonomic control. A direct lamina-I spino-thalamo-cortical pathway to insular cortex maps the state of the body and leads to re-representations in the anterior insular cortex that engenders subjective feelings of physical and emotional states “how we feel”.

Arthur Craig anatomically established that each person can consciously use the pain pathway as a reflex mechanism of “perception-action” empathy to generate and maintain affective motivation. Thus, person can be able to assess the actual space of living and the possibility of a potential threat of distress, predict and overcome such a threat, instead of exposing himself to random and inevitable stress factors.

Skin nociceptors (receptors "C") takes place in a non-specific affective mobilizing state of the somatic orienting pathway, and the potential effect of stressors and their distribution in the neurophysiological systems of the body may be quite predictable.

Thus, somatic skin sensation as affective or anxiety-uncertain can be a marker of the state of the somatic orienting pathway and subsequent responses of the Central Autonomous System.

The series of discoveries that we are showing you today are very important in terms of the possibilities of homeostasis control.

In the area of the second lamina, there is competition between visceral homeostasis and somatic allostatic state. It is in this area of the brain stem the issue of a person's withdrawal from dependence on homeostasis is solved. Either we insist on somatic and due to Skin receptors take under control Central Autonomous System and use the pain pathway as a reflex mechanism of

prediction and overcoming any a threat, any stressor. Or we get under unvoluntary control of Visceral Homeostatic balance and cannot control anything.

PolyVagal theory by Stephen Porges on the basis of the anatomical analysis reveals highlights the critical difference between smooth visceral muscles and the peculiar somatic groups of muscles which he called social somatic muscles. These muscles are facial muscles, larynx, pharynx, mastication, middle ear and mastication muscles.
The social somatic muscles are efferent muscles. They are under voluntary control of the evolutionary new branch of the vagus nerve which contributes to the state of safety. In contrast smooth visceral muscles are control of the spontaneous involuntary innervation of the sympathetic nervous system which is involved in mobilization in the state of uncertainty and danger. Social somatic muscles are linked on the one hand to external stimulation of the environment and on the other hand to involuntary respiratory and heart beating responses of the lungs and heart which provide metabolic exchange. Actually smart "face-heart" vagus brunch may keep under control online metabolic exchange.

EMPATY AS OVERCOMMING THE LIMITS OF DISABILITY
It is worth to note that Visceral sense of the other innervates smooth muscles of the internal organs which inevitably produce efferent copies and tend to reproduce the sense of one's own internal sensory model. Therefore, the visceral sense of the other cannot be appreciated as empathic sense of the other. **Empathic concern** means to feel suffering of the other without mixing that feeling with your own. Disabled people actually feels the threat of the disadvantages, of the potential pain, they feel suffering and so badly need somebody who truly feels exactly that suffering without mixing with his efferent copies, with his emotional, mental internal models.
On the basis of the neurophysiological data we can state that social somatic group of muscles can actually produce empathic sense of the other.
Now we invite you to watch the video of OVERCOMMING THE LIMITS OF DISABILITY DUE TO EMPATHIC CONCERN in case of Cerebral palsy.

OVERCOMMING THE LIMITS OF DISABILITY in case of Cerebral palsy (you can see the full version of Cerebral Palsy Case here https://inclusivepractices.ge/cerebral-palsy-case/)

1. **Initial Visceral Homeostatic state.**

Visceral Homeostatic state as the habitual state spontaneously, unconsciously protects sensory-motor balance and isolation from another person. In case of Cerebral palsy, we can see how Visceral Homeostatic state is expressed in spasms of the facial, laryngeal muscles, impaired speech function, tensed, difficult respiration and speech.

2. **C-tactile receptors connectedness.**

C-tactile receptors all over the body, face and lips are sensitive to the same C-tactile receptors of another person. Therefore, we start with conscious voluntary distant C-tactile receptors connectedness and activity of Social Somatic muscles. Here you can observe how C-tactile receptors of cheeks, eyebrows, forehead, lips of intern start to feel the same C-tactile receptors of the trainer.

3. **Respiration within tactile connectedness.**

Here we can see how voluntary distant contact changes respiratory rhythm in favor of tactile connectedness. Voluntary inhalation becomes deep, that increases the volume of lungs, exhalation becomes slower and lasts as long as Pavel and Dinara control it within the contact.

In contrast we saw at the beginning of the video how tensed it Pavel's respiration when he has to speak within Visceral Homeostatic balance. It was habitual, so called "quiet" low respiration or gas exchange. Any visceral homeostatic disbalance (negative perception, emotions, thoughts cause sympathetic tension).
Now due to Social Somatic muscles the smart "face-heart" vagus brunch may keep under control online metabolic exchange.

4. Audi-tactile integration within tactile connectedness of face and lips.

Dinara controls distant C-tactile receptors connectedness of their lips, mutual inhalation and exhalation within the tactile contact. Deep mutual exhalation becomes the base of audi-tactile vocalization in actual space of their contact.
Pavel trains how to activate Somatic through experience of another person within empathic connectedness. We see how within the contact uninhibited sound and intonation increase. During the vocalizing / intonation / singing tactile activity of the body increases.

5. Neuro-psycho-social impact on behavior and emotions.

In contrast with initial state of Visceral Homeostatic balance now we can see how Somatic allostasis functions as socially orienting response system. Within tactile connectedness Pavel sings and speaks and voluntary avoids the consequences of Cerebral Palsy, such as spasms of the facial, laryngeal muscles, impaired speech function.

Any kind of visceral homeostatic disbalance (negative perception, emotions, thoughts etc.) causes sympathetic tension as stressor for heart's intrinsic nervous system, which leads to increase of the heart beating rate and to nervous tension. In fact, in spontaneous everyday living one can neither to escape stressors nor to cope with them. There is no chance to experience online actual orienting response in the real global space.
In contrast, somatic homeostatic state not only might be but should be successfully challenged by online actual orienting response in the real space.

NOVEL TRIP

The approach shown here is actualized in the program of the "Novel Trip" project.
Along with a travel around Western Georgia, Novel Trip participants have a unique opportunity to take a practical course which includes:

1) Detailed acquaintance with the Neurophysiological, Psychological and Social features of Somatic overcoming the stress.
2) A real practical workshop, both during cold swimming and during experimental work with Disability cases.

We are absolutely open for business cooperation and will be more than happy to get your suggestions and comments.

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