

## Everybody Upside-Down

Let gravity work for you. Inversions are good for your lungs, heart, thyroid, and more.

By Yoko Yoshikawa

A year ago, the morning after carrying his bouncing 2-year-old boy on his shoulders, Peter woke up and discovered he couldn't move his head. The pain in his neck and shooting down his left arm was so intense that he could not lie on his back, sit upright, or focus enough to drive a car. Diagnosed with cervical radiculitis at C5, C6, and possibly C7, Peter missed work, numbed himself with muscle relaxants, and kept his neck trussed up in a brace for two weeks. He discovered that the pose that gave him greatest relief was Uttanasana. For months, his practice was gentle and low-to-the-ground: hip-openers, forward bends, and restorative work. Five months later, the skin of his left elbow was still numb and the first fingers on his left hand occasionally tingled.



The irony of his injury wasn't lost on him. Forty-one years old at the time, Peter had been practicing yoga for 13 years. Though he knew he was getting older, Peter had always been "good" at yoga, handling advanced poses with aplomb, competing with his peers for the teacher's compliments.

He had started practicing inversions within the first year of his practice. Shouldn't those 13 years of Headstands and Shoulderstands have guaranteed that Peter's neck would be strong, supple, able to withstand his child's weight and unpredictable, energetic kicks?

Or is it possible, rather, that Peter's inverted practice created the conditions for his injury? Peter has had tight neck muscles throughout his adult life, and in times of stress, his shoulders hunch up toward his ears. Peter's modus operandi for years was to show up for class a few times a week and blithely hoist his densely muscled body upside down via his neck muscles.

He forced himself to stay upright through a 10-minute Headstand, sweating liberally. Perhaps one can do that without repercussions at 20-something, but a dozen years later, the effort takes its toll. We all operate in a tangle of pernicious habits, and unless we consciously unpack and dismantle them in our yoga practice, they lie in wait and trip us up.

Many yoga practitioners in the United States are probably like Peter—householders pressed by other demands and desires, unable to practice yoga daily. So they show up for class whenever feasible, and execute every pose that does not provoke immediate and acute pain.

Peter's teacher, like any good yoga teacher, urged his students to develop a home practice, but Peter had never found the time. While it's impossible to say how pivotal Peter's inverted practice was to his injury, it's worth asking the question: If he had practiced more consistently, more mindfully, could he have averted it?

Sirsasana (Headstand) and Sarvangasana (Shoulderstand) are seductive poses—physically challenging, visually dramatic, and exhilarating. They are also surprisingly accessible. Despite the limitations of a tight lower back or hamstrings, most yoga practitioners can move into an inversion relatively easily.

As yoga grows ever more popular (there are more students practicing hatha yoga in California than in the entire country of India today, asserts Larry Payne, coauthor of *Yoga for Dummies*), students are enthusiastically practicing Headstand and Shoulderstand across the nation—in crowded Ashtanga classes without props, and for fairly long periods (10 minutes plus) in Iyengar Yoga classes.

Unfortunately, however, beginning and veteran yoga students are showing up in the offices of bodyworkers, chiropractors, and medical professionals with compression of the upper spine and impaired mobility in the neck, presumably from the practice of inversions.

In a culture that emphasizes competition and achievement, some students are clearly flinging themselves into inversions too soon. Couple that with the desultory nature of many people's practices—one class a week at best, on a drop-in basis—and classes that are too large for the teacher to see everyone in a given pose, and you have the recipe for possible disaster.

How, then, do we evaluate and approach inversions, poses that are said to be invaluable and that possess distinct physiological benefits? We can start by sculling back through the years and studying the role of inversions in classical yoga, at the river's source.

### **Fountain of Youth**

Yogis in India have experimented with their own bodies and breath in search of enlightenment for at least 5,000 years. What they came to understand about themselves was a direct result of sustained self-study and contemplation, or *svadhyaya*.

In their stringent meditation and ascetic practices, over the slow unfolding of days and months and years, they came to know and love the deep, enduring movements in the body—the pulse and rhythm of fluids and electric charges—and put exercises, images, and language to those movements, so we could follow.

The ancient texts state that there are seven main chakras (or psychic energy centers) along the vertical axis of the body. At the risk of being reductive, one might describe hatha yoga as practices designed to raise prana, or life force, up the spine, the path of the chakras. David Gordon White, in his fascinating book, *The Alchemical Body: Siddha Traditions in Medieval India* (University of Chicago, 1999), writes of an "inner void" that begins at the muladhara chakra at the base of the spine. It runs upward through the heart, and ends at the fontanelle, or

"cleft of brahman," known as the *brahmarandra*, in the cranial vault. He quotes the *Kathaka Upanishad* (6.16), which states: "There are a hundred and one channels of the heart. One of these passes up to the crown of the head. Going up by it, one goes to immortality."

The Natha siddhas and other Tantric schools, forebears of the hatha yoga tradition, believed that *amrita*, the nectar of immortality, was held within the cranial vault, at the seventh chakra, the *sahasrara* chakra. The valued nectar, meting out our days, dropped down through the center of the body and was consumed in the fire of the torso. Turn yourself upside down, the reasoning went, and amrita would be retained, thus prolonging life and preserving one's prana.

The *Hatha Yoga Pradipika* lists Viparita Karani Mudra as one of "the ten mudras which conquer old age and death." Unfortunately, that requires a daily practice of Viparita Karani Mudra for three hours!

From the *Goraksha Shataka*, a twelfth- or thirteenth-century text on hatha yoga, we learn that "in the region of the navel dwells the lonely sun, whose essence is fire; located at the base of the palate is the eternal moon, whose essence is nectar. That which rains down from the downturned mouth of the moon is swallowed by the upturned mouth of the sun. The practice [of Viparita Karani] is to be performed as a means to obtaining the nectar [which would otherwise be lost]."

### **Defying Gravity**

Until very recently, there has been little interest in the West in objectively documenting the effects of yoga on health, especially for the more advanced or esoteric practices, such as inversions. The medical doctors who have conducted the existing studies are predominantly Indian. Ralph Laforge, M.Sc., managing director at a clinic at Duke University Medical Center and an authority on the scientific foundations of hatha yoga, knows of only two clinical trials in this country designed to determine the physiological benefits of inversions, both of which were too "statistically underpowered" to draw clear conclusions.

Our understanding of how inversions benefit us, then, is built upon expert opinion, case studies, and educated reasoning. In the absence of more scientifically rigorous studies, we can cite biomechanical principles, measure indices such as heart rate or blood pressure, and witness the effects of inversions on people who practice regularly.

All the evidence points to one principal, galvanizing effect that inversions have on the practitioner: They upend one's relationship to gravity. Gravity has a profound effect on the physiological processes of the human body. As NASA discovered and Jerome Groopman reported in a *New Yorker* article (February 14, 2000), once humans enter zero gravity, we are subject to severe biomedical problems. Our sense of balance, determined by the vestibular system of the inner ear and calibrated to minute fluid movements, is destroyed. Blood, no longer weighted in the lower torso and legs, floods upwards and the heart speeds up, provoking dehydration and eventually anemia. Muscles atrophy and bone mass drops precipitously.

Here on earth, gravity slowly but surely weighs us down and saps our strength. We stand, sit, or walk with head above the heart, legs and pelvis underneath. As the years rack up, so do the damages. Subcutaneous fat sags. Varicose veins and hemorrhoids erupt. Weary of incessantly

pumping blood through its vast circulatory network, the heart falters. According to Payne, the ancient yogis called gravity "the silent enemy." The yogi performs a martial-arts sleight-of-hand: Upend oneself and enlist gravity's power to arrest the ravages of that self-same force.

The human body is sensitive to the fluctuations of gravity because it consists of more than 60 percent water. From the skin in, the body is dense with cells, floating in a bath of intercellular fluid. A complex network of vessels weaves in and around every cell, steadily moving fluids through valves, pumps, and porous membranes, dedicated to transporting, nourishing, washing, and cleansing.

According to David Coulter, Ph.D., who taught anatomy at the University of Minnesota for 18 years, when one inverts, tissue fluids of the lower extremities drain—far more effectively than when one is asleep. Areas of congestion clear. In a 1992 *Yoga International* article on Headstand and the circulatory system, Coulter wrote: "If you can remain in an inverted posture for just 3 to 5 minutes, the blood will not only drain quickly to the heart, but tissue fluids will flow more efficiently into the veins and lymph channels of the lower extremities and of the abdominal and pelvic organs, facilitating a healthier exchange of nutrients and wastes between cells and capillaries."

#### **All Systems Check**

There are four major systems in the body that the practice of inversions is said to positively influence: cardiovascular, lymphatic, nervous, and endocrine.

The circulatory system is comprised of the heart, the lungs, and the entire system of vessels that feed oxygen and collect carbon dioxide and other waste products from the cells. Arteries fan out in an intricate tributary system from the heart, which pumps freshly oxygenated blood from the lungs outward. Veins return blood to the heart, and, unlike arteries, make up a low-pressure system that depends on muscular movement or gravity to move blood along. One-way valves at regular intervals prevent backwash and keep fluids moving towards the heart in a system known as "venous return."

Turning yourself upside down encourages venous return. According to Pat Layton, physiology teacher for the Iyengar Yoga Institute of San Francisco's Advanced Studies Program, "People have to do aerobics because they don't invert. You have to run really hard—get the heart pumping hard—to circulate blood down to the feet and up the back. Not that you shouldn't do aerobics, but inversions are a healthier way to get the benefits [to the circulatory system], particularly as you get older."

Layton believes that inversions also ensure healthier and more effective lung tissue. When standing or sitting upright, gravity pulls our fluids earthward, and blood "perfuses" or saturates the lower lungs more thoroughly. The lower lung tissue is thus more compressed than the upper lungs. As a result, the air we inhale moves naturally into the open alveoli of the upper lungs. Unless we take a good, deep breath, we do not raise the ratio of air to blood in the lower lungs. When we invert, blood perfuses the well-ventilated upper lobes of the lungs, thus ensuring more efficient oxygen-to-blood exchange and healthier lung tissue.

Finally, as Payne says, "Inverting gives the heart a break." The heart works doggedly to ensure that freshly oxygenated blood makes its way up to the brain and its sensory organs. When inverting, the pressure differential across the body is reversed, and blood floods the carotid arteries in the neck. It is believed that baroreceptors, mechanisms that calibrate blood flow to the brain, sense the increase in blood, and slow the flow, thus reducing blood pressure and heart rate. It has not, however, been clinically established whether the practice of inversions could lower blood pressure over the long haul, and in fact, high blood pressure is typically considered a contraindication for inversions.

The lymphatic system is responsible for waste removal, fluid balance, and immune system response. Lymph vessels arise among the capillary beds of the circulatory system, but comprise a separate system that transports stray proteins, waste materials, and extra fluids, filtering the fluid back through the lymph nodes and dumping what remains into the circulatory system at the subclavian veins, under the collarbones. The lymphatic system is analogous to a sewage system—an intricate, underground network tied to every house in town—that keeps the citizens healthy.

Inversions, then, are analogous to the sump pump in the basement, propelling sewage into the pipeline. Lymph, like the blood returning to your heart via the veins, is dependent upon muscular movement and gravity to facilitate its return. Because the lymphatic system is a closed pressure system and has one-way valves that keep lymph moving towards the heart, when one turns upside down, the entire lymphatic system is stimulated, thus strengthening your immune system. Viparita Karani is the best example of this, as it is a mild inversion that one can enjoy for at least five minutes with no stress to the body when one is fatigued or ill. It's interesting to note that for problems like varicose veins and edema (swelling) of the feet, when lymph is unable to maintain the appropriate fluid balance in the lower extremities, doctors often simply tell people to put their feet up.

### **Head over Heels**

When one comes down from Headstand, one often feels clearer and calmer. The common assumption is that Headstand floods the brain with freshly oxygenated blood, and the brain is refreshed. Is there such a thing as too much blood to the brain? Dr. B. Ramamurthi, a neuroscientist based in India, has shown that the brain is protected from an influx of blood that would overwhelm its delicate structures, and that when a reasonably healthy individual inverts, there is usually no excessive influx in the blood vessels of the brain. Intense pressure in the head or bloodshot eyes, however, call for a modified practice. A study by Dr. F. Chandra, well known in Europe for her lectures on the physiological and psychological effects of yoga, posits that Headstand could effect a base-line opening of blood vessels, making them more efficient at dilating and constricting to efficiently shunt blood to the active areas of the brain.

Inversions may also affect the movements of cerebrospinal fluid (CSF), the juice of the central nervous system which flows from the brain to the spinal cord. The top of the skull receives intense pressure in Headstand, which, when properly done, may promote elasticity in the cranial bones, thus stimulating the production of CSF in the ventricles of the brain.

The effect of inversions on the intricate endocrine system, the body's glandular system of hormone delivery, has been much touted, but is perhaps the least understood: Shoulderstand is widely recommended for menopausal and perimenopausal women because it is assumed that it stimulates the thyroid and parathyroid glands, which secrete hormones that regulate one's metabolism. This has not been clinically proven, but Payne assumes that inverting places these glands, located in the upper chest, in a "general bath of blood," thus increasing their efficiency.

In Headstand, the pineal and pituitary glands (which sit behind the eyes in the center of the skull) are upended 180 degrees, directly over the fontanelle. We know that the pineal and pituitary glands are responsible for growth and sex hormones. We do not know what reversing these glands in the field of gravity does. Could this, however, be the dripping amrita of the ancient yogis—might they have sensed the slow release of hormones from the cranial vault and used inversions to stem or stimulate the release, promoting health and impeding aging?

### **To Invert or Not to Invert?**

B., an osteopathic therapist, spoke to me only on the condition of anonymity. He has worked with a few long-term yoga practitioners in their 50s who came to him with chronic pain or impaired mobility in their necks. They have bodies of 30-year-olds, but their necks are so stiff and pain-ridden from the yoga inversions, they are like the necks of 60-year-olds, he says. Over his 20-plus years of practice, B. has seen many clients who, already vulnerable in the upper spine from cervical degeneration, whiplash, an old injury, or misalignment, unknowingly exacerbate the situation by inverting in yoga class.

He explains that the brachial plexus, a key network of nerves that exit the spine from between the lower cervical vertebrae and upper thoracic (C5-8 and T1), enervates the entire upper extremities and shoulder region. Headstand and Shoulderstand place tremendous compressive force on the upper spine, which, for those who are vulnerable, can cause nerve irritation and compression to the brachial plexus, as well as "general thoracic outlet syndrome," which may compromise blood circulation and manifest as numbness in the arms and hands.

Arthur Kilmurray, director of Mystic River Yoga Studio in Medford, Massachusetts, has experiences that support B.'s claims. He began studying Iyengar Yoga in the late 1970s and was doing long inversions within four to five years. But by 1988, Shoulderstand had become impossible: He felt as if his head would explode when up in the pose. Kilmurray assumes this stems from a football injury at age 21, exacerbated by long inversions. Even now, although he feels no pain, chiropractors are astounded by the lack of range of motion in his neck. Kilmurray does not currently practice Headstand or teach inversions, and teaches his students to "develop sensitivity to the breath, prana, and fluidity of the inner body" before moving towards the longer inversions and more advanced poses.

Inversions are not for everyone. Even if you are inverting consistently now, there will be times when the practice is inappropriate. In the face of this "failure" to invert, it may be helpful to recall the yogic tenets of *ahimsa*, nonviolence or compassion, and *svadhyaya*. We practice yoga to decrease suffering and develop our capacity to be fully present in our lives. Why persist in practicing Headstand and Shoulderstand if it causes you pain? Restorative poses such as Viparita

Karani and a supported Setu Bandha (Bridge Pose) will give you some of the benefits of Headstand and Shoulderstand, without taxing the cervical spine.

If you are new to yoga, take your time before inverting—a year is not too long. Work closely with an observant and knowledgeable teacher. Attend class regularly. Learn the fundamentals: Find the extension of the spine first in Adho Mukha Svanasana (Downward-Facing Dog); open the shoulders with Adho Mukha Vrksasana (Handstand), Pincha Mayurasana (Forearm Balance), and Vasisthasana (Pose Dedicated to the Sage Vasistha); and develop balance, clarity, and strength with the standing poses.

Studying the *Yoga Sutra* and *Bhagavad Gita* will help you structure a yoga practice that is balanced and wise. Practicing alone will help you purge the urge to perform your asanas for others and cultivate a deeper understanding of your body and its rhythms so that you can practice in ways that respond to your needs. With mindfulness, even a beginner can practice inversions without injury.

If you already invert, ask yourself how you do it. Do you use muscle to stay up, as Peter did? How much do you observe yourself in the pose, focusing on your alignment? If you wish to work towards longer poses, by all means do so. But do so intelligently, and be willing to progress slowly if you want a healthy neck into your dotage. Observe the subtle changes in your neck and throat, and watch your breath. Stay up for short periods of time first—a minute or two. Back up on occasion. Always come down if there is pain.

After the injury, Peter has changed his practice. He now sits daily, attends a weekly restorative yoga class, and does shorter inversions. He has realized that intention and focus are more important than throwing himself through the poses. Practiced without wisdom and compassion, inversions can lead to injury. But at their best, these poses sing up the spine and the body hums with joy. Headstand and Shoulderstand are known as the king and queen of the asanas—and they can be rather cavalier with their subjects' necks. Be smart but undaunted: They grant great boons to those who approach with respect.

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