



Attributes of a Good Microsurgeon—A Brief Counsel to the Up-and-Coming Prospects

Joon Pio Hong, MD, PhD, MMM¹ Zulqarnain Masoodi, MS, MCh^{2,3}
Chieh-Han John Tzou, MD, PhD, MBA^{2,4,5}

¹Department of Plastic and Reconstructive Surgery, University of Ulsan College of Medicine and Asian Medical Center, Seoul, South Korea

²Division of Plastic and Reconstructive Surgery, Department of Surgery, Hospital of Divine Savior, Vienna, Austria

³Plastic Surgery Division, Florence Hospital, Srinagar, Jammu and Kashmir, India

⁴Faculty of Medicine, Sigmund Freud University, Vienna, Austria

⁵TZOU Medical, Vienna, Austria

Address for correspondence Joon Pio Hong, MD, PhD, MMM, Division of Plastic and Reconstructive Surgery, Department of Plastic Surgery, Asan Medical Center, University of Ulsan, 88 Olympic-ro 43-gil, Songpa-gu, Seoul, South Korea (e-mail: Joonphong@amc.Seoul.kr).

Arch Plast Surg 2023;50:130–140.

Abstract

Microsurgery, which deservedly sits on top of the reconstruction ladder, has been a boon to plastic surgery. It is because of this marvelous tool that plastic surgeons the world over have been able to tackle many reconstructive dilemmas, which were once considered to be an improbability. Microsurgery-aided revolutions have rendered a new meaning to all forms of reconstruction—whether it is postoncological, posttraumatic, or postlymphedema reconstruction. As the most advanced reconstructive medium at our disposal that has broadened the horizons of plastic surgery exponentially, it is but obvious that many budding plastic surgeons are drawn toward this subspecialty. In lieu of the aforementioned facts, it is necessary to sensitize all such aspiring surgeons about the various intricacies concerning the field of microsurgery. This article with its focus on the six desirable microsurgical attributes of “Clarity, Curiosity, Perseverance, Passion, An Open Mindset and Action,” is meant to be a modest attempt on part of the authors to share their microsurgical insights, procured through their respective journeys, with budding aspirants, hoping to sensitize as well as motivate them for the challenging path that lies ahead.

Keywords

- ▶ microsurgery
- ▶ training
- ▶ attributes

Pride is one of the biblical sins, which one should avoid at all costs.¹ For a microsurgeon, this temptation is the hardest to resist whenever he looks at a patient with a replanted hand, writing his name on that crumbled piece of paper or whenever he notices a lymphedema patient, wearing her favorite polka-dot skirt from her disease-free years, once more. In today's world of rapid surgical advancement where technologies and procedures may become obsolete overnight^{2,3}

microsurgery has perched on top of the reconstructive ladder for quite some time now, which in itself is a remarkable feat. Calling it the pinnacle of reconstructive prowess achieved by human seems like a fair statement, until something substantive surpasses it in the foreseeable future.

The fascination of our ancestors with reassertment of conventional anatomy and permutating it into novel forms has often manifested through replete religious symbolism or

received

January 24, 2022

accepted after revision

August 17, 2022

DOI <https://doi.org/10.1055/s-0042-1759786>.

10.1055/s-0042-1759786.

eISSN 2234-6171.

© 2023. The Korean Society of Plastic and Reconstructive Surgeons. All rights reserved.

This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Medical Publishers, Inc., 333 Seventh Avenue, 18th Floor, New York, NY 10001, USA

Creativity is thinking up new things.
Innovation is doing new things.

– Theodore Levitt –

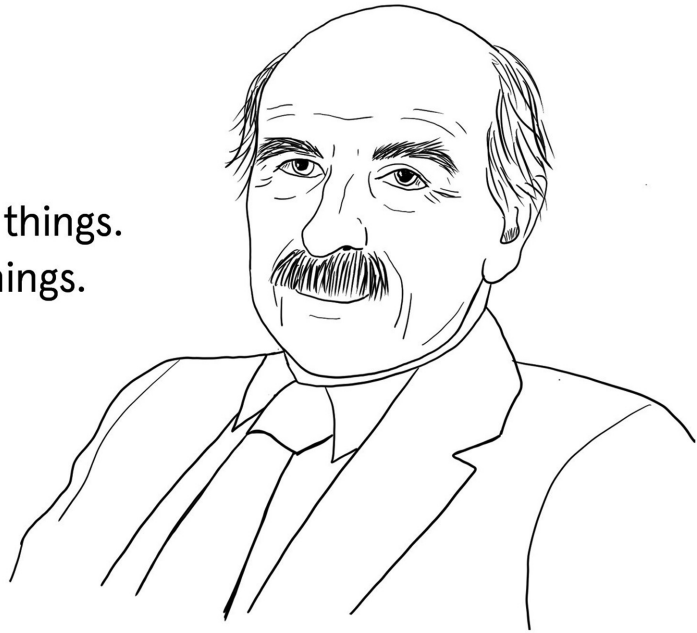


Fig. 1 First attribute-Clarity of thoughts.

mythical imagination over the ages.⁴ Only, that these ideas remained embedded in beautifully lyricized folklore and despite the various transcendental powers at their disposal, none of the gods and goddesses could transform this fascination into reality. Microsurgery as we see it today is instead a by-product of the sweat and blood of numerous real-life heroes who climbed every unsurmountable mountain without the aid of fire-breathing dragons or magic carpets. Every reported success was a culmination of an untold saga of a million preceding failures.⁵

From its humble beginnings as an experimental endeavor that mostly had nonhumans as its first patients to its present, highly evolved state, microsurgery has been a worthy example of human determination to mimic nature's artistry and sophistication. An art that was previously ascribed to miracles and was synonymous with supernaturalism is now being performed with impunity by microsurgeons the world over. Be it a fibula molded into a new jaw, redundant abdominal tissue crafted into a near normal breast or a whole new face being given to a faceless man; these are the very examples that make every reconstructive surgeon indulge in that sin of pride, even if for a moment.^{6,7} One is tempted to think, if microsurgeons, with their miraculous ordeals of reattaching limbs and henceforth, would have been the obvious saints of yesteryears.

While these astounding marvels are flashed the world over as articles of success and garner unprecedented attention, much remains unsaid about the hidden ordeals that all microsurgeons undertake to prepare themselves before they reach the zenith of their careers. This journey is full of challenges and hardships and before embarking on this arduous trail, it is imperative that a young aspirant is cognizant of these challenges as well as the various desirable attributes that will make his journey easier.⁷ This essay, mostly deduced from personal experience, is a humble

attempt on part of the authors to sum up the attributes that would be considered beneficial for all novices contemplating to enter this exciting field. The six basic attributes that are quintessential from a microsurgical point of view are Clarity, Curiosity, Perseverance, Passion, An Open Mindset, and Action.⁸

Clarity (–Fig. 1)

Eminent economist Theodore Levitt was a great proponent of creativity and innovation but at the same time he also stressed upon the need of being in the right field so as to maximally harvest one's potential and thus, be of maximum service to the society.⁹ While this mercantile and rather cold approach may be viewed with a bit of skepticism by some in the medical fraternity but nevertheless, it is an important tool before choosing any profession, including microsurgery. Before stepping into the world of microsurgery, one of the most important answers to be sought is, "What is it that draws you to this discipline?" Mundane as it may seem, but a clear answer to this question is a stepping stone toward a successful career as a microsurgeon. Prospective candidates may have a myriad of reasons to join this field, consistent with their own desires and ambitions.

The answer spectrum can vary from patient care, enthusiasm for the subject, achieving a name, emulating a mentor, monetary reasons to many more. While enthusiasm and patient care have been traditionally viewed as the ideal qualities,¹⁰ it is perfectly fine to pursue a profession if the reasons are "unconventional." Some of the greatest visionaries over the years have been people who were influenced by a role model and would have not excelled if it wasn't for this influence. Legendary surgeon, Emil Theodor Kocher, by his own admission, was significantly influenced by the work of Theodor Billroth and as well as von Langenbeck, both of

whom made an indelible mark on his future professional life.¹¹ A strong desire to achieve fame should also not be seen through the tinted glasses of bias, as it is a basic human trait which can do wonders to a person's motivation. Fame and mercantilism (rather than pure scientific temper) have been postulated by many as the reason for Thomas Edison's countless inventions. Regardless of his intentions, all his contributions are still a boon to humanity.¹²

Armed with an answer, the next logical step is to do a cost-benefit analysis of one's capabilities versus one's desires. A person is one's own best judge and does not lie to oneself. It is highly unlikely that you will have all the desired qualities that are required to be a good microsurgeon, at the very onset of your journey. Also, many of these qualities can be acquired by means of sheer hard work and dedication later on, so this should not be a cause of worry. At the very least, you should pay attention to any red flags that might prove as an impediment toward your chosen path. Do you have enough respect and passion for this field and will it last? Are you temperamentally prone to being easily influenced and later abandoning your new path, midway? Are your expectations realistic? Do you suffer from any physical condition that may not be compatible with long hours under the microscope or will potentially aggravate it? Have you discussed your decision with immediate family members or persons who may be affected by lack of your presence in their lives on a regular basis? If the answer to any of these questions is in the affirmative, then perhaps you should get back to the drawing board, reassess your priorities and then make a valid decision thereof.

This clarity of vision serves as guide for a prospective microsurgeon and has the benefit of forewarning him/her about the many undulations that lie ahead, and in some cases, it can outrightly make him/her realize that there is a stark difference between his/her attributes and the stipulations. A discipline that is more appropriate can thus be chosen accordingly. If attention is not paid to these preliminary questions, there is a possibility of disillusionment and loss of interest in the subsequent phase of one's career that is relatively a lot harder situation to deal with.

The journey of Robert Acland, illustrious microsurgeon cum educator whose world-famous videos have succored all of us in our nascency, is a specimen of clarity and lesson for every budding microsurgeon. While discharging minor surgical duties as a medical intern in Africa, he developed a keen interest in surgery and was convinced that this is how he was going to contribute toward the welfare of his fellow human beings.¹³ Accoutered with this clear objective, every subsequent step of his journey was laden with immense coherence that eventually propelled him toward microsurgical pre-eminence, while concurrently nurturing the careers of numerous other microsurgeons by means of his innovations and revolutionary ideas.

Upon his return to the United Kingdom, he was fascinated by the punctilious craft of microsurgery and more importantly, he was correctly able to predict the plethora of possibilities that microsurgery could offer for many reconstructive dilemmas. He immersed himself in further training

in this unknown field, not letting the fear of failure dampen his spirits. Despite the absence of any clear-cut guidelines, it was his clarity that kept him going on and he soon realized that the biggest impediment to microsurgery in those early times was the lack of customized microscopic instruments and fine suture materials.¹⁴ He also realized that the problem at hand required a dedicated approach which warranted that he temporarily halts his clinical career, and instead dwell into the world of research and innovation.^{13,14}

Subsequently, he applied for a grant with the Medical Research Council and despite being a novice trainee, his grant was approved on account of his clear-cut ideas, the gist of which he was effectively able to communicate to the council. During this research stint, he came up with many marvels like refined microvascular threads/needles, the "Acland clamp" and much more.¹³ His hard work started to bear fruits as many of the earlier technical hurdles plaguing microsurgery ceased to exist. He continued his crusade of refinement, and popularized the usage of microvascular techniques, while working as a registrar in Plastic Surgery at the Canniesburn Hospital at Glasgow.¹⁵

As these meticulous microsurgical procedures were time consuming and meant that Acland would occupy the operating room for as much as 12 hours or more at a stretch, many in the National Health Service started questioning the logic of dedicating so much time and disproportionate resources toward a newly created discipline, which was still in its infancy and conjured ambiguous outcomes. Taking note of this indifference toward his work, Acland soon realized that his current work environment was not really the appropriate one, as his nascent ideas needed a lot of nurturing and unflinching commitment. This realization made him undertake a crucial decision—that of leaving the comfort of his home along with everything that he had built over the years and migrate across The Atlantic too far away Kentucky, where he would establish a new microsurgery teaching laboratory from scratch.¹⁶ To his credit, it was here in Kentucky, where over many decades, he contributed immensely toward the development and popularization of microsurgery. Toward the latter part of his career, he metamorphosized from a clinician to a world-class educator, with his widely popular video tutorials bearing a testimony to his credentials and lucid foresight.¹⁷

Curiosity (– Fig. 2)

A few words that have profoundly altered the discourse of human history are *why*, *how*, *when*, *who*, and *where*. Most groundbreaking ideas have taken flight upon the utterance of these innocuously sounding words, by a curious observer at various points of time. As best depicted in the book "The Little Prince" by author Exupery, one has to question his surroundings like an innocent child, trying to seek as much clarity as he can, about everything that mystifies us. The famous quote from this book, "Only the children know what they are looking for," symbolizes this attitude in body and spirit.¹⁸

"Why" was it not possible to repair, assassinated French president Sadi Carnot's severed portal vein, ushered Alexis

Only the children know
what they are looking for.

— *The Little Prince* —



Fig. 2 Second attribute-Curiosity.

Carrel toward his journey of seeking a stabler approach for vascular anastomosis and the subsequent development of his now famous “triangulation technique” that eventually fetched him the Nobel Prize.¹⁹ “How to increase the resolution of the of the microscope?” was the question that made Ernst Abbe dedicate his life toward optical physics and conjure marvels like the Abbes condenser, refractometer, and Abbes number, without which microsurgery would have been impossible to perform.²⁰ “Where, would he, be able to transform his nascent but brilliant microsurgical ideas into reality?,” led Robert Acland (previously discussed) to leave a life of comfort in his native England and set up a new institute from near scratch in faraway Kentucky.²¹

Curiosity is the basic ingredient that makes one seek the unknown and realize how he/she is better off, with this newly acquired knowledge.²² Lack of curiosity is the biggest obstacle for the development of a microsurgeon as it curtails the zeal of venturing out of one’s comfort zone and embracing newer ideas. It is the driving force that makes a microsurgeon want to know how his techniques or abilities fare in comparison to his peers and obtain feedback, so that he can constantly improve himself. Curiosity makes him brave enough to let his work be scrutinized without the fear of being ridiculed, say if a possible lacuna was to be found in somewhere.²³ It also makes him question things eternally, even when he reaches the pinnacle of his trade, and he never lets the degree of his seniority turn him complacent. He is willing to exchange ideas with one and all, knowing fully that every discussion will polish his knowledge further and may also help him identify any shortcomings, which could have escaped his notice, till date.

Thus, a microsurgeon should always be analytical and should never shy away from questioning the logic, working, merits, and demerits behind a particular procedure or a protocol. The important thing though is to maintain a fine balance between genuine curiosity versus questioning for the sake of self-glorification or for the mere purpose of impressing one’s peers. Also, one should extensively explore

a given topic with all sincerity before proceeding for help. Self-exploration may obviate the need to seek answers to many questions, while enriching one’s comprehension at the same time.¹⁸ Seeking answers without self-analysis is akin to glorified spoon feeding that may provide fleeting advantages, at the cost of impairing the overall growth of a budding microsurgeon and thus should be discouraged.

Perseverance (► Fig. 3)

“In the early days of my fellowship, I failed three consecutive flaps and I thought I was not talented to work in the field of microsurgery. It was only then my mentor Yoon Kyu Chung told me that you will not be a true microsurgeon till you fail 100 flaps. It was from this encouragement that I learned from the failures and avoid making the same mistake. Today over +20 years of experience and +3000 microsurgery cases, according to his definition, I am still not a true microsurgeon.”

—Prof. J. P. Hong

As Edison famously said about his light bulb, he counted all his previous one thousand failed attempts as rewarding experiences, which were instrumental for his eventual success. This Edisonian spirit is what symbolizes the importance of being persistent in life.²⁴ All of us must have seen stalwart microsurgeons, either live or in videos, weaving their magic with such elegance that it leaves one spellbound. Meticulous hand movements, precise dissection, crafty anastomotic techniques; it just seems like an opera being conducted under the microscope. But did they reach this crescendo overnight? Were they innately blessed with such surgical exquisiteness? Surely, most of these stalwarts, if asked, would narrate their bespoke tales of grit and endurance that have been written over entire lifetimes. In short, it just boils down to one word, “perseverance.”

I didn't fail 1000 times.
The light bulb was an
invention with 1000 steps.

— Thomas A. Edison —

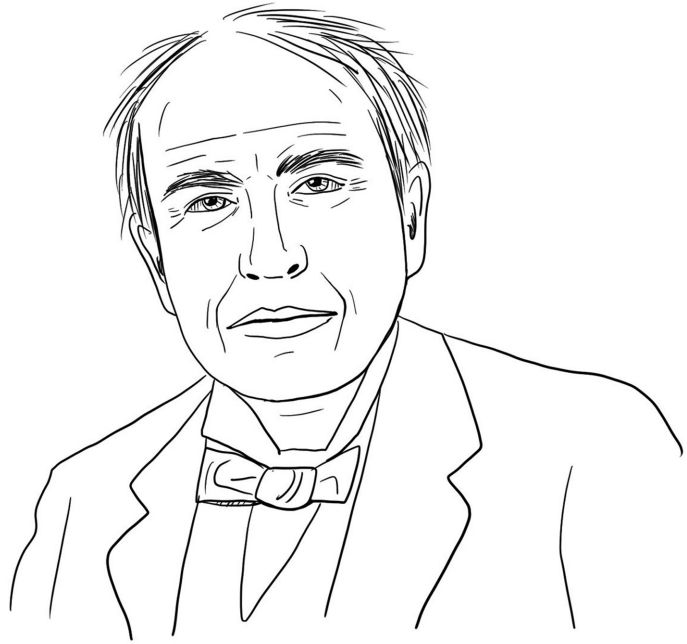


Fig. 3 Third attribute-Perseverance

Rapid advancement has turned microsurgery into the acme of reconstruction and as a corollary, the competition has also increased manifold. Right from the moment when one decides to plunge in this exhausting but rewarding discipline, perseverance is the key factor that will propel you from one difficult stage to the other. In his bestselling book titled “Outliers: The Story of Success,” Malcolm Gladwell has very succinctly postulated his “10000 Hour Rule” as a general guideline on the amount of practice any individual requires to become an expert.²⁵ A typical 40 hours/week schedule usually amounts to 20 hours/week of real practice (after deduction of time which is spent on ancillary activities). These 20 hours can be considered unadulterated practice hours and may involve practicing the skill, striving for improvements, monitoring for improvements, evaluating success, and concentrating on weaker areas. At this rate, it generally takes about a decade for any individual to accomplish these 10,000 hours of practice and attain expertise of any craft. There can always be exceptions where one can take more or less time in achieving proficiency, but in our experience this “10000 Hour Rule” is a good tool for a microsurgeon to quantify the amount of time he needs to have under his belt before he can consider himself accomplished.

The story of success is the ability to move on from one failure to the other. Similarly, a microsurgeon's path is bound to be punctuated by many setbacks, as he meanders through his journey. Even after working with absolute dedication and honesty, success is never a guarantee. Perseverance is the key factor that enables a microsurgeon to take these failures into his stride and be ready for the next challenge. A microsurgeon should always be ready to accept failures as the best method of learning how not to repeat mistakes and how to take corrective measure for the future. Each failure and nullification of the accompanying hard work should not

demoralize a budding microsurgeon but should instead galvanize his resolve to overcome failure. He should be ready to imbibe the positives from his failed efforts and quickly move forward with doubled resolve to tame the problem at hand.

Microsurgical history is inundated with examples where stalwarts, who came to be known for their exemplary work later on, were initially met by heartbreaking disasters and nonfulfilment. If it was not for their persistence and never-say-die attitude, they would have otherwise succumbed to despair, and we would have been deprived of all their marvelous work. The life story of Harry Buncke fondly called the “Father of Microsurgery” in mainland America is a befitting tale of perseverance and a perfect template to emulate for upcoming microsurgeons, for years to come.²⁶ A Canadian by birth, he trained initially at Cornell University and at Glasgow, Scotland, before finally settling in California. Like all great minds who are triggered by an event that may seem ordinary to the lesser mortals, the numerous digital amputations that he encountered in his daily practice and his inability to offer a satisfactory solution to this menace turned out to be his beckoning. Determined to improve the outcome of such amputations, he famously started his revolution from his garage. His efforts were also directed toward one of the most common problems encountered by microsurgeons of that era—the unavailability of proper microsurgical instruments that were in turn hampering the execution of many microsurgical procedures. Over a period, he developed many microsurgical instruments that greatly eased the sufferings of microsurgeons. Very famously, his first successful transplantation of a rabbit ear was possible after exactly 50 unsuccessful attempts, which is a measure of the man's perseverance and patience. He never stopped and continued his mission of microsurgical refinement and ended up doing the first successful case of toe to thumb transfer in the United States.²⁶



Choose a job that you love,
and you will never have to
work a day in your life.

— Confucius —

Fig. 4 Fourth attribute—Passion for the subject.

Passion (–Fig. 4)

“Choose a job that you love, and you will never have to work a day in your life,” said the Chinese philosopher Confucius.²⁷ Among the various attributes that an ideal microsurgeon should possess, passion is that one quality that already endears an aspiring candidate to us, and at times, even makes us turn a blind eye to his other possible shortcomings. Passion is not a quantifiable attribute but instead it signifies that abstract zeal that someone possesses for a given discipline.²⁸ Unless somebody is not passionate about microsurgery, he can rarely cultivate the other attributes (perseverance, hard work, etc.) that are required to excel in this field.

A microsurgeon’s passion should be multidimensional and not confined to the technical aspects of the subject alone. Primarily, a microsurgeon should be passionate about the well-being of his patients. Empathy for fellow human beings is probably the biggest motivational factor that makes all of us embrace this noble profession and microsurgeons are no different.²⁹ Whatever we plan, strive, or execute as microsurgeons should be guided by a solitary principle—genuine passion for patient care. Will it benefit my patient? How can I ameliorate his sufferings? How can I restore his functions with minimal morbidity? Our every effort should be directed toward achieving these goals and everything else should be secondary. It should be our aim, first and always, that our reconstructive strategies are dictated by a genuine need and not by our personal ambition or stature. It is paramount to explain to the patient the various options available to him as well as the advantages and limitations of each option. A patient should be an equal participant and a didactic conversation should always be the norm in such scenarios.

Second, a microsurgeon should be passionate about his work.³⁰ From an early stage a budding microsurgeon should function like a sponge, trying to absorb as much information as he can either from mentors, seniors, or peers. He should especially cherish the time he spends in the emergency section as well as in the operating room, whether he is actively involved in a procedure or not. A single glimpse at a live procedure can many a times fetch more information than an entire textbook. Additionally, the feeling of acclimatization with the microsurgical environment often boosts the morale of younger recruits and also helps them plan for the various tasks that lay ahead. With the advent of internet and easy availability of videos and books, a young microsurgeon can greatly enhance his surgical as well as clinical skills, even before he gets to execute a certain procedure in future.

Third, a microsurgeon should be passionate about ideas. Once he has acquired academic and practical knowledge, he should use his imagination and approach a problem from multiple directions which will multiply his learning avenues and invigorate his enthusiasm. If possible, he should assemble a team of like-minded individuals who can collectively enhance each other’s aptitude. From an early stage, adequate time should be set apart for academic activities like conduction of studies, presentations, and experimentation.³¹ Additionally, a microsurgeon should be well versed with various formats of epidemiological studies (case control studies, cohort studies, randomized control trials) and should have at least a working knowledge of various statistical modalities commonly applied in such studies.

The evolution of the perforator flaps, serves as a lucid example demonstrating how this “passion” for a better method of reconstruction, eventually ended up revolutionizing the world of reconstructive surgery.³² A divergent group of people

built on each other's work and like runners in a relay race passed on the baton forward to the next person, without actually meeting in real life.³³ The idea of a customized flap with no excess baggage but just the pure blood supply needed for survival had been envisioned for a long time by many. This, yet to be named flap, was the likely holy grail that could be an answer to many reconstructive dilemmas.

The evolution and subsequent refinement of skin flaps (perforator flaps included) were possible because a group of determined individuals decided that a fellow human being with a partially gangrenous body part or a limb with chronically exposed bones deserved something better than an outright amputation. The obsession of these people, who may have lived during different periods of time, but with a common passion of finding ways to salvage a human body part staring at amputation, was the reason skin flaps took birth and evolved. This continuum of passion that has manifested over the ages either through a Sushruta³⁴ (ancient times), a Tagliacozzi⁴ (Middle Ages), a Koshima (initial phase),³⁵ or a Hong³⁶ (more recent times) aptly describes this journey of constant passion owing to which a flap was transformed from a bulky mass of flesh to a customized unit of tissue based on a tiny, microscopic perforator.

In specific pertinence to perforator flaps, Taylor³⁷ and his colleagues, feeling confident after their industrious work on vascular territories, were the first ones who separated mud from water and suggested a practical way of harvesting such flaps by chasing these perforators through fascia, soft tissue, or even muscles, correctly hypothesizing that it was the "ends" (eventual perforators supplying the flap) and not the "means" (whether harvested as direct/septal/muscular fashion) that were important for flap survival. Due to their deep inquisitiveness, numerous investigators from around the world decided to test Taylor's brilliant but untested suggestion and find out how feasible it would be to isolate

these tiny perforators through dense jungles of connective tissue/muscle fibers. They started working on the challenge from multiple dimensions and while some, like Kroll, targeted the septal perforators on account of their relatively easier anatomy,³⁸ others like Hallock trapped the more elusive muscular perforators as a vascular basis of their newly harvested perforator flaps.³⁹ The credit for one of the earliest documented perforator flaps though, goes to Koshima, who used the inferior epigastric artery skin flaps without the rectus muscle to demonstrate his concept.⁴⁰ His constant pursuit *for* refinement made him challenge the limits further which subsequently led to his next milestone, in the form of a paraumbilical perforator flap from the deep inferior epigastric artery, arguably one of the original perforator flaps in true sense that cemented his name as a pioneer in perforator flap history.⁴¹

Soon plastic surgeons the world over realized the potential of perforator flaps and started to weave their own threads of magic from the template provided by Koshima and other pioneers. Alan and Treece⁴² started using it for breast reconstruction, Angrigiani customized his own version in the form of the thoracodorsal artery perforator flap,⁴³ Martin gave us the superficial musculoaponeurotic system flap,⁴⁴ while Hong has extensively used it for lower leg reconstruction and hence made its use really popular for lower limbs.⁴⁵⁻⁴⁷ From scratch, we suddenly find ourselves at a stage where more than 400 cutaneous perforators have already been described⁴⁸ and the situation has ironically become such that we are starting to find ways to deal with the problem of plenty!⁴⁹

Open Mindset (→ Fig. 5)

Human education starts from the day of birth and continues until our last breath, with every new dawn enriching our

Where there is an open mind,
there will always be a frontier.

— Charles Kettering —



Fig. 5 Fifth attribute-An open mindset.

minds with knowledge that was concealed to us, a day before. Whenever a person decides that he knows everything is the exact moment when his intellectual decline commences.⁵⁰ Microsurgery, being a discipline that owes its existence to experimentation and generous exchange of ideas, is a glaring case in point, highlighting the importance of an open mindset. Thereby, it remains one of the quintessential qualities that a microsurgeon should possess.

He should be open to people as well as ideas. Instead of rigidly adhering to his own thoughts or conclusions and considering them infallible, he should always have the sagacity to accommodate a varying viewpoint, validate it for its possible authenticity, and only discount it after a rigorous scrutiny.⁵¹ This “varying viewpoint” can come from a senior or a junior peer, an ancillary staff member or even from a patient. Such viewpoints should be judged strictly on the basis of merit and not on stature. We personally bear testimony to instances where eagle-eyed nurses or para medical staff have been the first ones to recognize atypical features of a flap in the recovery room and whose vigil thereby led to timely intervention and subsequent salvage of such flaps.

Similarly, benign suggestions from junior colleagues can many times lead to substantial improvements in the end result and thus should be treated with due respect instead of contempt. A microsurgeon should welcome all such suggestions and incorporate them even if it means deviating from the originally formulated plan. This “mentorship reversal” is an essential feature by means of which growth becomes a two-way exchange between various members of the team rather than flowing from top to bottom always.^{52,53} It also strengthens the bonds between members, as younger colleagues view themselves as equally appreciated and valued components of a team.

Also, a microsurgeon must have the ability to take criticism in a positive way.⁵⁴ Criticism is usually synonymous with outright rejection of one’s work and hence is different from the “varying viewpoint” as described above. Critics come in all forms and shapes and can include well-meaning mentors, purely analytical observers, or a subset of “jealous peers” whose job is, only and only, to belittle us! Regardless of the source of this criticism, a microsurgeon should view every commentary on his work as an opportunity to introspect whether the aspects of his work being questioned are really in need of some overhauling. As a corollary of the same principle, a microsurgeon should always be truthful about his assessment of others work and personal relationships should never obfuscate his sense of judgement. Favorably assessing a friendly colleague’s “not so brilliant” work or unnecessarily downgrading meritorious work from some other colleague, whom we may be not very fond of, are both equally condemnable endeavors.

A closed mindset on the contrary is everything that a microsurgeon should stay away from.⁵⁵ Self-obsession, poor communication skills, inability to deal with criticism, no zeal for self-correction as well as being surrounded by “yes men” are all attributes that are detrimental in the overall growth of a good microsurgeon.

The Fifth International Course on Perforator flaps held in Belgium, 2001 (“The Gent Consensus”) is a fine example that illustrates the benefits of this open mindset in its most pristine form.⁵⁶ On account of the rapidity with which progress was being made in the field of perforator flaps, a lot of confusion had prevailed regarding the nomenclature and terminology of this newly evolved mode of reconstruction, which seemed full of promise otherwise. To cut this clutter, wise men from all parts of the globe got together, set their individualities aside and simplified the whole issue for the common good of their colleagues. The end result was a “duck soup” version of perforator flap nomenclature, devoid of all redundancies and easy for plastic surgeons the world over to use and compare their results, an exercise that has further proliferated and helped in the usage of perforator flaps universally.⁵⁷

Action and Innovation (–Fig. 6)

The final but the most important attribute that makes it possible for a microsurgeon to transform all his lofty ideas into palpable reality is by simply acting on them. There is no substitute for hard work and in fact, sheer hard work can compensate for many other attributes that many of us may lack initially.⁵⁸ One stark similarity between people who have shone in their respective fields is that after dreaming big, they dedicated time to achieve those dreams by virtue of their toil and grit.

First of all, it is imperative that microsurgeon sets up a graduated target list for himself wherein he allocates a specific period of time to achieve a stipulated target and then moves on to the next level. During this time, his entire focus should be toward attainment of the said goal with all the dedication at his disposal. Mastering a certain technique or a procedure is the glorified end result of numerous background exercises that one has to achieve proficiency at beforehand. The list may include dusting off those old anatomy books, cadaveric dissections, practicing on animal models, seeking help from mentors, attending workshops, apprenticeship, and years of relentless practice. Each and every step demands action and discipline of the highest order possibly at the cost of leisure time and involves odd hours.

An honest appraisal of one’s capabilities as well as limitations should always be taken into consideration while formulating a list of targets.⁵⁹ As such, the list should be as ambitious as possible but should always be within the ambit of achievability. Setting up impossible targets for oneself with mismatched expectations only leads to disappointment as well as wasting of precious time and energy.

Innovation is yet another characteristic that fuels the growth of an individual and is a natural by-product of being proactive. A microsurgeon should always have a good sense of anticipation and an ability to stay ahead of competition and this can be only achieved by constant innovation. In his bestselling book titled “Zero to One,” Peter Thiel explains the importance of being innovative in a marvelous way and the concept has universal applications, including in the field of

Every time we create something
new we go from zero to one.

– Peter Thiel –



Fig. 6 Sixth attribute-Action.

microsurgery.⁶⁰ The biggest threat to any discipline comes from stagnation and complacency and microsurgery is no different. To stay relevant, innovation serves as the tool that prunes the microsurgical tree at regular intervals, helps it get rid of concepts that have turned redundant, which in turn paves a new way for proliferation of concepts that are pertinent and contemporary.^{61,62} A good microsurgeon is never content and should always be on the lookout for opportunities wherein he can simplify things for others. He should be on a relentless pursuit to identify problems and be the first one to try to seek innovative approaches to tackle these problems. These innovative approaches can relate to microsurgical techniques, decision making, patient care, as well as the society in general. His tendency should always be to turn good into better and better into best. While it may all seem too radical at the beginning, but over a period of time one can realize the benefits of such an approach as his labor starts to bear fruits. If we analyze some of the most important microsurgical innovations in hindsight, they all seemed either unconventional or a bit too radical at the beginning. It was only due to the self-belief of the persons involved that such radical ideas eventually gained approval as well as appreciation from one and all.

Surgical treatment of lymphedema was something that traditionally generated more scoff and barely any enthusiasm, for the better part of history. It was usually considered as a last resort for patients who otherwise seemed refractory to all other forms of conservative treatment.^{61,63} To be fair, the unpredictability of the surgical results did not do improve its bleak reputation either. All these procedures (Charles's procedure,⁶⁴ Homan's procedure,⁶⁵ etc.) were essentially gross debulking measures with scant regard for any physiological principles and thus yielded unsatisfactory results, especially with regard to recurrence and cosmesis.⁶⁶

Fast forward to the present times, where surgical treatment in its various avatars (LVA, VLNT, VLVT, SCIP flap, and

the list seems to be growing!) has become our primary tool to deal with lymphedema of all forms while producing results that are far superior to yesteryears.⁶⁷ It is to the credit of pioneers like Koshima, Hong, and others, who refused to surrender to the status quo and stuck to their beliefs that surgical treatment for lymphedema had the potential to offer much more than the crude procedures being offered at that time.^{68,69} Their zeal for innovation and their desire to act outside their comfort zones fueled the revolution that changed the management of lymphedema for good and thus lessened the sufferings of countless lymphedema patients the world over.⁷⁰

Conclusion

Plastic surgery (including microsurgery) is probably the most dynamic among all surgical branches, wherein techniques that were considered infallible and worshipped once were consigned to the bin of history overnight, as better ones started displacing them. A random glance at the trends of publications or at the most frequently searched plastic surgical terms bears testimony to this fact, wherein words like VLVT, VLNT, and SCIP flap, which would have seemed like alien words a decade ago, are currently the flavor of the season.⁷¹ To stay relevant, it becomes paramount that a young microsurgeon imbibes into his training, all the attributes that will help him achieve proficiency in his field and that he can do justice to his chosen profession as well as to himself.

The making of an accomplished microsurgeon is not a static point in time that arrives after obtainment of a specific diploma or a fellowship. It is instead, a lifelong process³⁵ and the only mantra that makes it possible, is by working toward his goal with utmost honesty and self-discipline. The above essay with its six basic ingredients of "Clarity, Curiosity, Perseverance, Passion, An Open Mindset and Action," is meant to be a modest attempt on part of the authors to

share their microsurgical insights, procured through their own respective journeys, with budding aspirants, hoping to sensitize as well as prepare them for a challenging, but beautiful and promising future, that lies ahead.⁷²

An equally compelling reason that prompted the authors of this manuscript to pen this rather philosophical chronicle is to reiterate the rich and proud history of reconstructive surgery and to reinvigorate us all as plastic surgeons. Inadvertently or not, this history seems to be lost in oblivion and is probably not discussed as frequently as it should be. While it may be spoken in hushed up tones, but the thought regarding a disproportionate number of young plastic surgeons opting for the more glamorous and financially overwhelming sub-discipline of cosmetic surgery, is a thought that must have crossed the mind of every plastic surgeon, who holds reconstructive surgery close to his heart. There is no denying of the fact that cosmetic surgery is the most famous member of our family and is in no way any less important. It brings a smile to millions of faces worldwide and has given us, plastic surgeons, fame and recognition among general masses. While joining this glamorous branch of plastic surgery needs very little motivation on account of the self-propelled and ever-increasing beauty conscious environment we live in, this article is an attempt on part of the authors (all self-confessed reconstructive surgery radicals!) to make budding plastic surgeons aware of the rich past that we come from as well help them choose a path ahead.

Author Contribution

Conceptualization: J.P.H, Z.M., C.T.
Methodology: J.P.H, Z.M., C.T.
Writing: J.P.H, Z.M., C.T.
Review: J.P.H, Z.M., C.T.

Conflict of Interest

J.P.H. and C.H.J.T. are editorial board members of the journal but were not involved in the peer reviewer selection, evaluation, or decision process of this article. No other potential conflicts of interest relevant to this article were reported.

Acknowledgments

The authors wish to thank Maria Prieto Barea (www.mariaprietobarea.com) for her graphical support with the figures.

References

- Bible KJ (1996). King James Bible (Vol. 19). Proquest LLC.
- Surgery in the 2020s: Implications of advancing technology for patients and the workforce Richard Sc Kerr. *Future Healthc J* 2020; 7(01):46–49
- Amin K, Moscalu R, Imere A, et al. The future application of nanomedicine and biomimicry in plastic and reconstructive surgery. *Nanomedicine (Lond)* 2019;14(20):2679–2696
- Whitaker ISKaroo RO, Spyrou G, Fenton OM. The birth of plastic surgery: the story of nasal reconstruction from the Edwin Smith Papyrus to the twenty-first century. *Plast Reconstr Surg* 2007;120(01):327–336
- Bennett JP. Aspects of the history of plastic surgery since the 16th century. *J R Soc Med* 1983;76(02):152–156
- Gbara A, Darwich K, Li L, Schmelzle R, Blake F. Long-term results of jaw reconstruction with microsurgical fibula grafts and dental implants. *J Oral Maxillofac Surg* 2007;65(05):1005–1009
- Hallock GG. The four P's that make a microsurgeon: perfectionist, pragmatist, persistent, and paranoid. *J Reconstr Microsurg* 2013; 29(07):425–426
- Hong JP. Godina Lecture at the Annual Meeting of the American Society of Reconstructive Microsurgery 2016, Jan 16 to 19, Scottsdale, AZ, USA
- Levitt T. What business are you in? Classic advice from Theodore Levitt. *Harv Bus Rev* 2006;84(10):126–137, 150
- Diering SL. *Love Your Patients! Essential Behaviors That Enrich the Lives of Patients and Caregivers*; California: Blue Dolphin Publishing, Inc. 2006
- Choong C, Kaye AH. Emil theodor kocher (1841-1917). *J Clin Neurosci* 2009–155416(12):1552–1554
- Accessed October 9, 2022, at: <https://www.newyorker.com/magazine/2019/10/28/the-real-nature-of-thomas-edison's-genius>
- Fricker J. Robert Acland: Pioneer of microsurgery who forged a second career in anatomical teaching. *BMJ* 2016;352:i1761
- McGruther DA. Robert Acland (1941-2016) innovator, microsurgeon, anatomist and teacher. *J Plast Reconstr Aesthet Surg* 2018;71(02):126–131
- Runyon K. *Microsurgery*. Louisville, Kentucky: Courier Journal; 1976
- Kleinert H. *Hand Surgery in Louisville*. Louisville, KY: Kleinert-Kutz Hand Center; 2018
- Acland R. *How the Project Began*. Acland's Video Atlas of Human Anatomy. Wolters Kluwer <https://aclanganatomy.com/public/About.aspx>
- The Little Prince by Antoine de Saint-Exupery. Hardcover; New York: Harcourt, Brace & World, 1943; ISBN-13: 978-0152465032
- Sade RM. Transplantation at 100 years: Alexis Carrel, pioneer surgeon. *Ann Thorac Surg* 2005;80(06):2415–2418
- Ernst A, Lawson H. Translated by Fripp, H. E. "A Contribution to the Theory of the Microscope and the Nature of Microscopic Vision". *Proceedings of the Bristol Naturalists' Society*. London, UK: Williams & Northgate; 1876:200–261
- Tobin G. Robert D. Acland, F.R.C.S., 1941 to 2016. *Plast Reconstr Surg* 2016;138(06):1376–1379
- Opdal PM. Curiosity, Wonder and Education seen as Perspective Development. *Stud Philos Educ* 2001;20:331–344
- Marsh HW, Martin AJ, Hau K-T. (2006). A Multimethod Perspective on Self Concept Research in Educational Psychology: A Construct Validity Approach. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 441–456). American Psychological Association
- Dahlin K, Taylor M, Fichman M. Today's Edisons or weekend hobbyists: technical merit and success of inventions by independent inventors. *Res Policy* 2004;33(08):1167–1183
- Gladwell M. (2008). *Outliers: The Story of Success*. New York: Little, Brown and Company
- Chase RA, Harry J. Buncke, MD July 16, 1922–May 18, 2008. *J Hand Surg Am* 2008;33(07):1245
- Lau DC (ed.) (2000). *Confucius: The Analects*. Columbia University Press 2008
- Singletary SE. A fire in our hearts: passion and the art of surgery. *Ann Surg Oncol* 2010;17(02):364–370
- Fields SK, Mahan P, Tillman P, Harris J, Maxwell K, Hojat M. Measuring empathy in healthcare profession students using the Jefferson Scale of Physician Empathy: health provider–student version. *J Interprof Care* 2011;25(04):287–293
- Joyce KM, Joyce CW, Kelly JC, Kelly JL, Carroll SM. Levels of evidence in the plastic surgery literature: a citation analysis of the top 50 'classic' papers. *Arch Plast Surg* 2015;42(04):411–418

- 31 Shurey S, Akelina Y, Legagneux J, Malzone G, Jiga L, Ghanem AM. The rat model in microsurgery education: classical exercises and new horizons. *Arch Plast Surg* 2014;41(03):201–208
- 32 Blondeel PN, et al, Eds. *Perforator Flaps: Anatomy, Technique, & Clinical Applications*. Boca Raton, FL: CRC Press 2013
- 33 Hallock GG. Direct and indirect perforator flaps: the history and the controversy. *Plast Reconstr Surg* 2003;111(02):855–865, quiz 866
- 34 Champaneria MC, Workman AD, Gupta SC. Sushruta: father of plastic surgery. *Ann Plast Surg* 2014;73(01):2–7
- 35 Koshima I, Yamamoto T, Narushima M, Mihara M, Iida T. Perforator flaps and supermicrosurgery. *Clin Plast Surg* 2010;37(04):683–689, vii–iii
- 36 Jeong HH, Hong JP, Suh HS. Thin elevation: a technique for achieving thin perforator flaps. *Arch Plast Surg* 2018;45(04):304–313
- 37 Taylor GI, Palmer JH. The vascular territories (angiosomes) of the body: experimental study and clinical applications. *Br J Plast Surg* 1987;40(02):113–141
- 38 Kroll SS, Rosenfield L. Perforator-based flaps for low posterior midline defects. *Plast Reconstr Surg* 1988;81(04):561–566
- 39 B Hallock GG. A brief history of perforator flaps. *J Xiangya Med* 2018;3:4
- 40 Koshima I, Soeda S. Inferior epigastric artery skin flaps without rectus abdominis muscle. *Br J Plast Surg* 1989;42(06):645–648
- 41 Koshima I, Inagawa K, Urushibara K, Moriguchi T. Paraumbilical perforator flap without deep inferior epigastric vessels. *Plast Reconstr Surg* 1998;102(04):1052–1057
- 42 Allen RJ, Treece P. Deep inferior epigastric perforator flap for breast reconstruction. *Ann Plast Surg* 1994;32(01):32–38
- 43 Angrigiani C, Grilli D, Siebert J. Latissimus dorsi musculocutaneous flap without muscle. *Plast Reconstr Surg* 1995;96(07):1608–1614
- 44 Martin D, Pascal JF, Baudet J, et al. The submental island flap: a new donor site. Anatomy and clinical applications as a free or pedicled flap. *Plast Reconstr Surg* 1993;92(05):867–873
- 45 Hong JP, Kim EK. Sole reconstruction using anterolateral thigh perforator free flaps. *Plast Reconstr Surg* 2007;119(01):186–193
- 46 Hong JP. The use of supermicrosurgery in lower extremity reconstruction: the next step in evolution. *Plast Reconstr Surg* 2009;123(01):230–235
- 47 Hong JP, Sun SH, Ben-Nakhi M. Modified superficial circumflex iliac artery perforator flap and supermicrosurgery technique for lower extremity reconstruction: a new approach for moderate-sized defects. *Ann Plast Surg* 2013;71(04):380–383
- 48 Morris SF, Tang M, Almutari K, Geddes C, Yang D. The anatomic basis of perforator flaps. *Clin Plast Surg* 2010;37(04):553–570, xi
- 49 Saint-Cyr M, Schaverien MV, Rohrich RJ. Perforator flaps: history, controversies, physiology, anatomy, and use in reconstruction. *Plast Reconstr Surg* 2009;123(04):132e–145e
- 50 Zeiger RF. Toward continuous medical education. *J Gen Intern Med* 2005;20(01):91–94
- 51 Raskin JD. Constructivism in psychology: personal construct psychology, radical constructivism, and social constructionism. *Am Commun J* 2002;5(03):1–25
- 52 Leung CCM, Ghanem AM, Tos P, Ionac M, Froschauer S, Myers SR. Towards a global understanding and standardisation of education and training in microsurgery. *Arch Plast Surg* 2013;40(04):304–311
- 53 Creps E. *Reverse Mentoring: How Young Leaders Can Transform the Church and Why We Should Let Them*. Vol. 41. Hoboken, NJ: John Wiley & Sons; 2008
- 54 Aasland OG, Førde R. Impact of feeling responsible for adverse events on doctors' personal and professional lives: the importance of being open to criticism from colleagues. *Qual Saf Health Care* 2005;14(01):13–17
- 55 King RB. A fixed mindset leads to negative affect. *Z Psychol Z Angew Psychol* 2016
- 56 Blondeel PN, Van Landuyt KH, Monstrey SJ, et al. The "Gent" consensus on perforator flap terminology: preliminary definitions. *Plast Reconstr Surg* 2003;112(05):1378–1383, quiz 1383, 1516, discussion 1384–1387
- 57 Taylor GI. The "Gent" Consensus on Perforator Flap Terminology: Preliminary Definitions; Phillip N. Blondeel, MD, Ph. D., Koen HI Van Landuyt, MD, Stan JM Monstrey, MD, Ph. D., Moustapha Hamdi, MD, Guido E. Matton, MD, Robert J. Allen, MD, Charles Dupin, MD, Axel-Mario Feller, MD, Ph. D., Isao Koshima, MD, Naci Kostakoglu, MD, and Fu-Chan Wei, MD. *Plast Reconstr Surg* 2003;112(05):1384–1387
- 58 Rau W, Durand A. "The academic ethic and college grades: does hard work help students to" make the grade? *Sociol Educ* 2000;19–38. Doi: 10.2307/2673197
- 59 Thompson KR, Hochwarter WA, Mathys NJ. Stretch targets: what makes them effective? *Acad Manage Perspect* 1997;11(03):48–60
- 60 Thiel P, Masters B. Zero to One: Note on Start Ups, or How to Build the Future. *Gyan Management Journal* 2017;11(01):129–130
- 61 Hong JP. Innovation in plastic surgery-why and how? *Arch Plast Surg* 2021;48(05):471–472
- 62 Hallock GG. Innovations: a dawning of a new age. *Arch Plast Surg* 2021;48(02):147–148
- 63 Thompson N. The surgical treatment of chronic lymphoedema of the extremities. *Surg Clin North Am* 1967;47(02):445–503
- 64 Charles RH. The surgical treatment of elephantiasis. *Ind Med Gaz* 1901;36(03):84–99
- 65 Homans J. Lymphedema of the limbs. *JAMA Surg* 1940;40(02):232–252
- 66 Dellon AL, Hoopes JE. The Charles procedure for primary lymphedema. Long-term clinical results. *Plast Reconstr Surg* 1977;60(04):589–595
- 67 Tinhofer IE, Steinbacher J, Tzou CJ. Mikrochirurgische Therapieoptionen beim Lymphödem. *Phlebologie* 2021;50(02):141–146
- 68 Koshima I, Inagawa K, Urushibara K, Moriguchi T. Supermicrosurgical lymphaticovenular anastomosis for the treatment of lymphedema in the upper extremities. *J Reconstr Microsurg* 2000;16(06):437–442
- 69 Hong JP, Song S, Suh HSP. Supermicrosurgery: principles and applications. *J Surg Oncol* 2018;118(05):832–839
- 70 Tzou CJ, Steinbacher J, Czedik-Eysenberg M, et al. Institutionalization of reconstructive lymphedema surgery in Austria-Single center experience. *J Surg Oncol* 2020;121(01):91–99
- 71 Mackenzie EL, Larson JD, Poore SO. Plastic surgery and specialty creep: an analysis of publication trends. *Arch Plast Surg* 2021;48(06):651–659
- 72 Neligan PC. The future of plastic surgery. *Arch Plast Surg* 2022;49(01):1–2