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Editorial

How are great ideas born in hand surgery?

Comment naissent les bonnes idées en chirurgie de la main?



Between December 2018 and January 2019, five eponymous and internationally renowned hand surgeons—Guy Foucher (GF), Timothy Herbert (TH), Adalbert Kapandji (AK), Alain-Charles Masquelet (ACM) and Christophe Oberlin (CO)—were interviewed for a Swiss symposium on how great ideas are born ([Videos 1 and 2](#)). As we try to retrospectively retrace the path of great ideas in hand surgery, we must not forget that what follows is based on discussions and not on scientific observation. Indeed, since the surgeons may not be aware of certain elements of the creative process because they involve unconscious mechanisms, we must interpret these statements carefully. The discussions were done without the surgeons having prior preparation, in order to collect spontaneous thoughts.

I chose to divide the creative process into three parts: the first relates to the ingredients necessary for great ideas to be born; the second to the “recipe” i.e., the creative mechanisms themselves, and the last to how these great ideas are brought to fruition.

1. Ingredients

The ingredients needed for the creation of great ideas can be summarized as an individual in an environment, at a given time, who is subject to constraints.

1.1. The individual and his qualities

1.1.1. Knowledge

“To have ideas, we first need a solid foundation of knowledge in our field before we can go beyond it” (ACM). According to AK and CO, one of the keys of hand surgery is, without a doubt, a sound knowledge of anatomy and function. This allows surgeons to carry out very detailed clinical examinations and make discoveries. “It is essential to nourish the mind every day. The broader the knowledge and training, the less limited the ideas” (GF). All of the surgeons lamented how this has been affected by the reduction in time spent on general surgery training in our specialty.

“It is important to have a knowledge of recent literature, but we can find important things in older studies, as well” (ACM). CO and AK touched on the importance of the works and writings of clinician and anatomist Duchenne de Boulogne. GF remembers the written works of Bill Littler and Henri Mondor, whom he describes as more than surgeons: “They lived for surgery” (GF). For ACM, “Introduction

à l'étude de la médecine expérimentale” by Claude Bernard, remains a classic. According to AK, reading does not paralyze the imagination but opens new perspectives. Likewise, knowledge of an art such as drawing may be important and take on its full meaning in our specialty.

However, when we read, it is another person who thinks for us and reflects [1]. While reading is essential, reading excessively may cause some paralysis of thought. “I have not read a hand surgery article for more than 15 years, but that did not stop me from deepening my experience” (CO). “Clear your mind of what you know when faced with an original problem, take time to reflect alone before consulting the literature and remember Kant's philosophy [2]: Dare to think for yourself!” (ACM).

1.1.2. Wonder and curiosity

“One of the important abilities we have as children and that was stimulated by my father was curiosity. Another ability that we lose as adults is the ability to be amazed by nature's creations, which are fantastic and born of a higher intelligence” (AK). “We need to know how to be amazed by small things, not only extraordinary ones, to stop on a particular subject, and have the curiosity to pursue a field” (ACM). According to CO, curiosity is an essential quality for researchers, and we need to be curious about different behaviors and different ways of working by traveling to other countries, for example.

1.1.3. Perseverance, obsession, work

AK describes having a mind that never rested, one that could never be empty and of having the tenacity to pursue his idea until the end. “When faced with a problem, we have to think about it nonstop” (ACM). The Herbert screw took about 8 years to develop. It was very challenging because of major obstacles and multiple rejections, especially from the medical device industry. “You must never give up if you really believe you have a great idea. It takes courage” (TH). “You must never accept failure and you have to have some degree of personal obsession” (GF). GF added that after a broad education, a surgeon must focus only on hand surgery and do only that, sometimes putting aside other passions (at least temporarily). Lastly, GF gives an example: while writing an article can be demanding and challenging, it is often then that we think back on the surgery, so this is not merely a tedious exercise, but a creative task.

1.1.4. Motivation and emotional factors

Motivation can be extrinsic. *“I came up with solutions to problems that did not have solutions, which is where motivation comes from: it comes from a patient and the challenge of solving that patient’s problem”* (CO). For GF, the motivation to perform carpal tunnel surgery came from the fact they were starting a new clinical study and that it would be useful for research and for better understand this pathology. *“I stopped my practice precisely because the time came when I no longer had the motivation and enthusiasm for asking myself questions”* (GF).

Motivation can also be intrinsic. *“The important thing to me was to get a job that would advance my career. In fact, I was a bit older than the other residents, as I had spent 5 years traveling in the Navy, thus I had to become a specialist in something”* (TH). GF stated that he was also partly motivated by a desire for recognition, as he resented not having been able to pursue an academic career. To write his three books on joint physiology, AK said he was partly motivated by his love of drawing, a love passed down to him by his mother. For ACM, the motivation was the feeling of acting on the real world to bring an idea to life.

1.1.5. Intuition, imagination

Claude Bernard listed three elements as being crucial to scientific discovery [3]: Feelings, reason and experimentation—*“Feelings correspond, in fact, to intuition and imagination”* (ACM). *“Intuition is characteristic of human intelligence”* (AK). CO recounts that his idea for the “ulnar-biceps” transfer combined a logical idea (connect as close as possible) with his experience (up to 70% of the ulnar nerve’s fibers can be lost without noticing it), while ACM describes intuition as the ability to bring together two ideas that seem totally unrelated. TH also talks about having some intuition about mechanical concepts when he was developing his screw, even though he had no formal training in this field.

1.2. Environment and time

1.2.1. Environment

1.2.1.1. Material conditions. GF talks about the importance of experimental surgery in stimulating the imagination and recounts his experience in a Lille laboratory where he spent 4 years working on his thesis in an environment conducive to reading, research and the emergence of ideas. CO confirms that, had he not had access to an anatomy laboratory, he would not have published so many scientific articles. AK specifies that, for a surgeon, the primary laboratory is the patient and that it’s while doing surgery that we discover ideas.

“The available means, such as laboratories, mainly serve to confirm a hypothesis or idea” (ACM) or even to allow the dissemination and broad uptake of an idea, rather than its creation, according to TH. GF talks about the personal and financial investments needed to create his own private facility, which provided him with a certain amount of freedom and contributed to the emergence of some of his ideas.

On the other hand, *“an environment without resources and with precarious conditions helps to strip away the unnecessary and leads to great ideas”* (ACM), *“for example, a healthcare facility with no beds gave me the opportunity to develop outpatient procedures and to improve patient comfort”* (GF) and, in some cases, even limited means can suffice: *“paper and a pencil, like Einstein”* (AK).

1.2.1.2. Freedom. All the surgeons indicated they had the opportunity to have both great mentors with big ideas and total freedom, even if heated discussions sometimes occurred. For these surgeons, *“freedom was a driver”* (CO). ACM and CO remarked with some concern that more and more decisions in medicine are being made

using evidence-based medicine or surgery, and that, in some cases, the only time a surgeon really thinks is when placing a patient in a classification system, at all costs, to find the right treatment. In this case, creativity is stifled: *“People must be in an environment where they can speak out and do not feel a need to practice self-censorship”* (ACM). Finally, we could say that *“we must speak up during staff meetings, then bring into play what is rational and reasonable”* (ACM). TH reminds us that it is also important to preserve our family environment and to keep some free time outside of work.

On the other hand, *“the lack of freedom that may be due to external constraints can also produce ideas, behaviors and ways of working”* (CO). TH trained in Great Britain at six different hospitals. He remembers an extraordinary department head who encouraged free thought, but he also remembers other departments being very strict and admits that discipline is also an important factor in idea creation.

1.2.1.3. Exchanges. Exchanges can be important to developing an idea. For example, for TH, exchanging ideas with a young engineering student was critical to the discovery of the Hebert screw. *“We discussed and drew the shape of the screw, its size; we already had the idea of a headless crew, threads with a smooth section in the middle of the screw, and then suddenly, in the middle of a discussion, I thought of using two different threads to ensure compression”* (TH). This idea was quickly validated by his engineering colleague. Exchanges are equally important with younger surgeons and students and *“those can look at the field with fresh eyes and raise questions that may lead to innovative answers since experience can make us somewhat biased”* (GF). According to GF, there can also be a certain lack of consideration, freedom of speech and exchanges with younger members of certain learned societies, which represses new ideas. *“During discussions, we sometimes have to accept the other person’s opinion, place ourselves on equal footing and not imagine that we are always right; this behavior could be found in Narakas, Allieu and Kapandji, who shared their experiences yet knew how to listen”* (CO). *“It is important not to always be immersed in discussions, as this can also be limiting; sometimes it is best to step away”* (ACM). ACM also points out that the most significant discussions are not always explicit.

1.2.2. Time

Some discoveries can occur during periods of relentless work or intense concentration, after a certain amount of time for ideas to ripen, like during surgery according to GF, but we can have a flash of inspiration—instantaneous—according to CO. These ideas arrive without warning and may be unrelated to what we are doing currently. This expresses well the unconscious and misunderstood workings of the brain, *“which means that we think despite ourselves, that it just smacks us in the face!”* (ACM). AK remembers very well having the idea for Kapandji pinning while on vacation. Other ideas have popped up while doing sports (GF) or while in the shower (CO). ACM describes that, for many years, he has been regularly driving out of town to visit patients. To him, this is his preferred time for thinking, as the brain in these situations is on auto-pilot and works by itself. TH points out that surgeons are very busy with their day-to-day tasks and that the time spent at conferences is conducive to generating new ideas. Moreover, every person’s brain is configured the same way, so there is a certain universality of knowledge according to ACM. Thus, ideas can be born at the same time in different areas, such as for the posterior interosseous flap. GF admits that other people likely had the same ideas and were doing the same things, but he is the one who published them.

1.3. Constraints, obstacles

An individual in a given environment is not sufficient: what “lights the fire” is the problem or the constraints we are faced with.

An idea comes from a problem, an obstacle: “*Necessity is the mother of invention*” (TH). The problem must first be identified. TH recounted that his constraint was clearly identified—how to resolve the scaphoid fracture problem while abiding by the AO principles (anatomic reduction, internal fixation, early mobilization). He was impassioned by this problem. For CO, constraints force us to find solutions. He brings up the fact that, during his career, he was mostly interested in difficult problems. Here, it is the obstacle, and sometimes its difficulty, that acts as a powerful trigger of the enthusiasm or passion for tackling the job. “*Adversity, the lack of means, and being placed in an uncomfortable situation that falls outside standard practice, all contribute to the birth of certain ideas*” (ACM).

TH points out the significant constraint of working in the medical device industry, where it is difficult to come to an agreement. Only twice did he manage to agree with a company. GF recognizes that his failure to become a university professor was the obstacle, but it also propelled him to do things in the private sector that he couldn't do in the public one. His career was his revenge.

TH also reports opposition from certain colleagues who were not ready to accept change, who argued that scaphoid fractures are being treated very successfully with a cast and that his screw was only a business venture.

2. Creative mechanisms

The mental mechanisms responsible for idea creation are numerous, complex and often entangled. The course taken by these surgeons, even subconsciously, is absolutely fascinating because “*it does not always obey the scientific mind—a large portion is irrational!*” (ACM).

2.1. Analogy

A metaphor is not only a stylistic device but also a powerful thought mechanism that allows us to perceive a resemblance between two phenomena. The biomimetic approach is now a powerful mechanism for technological innovation. AK brings up his wonder of nature, of a higher intelligence, of the wonderful world in which he lives, which is a limitless source of inspiration. The analogy is sometimes also being inspired by the work or inventions of others. TH explains that he was inspired by Swanson's work when developing his ulnar head prosthesis.

2.2. Bisociation [4]

This is the process by which an idea joins together two apparently unrelated fields. GF touches on the bisociation phenomenon by explaining that his ideas came from several people. He talks of a wandering of the mind, an amalgamation of several ideas. His contribution was sometimes to make a connection between these ideas; however, he felt his contributions were only small improvements. ACM notes that we can bring two ideas closer together only if we have accumulated enough knowledge, hence the importance of the “ingredients” mentioned previously. CO recounts that a bisociation mechanism came into play when he came up with the Oberlin transfer (merging of a logical idea with an experience).

2.3. Serendipity

Serendipity is the power to discover, invent or create something we are not looking for. Without a doubt, the example that applies the best to our specialty is the invention of microsurgery [5]. ACM recalls the importance of serendipity in the discovery of the

properties of the induced membrane. TH also mentions serendipity: “*while looking for something to advance my career, my attention was drawn to scaphoid fractures—it could very easily have fallen on something else!*”

2.4. Change of reference, shift in perspective

ACM describes a change in perspective as a relevant source of new ideas; he gives as an example the reverse shoulder arthroplasty, which initially was completely counterintuitive but has led to very good outcomes.

2.5. Transgression or diverging thinking

“We learned in surgery that we should never place an implant at the fracture site” thus, from this view point, the intra-focal pinning technique for distal radius fractures was “an act of provocation” (AK). “Certain surgeons and department heads in that era could not even imagine doing my procedure and never performed it” (CO). A touch of provocation, “bringing our habits into question, established things, but also knowing how to recognize our errors” (CO). “I defied convention, but it was more of a transgression in the eyes of others” (GF). “We must always keep an open mind, think outside the box and always ask ourselves what the best path is to take” (TH). When choosing a specialty like hand surgery, becoming hyperspecialized, we do it to change things, “think while putting aside the ideas of others” (GF).

2.6. Abduction, induction, deduction

All the surgeons, to various degrees, mention the mechanisms of logic or human reasoning in their inventions. Several surgeons bring up the mechanism of abduction without inevitably being conscious of it, a mechanism that builds hypotheses and calls upon imagination and intuition.

3. Materialization of great ideas in hand surgery

3.1. From practical implementation to publication

“*An idea must be put to the test and evaluated*” (ACM) before being recognized and determined to be good. Today, this materialization step faces a growing number of hurdles: normative environment, ethics committee, litigious society such that “*any deviation from standards constitutes a risk*” (GF), and financial cost. All the surgeons interviewed feared this would put an end to the inventive process, which must be protected. Some surgeons even feel their inventions may never have seen the light of day in today's environment and culture. TH recalls that the first time he implanted a screw, the procedure was between him and his patient. There was no ethics committee, and he considers that “*luck was on his side.*” Fifteen years later, when he developed his ulnar head prosthesis, things had greatly changed. According to ACM and CO, surgical experimentation in a single case definitely still occurs. The relationship with the patient and trust play an essential role.

3.2. Recognition

What is a great idea but a social judgment? We sometimes feel immediately sure about an idea because it has certain features such as simplicity (CO brings up the Zancolli lasso procedure), esthetic qualities (GF brings up the SORL technique) or because it causes a shift in perspective (ACM brings up the reverse shoulder arthroplasty). Nevertheless, all great ideas in surgery are judged after having been tested. The time needed for this new idea to be

accepted, recognized and disseminated varies. Sometimes, a new idea or a book is an immediate success. It has “*a viral effect when it answers the students' question*” (AK). Other times, and in most cases, this time frame is fairly long, because the new idea increases risk and disrupts our routine. Many years elapsed before the benefits of the Hebert screw were recognized, according to TH. The Oberlin nerve transfer took about 10 years to be accepted, according to CO, and it took 30 years for the induced membrane technique (aka Masquelet technique), according to ACM.

4. Conclusion

The story of great ideas in hand surgery deserves to be told, because ideas do not fall out of the sky. Conveying the steps taken allows the training of, and also emulation by, younger surgeons. Let's hope they find their place in Hand Surgery & Rehabilitation.

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Appendix A. Supplementary data

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