Neurosurgical Forum

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“Reinventing the wheel”: reflections on a recurrent phenomenon in the history of neurosurgery

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ALTHOUGH likely not a particular privilege of our noble specialty, the “reinventing the wheel” phenomenon seems to have repeatedly manifested itself with a disturbing frequency in the history of neurosurgery. Despite the absence of any report of a second physicist claiming to have discovered the law of special relativity after Einstein’s initial publication in 1905,¹⁶ nor of any biologist proclaiming as their own achievement the description of the helical structure of DNA after Watson and Crick’s 1953 article,⁴³ a brief examination of our specialty’s history reveals innumerable examples of enthusiastic reports of supposedly novel techniques that actually represent procedures that not only had already been previously described in the literature, but which had also been employed by other surgeons for years.^{1,8,22,25,32} Ultimately, despite the natural curiosity that some of these stories of scientific duplication may arouse, it is possible that most neurosurgeons would probably not manifest a deep-seated concern regarding such apparently benign and trivial historical mistakes until personally experiencing the unpleasant sensation of having their own original contribution³⁰ overlooked by an enthusiastic wheel-reinventer.¹¹

Simultaneous Independent Discoveries

The above-described circumstance, in which a new publication claims credit for a discovery, invention, or technique that has already been formally described in the scientific literature (usually years or decades beforehand) should, of course, be distinguished from the not-so-uncommon situation (especially in the basic sciences) of

simultaneous independent (also called multiple) discoveries, in which distinct research groups pursuing a similar research line concomitantly arrive at an identical solution for a certain scientific problem. In the physics community, for example, the occurrence of simultaneous independent discoveries has often led to the granting of the Nobel prize to multiple researchers (the most recent example being the 2015 Nobel Prize in Physics, shared by Takaaki Kajita of Japan and Arthur B. McDonald of Canada, who independently demonstrated that neutrinos have mass).³

One of the few true episodes of simultaneous independent developments in spine surgery seems to have occurred in the early 20th century when two distinct techniques for posterolateral fusion employing autograft were published in the same year. One of them, described by the orthopedic surgeon Fred H. Albee from the New York Post-Graduate Hospital, involved a splitting of the spinous processes in two and the insertion of a cortical tibial strut graft between the two clefts.² The other, described by Dr. Russell A. Hibbs, a surgeon at the New York Orthopedic Hospital, consisted of decortication of the intervertebral joints followed by partial osteotomy of the base of the spinous processes, which were then folded down over the denuded bone.²⁴ Interestingly, Albee’s method, which was published in the prestigious *Journal of the American Medical Association (JAMA)* ultimately fell into obscurity, while the Hibbs technique, published in the less distinguished *New York Medical Journal*, became a very popular and widespread technique, ultimately suggesting that, apart from the glamour of the scientific arena, history has its own ways of crediting key scientific advances through an inherent “survival of the fittest” process.

Scientific Duplication and Misappropriation in Neurosurgery History

Unfortunately, in neurosurgery history such interesting but quite isolated instances of simultaneous independent scientific developments are by far outnumbered by the countless regrettable examples of scientific duplication. Besides an inherently educational purpose, a brief analysis of a few examples (Table 1), although not altering

TABLE 1. A non-exhaustive list of historical instances of scientific duplication and misattribution in neurosurgery, spine surgery, and neurology

Topic	Original Publication	Duplicate Publication
C1–2 sublamina wiring	Mixter SJ, Osgood RB: Traumatic lesions of the atlas and axis. <i>Ann Surg</i> 51:193–207, 1910	Gallie WE: Fractures and dislocations of cervical spine. <i>Am J Surg</i> 46:495–499, 1939
Lumbar microdisc-ectomy	Dandy W: Loose cartilage from intervertebral disk simulating tumor of the spinal cord. <i>Arch Surg</i> 19:660–672, 1929	Mixter W, Barr J: Rupture of the intervertebral disc with involvement of the spinal canal. <i>N Engl J Med</i> 211:210–215, 1934
Anterior cervical discectomy & fusion	Robinson RA, Smith GW: Anterolateral cervical disc removal and interbody fusion for cervical disc syndrome. <i>Bull Johns Hopkins Hosp</i> 96:223–224, 1955	Cloward RB: The anterior approach for removal of ruptured cervical disks. <i>J Neurosurg</i> 15:602–617, 1958
Vertebral venous plexus	Breschet G: <i>Essai sur les veines du rachis</i> . Paris: Méquignon-Marvis, 1819	Batson OV: The function of the vertebral veins and their role in the spread of metastases. <i>Ann Surg</i> 112:138–149, 1940
Acute inflammatory demyelinating polyneuropathy	Landry O: Note sur la paralysie ascendante aigüe. <i>Gaz Hebd Méd Chir</i> 6:472–474, 1859	Guillain G, Barré JA, Strohl A: Sur un syndrome de radiculonévrite avec hyper-albuminose du liquide céphalo-rachidien sans réaction cellulaire. Remarques sur les caractères cliniques et graphiques des réflexes tendineux. <i>Bull Mém Soc Med Hôp Paris</i> 40:1462–1470, 1916
Normal pressure hydrocephalus	Hakim S: <i>Some observations on C.S.F. pressure: hydrocephalic syndrome in adults with “normal” C.S.F. pressure. (Recognition of a new syndrome.) [thesis]</i> . Bogotá: Javeriana University School of Medicine, 1964	Adams RD, Fisher CM, Hakim S, Ojemann RG, Sweet WH: Symptomatic occult hydrocephalus with normal cerebrospinal-fluid pressure. <i>N Engl J Med</i> 273:117–126, 1965
C1–2 posterior screw fixation	Goel A, Laheri V: Plate and screw fixation for atlanto-axial subluxation. <i>Acta Neurochir (Wien)</i> 129:47–53, 1994	Harms J, Melcher RP: Posterior C1–C2 fusion with polyaxial screw and rod fixation. <i>Spine (Phila Pa 1976)</i> 26:2467–2471, 2001
S1–alar iliac fixation	Mattei TA, Fassett DR: Combined S-1 and S-2 sacral alar-ilial screws as a salvage technique for pelvic fixation after pseudarthrosis and lumbosacropelvic instability: technical note. <i>J Neurosurg Spine</i> 19:321–330, 2013	DePasse JM, Valdes M, Palumbo MA, Daniels AH, Ebersson CP: S-1 alar/ilial screw technique for spinopelvic fixation. <i>J Neurosurg Spine</i> 28:543–547, 2018

the somber reality of historical unfairness, may at least provide an opportunity to give proper credit to whom it is truly due.

A notable example of scientific duplication, which becomes even more relevant as the authors of such a procedure are still alive, involves the technique for posterior C1–2 screw fixation, commonly referred to as the “Harms” construct.²³ It has already been voiced, if not by others at least by Dr. Atul Goel himself, that Goel had already described exactly the same technique almost a decade before,²⁰ albeit employing an older generation of spinal hardware with plates instead of rods to connect the C1 lateral mass to the C2 pedicle screws (Fig. 1). Despite the complaints of Dr. Goel (as well as a few futile attempts to formally correct such historical inaccuracy),³⁵ taking into account the already widespread use of such a nomenclature for decades, there is overall little hope that such an unfortunate situation may be thoroughly rectified so that Goel’s pioneering contribution would be properly recognized. A similar lamentable instance (also involving the history of craniocervical instrumentation) was the failure of Gallie, while describing his technique of C1–2 sublamina wiring,¹⁹ to reference the pioneering contribution from Mixter and Osgood, who had already described a very similar technique (albeit with a suture and without placement of a strut graft) almost 3 decades earlier (Fig. 2).³²

Another comparable episode, also involving major historical figures in spine surgery, was the description of anterior approaches to the cervical spine. Although the

initial technique had already been described by Robinson and Smith in 1955 at the Johns Hopkins Medical Society meeting (and published along with other proceedings in the *Bulletin of Johns Hopkins Hospital*),³⁶ the article published 3 years later in the *Journal of Neurosurgery* by the distinguished Dr. Ralph Bingham Cloward,⁸ Hawaii’s first full-time neurosurgeon, is usually more widely cited^{18,25} than Robinson and Smith’s original description. Actually, in the same year of Cloward’s publication, Robinson and Smith (with a swap in the authors’ order, which would be forever immortalized by identifying such an approach as the Smith-Robinson technique), republished their technique in the more popular *Journal of Bone & Joint Surgery*,³⁸ an article which is usually (although inaccurately) referenced as the original publication of such an approach by these authors.²⁹ The widespread neglect of Robinson and Smith’s initial description in 1955 is evidenced, for example, in a recent article⁴ that claims that it was actually the Belgians Albert Dereymaeker and Joseph Cyriel Mulier who first described such a technique in an article published in French in the journal *Neurochirurgie* in 1956.¹² This incident, although not properly fitting the framework of independent simultaneous development, illustrates quite well an analogous situation in which, even before its initial official scientific description, a surgical technique has likely already gained such a widespread popularity among the surgical community for the treatment of a certain pathology that it becomes quite challenging to even properly attribute specific authorship to it. In this type of scenario, although not constituting an excuse to disregard

Plate and Screw Fixation for Atlanto-Axial Subluxation

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Summary

Our experience with 30 cases of atlanto-axial dislocation, over the period of 3 years and 9 months, is described. A modified plate and screw method of fixation of the lateral masses of the atlas and axis was successfully used in these cases. The technical aspects and merits of the method, wherein a 100% union rate was achieved, with no morbidity, mortality, or instrument fatigue or failure, are presented. The average follow-up period is of 19 months. The technique provided immediate rigid segmental internal fixation, permitting early mobilization with minimal external support. Onlay and inter-facet bone grafts subsequently produced bony fusion. Direct application of screws to the atlas and axis, thus utilizing the firm purchase in their thick and large cortico-cancellous lateral mass, provides a biomechanically strong fixation of the region.

Occipito-cervical fusion can be achieved in selected cases by a modification of the method. It appears that such a method of fixation could be useful at least in some complex congenital or traumatic craniocervical region instability where the conventional methods have failed or are not suitable.

FIG. 1. Left: Abstract of Dr. Atul Goel's original description of the technique for C1 lateral mass–C2 pedicle screw fixation which was published almost a decade before the widely cited article from Dr. Jürgen Harms (highlighting added). Right: Drawing of the proposed screw and plate C1–2 fixation technique (upper) and postoperative radiograph (lower) of a patient in whom this technique was employed. Reprinted with permission from Goel A, Laheri V: Plate and screw fixation for atlanto-axial subluxation. *Acta Neurochir (Wien)* 129:47–53, 1994.

the key contributions of specific individuals, it seems that the surgical field itself had already become mature enough that it could be possibly stated that with (or likely even without) such pioneers, the technique would inexorably sprout forth as a natural byproduct of a surgical era that has finally become ripe for such a development.

Even if not as often as it would be desired, it should be noted that occasionally some commendable works of careful scientific historiography have played an important role in correcting such types of historical injustices, ultimately providing a venue through which true pioneering academic contributions can be properly recognized. One example of that is a recent article⁴⁴ that, albeit post-humously, properly credits Dr. Walter E. Dandy for the first scientific description of the clinical and operative course of patients submitted to lumbar discectomy for the treatment of lumbar radiculopathy,⁹ a contribution that precedes by 5 years the more commonly cited article by Mixter and Barr, which was published in 1934 in the *New England Journal of Medicine (NEJM)* (Fig. 3).³³ Although, contrary to what is generally believed, the article by Mixter and Barr was not the first scientific description of such a procedure, it should be recognized that their publication displays its own scientific merit, not only for being one of the first studies (along with Dandy's article) to clearly describe the traumatic origin of such a pathology (confronting the widespread misconception about

a possible neoplastic origin of such disc fragments—at that time called chondromas or enchondromas), but also for presenting a larger operative series that also included cervical and thoracic disc herniations. Finally, although other factors related to academic politics (such as Dandy's exclusion from the Society of Neurological Surgeons after his disagreements with Harvey Cushing) have been speculatively entertained as possible explanations for why Dandy's original publication unfortunately fell into the ditches of historical oblivion,⁴⁴ it should be emphasized that in their article Mixter and Barr properly acknowledged the primacy of Dandy's original work.

It is certainly somewhat disturbing that some “wheel-reinventers” have relished the honor of having their own names improperly attached to certain discoveries, while the ingenious work of previous pioneers has been forgotten in the gloomy darkness of historical oversight. As an illustration of this commonplace phenomenon in science, in 1980 Stephen Stigler, a statistics professor at the University of Chicago, proposed what became known as Stigler's law of eponymy, a principle which states (perhaps with some exaggeration) that “no scientific discovery is named after its original discoverer.”³⁹ As an ironic proof of his own rule, it should be noted that such a maxim was definitely not new, having already been, in similar words, previously enunciated by the American poet Mark Twain, as well as by the English philosopher Alfred North

TRAUMATIC LESIONS OF THE ATLAS AND AXIS.

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When this accurately fitting apparatus was ready the following operation was performed. The boy was placed in the ventral position, the head being supported manually over the end of the table. A linear four-inch incision was made in the median line of the neck and carried down until the hooked spine of the axis was defined. Next the posterior arch of the atlas forwardly displaced was sought and exposed. With an aneurism needle a stout braided silk soaked in compound tincture of benzoin was passed about this posterior arch between it and the spinal cord. While forward pressure on the anterior arch was exerted through the pharynx, traction was made on the posterior arch. There was firm resistance to replacement and only a slight amount of reposition was accomplished. This was maintained, however, and the atlas firmly anchored by tying the silk band about the hooked spinous process of the axis. The wound was closed with deep silkworm gut sutures, and the leather cuirass applied and strapped tight (Fig. 4, *a* and *b*). The wound was dressed through a posterior window. There was first intention and the boy made an uneventful convalescence, with no paralytic symptoms and an absence of pain. The apparatus was worn for two months, gradually omitted, and up to the present time he has remained well, without symptoms other than slight stiffness of the neck, and has led an active life.

FIG. 2. Left: Article title as well as excerpt of a case description (page 200 of the original publication, highlighting added) in which Mixer and Osgood describe the original technique for posterior C1–2 stabilization using a sublaminar stitch in C1 anchored to the spinous process of C2. Right: Leather cuirass employed by the authors as postoperative bracing in the described case. Reprinted from Mixer SJ, Osgood RB: Traumatic lesions of the atlas and axis. *Ann Surg* 51:193–207, 1910.

Whitehead, to whom the following adage is popularly attributed: “Everything of importance has been said before by somebody who did not discover it.”

If the focus of our analysis is only slightly enlarged beyond the realm of surgical techniques to include anatomical reports as well as descriptions of signs and symptoms of common neurological diseases, the list of duplicated publications and miscredited eponyms seems to substantially increase.³⁴ The following examples are illustrative: Despite the fact that the American surgeon Oscar V. Batson has been rewarded with an eponym for his anatomical description of the vertebral venous plexus (and indeed deserves credit for his original elucidation of the role of such a venous system in the spread of prostate metastases),⁵ the magnum opus from the French anatomist Gilbert Breschet,⁷ which preceded Batson’s scientific contribution by more than a century, already included a detailed anatomical description of the venous vertebral plexus through an ingenious technique that involved Prussian blue injection in cadaveric specimens. Unfortunately, Batson’s article from 1940 makes no mention of Breschet’s original work. Although the name of the Irish physiologist Robert Bentley Todd has been classically associated with the symptom of postconvulsive paralysis,⁴⁰ the sign had already been described almost 2 decades earlier by the French Louis François Bravais in his doctoral thesis.⁶ In 1916, Guillain, Barré, and Strohl described the clinical course of two

French soldiers who suffered from acute ascending paralysis during World War I.²¹ However, more than 50 years before, Jean-Baptiste-Octave Landry de Thezillat had already published a comprehensive description of not only the typical progressive pattern of what is today known as “acute inflammatory demyelinating polyneuropathy”), but also the key etiological role of the antecedent infectious illness.²⁶ Although it is indisputable that Guillain, Barré, and Strohl’s report had the great merit of describing the classic finding of albumin-cytological dissociation in the cerebrospinal fluid, it seems unlikely that such a contribution would reasonably justify eliminating the merit of Thezillat’s original description while granting Guillain and Barré the distinction of a brand new eponym. Finally, the famous straight leg raise test for the diagnosis of lumbar radiculopathy was not described by Lasègue anywhere in the classical article by this author which is commonly referenced,²⁷ but by one of his students in a doctoral thesis almost 30 years later.¹⁷ This justifies the claim^{13,14} that Lazar K. Lazarević, a Serbian physician who independently described the same test as early as 1880 in an obscure Serbian medical journal,²⁸ should be credited for the first scientific description of this maneuver.

The So-Called “Matthew Effect”

Some instances of improper scientific recognition may also be attributed to what the sociologist Robert Merton

LOOSE CARTILAGE FROM INTERVERTEBRAL DISK SIMULATING TUMOR OF THE SPINAL CORD*

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The two loose cartilages here reported were disclosed at operation for presumed tumors of the cauda equina. In each instance the spinal canal was completely blocked as shown by the shadows of iodized oil 40 per cent (figs. 1 and 2). The signs and symptoms were so rapidly progressive and the pain in the spinal column so severe that presumptive diagnoses of carcinoma of the vertebra were made. The fact that the two cases appeared only a few months apart leads me to believe that the lesion may not be so infrequent, although a review of the literature has failed to disclose other cases of their kind. The lesion is a completely detached fragment of cartilage from an intervertebral (lumbar) disk and is surrounded by serum. It bulges dorsally into the spinal canal as a tumor, and by compressing the roots of the cauda equina causes motor and sensory paralysis, loss of reflexes and of rectal and vesical control. The lesion is undoubtedly of traumatic origin.

REPORT OF CASES

CASE 1.—A sparsely nourished man, aged 47, was referred by Dr. Lewellys F. Barker. Whether or not the past history was relevant to the present illness was not clear at the time. Three years earlier a tumor had been removed from the hand; a microscopic diagnosis of a sarcoma was made. The scar on the hand, the regions of the epitrochlear and axillary glands, had since been treated intensively with radium. Subsequently an axillary gland was removed, but no sign of malignancy was discovered. Two years later, he consulted Dr. Barker because of convulsions which dated back two years.

The patient was readmitted to Dr. Barker's service on May 15, 1928, with an entirely different complaint. Ten weeks before admission he had a severe attack of pain in the lumbar region and both hips; there was more pain in the right hip. The pain radiated down the back of both legs, with more pain in the right leg. After two months of excruciating pain, it was necessary to resort to morphine for relief. Six weeks before admission to the hospital, a "dead feeling" developed in both legs and gradually increased. Two weeks before, he was barely able to stand alone. Assistance was necessary to walk a short distance. One week before, retention of urine and feces developed; after that time he was catheterized twice daily. He lost 42 pounds (19.1 Kg.) in weight, 15 pounds (6.8 Kg.) of which were lost in the last two months before admission. Pain in the lumbar region, hips and legs steadily became more severe.

On admission to the Johns Hopkins Hospital, the patient was found to have a total flaccid paralysis below the knees. Except for feeble flexion and extension

* Submitted for publication, April 29, 1929.

* From the Johns Hopkins University and Hospital.

FIG. 3. Left: Abstract and portion of report of case 1 from Walter E. Dandy's original description of the clinical and operative course of patients submitted to lumbar microdiscectomy (highlighting added). Right: Sketches demonstrating the relationship of the herniated piece with the intervertebral disc space (upper) and surgical view after a lumbar laminectomy (lower). Note that Dandy's initial technique involved a quite aggressive transdural approach to reach the herniated fragment. Reprinted with permission from Dandy W: Loose cartilage from intervertebral disk simulating tumor of the spinal cord. *Arch Surg* 19:660-672, 1929.

called the "Matthew effect,"³¹ in reference to the biblical parable of the talents described in the Gospel of Matthew in which it is stated (chapter 25, verse 29): "For whoever has, more will be given, and they will have an abundance. Whoever does not have, even that which they have will be taken away." This principle basically describes that eminent scientists tend to obtain more credit than comparatively unknown researchers, even if their work is quite similar. Likewise, in any scientific endeavor, there seems to exist a clear tendency to allocate a disproportionately large share of the merit to already famous researchers, even if the majority of the hard work has been performed by lower-ranking assistants.

A classic example of the Matthew effect in the history of neurosurgery involves the initial description of normal pressure hydrocephalus (NPH). Although more recent

literature has properly acknowledged the predominant (if not exclusive) role of the Colombian neurosurgeon Salomón Hakim in the original description of such pathology,⁴¹ the already renowned American neurologist Raymond D. Adams (at that time chief of neurology at the Massachusetts General Hospital and associate professor of neuropathology at Harvard Medical School) not only had his name as the first one in the supposedly original publication of the syndrome in *NEJM*,¹ but also, throughout the article, failed to properly credit Hakim with the discovery of this new syndrome. According to historical reports, Hakim had already started his investigations on NPH in 1957, having presented his doctoral thesis entitled "Some observations on C.S.F. pressure: hydrocephalic syndrome in adults with "normal" C.S.F. pressure. (Recognition of a new syndrome.)"²² in 1964 (Fig. 4), 1 year

FIG. 4. **Upper:** Cover of Salomón Hakim's doctoral thesis presented at the Javeriana University School of Medicine in Bogotá, Colombia, in which the new syndrome of normal pressure hydrocephalus was originally described. Published with permission from Dr. Fernando Hakim Daccach. **Lower:** Dr. Hakim at his pathology lab in the early years of his career. Photograph reprinted from "The Reprieve: Reversing Dementia" by Rose Tibayan. Published with permission. Figure is available in color online only.

before the publication of the classic article in *NEJM*. In face of such an example of scientific merit misappropriation, and taking into account the subsequent successful career of Dr. Hakim as an international scientific leader, it took no more than a few decades for the literature to start the process of grievance redress by either referring to the disease as Hakim-Adams syndrome (despite the authors' order of the original publication)¹⁵ or with citation of subsequent works in which Hakim was the first author.³⁷

The Root of the Problem

Despite the fact that, in the long run, history has occasionally found its own way to rectify some of the faults committed against true pioneers, it seems clear that both intensity of academic enthusiasm and absence of immediate controversy seem to behave as quite poor surrogate measures of scientific integrity. In fact, recent research on the issue has demonstrated that some articles that ended up being formally retracted due to a broad range of issues compromising academic integrity were widely cited before the retraction.⁴²

Perhaps we neurosurgeons are so excited about communicating to our peers our "new" findings and inventive techniques that we simply ignore the fact that the first step before dedicating time and efforts to any scientific topic should consist in making sure that the question under analysis has not yet been properly answered by others in the past. We are quick to speak but likely quite slow to listen. We are eager to teach but probably rather reluctant to learn.

Maybe the phenomenon of scientific duplication is but a natural consequence of our unbalanced attention to the future, our habitual predilection for the innovative, our passion for the brand new and the cutting edge. Perhaps, although outwardly denying, deep inside we do believe that, because of the fast pace of technological development that so drastically affects our specialty, a proper approach to the scientific literature would involve an attention span that exponentially decreases in the direction of the past. We are indeed able to look further because we stand on the shoulders of giants. Nevertheless, we routinely fail to properly recognize the giants upon whose shoulders we stand, foolishly believing we are standing on our own merits.

Some of the mistakes of past generations could be at least partially explained by the absence of easy access to scientific works, especially to articles published in different countries and languages, a justification that is hardly plausible to our PubMed generation. In fact, it seems undeniable that such an easy access to scientific resources through online databases generates an additional degree of responsibility regarding proper recognition of prior publications, ultimately functioning as a potent driving force against plagiarism and toward scientific originality.¹⁰

Furthermore, it seems clear that neurosurgeons younger than 40 years belong to a quite different generation. We operate with surgical instruments that we did not have to develop; we confidently treat neurosurgical diseases whose complex pathophysiology we did not have to fastidiously research; we confidently base our daily decision-making on reliable information about the natural history of neurological diseases affecting patients whom we did not have to rigorously follow in order to observe such evolution. The

noble task laid upon our generation apparently consists in struggling with the pursuit of high-quality scientific evidence regarding neurosurgical diseases we already understand reasonably well, only because the basic foundations have already been laid a long time ago by the diligent work of the scientific titans who came before us. Nevertheless, we are likely more haphazard and unsystematic when performing our literature reviews than any generation before us. We often overestimate our familiarity with such a vast scientific literature before us, bypassing the fundamental and indispensable step of meticulous research.

Conclusions

In the face of such a dilemma that seems to repeatedly haunt our specialty, we should be willing to make it “*mea culpa*”: it is my fault, our fault as neurosurgeons to have forgotten that, in our path toward greatness, we must necessarily pass through the conquests of those who came before us. If we are really devoted to the pursuit of great goals (possibly avoiding spending our time and efforts reinventing the wheel in every generation), the admonition of the ancient Chinese philosopher Confucius may be now more timely than ever:

“Study the past if you would define the future.”

Confucius (551 BC–479 BC)

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Disclosures

The author reports no conflict of interest.

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