Medicine: Art or Science
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Physicians commonly ask: Is some aspect of medicine – be it weaning, noninvasive ventilation, or whatever – an art or a science
The question usually carries pejorative connotations.
Science is the acme of a physician’s aspirations
Science is the acme-pinnacle of a physician’s aspirations, whereas clinical activity – and especially art – is judged less cerebral and praiseworthy.
Before I address the question (Is medicine an art or a science?), I need to deal with the meaning of the words involved.
Science is too diverse and protean an enterprise to be captured by a concise definition, and no definition has ever commanded widespread assent.
It does, however, possess several distinctive characteristics.
Science strives to deepen our understanding of the world and its structure.
The use of scientific instruments has prodigiously expanded our grasp of physical reality.
The use of scientific instruments has prodigiously expanded our grasp of physical reality.
The goal is to continually expand our ability to glimpse into regions that extend beyond previously mapped-out territory.
Explanations are sought in terms of physical forces and events – to gain understanding in a mechanistic and causal way.
Research is as much a work of the imagination as effort at the laboratory bench.
Research is as much a work of the imagination as effort at the laboratory bench.
Research is as much a work of the imagination as effort at the laboratory bench – the most important instrument is always the mind of the investigator.

Albert Einstein
1879-1955
As with science, there is also no universally accepted definition of medicine.
William Osler articulated the goals of medicine as:

“

“Local boy: born in Bond Head Greater Toronto

“"To prevent disease, to relieve suffering and to heal the sick – this is our work”"
Of over 11.7 million employees involved in American healthcare (constituting 1 in 10 of the entire US workforce), only 1 in 20 is a physician.
Facilities and backup services have a place in healthcare, but they are not medicine.
Medicine is simply the intimate care that a doctor delivers to a sick person – all else is secondary.
The words science and medicine are challenging enough, but things get stickier when we come to “Art”
It is the word “art” which renders commentator statements inchoate and fatuous.
Meaning becomes muddled by layers of ambiguity and confusion arising in part from mutations in usage of this word over centuries.
The word dates back to texts gathered within the Hippocratic Corpus, such as *On the Art*
The Corpus also contains the most famous aphorism in medicine:

“Vita brevis, ars longa,”

usually translated as

“Life is short, art is long”
By “Ars,” Hippocratic physicians are referring to the capacity for planned action – the ability to act prudently.
"Ars" refers to the capacity for planned action, the ability to act prudently, as opposed to action on the basis of chance – arbitrary action.
“Art” is also referred to as a skill or craft, as conveyed in expressions such as “The Art of War”
“Art” is a skill as conveyed in expressions such as "The Art of War" and “The Art of Boiling Sugar” – an essential skill for confectioners.
In the eighteenth century, scholars made a distinction between the "practical arts" (associated with technology) and the "fine arts," dealing with aesthetic activities of painting, music and literature.
In the Anglophone world, “art” is today used as a synonym for the “fine arts.”
The commingling of “art” and “fine arts” does not happen on the European continent, but it is a taken-for-granted premise among Anglophone authors writing on the binary framework of art-science.
When physicians contemplate the question “Is medicine an art or a science?” in such an aesthetic sense, their thinking can only be muddled and fatuous.
Commentaries on this subject have strayed very far from the Hippocratic meaning of *Ars*.

"Vita brevis, ars longa"
The most insightful comments on the binary framework of art-science were made by the Nobel Laureate, Peter Medawar, founding father of transplantation immunology.
“In Commencement Addresses and other uplifting declarations, clinicians who discourse upon the ‘spirit of medicine’ will always point out that, while there is a large and profoundly important scientific element in the practice of medicine, there is also an indefinable artistry, an imaginative insight, …”
“In Commencement Addresses and other uplifting declarations, clinicians who discourse upon the ‘spirit of medicine’ will always point out that, while there is a large and profoundly important scientific element in the practice of medicine, there is also an indefinable artistry, an imaginative insight, and medicine (they will tell us) is born of a marriage between the two”

Oxford University Press, 1984, p100
"But then (it seems to me) the speaker spoils everything by getting the bride and groom confused"

Peter Medawar
1915-1987

Induction and Intuition in Scientific Thought,
In: Pluto's Republic, OUP, 1984, p100
Medawar is emphasizing that the key element in scientific advance is the imaginative, intuitive aspect.
Creativity: Imagination

Medawar is emphasizing that the key element in scientific advance is the imaginative, intuitive aspect – the so-called female component.
Medawar regarded the creative intuitive element as more important than use of equipment, ritual fact-finding, and induction – the so-called male component.
It is the imaginative bride, not the groom, that drives progress in science

Induction and Intuition in Scientific Thought,
In: Pluto's Republic, OUP, 1984, p100
The key thought here is that transformative research depends on great leaps of imagination – the bride – not incremental change.
Clinical practice needs to be constantly advancing; otherwise, it becomes regressive.
Transformative Science

First balloon-dilating catheter hand-made by 32 yo Grüntzig, 1972

© Georg Thieme Verlag, Stuttgart

Perkutane Rekanalisation chronischer arterieller Verschlüsse mit einem neuen Dilatationskatheter
Modifikation der Dotter-Technik

A. Grüntzig und H. Hopff

Departement für Innere Medizin (Prof. Dr. P. Frick, Prof. Dr. A. Labhart, Prof. Dr. W. Siegenthaler) und Röntgendiagnostisches Zentralinstitut (Prof. Dr. W. Wellauer) der Universität Zürich

Eine Modifikation der Dotter-Technik wurde bei 15 Patienten mit Stenosen und Verschlüssen der Oberschenkel- und Stenosen der Beckenarterien angewendet. Bei diesem neuen Verfahren wird das Verschlussmaterial nicht mehr durch die übereinandergeschobenen

Andreas Grüntzig
Internist, Kantonspital, Zürich

Only through transformative research can clinical practice surmount challenges as they arise
The science of cardiology was transformed by the balloon-angioplasty catheter (PTCA, percutaneous transluminal coronary angioplasty), invented by 32-year-old Andreas Grüntzig on his kitchen table in evenings after full-time clinical activity – and with no research funding.
The science of sleep apnea was transformed by a study on CPAP conducted by 36-year-old Colin Sullivan in five patients.
Transformative discoveries stimulate large bodies of research by other investigators who subsequently map out the ultimate ramifications of a new discovery.
Transformative discoveries stimulate large bodies of research by other investigators who subsequently map out the ultimate ramifications of a new discovery.
Today, many young physicians misunderstand what constitutes transformative medical science.
We are constantly instructed to look on randomized controlled trials as the pinnacle of research: RCTs are accorded laudatory terms as Level 1 and gold standard.
We are constantly advised to look on randomized controlled trials as the pinnacle of research: RCTs are accorded laudatory terms such as Level 1 and gold standard.
RCTs do not contain new ideas

VENTILATION WITH LOWER TIDAL VOLUMES AS COMPARED WITH TRADITIONAL TIDAL VOLUMES FOR ACUTE LUNG INJURY AND THE ACUTE RESPIRATORY DISTRESS SYNDROME

THE ACUTE RESPIRATORY DISTRESS SYNDROME NETWORK

NEJM 2000; 342:1334

Experimental Pulmonary Edema due to Intermittent Positive Pressure Ventilation with High Inflation Pressures. Protection by Positive End-Expiratory Pressure

HERBERT H. WEBB and DONALD F. TIERNEY

ARRD 1974; 110:556

SUMMARY

We used a small animal respirator to ventilate normal, anesthetized rats with inspiratory pressures of 14, 30, or 45 cm H2O and no added end-expiratory pressure (EEP) or positive pressure breathing (IPPB) 14/0, high inspiratory positive pressure breathing (IPPB) 30/0, high inspiratory positive pressure breathing (IPPB) 45/0. Other rats were ventilated with the same high inspiratory pressure added end-expiratory pressure of 10 cm H2O (positive end-expiratory pressure PEEP 45/10). Control rats that were not ventilated and the IPPB 14/0 group showed lung changes. The HIPPB 30/0 and PEEP 30/10 groups had perivascular edema. The HIPPB 45/0 animals had alveolar and perivascular edema, severe hemorrhage, necrosis, and died within one hour. In contrast, the PEEP-45/10 group showed no signs of lung damage. These results suggest that intermittent positive pressure breathing (IPPB) may be hazardous to lung parenchyma and interstitial pressure measurements are important in determining the severity of lung injury.

Intermittent Positive-Pressure Hyperventilation with High Inflation Pressures Produces Pulmonary Microvascular Injury in Rats

DIDIER DREYFUSS, GUY E. DEPARIS

ARRD 1985; 132:880

Interruption of positive pressure ventilation (IPPV) with peak inspiratory pressures as high as 30 to 45 cm H2O (HIPPB) were responsible for the development of pulmonary interstitial (pulmonary edema) and, ultimately, edema. Webb and Tierney (1) pointed out that interstitial edema might be explained by pulmonary interdependence (pulsion and alveolar edema by an increase in vascular permeability forces because of depletion or suppression of surfactant (6-9). Both interstitial edema and interdependence are responsible for the increased ultrafiltration rate, susceptibility of endothelial and/or epithelial cells to injury, and lesions consecutive to HIPPB have been excluded.

But RCTs are hardly ever about new ideas, merely the application of ideas put forward by some basic researcher...
A defining characteristic of RCTs is their "me too" flavor
Planning a RCT, obtaining funding for it, enrolling patients, and reporting results has become a formulaic, logistical exercise.
Randomized Controlled Trials

It requires management skills, as exemplified by Contract Research Organizations (CRO), typically hired by pharmaceutical companies to conduct trials.
It would be better to classify RCTs not as science, but as health-technology assessment – the term employed in the past.
RCTs simply do not contain the imaginative creative component that characterizes transformative science.
This is not to demean RCTs: they are very helpful in guiding clinical practice, and I have published RCTs in the New England Journal of Medicine and JAMA.
I have also published papers containing descriptive demographics and audit analyses, which also lack the imaginative creativity of transformative science.
I have also published papers containing descriptive demographics and audit analyses, which do not possess the imaginative creativity of transformative science.
The difference between RCTs and transformative science parallels the difference between prose and poetry.
Transformative science depends on researchers with their head in the clouds, dreamers, conjuring up new mechanisms and entities that nobody has previously conceptualized.
Transformative science depends on researchers with their head in the clouds, dreamers, conjuring up new mechanisms and entities that nobody has previously conceptualized.
As contrasted with practical, prosaic journeymen, with feet implanted securely on terra firma
To illustrate the contrast between transformative science and RCTs, I turn to Marshall and Warren’s discovery of the role of Helicobacter in causing peptic-ulcer disease.
Barry Marshall is the only practicing clinician to receive a Nobel Prize in the past 50 years.
In July 1981, the 29-year-old internal medicine resident began a GI (gastroenterology) rotation in Perth, Western Australia.
Neither Marshall nor his supervisor, Robin Warren, a clinical pathologist, had any research funding.
Medical dogma of the day decreed

“the stomach was sterile and bacteria could not survive in gastric acid”
But Warren had repeatedly seen bacteria in the stomach: “I preferred to believe my eyes, not the medical textbooks or the medical fraternity”
Marshall prospectively obtained biopsy specimens in patients undergoing upper GI endoscopy; Warren read the histology blinded to clinical details.
Although bacteria could be seen on Gram stain, 34 attempts to culture bacteria between August 1981 in March 1982 were unsuccessful.
On Holy Thursday (April 8, 1982), the 35th biopsy was placed in the culture cabinet.
Technicians typically inspected plates after two days.
Because of the 5-day public holiday, the plates were not inspected until Tuesday (April 13), and tiny colonies (of H. pylori) were visible.
Robin Warren: “I think the best term is serendipity; I was in the right place at the right time and had the right interests and skills to do more than just pass it by.”

Serendipity. Yes, the Easter holiday was good luck. But mucking around in a lab puts you in the path of luck; real-life science offers opportunities not foreseen in the constrained protocol of a research grant.
In July 1982, Marshall rotated at Port Hedland Hospital, a remote location >1,000 miles north of Perth.
Instead of complaining of being detached from the center of activity, Marshall reflected: “It was an important period. I had time to do an extensive literature search … time to digest our results and write it up”
In January 1983, Marshall submitted preliminary findings as a "Letter to the Editor," which would be below level 5 on the EBM grading scale.
In February 1983, Marshall submitted an abstract to the Gastroenterological Society of Australia, which was meeting in Perth (and so would not involve travel costs).
The abstract was rejected; the secretary wrote of 67 abstracts submitted we could only accept 56.
Marshall and Warren’s findings flew in the face of accepted dogma.

Marshall: “It was undercutting the basis of gastroenterology, which had experienced a funding boom with the advent of the $H_2$ receptor blockers, the world’s most widely used drugs.”
Marshall recalls: “I used to get into pretty hostile arguments. At one conference I was just about leaping off the stage throttling people who were making very inane comments.”
He recognized he needed more convincing causal evidence to convince critics.
1984 was the centenary of Koch’s postulates

Robert Koch, 1843-1910
Koch’s third postulate states: “The organism isolated in pure culture must initiate and reproduce the disease when reinoculated into susceptible animals.”
Koch’s Third Postulate

Postulate 1
The same microorganisms are present in every case of the disease.

Postulate 2
The microorganisms are isolated from the tissues of a dead animal, and a pure culture is prepared.

Postulate 3
Microorganisms from the pure culture are inoculated into a healthy, susceptible animal. The disease is reproduced.

In January (1984), Marshall tried to infect pigs with the organism, but the experiments failed.
In June (1984), he underwent endoscopy: his gastric mucosa was normal.
Ten days later, endoscopy revealed active gastritis and many *H. pylori* organisms, satisfying Koch’s third postulate.
Koch’s Postulates

Attempt to fulfil Koch’s postulates for pyloric campylobacter

Barry J. Marshall, John A. Armstrong, David B. McGechie and Ross J. Glancy

ABSTRACT: A volunteer with histologically normal gastric mucosa received pyloric campylobacter by mouth. A mild illness developed, which lasted 14 days. Histologically proven gastritis was present on the tenth day after the ingestion of bacteria, but this had largely resolved by the fourteenth day. The syndrome of acute pyloric campylobacter gastritis is described. It is proposed that this disorder may progress to a chronic infection which predisposes to peptic ulceration.

The association between the newly described bacterium, pyloric campylobacter (PC), and gastritis has now been confirmed in several countries, and is further substantiated by the study of Marshall et al., which also appears in this issue of the Journal. Nevertheless, the possibility remains that these bacteria are not involved.

Second postulate. “The germ should be obtained from the diseased animal and grown outside the body.” PC was first isolated in 1982 from a patient with gastritis. Since January 1983 PC has been cultured from over 150 patients in our hospital. In almost all patients, an infiltration of polymorphonuclear cells has been found in the specimens of antral mucosa on the initial or a subsequent biopsy.

The experiment described in this paper was undertaken in order to fulfil Koch’s third and fourth postulates; that is, to demonstrate that PC could colonize histologically normal mucosa and induce gastritis.

Methods and results

The histological and microbiological techniques used in this experiment were identical with those described in the following paper. Electron microscopic examination confirmed the presence of PC in the gastric epithelium. The volunteer with gastritis in the same gastroscopy session. The test isolate was taken from the latter patient, a 66-year-old man with non-ulcer dyspepsia. Before the human experiment was conducted, a portion of this isolate was inoculated intraperitoneally into two rats which suffered no ill effects after the inoculation. The isolate was sensitive to ampicillin, erythromycin, trimethoprim, doxycycline and rifampicin. It was freeze-dried, then revived for the experiment.

One month later, when electron microscopic results were available and any lesion which resulted from the initial biopsies could be presumed to have healed, the subject fasted overnight and received premedication with cimetidine (600 mg) at 8 a.m. to produce temporary achlorhydria. At 11 a.m. the subject swallowed the growth from a flourishing three-day culture of the isolate (about 10⁹ colony-forming units)
In 2005, Marshall and Warren were awarded the Nobel Prize for their work on *H. pylori*
In his Nobel lecture, Marshall quoted historian of science Daniel Boorstin
Marshall quoted historian of science Daniel Boorstin: “The greatest enemy of knowledge is not ignorance; it is the illusion of knowledge”
Gastroenterologists were confident they knew what caused – and did not cause – peptic ulcers.
Marshall was a lowly resident, planning to become a rheumatologist, and had not bought into the gastroenterology consensus viewpoint.
“I am told by others that I have a lateral-thinking, broad approach to problems, sometimes to my detriment” Marshall remarks
Lateral thinking was coined by Edward de Bono, a Maltese physician: the intent is to break up established habits of thought, recognizing that conventional thinking can impede creativity.
Marshall: “I was thinking out of the box… Australia is out of the box if you're an American. And Western Australia is out of the Australian box”
Everything about the Marshall story is diametrically opposed to EBM ideology.
Leaving the backwoods of Australia and moving to the heartlands of Europe in the latter half of the 19th century
At this time, there was a dramatic surge in laboratory science, providing a new scientific base for clinical practice.
In Germany, the term innere Medizin was introduced to distinguish a new cadre of physicians who based their practice on an understanding of underlying causes and mechanisms of disease as opposed to "clinical medicine" which focused on symptoms (praktischer Arzt).
In Germany, the term innere Medizin was introduced to distinguish a new cadre of physicians who based their practice on an understanding of underlying causes and mechanisms of disease as opposed to "clinical medicine" which focused on symptoms (praktischer Arzt).
39 year-old William Osler dissecting
Blockley Dead House
Philadelphia Hospital, 1888

These “internists” recognized that diseases have their origin in internal or hidden organs
It was at this time that doctors started to wear white coats.
White coats partly originated in operating rooms, to avoid cross-contamination but this does not explain their use by non-surgeons.
White coats partly originated in operating rooms, to avoid cross-contamination, but this does not explain their use by non-surgeons.
Charles Nicolle, MD (1866-1936)

Pasteur Institute, Tunisia
Identified: lice transmit typhus
Nobel Prize, 1928

The main reason doctors adopted white coats is because of their association with the scientific laboratory: clinicians wished to present themselves as scientists
As physicians’ association with science became more ascendant, the art of medicine was seen to represent irrational remnants that would eventually be eliminated by means of additional research.
Theodor Billroth operating in auditorium of Allgemeine Krankenhaus (Vienna General Hospital), 1890

We need “to establish the art of medicine for all time so firmly in writing" as "to transform it wholly into a science”

Theodore Billroth, Viennese surgeon, wrote about the need “to establish the art of medicine for all time so firmly in writing" as "to transform it wholly into a science”
Despite colossal advances since the time of Billroth, it is now clearer than ever that large portions of clinical practice cannot be reduced to the application of universal rules.
Consider mechanical ventilation in patients with ARDS, where a tidal volume of 6 ml/kg has been shown to lower mortality.
This setting is so widely accepted that it has become de rigueur in protocolized management.
Protocol advocates, ungrounded in physiology, do not recognize that low $V_T$ is necessarily accompanied by shortening of mechanical inspiratory time; and
...accompanied by shortening of mechanical TI; and once mechanical inspiratory time becomes less than neural inspiratory time, double triggering is inevitable.
Protocol enthusiasts believe they’re delivering a tidal volume of 6 ml/kg, but the patient is actually receiving 12 ml/kg – a setting proven to increase mortality.
There is no substitute for deep understanding and clinical wisdom when taking care of patients.

René Laënnec (1781-1826) at Necker Hôpital: Ausculte Un Phtisique
Théobald Chartran (1849-1907), Sorbonne
Clinical Judgment

The hallmark of an expert is sound intuitive judgment.
Tacit Knowledge

“Knowing how”
versus
“Knowing what”

Intuition shares many features with tacit knowledge, which is contrasted with explicit (conscious) knowledge.
Tacit knowledge involves inarticulate knowledge based in actions, involving the fluid performance of a bodily skill, rather than conscious deliberations.
Tacit knowledge involves inarticulate knowledge based in actions, involving the fluid performance of a bodily skill, rather than conscious deliberations.

Conscious thinking about the sequence of actions interferes with execution and is detrimental to performance.
Many skills in clinical medicine depend not simply on manual dexterity, but are cognitive and interpretative – the characteristics of a connoisseur of the highest rank.
These skills can be communicated only by example, not by precept – you cannot learn these skills out of books or in a lecture hall.
Much of the “art of knowing,” which a student or resident needs to learn, cannot be formulated as written precepts.
Instead, these skills are learned during years of apprenticeship under the guidance of a master.
Talk of intuition has obvious appeal to the lazy who think that true expertise is nothing more than a random guess or the inspiration of a Zen Buddhist or Jungian mystic.
Guessing involves reaching a conclusion when one does not have sufficient knowledge or experience to do so.

Talk of intuition has obvious appeal to the lazy who think that true expertise is nothing more than a random guess or the inspiration of a Zen Buddhist or Jungian mystic.
In contrast, true intuitive skill is the final fruit of many years of experience and the use of deliberative analytic thinking as a trainee.
Even though it looks automatic and we call it “intuition”
Even though it looks automatic and we call it “intuition,” it is knowledge hard earned and shaped by years of experience.
In this editorial, I point out that the intersection between science and clinical practice involves the distinction between generalizability and singularity.
The bedrock of science is generalizability: to move from the particulars of a data set and make inferences about future patients.
The bedrock of science is generalizability: to move from the particulars of a data set and make inferences about future patients.
Clinical practice moves in the opposite direction:
from the universal to the particular
The clinician needs to take broad principles (gained through research) and customize them to the peculiarities of an individual patient.
Focusing on a single individual as opposed to gazing upon a large number of persons produces a radical change in perspective.
“One single Anne Frank”
“One single Anne Frank,” observed Primo Levi, “moves us more than the countless others who suffered just as she did but whose faces have remained in the shadows.”
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“One single Anne Frank,” observed Primo Levi, “moves us more than the countless others who suffered just as she did but whose faces have remained in the shadows.”

“Una sola Anne Frank commuove più delle innumerevoli altre vittime che hanno sofferto come lei ma i cui volti sono rimasti nell’ombra.”

Medicine: Universal → Particular
Each patient considers his or her complaint as one of great peculiarity or even obscurity, and craves for personal attention.
The patient is hoping for empathy
Self-Portrait with Doctor Arrieta, 1820
Francisco de Goya (1746–1828)
Institute of Arts, Minneapolis

This painting is a self-portrait by Goya, when he thought he was on his deathbed, attended by his physician.
Goya is propped up in bed, struggling in acute pain
Dr Arrieta’s entire physiognomy is animated by the most benevolent expression
The inner character of Dr Arrieta, captured by Goya, highlights the point I am making: At any one time, a physician must focus solely on the needs of an individual patient.
Patients desire empathy, but they place a higher mass on expert knowledge and clinical judgment.
Compassion never compensates for cognitive and technical incompetence
In contrast with the clinician’s focus on a solitary patient, the scientist can improve the lives of millions.
Figuring out how better to wean a patient helps patients not only in Chicago, but also in Cork, Cairo, Calcutta, and Christchurch.
One topic on which science and art dovetail is understanding
But science is no more an inventory of facts than history is a chronology of dates.
Instead, science strives to make generalizable statements based on a deep understanding of the workings of nature.
Facts and knowledge are greatly valued, but understanding is treasured more...
"I try to understand" (Je cherche à comprendre) were the last words uttered on his deathbed by Jacques Monod, one of the founders of molecular biology.
To make sense of information – to understand it – requires expert judgment.
To make sense of information – to understand it – requires expert judgment, finding patterns, drawing inferences, and seeing a whole that is larger than its parts.

AJRCCM 2005;171:1408
Dyspnea and Decreased Variability of Breathing in Patients with Restrictive Lung Disease

Thomas Brack, Amal Jubran, and Martin J. Tobin

Division of Pulmonary and Critical Care Medicine, Edward Hines Jr., Veterans Affairs Hospital; and Loyola University of Chicago, Stritch School of Medicine, Hines, Illinois

To make sense of information requires expert judgment, finding patterns, drawing inferences,
Science and Understanding

finding patterns, drawing inferences, and seeing a whole that is larger than its parts
Physicians at the bedside also hanker after understanding.

Local boy: born in Bond Head Greater Toronto

50 year-old Osler at the bedside
When faced with a difficult case, what a physician wants more than anything else is to figure out – to understand – what is happening inside a patient's body.
Tanenbaum undertook an ethnographic study of how physicians reason and think...
The vast majority of physicians spent most of their time thinking and communicating with one another in terms of mechanisms of disease – precisely what the founders of innere Medizin recognized.
The vast majority of physicians spent most of their time thinking and communicating with one another in terms of mechanisms of disease – precisely what the founders of innere Medizin recognized.
Physicians spent much less time using probabilist information.

Tanenbaum SJ
*J Health Politics, Policy & Law* 1994;19:27

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### Risk Difference in Hospital Mortality Rate (95% CI)

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<th>Study (Reference)</th>
<th>Risk Difference in Hospital Mortality Rate (95% CI)</th>
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Physicians spent much less time using outcomes-type information, such as RCTs.
Even average cases can be challenging to a trainee, whereas experienced clinicians take them easily in their stride.
But a small proportion of patients – fewer than 1 in 100 or 1 in 1,000 – present a major diagnostic challenge to even very experienced clinicians.
But a small proportion of patients – fewer than 1 in 100 or 1 in 1,000 – present a major diagnostic challenge to even very experienced clinicians.
These are cases that disturb the sleep of a conscientious physician.
The solution of these conundrums never rests in the capacity to recite some algorithm or apply some protocol, but depend on the clinician’s power of imagination.
Imaginative Power

The solution of these conundrums never rests in the capacity to recite some algorithm or apply some protocol, but depends on a clinician’s power of imagination.
Solving these mysteries depends on a clinician’s capacity to imagine internal mechanistic happenings that can explain external clinical manifestations.
Imaginative Power

Just as with transformative science, resolution requires the mind of a poet as opposed to a writer of prose.
Speakers commonly talk of science and art in terms of a binary framework as if one is antagonistic towards the other, part of some zero-sum game.
Is Weaning an Art or a Science?

J Milic-Emili

The article of Tobin and coworkers (1) reiterates the accepted notion that the “conventional” criteria for predicting successful outcome from mechanical ventilation, criteria based on clinical and the patient’s ability to develop maximum negative inspiratory pressure against a manometer (P_{iast} - 20 cmH_2O (2), are not reliable. Their results indicate that patients exhibited high values of mouth occlusion pressure (P_{o1}), a sign of high neuromuscular inspiratory drive. In fact, successful weaning outcome occurred only in patients in whom the P_{o1} values were relatively low. Since measurements of the power spectrum of the diaphragm are technically very difficult while measurements of P_{o1} are relatively simple, the latter appear more suitable for clinical use. It should be noted that Murciano toto
But both are required in the practice of medicine: the necessary body of knowledge contains both science and art (practical craft).
The doctor is not functioning as a scientist, but rather as a skilled technologist: applying the principles of science in the care of an individual patient.
Medical knowledge contains science, but a medical doctor does not operate as a scientist.
Scientific principles gained through research are collective in outlook (generalizable universal statements)
Scientific principles gained through research are collective in outlook, whereas the clinician’s gaze is concentrated on the solitary patient.
In conclusion, the capacity to switch between the two systems – science and art – demands equal proficiency in the use of a telescope and a microscope.
The capacity to switch between the two systems – **science** and art – demands equal proficiency in the use of a telescope and a microscope.
The capacity to switch between the two systems – science and art – demands equal proficiency in the use of a telescope and a microscope.
The capacity to switch between the two systems – science and art – demands equal proficiency in use of the telescope and microscope.
End
The requirement is similar to demands with other highly skilled activities, such as sport, playing a musical instrument, and so on.
“Picture” of white box
At this time, there was a dramatic surge in laboratory science, providing a new scientific base for clinical practice.
The requirement is similar to demands with other highly skilled activities, such as sports, performance with a musical instrument, and so on.
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Despite colossal advances since the time of Billroth, it is now clearer than ever that large portions of clinical practice cannot be reduced to the application of universal rules.
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