

The 28th Rovenstine Lecture: Lessons from on High

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MY TITLE for the 28th Rovenstine lecture, "Lessons from on High," is a presumptuous perturbation of that used by Sir Joseph Barcroft for his classic volume describing extensive research on man at high altitude, *Lessons from High Altitude*.¹ Barcroft is the person who described the maternal environment of our beginnings as Mount Everest in utero. His writings were among those that shaped my own life. Actually, a somewhat more accurate description of my goals today might be the addition of "Questions from on High," for there are as many of those as answers at this stage.

I am immensely honored to be invited to speak before this spacious gathering of colleagues, students, teachers, a shrinking group of mentors, and others of you. As will become increasingly the case with these events as the years go by, I am among those who never knew or met Emery Rovenstine, but I have felt his paternity in the evolution of our specialty through the teachings of his students, some of whom are members of this audience. I was curious about Dr. Rovenstine, and, in particular, wondered about his perspectives on my theme for today. Although I have not made a scholarly review of his life, I did discover a series of articles that appeared as "Profiles" in *The New Yorker* in the fall of 1947.[†]

Of the many things that caught my attention, I share two with you. The first is purely a historical note and provides a glimpse of his personality*:

Rovenstine's residents received room, board, and only from thirty-five to seventy dollars a month—far less than even the moderate salaries of nurses, and they worked longer hours. Now, however, a resident at Bellevue draws as much as a hundred dollars a month. 'The money is all gravy anyway,' Dr. Rovenstine has said. 'I see to it that they don't get any time to spend it. I believe in working

a resident to death. He gets three years of hell from me, and then, if he wants, he can go out and make that fifty thousand a year.'

The author of the article goes on to say that Rovenstine is more interested in physicians who, like himself, take less lucrative academic positions and devote themselves to research and teaching.

That dedication to the development of our specialty and the pursuit of understanding fits well with the next anecdote I share with you, which is more relevant to my purpose today. This is from a chest surgeon who had been through World War II and the Battle of the Bulge with Rovenstine and who was extolling his contribution to decreasing the morbidity and mortality associated with thoracic surgery, which heretofore had been an exceedingly high-risk procedure. The surgeon spoke of a case in a New York hospital on which both he and Rovenstine were called in after it looked fairly certain that the patient was going to die.* He said:

It's something to work with Rovey. He's willing to experiment, to *take a risk* if it will advance medicine and possibly save a life. Rovey and I had that patient on the table, working on him, for seven hours and twenty minutes, and when we finished, his blood pressure was a hundred and twenty over sixty, and he was talking. Rovey was responsible for that. All I had to worry about was my cutting and my repairing. When it was over, Rovey said to me, 'That's the kind of surgery I like.'

Emery Rovenstine's willingness to "take a risk" exemplifies the theme of my comments. Risk is an inextricable part of our professional lives. Our effective function is influenced at times by our ability to accept risk. As an academic physician, I target risk-acceptance in respect to two areas critical to our ultimate practice of anesthesiology: research and residency training. My bottom line is that risk is an essential dietary constituent in medicine, particularly in our specialty.

In 1963 I was a member of the first American expedition to climb Mount Everest. Some of us had the hope of climbing to the top by a new way, up the West Ridge, and perhaps even traversing down the classic way, the South Col Route. As we gravitated by our personal choices to our preferred routes, we even began to refer to ourselves as "Ridgers" and "Colers." This dual goal, two groups aspiring to climb the mountain by two different routes with vastly different levels of uncertainty, provided the stage for Dick Emerson's research. Dick was a professor of sociology at the University of Cincinnati at the

*Professor and Chairman.

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† Murphy M: Anesthesiologist: I. The Cold and Drousy Humour. *The New Yorker*, Oct. 25, 1947, pp 36-45

Murphy M: Anesthesiologist: II. Drugs, Medicines, and Notions. *The New Yorker*, Nov. 1, 1947, pp 33-43

Murphy M: Anesthesiologist: III. The Patient is Doing Well. *The New Yorker*, Nov. 8, 1947, pp 38-51

-5 -4 -3 -2 -1 0 1 2 3 4 5

(11 A) Date 5/21/63 Time 8⁴⁵_P Location 5W

TODAY Travel 4W → 5W Track (B-G) 1 Lbs 2.5
 I felt (weak-str) 3 I now feel (tired-rested) 1
 Weather (B-G): during the day 3; This moment 1
 Terrain was: (dangerous-safe) 1, (diffi-easy) -1
 Associates: WU, DE Team prog (B-G) +2

TOMORROW Feel (weak-str) 1/4 Weather (B-G) -2/4
 Terrain: (dangerous-safe) -2/3 (diffi-easy) -4/2
 I feel now (appreh-expec) 4. If possible I: (should; will; would like to) reach summit of M.E. & down S. Col.

FIG. 1. Page from the author's diary on May 21, 1962, Camp 5W on Mount Everest, the night before final summit attempt.

WU's enthus is within this "low-high" guess: (3B)

(L-H): Ec 0 3 Ew 4 5 Et 4 5 Nu -5 -2 Lh -5 -1

He sees chance of F-S within this low-high guess:
 (F-S): Ec 1 4 Ew -2 1 Et -2 0 Nu -5 -2 Lh -4 0

Today mountains seem (0-5): Remote 0, peaceful 1, brooding 1, tranquil 1, impersonal 0, exhilarating 4, inviting 5, menacing 2, quiescent 1, punishing 1, provocative 4.

Pers Morale (L-H): of WU seems 2; of DE seems 0
 Diary (annoy-pleasant): 0

time, subsequently to join me as a colleague, friend, and climbing companion at the University of Washington before his death from cancer in 1982. One of our daily chores on the expedition, to abet Dick's then mysterious inquiry, was to fill in the blanks on each day's page of an indestructible diary. On a scale from -5 to +5 we were to record our hopes, our moods, and our optimism and pessimism. For example, on May 21, 1963, the evening Willi Unsoeld and I spent on an airy narrow perch prior to climbing to the summit the next day, I dutifully recorded these feelings (fig. 1).

The two bits of information I call to your attention are my enthusiasm for the several alternative endeavors available to us—that is, my motivation: I assigned a +4 to +5, near total commitment, to the West Ridge route and the traverse. My assessment of chances of success: -2 to 0, close to but a little on the pessimistic side of maximum uncertainty, far from either certainty of success or certainty of failure.

Emerson's hypothesis,[‡] we learned afterward, had two components. First, motivation is maximized by uncertainty: the more the outcome is in doubt, the greater the

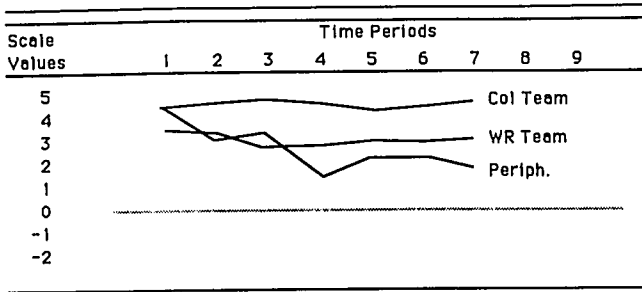
level of motivation. Second, information gleaned from the environment and exchanged among individuals serves to maximize uncertainty—that is, to keep the outcome in doubt. For example, on the twice-climbed Col Route, the mountain offered more encouraging signals. To maximize uncertainty, therefore, the information exchanged among individuals would tend to be more pessimistic. For example, someone might say, "Looks like a storm brewing off to the west. That may cause us trouble." On the West Ridge, which came well supplied with as much environmental uncertainty as one might desire, the communication tended to take on a more optimistic note, all designed to keep the outcome maximally in doubt. How did it all work out?

First, *motivation*, (fig. 2): Over time each team was understandably more committed to its own endeavor than to that of the other group. While various events caused minor perturbations in motivation, the basic commitment remained, and indeed the motivation of the Ridgers even increased, perhaps in part because of being number two in the pecking order.

Regarding *uncertainty* (fig. 3): The Colers tended to be more to the optimistic side of maximum uncertainty, but they were certainly less confident of their own success than were we who were not invested personally in their goal. On the West Ridge Route, though, the Ridgers managed to keep their motivation charged by sustaining

[‡] Emerson RM: Mount Everest: A case study of communication feedback and sustained group goal striving. *Sociometry* 29:213-227, 1966. University of Washington Department of Sociology, Seattle, 1965.

SOUTH COL GOAL: Self-Ratings on Motivation, by Team and by time period (Averaged within 10-Day Periods)



WEST RIDGE GOAL: Self-Ratings on Motivation, by Team and by time Period (Averaged within 10-Day Periods)

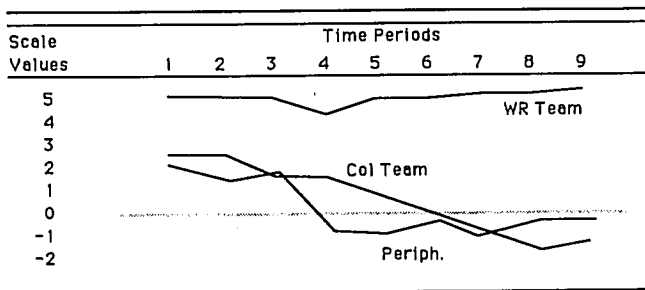


FIG. 2. Average level of motivation of members of the 1963 American Mount Everest Expedition over the duration of the climb. *Top:* Motivation on the South Col route of those attempting it ("South Colers") and those committed to an alternative route ("West Ridgers"). *Bottom:* Motivation of each group for West Ridge route. Maximum motivation = +5; maximum disinterest = -5.

near maximum uncertainty; the Colers, looking at us, increasingly began to doubt mightily our ability to pull it off.

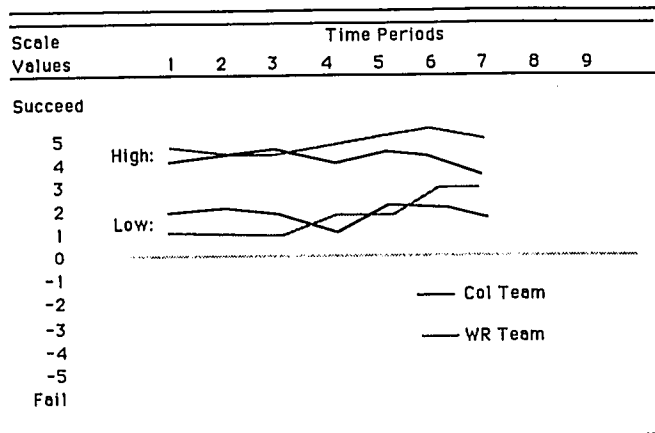
The message here? Uncertainty is an essential ingredient to motivation, to accomplishing any difficult task or goal. Although not all that is uncertain involves risk, uncertainty is an essential element of risk.

According to the Oxford English Dictionary,² to risk is to expose to the chance of injury or loss. There are three elements to this definition. The first is to *expose*, which implies a choice. You can take it or leave it. In other words, a decision is made to opt in, to gamble, based upon the perception that what is to be gained justifies the possibility of loss. The second element is *chance*, the *possibility* of loss. If loss or injury is certain, that is not risk; there is no uncertainty. Here is where risk and Emerson's uncertainty principle regarding motivation come together. The third element, by now obvious, is *injury* or *loss*. What is being laid on the line if one fails may range from a small hurt to permanent injury or loss of livelihood or life.

As I present risk as an essential dietary constituent, how do I justify espousing such a point of view to all of us whose goal in life is to minimize risk for our patients? As human beings and as physicians we are programmed almost from the beginning to minimize risk, to strive for safety and security.

We strive through education and occupation to be self-sustaining human beings, seeking security for ourselves and our families, a safe haven, freedom from worry, all those things that are the antithesis of uncertainty. As anesthesiologists we strive to provide safe passage for our patients, to minimize their risks. We practice defensive

SOUTH COL GOAL: High and low Estimates of Likely Outcome, by Team and by Time Period (Averaged)



WEST RIDGE GOAL: High and Low estimates of Likely Outcome, by Team and by Time Period (Averaged for 10-Day Periods)

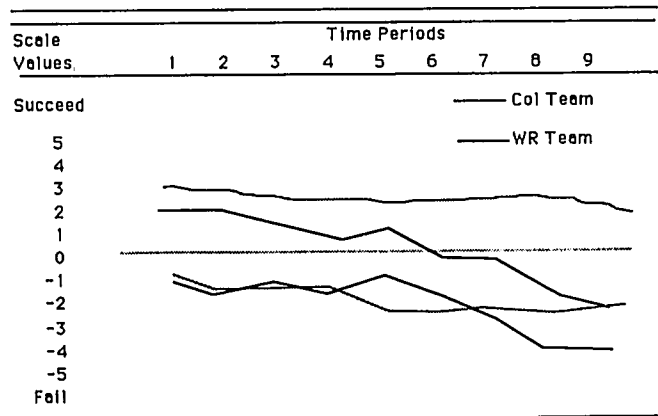


FIG. 3. Average assessment of chances of success by members of the 1963 American Mount Everest expedition over the duration of the climb. *Top:* Chances of success or failure on the South Col route as assessed by those attempting it ("South Colers") and those committed to the West Ridge route ("West Ridgers"). *Bottom:* Chances of success or failure on West Ridge route. Certainty of success = +5; certainty of failure = -5; maximum uncertainty = 0.

medicine, risk management, to minimize risks to ourselves. Some modern societal law of thermodynamics seems to be driving our western world toward a demand for a guaranteed, conception-to-grave, risk-free world. We are all too familiar with the medicolegal consequences of this attitude in our own country today.

Maybe we can view risk like we would a drug—beneficial to the organism in the proper dose. Too much or too little may be harmful, somewhat like oxygen pharmacologically. In defining the range of therapeutic dose, we must distinguish between timidity at one extreme and risk-seeking at the other, with risk-acceptance somewhere between. One of the major provisos of proper dose is that while one is willing to accept necessary risks, at the same time long-term survival is enhanced by avoiding as much as possible those that are unnecessary. Bertrand Russell points out³:

A life without adventure is likely to be unsatisfying, but a life in which adventure is allowed to take whatever form it will is likely to be short.

In our profession, especially in anesthesiology, I see the willingness to risk as essential, not simply as a seasoning to life but to effective function, as for example to the ability to be instantly decisive in the presence of a surfeit of uncertainty during a moment of crisis. We have all experienced such moments in our anesthetic practice. Inherent in the capacity to accept risk is the ability to accept failure, space within one's self image to be less than the omniscient, omnipotent creature that we as physicians are programmed to be or sometimes even program ourselves to be. The lack of the capacity to accept being less than perfect, even while striving for perfection, underscores the fact that our patients are not the only ones at risk when we practice medicine. Those of you who have been put through the wringer of malpractice litigation know whereof I speak. Suicide is not an unknown outcome of such stresses. And as a specialty we certainly seem to be winning the substance abuse marathon hands down.

Risk and Research

As one does not measure time so much by looking in the mirror as by watching one's children grow, so can I look back over these three decades of my own anesthesia practice and marvel at the incredible maturation of our specialty, fully recognizing that its birth and adolescence antedate my entrance into the scene by more than a century. What has brought about this change is research and its current handmaiden, technology.

One of my early-acquired talents was to pass a safety pin through the lead cap of a can of ether with sufficient skill so that the ether would drip out fast enough onto the gauze-covered mask to allow my patient to go to sleep, but not so fast as to drown him. That environment, with

its blood-pressure cuff and a finger on the pulse of a spontaneously breathing patient, was awesomely simple compared with the intimidating sophistication and complexity of our current work station, with its delivery system, displays and sensors, alarms and evolving artificial intelligence to guide our ministrations, to short-stop our fatigue and, to a modest but evolving degree, to troubleshoot and protect us from its own complexity. This sophistication has allowed us to translate the physiology and pharmacology learned earlier as concepts into care of patients so ill that three decades ago they were simply not operated upon. The practice of critical care medicine has evolved from our role in the operating room.

What has happened to anesthesiology as it has come of age is far more than technology, though. We now attract among the brightest and best medical school graduates and have earned respect from our peers in other specialties, the absence of which for many years affected our own self image. We enjoy a practice of medicine that may be more scientifically based than most, thanks to technology and our ability to measure and titrate the care of very sick people. For example, we have become virtuosos at upping and downing and lateraling the cardiovascular system: we can increase inotropy or decrease it, and likewise the heart rate; we can alter vascular tone, even to some degree differentially for different vascular beds. What we can do with what we think we know is awesome. Our decisions are based increasingly on sound physiologic principles and logical assumptions as to what is best. But what is best? How do we know?

Let me offer an illustration. Twenty-one years ago at this same event, Herman Rahn, head of the Department of Physiology at the University of Buffalo, spoke eloquently about how the *pH* of cold-blooded animals correlated with the decreasing tendency for water to dissociate to hydronium and hydroxyl ions as temperature decreased. Application of this observation to us homeotherms has resulted in an approach to *pH* regulation for patients made hypothermic for cardiac or other surgery. By preserving the usual buffering configuration of the histidine molecule, Rahn proposed that the normal *pH* should become more alkaline as temperature falls, rather than remaining at 7.4, the normal value at 37° C. A growing literature has begun to explore the physiologic consequences of *pH* control during hypothermia, examining effects upon the heart and the brain. What is not known is the bottom line: Does it matter? What *pH* is best? Is either of these alternatives optimal? These are different from questions concerning what happens to cerebral blood flow or cardiac output or myocardial contractility, even though we think we can assign a goodness or badness value to such changes. We possess little knowledge as to whether the patient is improved or harmed. Under what circumstance is the outcome best?

This same query can be applied to an unending array of clinical questions. How much can we let the hematocrit safely decrease now that the risk of acquired immunodeficiency syndrome (AIDS) from blood transfusion is part of our concern? Are opiates truly better for patients with heart disease? Does the coronary steal of isoflurane matter? Although we can administer anesthesia without nitrous oxide in this day and age, is that really better? What are the trade-offs between the benefits and costs? These are simple questions to ask but difficult, and sometimes impossible, to answer. They are outcome questions, attempting to provide information on whether the things we do to benefit our patients actually help, possibly harm, or really do not matter very much.

The *first research challenge* I see ahead of us, therefore, is to move beyond theoretical extrapolation from physiologic observation to assessment of how a particular approach affects outcome. Outcome studies are not easy (not that any good clinical studies are). They require thoughtful design, careful statistical analysis to account for contributions of other variables, and often a large population of patients of the appropriate variety. These are studies that can be done only in the clinical setting; they often require collaboration across institutions to obtain a sufficient patient population. They are difficult and costly and therefore should be targeted to important questions.

The *second research goal*, which perhaps I should have mentioned first, is that we identify and invest our resources and energy in things that count, whatever the nature of the research. Sir Peter Brian Medawar put it this way in *Advice to a Young Scientist*⁴:

It can be said with complete confidence that any scientist of any age who wants to make important discoveries must study important problems. Dull or piffling problems yield dull or piffling answers. It's not enough that a problem should be 'interesting'—almost any problem is interesting if it is studied in sufficient depth.

As we bemoan the seemingly increasing difficulty we face in competing for National Institutes of Health (NIH) funds or other sources of support, we need to ask ourselves what anesthesiology's important questions and concerns are and ask also where they fit into the larger universe of biomedical inquiry. How much of a finite resource can we justifiably command? Where, for example, does the question of optimum hypothermic *pH* fit relative to issues such as AIDS, malnutrition, cancer, heart disease, accidents, drug dependency?

Third, I see another purpose for research by anesthesiologists, even when the question being addressed may be of modest importance, perhaps even verging on the piffling. If the experience of doing research can help young anesthesiologists to learn to think more critically, more questioningly, of what they know and see, then there

is a gain for society separate from addition to our collective wisdom. But for the energy committed to this objective to be meaningful, experienced guidance, feedback, and critique are needed. To provide such help, if research is to be part of the training experience, is, I believe, an obligation of our training programs and their qualified faculty.

Finally, a chosen and dedicated few are challenged by the pursuit of fundamental understanding. At times this research will address important clinical questions. At other times the ultimate utility will be no more than a futuristic fantasy, such as anesthetic-receptor interactions or how opiates and inhalation anesthetics work to create the anesthesia state in its varied complexity. Again quoting from Medawar, this time in *The Art of the Soluble*⁵:

Science is above all else an imaginative and exploratory activity, and the scientist is a man taking part in a great intellectual adventure. Intuition is the mainspring of every advancement of learning, and *having ideas* is the scientist's highest accomplishment; the working out of ideas is an important and exacting but yet a lesser occupation. Pure science requires no justification outside itself, and its usefulness has no bearing on its valuation.

We need a few among us willing to pursue what Lionel Terray, a famous French mountaineer, referred to as the "conquest of the useless," in this instance the pursuit of understanding simply to understand. More and more, as basic research probes the innards of the cell and the behavior of molecules, we clinician-scientists will need to collaborate with basic scientists to seek increased understanding of such things as how anesthetics work and how our special pharmacology may serve as a tool for exploring fundamental biologic processes.

Research, especially important research, requires major commitment. And when the research is to test hypotheses, rather than simply to describe what happens, then it carries appreciable risk. Most who have pursued such inquiry have experienced the disappointment of finding months or even years of effort down the drain when their pet hypothesis doesn't pan out. Yet at times we are rewarded serendipitously, finding something important that was not in our original thinking whatsoever.

The willingness to tolerate uncertainty, to invest immense effort with the outcome very much in doubt, is an integral aspect of this type of research. We heard some of the fruits of such commitment when Jack Michenfelder spoke in 1988 about protection of the brain from hypoxic injury,⁶ and we can find it as well in the contributions of many others as, for example, the recipients of the ASA Award for Excellence in Research, John Severinghaus, Ray Fink, Francis Foldes, and Ted Eger (and Michenfelder himself in 1990) and others yet to come. Our clinical practice has been extended and our specialty enhanced by the insatiable lust to know and the willingness to risk of individuals such as these.

Risk and Training

Finally, and more speculatively, I would like to explore some thoughts on risk-acceptance as it might relate to the selection and training of anesthesiologists. Himalayan mountaineering has been characterized as hours of sheer (albeit breathless) boredom, punctuated by moments of stark terror. This same assertion has also been applied to the administration of anesthesia. In both instances, the boredom-terror analogy, albeit attention-getting, is an oversimplification of reality as well as an undervaluation of what represents our usual and customary function. Our function has also been compared to that of airplane pilots with hours of conventional flight (in anesthesia the low-risk patient and procedure) *versus* moments of intense, decisive action. While managing a steady state of anesthesia demands certain attributes, among them the vigilance that is contained in our Society's emblem, the capacity to function well in moments of crisis is, I believe, a critical characteristic for the anesthesiologist, and indeed this attribute may to some degree distinguish the practice of anesthesiology from many other types of medical practice.

Like most of you in this room, I cherish a collection of hypotheses, or biases, as to what attributes make for a good anesthesiologist, even while as an educator of anesthesiologists I am impressed by the broad spectrum of personality traits that are *seemingly* compatible with becoming competent. I underscore *seemingly*, for in fact we really don't have much information on the issue. Some individuals seem to be naturally endowed with the right stuff. Most of us exhibit an impressive capacity to learn. But to stay cool under fire is not everyone's cup of tea. Can we assess the lack of enough of this capability prospectively? Can we do a better job of helping people to learn to function in such situations? Can we develop ways to measure whether someone has acquired an acceptable capacity at the end of training? This issue has not been a major target for attention, partly because it's a tough one to deal with. Yet without addressing this question directly, we have somehow managed to garner insights that may be relevant. I have found only one study that has tried to characterize anesthesiologists, a work published by Peter Reeve in *Anaesthesia* nearly a decade ago.⁷ Reeve assessed the distinctive personality traits of 44 English anesthesia trainees, 80% of whom performed satisfactorily, but some of whom didn't do so well (table 1).

Recently I—the mountaineering Hornbein, that is—was interviewed by a reporter writing about risk for a medical magazine. When the article appeared I found myself in the company of individuals characterized as "type Ts," "thrill (risk)-seekers" or "stimulus addicts," according to the description of a San Jose State psychologist, Bruce Ogilvie. I wrote to Dr. Ogilvie to protest

TABLE 1. Personality Attributes of Anesthesia Trainees (Type As)

Satisfactory Performers	Poor Performers
Independent	Timid, cautious
Dominant	Feelings of inadequacy
Decisive	Unsure
Calm	Tense
Emotionally stable	Emotionally unstable
Self-control	Undisciplined
Cooperative	Cunning
Conscientious	Self absorption
Detached	Frustrated
High standard	Irritable
Likes results, serious	

From Reeve PE,⁷ with permission.

such categorization as too simplistic, pointing out the spectrum between risk seekers and risk acceptors. He responded by sharing more of his assessments with me. § I found the characteristics that Dr. Ogilvie has discerned in type Ts, individuals such as race-car drivers and sky divers (but distinct from those who are involved in competitive team athletics) surprisingly similar to the attributes we have just examined (table 2).

Dr. Ogilvie points out that these individuals possess "positive personality organization," coupled with the need to test physical, emotional, and intellectual limits. The type Ts that he studied scored within the top 5–25% of the general population in regard to these values. If you scan this list carefully and compare it with *our* type As, where "A" in this instance stands for anesthesiologist, one sees striking similarities between thrill seekers and anesthesiologists. Among common attributes are some that may define the capacity for functioning well in moments of high stress, such as decisiveness and the ability to remain calm, in control, and detached. I underscore also the type T emotional detachment or "loner" attribute—the capacity for independent or autonomous function—as that at the top of both lists. Anesthesiologists experience a very different kind of medical practice from that of other physicians; to a significant extent we find ourselves in a lonely setting where we are called upon to make critical decisions independently, without the opportunity for consultation and collaboration. This quality of independence, of autonomous, detached function, a willingness and ability to "go it alone," may distinguish anesthesiologists from many other medical specialists.

What does it all mean? For those moments of maximum uncertainty when we need our catecholamines appropriately enhanced, when all we know and see must be mobilized quickly to elicit the right action, when we must take charge, decide, act and stay cool in the process—

§ Ogilvie BC: The stimulus addicts. *The Physician and Sports Medicine* 1:61–65, 1973

TABLE 2. Personality Attributes of Stimulus Addicts (Type Ts)

Autonomous
Will to dominate, lead
Decisive, self-assertive
Low anxiety
Emotional stability
Reliable
Responsible
Emotionally detached/loner
Adaptable, resourceful
Energetic
Nonconformity
Creativity, abstract ability

T = Thrill-seekers/stimulus addicts.
From Ogilvie BC §.

these are our survival traits. Only in retrospect can we take the time to introspect; it's an unaffordable luxury in the midst of a crisis. Yet we must continue to process new information and be willing to formulate new plans and new actions even in the heat of battle. That's an awesomely high order of function. We should not be surprised that even the best of us don't pull it off perfectly all the time. (And often in our game we don't even know how to define perfection in these situations.)

Is it surprising, then, that some might be less well suited for this type of function than others? How much does it matter? Can we discern an effect on performance or on outcome? I return to the airplane analogy. In the early 1970s Thomas Neuman developed for the Royal Swedish Air Force the Defense Mechanism Test, a selection procedure that differed radically from the conventional cognitive and psychomotor tests than in general use.[†] This test evaluated a person's perceptual defense organization, that is, his psychological defense and coping mechanisms in response to a threat, his adaptive style. Over the next 15 years this test was validated in respect to pilot performance, pass/fail rate of trainees, and frequency and severity of critical incidents. Subsequent use of the test to screen applicants succeeded in reducing failure rates of trainees and proved a predictor of pilot accident proneness.

Can a similar approach be applied to the screening and selection of anesthesiology trainees? Should it? Even the asking of the question represents a significant departure from our current approach to specialty choice and therefore feels threatening. But perhaps now our specialty has achieved sufficient maturity in regard to its role in patient care that societal responsibility demands that we gain a better handle on how well we do in preparing physicians for careers in anesthesiology. To what extent can we train people to this high level of performance? And can we

[†] Referred to in a presentation by Dr. R. B. Lee at the symposium on "Safety in the Operating Theatre: The Human Factor," University of Melbourne Faculty of Medicine, Australia, August 5-6, 1983.

evaluate how well such lessons are learned? Critical events are rare in our routine clinical practice, and indeed when they do occur the teacher ceases to be a passive observer and becomes actively involved in the care of the patient. Maybe again lessons can be learned from the pilot's world, in this instance from the flight simulator, an expensive device that can realistically reproduce a whole variety of events and critical incidents, where "crashes" can be repeated many times over until lessons are learned. Patients are more complex than planes in their behaviors, and the capacity to simulate their responses is more problematic. Even so, simulation might help us to deal with this important aspect of an anesthesiologist's performance that is, one hopes, rare in real life.

I have touched upon but two points of intersection of anesthesiology with risk acceptance. I know now that risk is as much a part of my professional life as an anesthesiologist as it is of my extraprofessional one as a mountain climber. I know that as a climber some risk, but only an acceptable dose, is an essential element to the endeavor. "Uncertainty maximizes motivation," Dick Emerson taught me. Did I choose my specialty for similar reasons? For our patients, though we wish it otherwise, risk is inseparable from their encounters with the medical establishment. Among the reasons, particularly for our specialty, are the inevitability of human error, of machine failure, of not knowing enough either individually or collectively, or simply of patients' not always responding in ways that fit with what we do know. Risk is a real and ever-present part of all our lives. We might wish at times to control the dose, but that, by definition, is not possible. That which we cannot control we must either accept or try to avoid. The control that one seeks is not of risk, then, but of oneself in living with and coping with risk and its attendant uncertainty. It is as if in this act of accepting uncertainty we transfer risk from the bodies and lives of our patients to ourselves. In the process we both benefit.

I share with you a relevant comment by a Seattle neurologist, Robert Colfelt, who for some time was the eloquent editor of our local medical bulletin^{**}:

If we are not careful we become too comfortable living within the abstractions of patient care, and become neglectful of each person in their uniqueness. . . . What allows us to escape those traps is our capacity for imagination, re-imagining our lives and our work as physicians. This means that we have no choice but to change our lives and keep the possibilities of being more than we are and different than we have ever been. As we climb higher in our journeys our falls are farther and more painful. When we don't want to get hurt we stay on level ground and out of harm's way. But we wanderers go where we must go and do what we must do. We pay high prices because we make plenty of mistakes in the process.

^{**} Colfelt R: Mystery and medicine. King County Medical Society Bulletin 66:8, 1987.

Or as Alfred North Whitehead put it:

Periods of tranquility are seldom prolific of creative achievement.
Mankind has to be stirred up.

As I reflect on what I know and see and, more than that, upon what I don't know and do not see and do not understand, I have come to believe that there are occasions when our commitment is complemented in inexplicable ways by what one might call luck. In our acts we find ourselves transported beyond what we know and see, beyond ourselves.

During our traverse of Everest, as we descended from the summit down the South Col route, Willi Unsoeld and I spent a night out with Barry Bishop and Lute Jerstad, whom we overtook in the dark. In 1963, to bivouac above 28,000 feet without oxygen would have been regarded as unsurvivable, yet it was a nearly windless night that we shivered through, continuing down the next day. At a reception in Kathmandu a short time later, I remember commenting to a Nepalese dignitary upon how lucky we were to have succeeded in our traverse and to have lived to tell about it. His rejoinder was, "Luck is what you make it." And mysterious as it may seem, I have come to believe that there is a message to be heeded in his comment. W. H. Murray,^{††} an English mountaineer of half a century ago, put it thus:

^{††} Murray WH: In Hornbein TF: Everest, the West Ridge. Seattle, The Mountaineers, 1980, p 56

Until one is committed there is hesitancy, a chance to draw back, always an ineffectiveness. Concerning all acts of initiative (and creation), there is one elementary truth, the ignorance of which kills countless ideas and splendid plans: that the moment one definitely commits oneself, then Providence moves too. All sorts of things occur to help one that would never otherwise have occurred. A whole stream of events issues from the decision, raising in one's favour all manner of unforeseen incidents and meetings and material assistance, which no man could have dreamt would have come his way. I have learned a deep respect for one of Goethe's couplets:

Whatever you can do or dream, you can begin it.
Boldness has genius, power and magic in it.

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