THE BACKLETTER®

Published by Lippincott Williams & Wilkins

Vol. 22, No. 2, February 2007

A Tribute to Alf Nachemson: The *Spine* Interview

Editor's Note: With this issue, the BackLetter *breaks a 20-year tradition and offers an interview as its cover story. The interview is a tribute to the immense personal and scientific legacy of Swedish spine research pioneer Alf L. Nachemson, MD, PhD, who died at the age of 75 at his home in Gothenburg, Sweden, on December 4, 2006.*

Arguably the most influential figure in the history of modern spine research, Nachemson rose to prominence with experiments conceived in the early 1950s and was dominant in the spine field for another half century.

His spine career began humbly with a part-time job delivering cadaver spines for experiments at the Karolinska Institute. It eventually involved research in more than 20 scientific fields; the publication of more than 500 studies, articles, and editorials; and collaborations and honors across medicine.

This interview was commissioned by Spine *editor-in-chief James N. Weinstein, DO, MSc, to document Nachemson's views on spine research and the evolution of his long research career.*

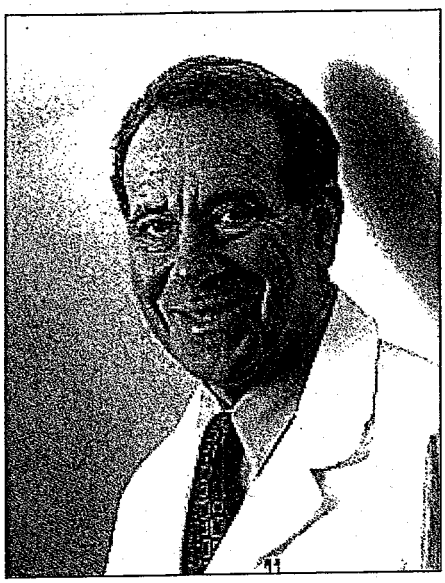
The interview was conducted by BackLetter *editor Mark Schoene in Washington, DC, on April 1, 2006. Nachemson reviewed and approved the final draft.*

The interview was published recently at the website of Spine (www.spinejournal.com), *where it can be found attached to Nachemson's obituary. (See Danielsson et al., 2007.) It is reproduced in the* BackLetter *through the kind cooperation of Dr. Weinstein,* Spine, *and Lippincott Williams & Wilkins.*

At a celebration for Nachemson at Gothenburg University in 1996, Gordon Waddell, MD, commented that the spine research field had never had a more dedicated and impassioned ambassador than Nachemson.

"He has carried the torch for back pain. He has traveled the world, the centers of power and influence, and spread the message," said Waddell. "Most of all, he has challenged traditional wisdom and authority, and insisted, demanded that we must do better for our patients with back pain." (See Waddell, 1996.)

Here is one final encounter with that ambassador—and his provocative scientific message.



Question: You have worked in the spine field for half a century. You've performed research in dozens of areas and published more than 500 studies and articles. What is your most significant research accomplishment?

Nachemson: I think my most important accomplishment has been to expand the boundaries of spine research by attracting other disciplines and fields to the study of back pain. I have always been an enthusiastic

Continued on page 18

Refining Stenosis Options

Medicine does not have any miracle cures for spinal stenosis. Existing treatments cannot turn back the clock a quarter-century for aging stenotic spines. But they can relieve pain, reduce disability, and restore the capacity to walk.

A newly published, randomized controlled trial (RCT) from Finland suggests that patients with moderate spinal stenosis can expect reasonably good outcomes from either surgery or active nonoperative care, with surgery having an overall advantage.

"Our trial shows that operative treatment is more effective in reducing pain and disability than nonoperative care, and the effect is [sustained at] two-year follow-up." according to Anti Malmivaara, MD, and colleagues. (See Malmivaara et al., 2007.)

"As a notable recovery also occurred in the nonoperative treatment group, we propose that surgical decompression should be suggested with caution, and only after due conservative treatment of the patient," the researchers added.

Continued on page 22

IN THIS ISSUE

Nachemson

Continued from page 13

observer of other areas of medicine and science—and eager to see new research ideas and techniques applied to the spine.

At the beginning of my career, back pain was regarded as a local anatomic problem related to biomechanical loading. Now we know it is an extremely complex issue that relates not only to local pathology but also to biochemistry, pain physiology, brain science, psychology, sociology, and economics.

My research led me to collaborations with scientists in all these areas. In some of these collaborations, I played a prominent role. In others, I just helped get things started, backed off, and let the experts take over.

Many of these scientists have continued to work in the spine area, as have their colleagues and students. As a result, we have seen an enormous increase in good research, and this has moved the entire field forward.

Question: To what do you attribute your lengthy track record of success?

Nachemson: To be successful in science you must be a little smart and a little lucky. You must be smart to recognize that something is worth studying. And lucky to have the experiments work out. I have been lucky in that a few of my experiments have stood the test of time.

But you must also acknowledge the community basis of good science. There are no purely individual accomplishments. Behind every name on a study there is a network of researchers and collaborators. There is a background to all successes.

Regarding my own career, I would quote Isaac Newton: "I have been able to see further because I stood on the shoulders of giants." None of my success would have been possible without the generous contributions of giants in many fields: Carl Hirsch who brought me into the spine field, Alice Maroudas in biochemistry, Paul Harrington and John Moe in the scoliosis area, Wilbert Fordyce in psychology, Ian Chalmers and Archie Cochrane who taught me about evidence-based medicine, to name just a few.

Question: Let's go back to the beginning of your career. You entered medical school in 1950. How did you get interested in the spine?

Nachemson: When I entered medical school I was, like most students, short of money. So I started looking around for a part-time job.

My parents owned a fruit store in Stockholm. It so happened that orthopaedic surgeon Carl Hirsch lived in an apartment across the street and was a regular customer. Since he worked at the University, my parents asked him if he could help me. He said that he would let me do some odd jobs, and work in his lab, if I would commit a certain amount of time to him.

Many people have focused on the disc as the potential cause of pain. But its role in back pain causation is no more proven than those of other structures.

My first assignment was to collect calf spines from the slaughterhouse. Hirsch then started studying the chemical composition of the disc and also needed cadaveric human spines brought back from the morgue.

Before this time, I had no interest in orthopaedics or in spine research. But Carl Hirsch was an enthusiastic teacher who got me fascinated in this area. So from year one of my medical training, I knew I would be an orthopaedic surgeon specializing in the spine. I was completely hooked.

I was so enthusiastic that the Karolinska Library gave me my own little cubicle in which to study the spine literature.

Then I started doing some compression experiments on spinal discs to see how they shrank and enlarged with various loads. My research career progressed from there.

Question: Your study of intradiscal pressures is one of the most celebrated experiments in spine research history. I understand that you first thought of that experiment in medical school.

Nachemson: This is an experiment where I partly borrowed the idea and technique from another area of medicine. As part of my medical school training, I worked with heart researchers who employed catheters to study intracardiac pressures.

So I came up with the bright idea on Christmas Eve in 1954 to use catheters to study disc pressures. I was so excited I called Carl Hirsch on the spot. He said: 'Nachemson, you are crazy calling me on Christmas Eve.' Then he hung up on me.

But we continued to work on the idea. He moved to Uppsala University, and I followed him there. I eventually got my PhD for measuring intradiscal pressures in cadavers. Then Hirsch sent me to Vern Inman, the giant of biomechanics in San Francisco, and I began measuring disc pressure in living people.

There were a few setbacks along the way. The catheter broke off in one of the first subjects. I worried about a liability suit. I remember going home that night and saying "Pack the trunks; we are going home to Sweden."

But Jim Morris, the orthopaedic surgeon who collaborated on this study, convinced me to stay in San Francisco. The experiment proved successful, and our study was published in the *Journal of Bone and Joint Surgery* in 1964. This was the beginning of my claim to fame in the spine world.

Question: Has that experiment been misinterpreted?

Nachemson: Yes. It was been widely misunderstood. And I probably misunderstood it myself for a while.

This experiment has been misinterpreted as evidence that the disc is a significant pain generator and that increasing the biomechanical load leads to greater pain.

But this study merely showed how the lumbar spine responds to normal physiologic loading in various positions of the body. It does not give any indication as to where the pain actually comes from.

Question: So where does the pain come from? What did you think then, and what do you think now?

Nachemson: One of the main goals of my career has been to determine the cause of nonspecific back pain. And in this I have failed. I didn't know the origin of back pain in those days, and I don't know now.

Many people have focused on the disc as the potential cause of pain. But its role in back pain causation is no more proven than those of other structures. Our knowledge of back pain causation remains poor. We still do not have diagnostic techniques that can link structural abnormalities to symptoms with any accuracy.

I continue to believe that the origin of nonspecific back pain lies in the motion segment. But I don't know where.

Question: How did you become disenchanted with purely biomechanical explanations for back pain?

Nachemson: When I returned from San Francisco, Carl Hirsch asked me to do some follow-up studies of Swedish Air Force pilots who had suffered painful vertebral fractures during ejection procedures.

I performed follow-up examinations on more than 20 of them. Their spines looked terrible on x-rays with fractures and disc injuries in the thoracolumbar and lumbar area. But to my great surprise, they all went back to flying within six to eight weeks, subjecting their spines to large G-forces! And not a single one had back pain at follow-up. So I started to scratch my head and wonder if there was more to back pain than structural abnormalities.

Then Carl Hirsch asked me to do a follow-up study on 60 patients who had undergone H-graft spinal fusions for degenerative disease. I opened them up after a year to see whether their fusions had healed. I found that about half had healed and half had not. And the results were equally lousy in both groups.

For me this was a nail in the coffin for the idea that back pain represented a simple mechanical problem that could be fixed with a simple mechanical solution.

Question: Where did your research go from there?

Nachemson: Biochemistry came into my thinking when an orthopaedic thesis from Stockholm suggested that subcutaneous injection of various low-pH solutions could cause pain. I discovered that patients who underwent discectomy often had a low discal pH. We showed that this was tied to poor oxygenation and high concentrations of lactates.

This led to the idea that abnormal biomechanical loading and other problems might lead to disc degeneration through a breakdown in disc nutrition. When I was in England in the late 1960s, I approached the biochemist Alice Maroudas who had studied the transport of nutrients into articular cartilage. I asked if it might be possible to perform similar studies in the disc.

She recruited Jill Urban—who was already studying cartilage—to also look at discs. Later Sten Holm and others became involved. The few simple questions posed in Alice Maroudas' office led to a major research movement that continues today. This is an example of the kind of synergy that can develop when researchers from different disciplines put their heads together.

This research movement among other things has demonstrated the importance of motion and activity in disc nutrition and the role of exercise in keeping the disc healthy. This observation has significant clinical implications.

The spine is a mirror for everything that happens in human life.

It actually changed my own lifestyle. Up to that time, I didn't have any interest in exercise. But I began jogging because I realized it would help keep my spine healthy. And I have been jogging regularly for 35 years now.

Question: What stands out repeatedly in your career is your ability to shift gears and change. You never became overly invested in the hypotheses you examined and were willing to move on when they no longer fit the scientific data. As an example, you were the godfather of spinal ergonomics but eventually became one of its leading critics. How did that transition occur?

Nachemson: We did a series of studies with Volvo and redesigned an entire plant to minimize stress on the spine—based on biomechanical principles. We found that ergonomics just didn't work as a preventive intervention. It didn't alter the level of sickness absence due to low back pain at all. And other scientific studies have failed to demonstrate a benefit for ergonomics as a primary intervention.

This eventually led to the Boeing study in Seattle and collaboration with Will Fordyce, the psychologist, where we showed for the first time that psychosocial factors play a significant role in back pain. To our surprise, they were better predictors of work disability than physical factors. This study opened my eyes, and those of the world, to the fact that back pain isn't only about the spine, it is also about the brain.

Later on in Sweden, we showed that back pain disability is also heavily influenced by government policies regarding sickness absence, compensation levels, and early retirement.

These results are all indications of the complexity of the back pain disability crisis and the need to come up with multimodal solutions that address that complexity.

Question: At the start of your career, the international back pain disability crisis was just heating up. It has caused tremendous suffering and economic losses across industrialized nations over the intervening five decades. Are we making any progress in dealing with this issue?

Nachemson: We have made progress in terms of knowledge but have much further to go. We have solutions for this crisis but haven't implemented them. The implementation effort will require reeducating the public, patients, primary care providers, orthopaedic surgeons, politicians, and the mass media. We must deal with this crisis at all these levels.

We've seen the kind of progress that is possible when we get these groups on the same page regarding the rational management of low back pain. I would point to the Victoria campaign in Australia, Working Backs Scotland, and the reduction in back-related disability pensions in the United Kingdom.

When I began my career, health care professionals and the general public held a variety of mistaken beliefs about back pain.

There was a widespread belief that back pain was caused by the physical stresses of work and that it was inherently disabling.

There was a belief that back pain would not go away on its own and required treatment. It was thought that bed rest and inactivity should be the mainstays of therapy.

Physicians held the view that patients should stay away from work and physical activity until the pain was gone; and that early return to work and activity would be dangerous for the spine.

These all turned out to be myths. All have been partially or completely disproved. But we need to finish dismantling them.

In the place of these myths, we can now offer effective, evidence-based advice to individuals with back pain: go on with normal living; try to find ways to move around

Continued on page 20

Continued from page 19

and stay active; don't see a doctor unless the pain is severe; don't go to bed and rest; continue to go to work.

As I have said previously, back pain is an overrated discomfort. Patients make too much of it. So do medical professionals. We live in a society that dreams of a pain-free life. But that is not going to happen. Back pain is a normal part of living. It shouldn't be the focus of life. It shouldn't be disabling. It should be thought of as something that will go away and not cause severe problems.

Question: Over the last few decades, you have been one of the foremost critics of inadequate research on back pain. Gordon Waddell once compared you to a combination of king and jester—king because of your contributions to spine research; and jester because of your ability to poke fun at those who didn't live up to your scientific standards. Many times you have had to stand alone and oppose consensus across the spine field. Was this a difficult or lonely task for you?

Nachemson: I have never been afraid of opposing current thinking and neither should any scientist. If there were no disagreements, we would never move forward as a field. Disagreement is an important part of science.

Being a critic was never difficult or lonely for me. There were a few times when conference attendees wanted to get into a fistfight with me next to the podium. A few people called me a stupid idiot and wanted to beat me over the head with a stick. But that goes with the job of being a scientist.

Because of my research background, I was always treated respectfully by the leadership of professional societies at which I spoke. More than 20 such organizations have honored me. Orthopaedists have a respect for scientific research even if they do not always heed its findings in their clinical practices.

And I think I changed a few minds along the way. Some of my former critics have come up to me in recent years and thanked me for pushing them toward performing more rigorous scientific research. When that happens repeatedly, it makes you feel good.

Question: You have treated thousands of patients over the course of your career. Is there one area of clinical care you are particularly proud of?

Nachemson: One of my major interests has been the etiology and treatment of spinal deformities, particularly scoliosis. This is an area of clinical care I am very proud of. I have treated more than 2000 scoliosis patients and performed surgery on more than half of them.

One of my greatest joys is to see my scoliosis patients 20, 30, and 40 years after treatment. Almost all of them consented to comprehensive long-term outcome assessment. And those treated surgically and nonsurgically are close to normal in every respect.

I spent part of my residency, as well as four sabbatical years, in the United States. And I learned a great deal about the treatment of scoliosis from American surgeons. For instance, John Moe taught me how do a proper scoliosis fusion, a technique which I then introduced into northern Europe. This operation worked fantastically well.

Those who believe I am prejudiced against spine surgery, and fusion surgery in particular, will be shocked to find out that I have performed more than 9000 levels of fusion in scoliosis patients alone. And with good long-term results, as assessed by unbiased observers.

Another American surgeon who had a major influence on me was Paul Harrington, who revolutionized the world of scoliosis treatment with the invention of the Harrington rods. He was criticized at first for a radical treatment. But this invention changed the entire concept of scoliosis treatment and helped patients tremendously. I brought this method back to Scandinavia, much to the benefit of our patients.

I also introduced conservative treatment approaches developed in the United States, such as Blount's Milwaukee brace and Hall's Boston brace. Since then, scientific studies have proven the long-term value of both types of bracing for our patients.

Question: For 30 years you chaired the Volvo Awards, the most influential of all spine research competitions—and one which has played a key role in advancing science in this area. How did these awards come about?

Nachemson: That is a funny story. Saab approached our department in the 1960s about designing a better car seat, based on our disc pressure studies. I agreed but said we would need to perform more research to guide the design process. This led to a detailed proposal, which Saab promptly rejected as too expensive.

The next month, Volvo came in and made the same request. I said, 'We'd be happy to do it.' I reached in my drawer and said, 'I have a proposal right here.' Volvo accepted, and this was the start of a 30-year research collaboration.

This partnership included studies in basic science, car design, ergonomic modification of the workplace, and three or four randomized controlled trials [RCTs] on the management of work-related back pain.

Eventually, Volvo said, 'You have done so much for us. How can we honor the spine field in return?' I said, 'How about a research award?' and the rest is history.

Question: You founded the Cochrane Collaboration Back Pain Review Group and co-chaired it for a decade. How did you become attracted to the Cochrane Collaboration? And what is the current state of evidence-based medicine in the spine field?

Nachemson: I became attracted to the Cochrane Collaboration when I heard about the work of its founder, Ian Chalmers. His group's reviews in obstetrics and perinatal care saved the lives of more than 10,000 babies over a 10-year period. I went to visit him at the UK Cochrane Center in the early 1990s and eventually agreed to found the Back Pain Review Group.

Since we don't know the specific causes of most forms of back pain, we have to rely on RCTs to determine which treatments work. There was initially some resistance to the idea of RCTs and systematic reviews in this field. But now there is almost universal agreement on the need for this type of research, particularly since payers have adopted evidence-based methods in reimbursement decisions.

There has been tremendous growth in the number of RCTs performed in the spine field. Approximately 1000 have been performed to date.

There has been improvement in the quality of RCTs overall. However, there are still far too many mediocre RCTs. In too many areas, no definitive results have emerged. As a result, many treatments remain unproven. Some treatments have been clearly proven to be ineffective but are still much used.

One of the major problems still to be overcome is convincing practitioners to apply the results of evidence-based medicine to their clinical practices. This has proved to be a very slow process.

As an example, an RCT that we performed at Volvo back in the 1980s—the study by Lindstrom et al.—gave convincing results that quota-based exercise training with a cognitive behavioral approach in the mode of Fordyce could successfully treat workers sick-listed with subacute low back pain. This approach has been confirmed by studies in several other countries. Yet despite the evidence, this method has not gained wide acceptance.

Why go through the trouble of performing randomized trials if no one follows the results? If we are going to do the studies, then we must heed the evidence.

Question: There is often a lag of 10 or more years between the time new devices and treatments are introduced to the spine marketplace and the time there is independent evaluation of their safety and efficacy. Do you believe that the current system of studying spinal treatments is in need of reform?

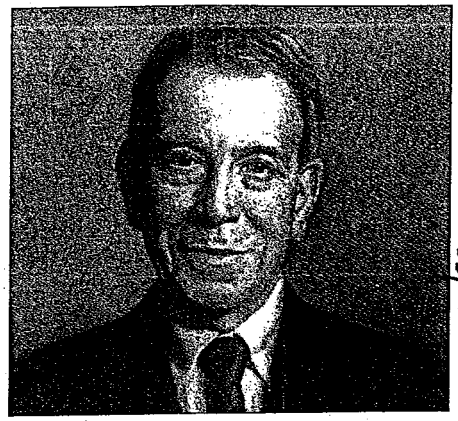
Nachemson: Yes. I am a strong proponent of the step-wise introduction of new technology into the clinical marketplace. But that process depends on high-quality, independent scientific research.

I have always been uncomfortable with commercial support for spine research, because of the potential biases it creates. Currently, most treatments reach the marketplace based only on commercially supported research.

I would favor early independent research funded by governments, universities, foundations, or third-party payers. Jim Weinstein, the editor-in-chief of *Spine,* proposed an independent clinical trials consortium in an editorial recently. This type of system—or some variation on it—might allow more definitive and timely evaluation of new treatments.

Question: You have spent much of the last 10 years studying the brain and the neurophysiology of pain. What attracted you to this area?

Nachemson: I have been saying for years that we must look upwards to the brain. Though the nociception may occur in the motion segment, the pain is processed in the brain. And, as our research has shown, the pain may change the brain and central nervous system.



Thus far, we have made a variety of interesting observations: that individuals with chronic back pain may suffer central sensitization; that they may have an increase in substance P and nerve growth factors, which promote pain. And they may have subnormal levels of pain-relieving endorphins in the cerebrospinal fluid.

There is some evidence that the constant bombardment of nociception may actually wear out some brain circuitry. And this may lead to impaired coping mechanisms.

At heart, I am still an orthopaedic surgeon interested in structural issues. As a result, I wanted to study the structural basis for back pain in the brain and nervous system. Imaging-based neuroscience—involving functional magnetic resonance imaging—gives us a window into the brain's structure and function. There is starting to be an explosion of research in this area, and this should give important insights into low back pain.

Question: If aspiring young spine specialists in Nairobi, Beijing, or Helsinki wanted to emulate your success, what would you advise them to do?

Nachemson: First and foremost, they should develop a thorough knowledge of study methodology and evidence-based medicine. Researchers must be able to determine if their ideas are good or bad. Clinicians must be able to identify which treatments are effective and which should be discarded.

They should learn how to test ideas, evaluate hypotheses in a scientific manner, and learn where the evidence lies. And they should be able to formulate their arguments and justify their treatments in terms of evidence-based medicine. This is the language of medicine now.

Question: And what fields should they study?

Nachemson: All the areas we discussed previously. It is necessary to be familiar with the whole spine field to be competent in any single area. Researchers need this understanding to gain insight into their own research and future research possibilities.

And they must be familiar with all these fields if they are going to be good doctors. Let's face it. The greatest problem in spine care today is that physicians treat x-rays and MRI scans rather than the whole person. Unless back care providers have an understanding of all these issues, they can't grasp that person.

It is not enough to understand the intricacies of pain from the motion segment to the spinal cord to the brain. They must also be able to understand the psychosocial, socioeconomic, and insurance issues that surround the patient.

And those who want to gain a comprehensive view of the modern back pain disability crisis around the world need to branch out into social policy, government regulation, and economic issues.

Question: If you were 25 again, knowing what you know now, what field would you go into?

Nachemson: I have never regretted entering the spine field. It has always fascinated me. The spine is a mirror for everything that happens in human life. This field allowed me to work with some of the world's great scientists. It has also given me the opportunity to help ordinary men and women with back pain and spinal problems. What would I do if I could start over? I would choose to become an orthopaedic surgeon and a spine researcher.

References:

Danielsson A et al., Alf Nachemson, MD, PhD (1931–2006), *Spine,* 2007; 32: 149–51; http://spinejournal.com/pt/re/spine/pdfhandler.00007632-200701150-00002.pdf;jsessionid=FCrRp87hS4LJHRTwBlCvjphQpjQXmchfVsQGPTr3vLJ79ThQqyyN!-1119014599!-949856145!8091!-1.

Waddell G, The joker and the king. In: *A Retrospective, Uncontrolled, Cross-sectional, Biased, 65-Year Study of Alf Louis Nachemson by Friends, Colleagues, and Students.* Gothenburg, Sweden: published privately, 1996.