

**Memoriam for Peter J. Van Soest (1929 – 2021)**  
**His Revolutionary Impact on the Science and Education of Fiber Nutrition**

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**Introduction**

Few, if any, animal scientists have the legacy of Peter J. Van Soest. He permanently changed the chemical and in vitro analysis of feeds and the understanding of herbivore nutrition throughout the world. His ideas were well-developed, comprehensive, and often, transformational. His novel and revolutionary methods of analysis provide the foundation for current methods of feed evaluation that are used worldwide.

I could write a book about my experiences with this brilliant man who became a foster father to me in many ways. I was lucky to spend many hours and days in the lab with him learning by observing, listening, and asking questions, and, more importantly, with him discussing his thoughts and asking me questions – and he usually didn't provide the answers. My job was to figure things out myself. I will tell a few stories (to the best of my recollection) to describe the man behind the accomplishments. He was personally as interesting and influential as he was professionally. It took me a while to understand his philosophy of science, but I think we were kindred spirits.

I first talked to Peter Van Soest during a telephone call on a Friday afternoon. I had visited five universities to find a compatible advisor and program. Peter was away from Cornell when I visited, and the previous day, I had decided to work with Dale Bauman at Illinois even though I did not like the course requirements there. Peter began the telephone conversation saying that I had made a good impression at Cornell and that he had an assistantship to offer after I completed my Purina Fellowship. Although I had taken the inorganic, organic and biochemistry series, I was hesitant because I had heard about how brilliant he was, and was concerned that I wouldn't meet his expectations. Dr. Van Soest said he would like to ask two questions. I thought "Oh no, here is the test!" But his first question was "Did I like course work?" I replied that I would be happy if I never sat in another lecture. He said "Fine" and promised that he would make sure I could take the minimum courses necessary. Then he asked, "Do you like to work in the lab?" I said that I loved lab work and it was one of the reasons I continued my education, so that I could understand the why and how of what I was measuring. He said "Great!" and that he expected me to be in the lab with him. I accepted his offer without hesitation. I would learn later that his philosophy was that I had to think on my own, do my own work, and learn at the hand of the master.

My goal was to obtain my Ph.D. before I turned 26, which meant I had three years to finish my degree. So, the first week I was at Cornell, I asked Dr. Van Soest what topic I should work on? He looked at me directly and said very bluntly that a Ph.D. was independent work and I was to pick the topic. I asked how my research would be supported and he said, "It is my job to get the funds, but it is your job to pick a suitable project." I thought, "How great is this, I get to pick something that I am interested in and Dr. Van Soest is going to pay for it." So, I went to the library to search the literature and picked a topic. At the end of the week, I presented it to Dr. Van Soest. He rubbed his beard thoughtfully and picked a green USDA lab notebook from his bookshelf, turned to the right page and said, "I looked at that in 1963 and it is not a fruitful avenue of work." For the next 10 weeks, the same result occurred, Dr. Van Soest had either already studied my idea or knew someone who had. Sometimes he gave me a paper or list of references to read and I came to the conclusion it was not the right topic. I was getting desperate. But I realized that I was learning more and more about intake, NDF and digestion kinetics. So, on a Friday before Thanksgiving, I told Dr. Van Soest that I thought there should be mathematical relationships between intake, digestibility, and NDF digestion kinetics and I proposed to develop a model to do this. Peter stared into space in deep thought and said, "Now that would be interesting." I ran out of his office before he could change his mind!

Not until later did I fully understand that he taught me several valuable philosophical lessons. Important science was not about single experiments, but about large bold ideas that required thought and experimentation. He also taught me that asking the correct question was the key to success. In addition, I learned that you search the literature before you do your dissertation work, or any research, and that you save a lot of time and effort, and home in on the best question, by learning what other people have done before you. These valuable experiences taught me a lot about Peter Van Soest, and now I will discuss his talents and accomplishments. At his CNC honorary symposium, I presented a thorough review of the detergent system of fiber analysis (Mertens, 2003) and I will only give a broad overview of his research in this paper.

### **Biographical Sketch**

Dr. Peter J. Van Soest, one of the most influential animal scientists and professors of the last century, died on March 21, 2021. Dr. Van Soest was born June 30, 1929 and grew up on a dairy farm in Snohomish, Washington. He graduated from Washington State University with a B.S. in Dairy Husbandry in 1951, and a M.S. in 1952. He obtained his Ph.D. from the University of Wisconsin in 1955 and was drafted into the Army where he served as a biochemist at Walter Reed Institute of Research. In 1957, he was hired by Dr. Lane Moore to join the Dairy Cattle Research Branch of the Animal Husbandry Research Division at the USDA-Agriculture Research Service in Beltsville, MD, and was given the mission to develop nutritionally relevant fiber analyses that would replace crude fiber (CF). In 1968, he joined the Animal Science Department at Cornell University, where he spent the remainder of his distinguished career as a scientist, teacher and cherished personality.

## Van Soest – The Scientist and Creative Thinker

Although its deficiencies were well known, CF had been used since the 1860s, and replacing it was no simple challenge. Dr. Van Soest initially focused on the measurement of lignin, the indigestible component of fiber. Nitrogen and hemicellulose contamination of lignin was a serious problem, and he used acid and detergents to remove them. This led to the acid detergent fiber (ADF) method, which was a preparatory step for the measurement of acid detergent lignin. His ADF method became the replacement for CF very quickly. His paper (Van Soest, 1963b) became a Citation Classic in April 1979 with 345 citations (it has many more now). In the Citation, Peter indicated that Dr. Lane Moore was certain that fiber was a crucial component in feeds, and that, “Without Lane Moore’s faith and support of my work, the story of fiber may well have turned out differently.” When explaining this work he stated “In developing my work on fiber it appeared that the central problem was the convenient separation of plant protein from lignin, both of which are alkali soluble. To solve this problem, I explored the ability of various kinds of detergents to remove protein . . . .” In another article, he remembered his work in the Army using chelating dyes to detect traces of minerals. He thought that perhaps the binding properties of detergents would change the way constituents could be dissolved from forages. This resulted in a revolutionary change in fiber analysis that did not evolve from anything previously done. A great mind at work!

Dr. Van Soest knew that ADF was not a measure of total fiber and created the neutral detergent fiber (NDF) method as an estimate of plant cell walls and a measure of total insoluble fiber in feeds and foods. His next Citation Classic (June 1992) was for the original NDF method (Van Soest and Wine 1967), his development of a comprehensive system of feed evaluation (Van Soest, 1967), and the first edition of his book (Van Soest 1982), Science Citation Index indicated that his book had 730 citations at the time, and the two papers had 915,320 citations – an incredible number. I wonder if the latter number was Peter’s total lifetime citations in 1992 because the Citation stated “These publications represent the developments of a lifetime. Originating with improved methods for the analysis of dietary fibers, the methods have been widely applied in agronomy, ruminant, nonruminant and human nutrition, and the forage ecology of wild herbivores.” To date, Van Soest et al. (1991) has nearly 25,000 citations, and Goering and Van Soest (1970) has over 14,000 citations (M. B. Hall, pers. comm.). I am sure the number of citations for the 1970 handbook is greatly undercounted because it is cited in so many different ways. Few researchers have a publication with 1,000 citations, yet these publications are only a part of the impact of Peter Van Soest.

Not content with these breakthrough analyses of fiber, Dr. Van Soest focused his efforts on the variable digestibility of fiber and total dry matter in feeds. He was the first to propose that dry matter digestibility was a function of the digestible NDF and digestible neutral detergent soluble matter (Van Soest and Moore, 1965), and that true digestibility could be measured by neutral detergent extraction of in vitro residues (Van Soest, Wine, and Moore, 1966). This in vitro method, developed with input from microbiologist Marvin Bryant at Beltsville, was included in the USDA handbook of analyses (Goering and Van Soest, 1970). He pioneered the concept of true digestibility, ideal nutritive entities, and a

summative equation that are the basis for our current evaluation of available energy in feeds (Van Soest, 1967). He postulated that NDF was the feed component that limited overall digestibility of feeds because it was the component with the greatest variability in true digestibility. These classic papers summarize his thoughts on those important concepts. His most important papers are listed in Appendix 1 (I have added a few to Peter's list). I believe that the papers in bold font should not just be cited, but read by everyone involved in animal nutrition.

Dr. Van Soest started his career trying to accurately isolate lignin, which was thought to define indigestible fiber at the time. He completed the circle of this seminal contribution at the end of his career by demonstrating that lignin was the major fiber component defining indigestible NDF and that lignin prevented other cell wall constituents from being fermented in the rumen. Indigestible NDF, or undigested NDF measured after long fermentation times in vitro, is one of the most important feed components currently used for feed evaluation. His last publication (Van Soest, Robertson, Hall, and Barry; 2020) focused on the unsuitability of Klason lignin for nutritional use.

For his efforts, he received numerous awards, including: American Feed Manufacturers Nutrition Award from American Dairy Science Association (1967); Hoblitzelle National Award in Agriculture (1968); Merit Award of the American Grassland Council (1969); Fellow of the American Institute of Chemists (1970); American Society of Animal Science Award in Nutrition Research (1983); Honorary Research Fellow, Institute of Grassland and Animal Production, UK (1985-92); Farma Foods International Fibre Prize (1991); International Dairy Production Award from American Dairy Science Association (1992); Pioneer Hybrid Forage Award from American Dairy Science Association (1993); Washington State University Distinguished Graduate Award (1995); Fellow of the American Society of Nutritional Sciences (1995); and Morrison Award American Society of Animal Science (2001). In 1992, he received an honorary Doctor of Science in Animal Production from the University of Milan.

What set Peter Van Soest apart was that he was a thinker and a creator of new ideas. I have met several people who thought they were geniuses because they knew things, but they had little to no understanding or wisdom. Peter was a true genius who not only knew, but also understood, and he understood so well that he could explain the most complicated concepts to the rest of us. Dr. Van Soest had a seemingly insatiable curiosity and the passion to learn, in great detail, about that which interested him – ranging from music, to languages, to architecture, to the influence of wild flowers in Sicily imparting flavors to cheeses (B. Mahanna, pers. com.). But he always wanted more than to know; he wanted to understand the how and the why. In my opinion this is what distinguished him from most other scientists. He was a deep and determined thinker about what he observed and learned. He also wanted to understand the history of a subject and would typically trace an idea to its origin, sometimes in the native language of the authors!

In the wee hours of the morning, we graduate students would often discuss what made Peter so different. His brilliance was easily recognized by anyone who spent 30 minutes with him. But how did he know and remember so much information, how could

he explain things so clearly, and how could he easily jump from one thought to the next so effortlessly and describe connections that we never expected? It was my opinion that everything he knew and understood was interconnected in a mental model that started with a big overall picture and progressed to the smallest detail. He also connected aspects of one subject to another (translational thinking). But there were no random (unexplained) or extraneous bits of information in his mind. He never got lost in details. He formed his own opinion about everything he read and added it to his mental model if it aided his understanding. If after careful review, the information made no sense he discarded it, typically after finding the “fatal flaw” in the paper. He constantly tested the limitations of his understanding.

Dr. Van Soest’s philosophy of science can be stated in his own words.

- “The danger facing the progress of nutritional research is the advancement of ***inadequate theories*** and methods by persons who are too anxious to produce a practical test without fully ***examining the limitations of their point of view***” (Van Soest, 1964).
- “. . . . a ***comprehensive theory*** regarding the availability of the dry matter of forages. . . .The ***principle*** upon which the ***new system*** is founded is that the dry matter of forages may be divided into a readily available soluble fraction and a fibrous fraction of partial availability” (Van Soest and Moore, 1965).
- “Progress in forage research, as in any science, is dependent on ***basic knowledge which leads to understanding true relationships***” (Van Soest, 1967).

The italics are mine, but you can see that Peter thought in terms of comprehensive theories developed from basic knowledge that led to understanding of true relationships, and in critical examination of his and other’s points of view. Peter practiced mental meta-analysis! He had little respect for those who only wanted to know, got stuck on small details, and did not expend the effort to comprehend and understand.

He also gave little credence in using statistics to tell you what the data meant. You had better have your understanding of relationships and hypothesis in place before you did statistical analysis. “One must conclude that the size of correlation is an inefficient tool for discerning basic relationships . . . .” (Van Soest, 1967). Although I cannot find the direct quotes, there are other comments Peter made in which he indicated that the sign and magnitude of regression coefficients must make sense (fit a mental model) for a statistical relationship to be an acceptable reflection of reality. He also was very suspicious of multiple regression for interpreting data because he felt that interactions often made the results uninterpretable. Thinking first, statistics later!

### **Van Soest – The Teacher**

As great as he was as a scientist, Peter Van Soest was also a consummate teacher and mentor – he loved to teach at every opportunity. Innumerable students benefited from his knowledge and ability to explain complicated concepts in ways that made them easy to understand. Thanks to Mike Van Amburgh and others, he was still informally teaching

graduate students at Cornell in his 90<sup>th</sup> year! His textbook, “Nutritional Ecology of the Ruminant,” is and will remain the definitive work on the concepts of digestion and metabolism, physiological relationships, feed characteristics, and feed evaluation principles that are crucial to our current understanding of ruminant and herbivore nutrition. His broad knowledge and deep understanding about the chemistry of feeds and principles of animal nutrition were inspiring. At times, his knowledge of chemistry could be daunting – he not only understood the basis for the periodic table, he could explain it to you! He was dedicated to helping his students and colleagues understand concepts and their applications to nutrition.

He taught by example, by experience, by questioning, by informal discussions (often after hours) and by lectures. I think he derived great satisfaction in sharing his knowledge and thoughts, and in seeing the light come on in the minds of those around him. I also believe that he enjoyed, if not needed, company to stimulate his thinking. There were so many carefully intertwined thoughts in his mind, that you never quite knew where the discussion or lecture was going to go. That was the fascination and excitement, you just knew that a conversation with Peter was going to be informative and would broaden your horizons.

This leads to two stories about the “teaching” relationship between my future wife, Carolyn, and Peter. I took Carolyn to a party at Peter’s home and noticed that they had a discussion. On the way back to her apartment, Carolyn said to please not leave her alone with Peter in the future because his intelligence was intimidating, and she didn’t want to say or ask something stupid. She had mentioned eating oatmeal and got a lecture on fiber! I told her that Peter never felt a question was stupid as long as you were interested and wanted to understand.

At the next party, she reminded me to stay close by. I did my best, but I briefly left the room and when I returned there was no Carolyn or Peter in sight. I finally found them touring Peter’s back yard. They seemed to be getting along so I decided that discretion was the better part of valor. Later, I asked Carolyn how it went, and she said, “I now understand why you admire and respect him so. I made a comment about a large stone in a flowerbed and Peter told me that it was millions, maybe billions, of years old and came from the bed rock of the earth’s crust up in Canada. He then described how it was shaped and delivered by glaciers. Next, he told me what elements and chemicals it was made of and how it was formed. I also made a comment about a flower and Peter then described the pigments, and their synthesis and purpose in the plant. It was all interesting and fascinating.” Peter had another convert, and they became good friends!

Another memorable event with Peter happened in Sicily. Peter and I were among the speakers and, on this occasion, Carolyn came to the conference with me. I asked her if she would like to attend Peter’s presentation and she said yes, but wondered if she would understand it. As I recall, it was an interesting talk about fiber and how it was digested by ruminants and other herbivores. She enjoyed it immensely and told me that she was happy that she understood most of it. After the talk, Peter asked us to take a walk around Ragusa. I was reticent, but Peter insisted. What an afternoon it turned out to

be, we got a personal tour by an astounding guide who described the geology of the city, its history and architecture, and the artwork in the many churches and chapels. Peter's knowledge was amazing and he wanted to teach us what he knew. It is a memory of him that we will both cherish.

As a teacher he was engaging, motivating, inspiring, passionate, and incredibly thought provoking. He wanted you to know and understand what he was presenting, and he had a knack for making the complex seem simple and attainable. But occasionally, he would go off-script. I took his graduate course the second time he taught it. He had developed a set of notes and I soon discovered that we had talked about everything in the course during our discussions in the lab and often much more. Occasionally, Peter would start thinking during a lecture and end up several concepts away from where he had planned. The students would typically stop by my office to have me explain what happened during the lecture. This taught me two things: you never know a subject until you try to explain it to someone and there is great personal satisfaction in teaching.

### **Van Soest – The Unique Person and Character**

Dr. Van Soest was a one-of-a-kind scientist and professor, but he was also a unique individual with a myriad of interests – a modern renaissance man. His curiosity knew few bounds and he had the passion and intellect to pursue whatever interested him. He could not only discuss the characteristics of the rare earth elements and the modeling of carbohydrate digestion and passage, but he could also describe the chemistry of plant pigments, the ecological interaction of herbivores with plants, the nutrition of zoo animals, the role of fiber in human diets, the heat damaged proteins in breakfast cereals, the nutrition of donkeys and elephants, and the evolutionary development of digestion in dinosaurs. In addition, Peter loved classical music (see his daughter, Anne's, comments in Appendix 2), geology, art, and history. What a treat for a dairy farm boy from Missouri, whose music background involved pickup trucks, honky tonks, and broken hearts, to listen to classical music from an incredible stereo system and have his major professor describe who wrote the piece, who their patron was, why the piece was composed the way it was, and the history of the era in which it was written. Wow! He was also a connoisseur of wild mushrooms and single malt whiskey, and loved to cook ethnic foods and curries. It was always informative and entertaining to have a conversation with Peter, and they invariably would involve a "teachable" moment.

Some years ago, I bought an expensive bottle of scotch for Peter. Naturally, I did not buy his favorite style. So, he got several partially empty bottles from his cabinet and arranged them in order. We sipped each one while he explained their character, the differences in the distilling processes, and location of origin for each. After the lesson, he put the bottles away and we spent the evening and night discussing his latest thoughts. I stayed overnight and was given three papers to read so that we could discuss them in the morning. Ever the teacher, ever the graduate student!

Peter was certainly a memorable character. He was at times socially awkward or unaware, but he was always approachable, even engaging. He could talk to anyone from a farmer to a renowned colleague and communicate in a language that each could understand. His style of dress was unusual, if not eclectic, and I never knew if this was a conscious decision, a tweaking of social conventions, or if the denim jacket was just comfortable! Peter was somewhat unassuming and never pretentious or presumptuous. For most of my life, I called him Dr. Van Soest. I was taught to respect your elders and give honor to those who deserved it. I never felt his equal and respected the work he did to become an esteemed scientist, scholar, and professor. Eventually, he became aggravated with me and demanded that I called him Peter. Even though he was a dear friend to many of us, at times, it still feels awkward for me to call him Peter or Pete.

Peter detested mindless bureaucrats and administrators, and meaningless rules and paperwork. If you couldn't defend your policies and ideas, he had little respect for your position and loved to thwart silly rules. Lane Moore at Beltsville "protected" his scientists, especially Peter because he was so different. When Peter was engrossed in an idea, he might spend 16 hours working and then rest on a cot in his office before getting back to work. After several days of intense work, Peter would go home and rest for a few days. But federal scientists still had to fill out a timesheet indicating that they worked 8 hours each day (brain ON at 8am and brain OFF at 4:30pm)! A secretary began tracking Peter to document where he was. Peter learned that she was afraid of rodents, so he promptly got a pet white rat, named Fritz, that he kept in his lab coat pocket so she wouldn't bother him in the lab. He would release Fritz into his office when he was away to keep her out of it as well. When he moved to Cornell, they found some "do not staple, bend or mutilate" punch-card paychecks in his office that had been chewed by Fritz and had to be replaced.

At times, Peter had little patience with colleagues that just didn't get it. You had better not be superficial or absorbed in your own ideas without inspecting their limitations. He could get very animated and was willing to debate anyone at any time. While he may have conceded some small points, he never lost an argument on the bigger picture. I would never bet against him in a scientific argument! He often put more thought into a competitor's idea than the originator. He was that thorough in his thinking.

But Peter was perhaps most known for his enormous powers of concentration. Because of this he was the epitome of the absent-minded professor. We graduate students joked that, when Peter was thinking about something, Morrison Hall could explode and he wouldn't notice unless someone told him! His ability to block everything out and focus all of his mind on one thing until he figured it out was phenomenal. We were all envious and wished we had a fraction of his ability. But his concentration and focus did lead to some interesting situations. One day, Peter stopped by my office grumbling that he had to walk home in the rain because he forgot his umbrella. Fifteen minutes later, Mrs. Van Soest was looking for him and I told her that he had left to walk home in the rain. She said, "But he just called 20 minutes ago and asked me to pick him up!"



The last story involves a professor of mine from Missouri (Dr. Fred Martz) who came for a sabbatical with Peter. We shared an office and I told him about the many rare reprints, copies and papers I had organized for Peter when his office got too cluttered. So, Dr. Martz asked if he could review and copy some of the materials. He collected quite a stack of material on his desk, and asked Peter to show him where the copy machine was. I had alerted Dr. Martz that Peter's secretary had strict bounds on what she would do (copy) for anyone other than "her" professors. One day Dr. Martz asked Peter again to show him where the copier was. Dr. Martz picked up a portion of the papers and he followed Peter to the third-floor elevator. They went down to the basement where the copy machine was, and walked past it, to the door at the end of the hallway. Then they went outside, up the street and turned down Tower Road. At this point Dr. Martz said, "No wonder your secretary doesn't like to copy things, this is quite a hike." To which Peter replied, "Oh, I forgot where we were going." Dr. Martz wondered where they would have ended up, if he hadn't said something. I remarked, "I have no idea, but it would have been an interesting journey!" How could you not love and enjoy a person like that?

### **Conclusions**

We will mourn the loss of a great scientist, teacher, mentor and friend, but our sadness is diminished by our appreciation of a life well-lived. It is impossible to contemplate what the current state of herbivore nutrition, feed evaluation, forage improvement and the ecology of plant-animal interactions would be without the efforts of Peter J. Van Soest. For those who knew him, he will be remembered for his awesome intellect, the intensity of his curiosity, the power of his concentration, his passion for scientific understanding, and his ability to share his knowledge and understanding with others.

On behalf of all of us, I want to thank his family for the sacrifices they must have made to allow Peter to become the great scientist that he was, and for sharing his time with us. It can be said that the value of a person is in the problems they solved, the friends they advised, and the family they left behind. Without a doubt, Peter was priceless!

### **Acknowledgments**

Thanks to Carolyn, my daughter Christa Evans, Nicole Schlau, and Bill Mahanna for proofreading and suggesting comments, to Mary Beth Hall for edits and corrections of my original memorial, to Mike Barry for transcribing Peter's autobiography and providing a list of his papers that Peter thought were important (Appendix 1), to his daughter, Anne Van Soest, for clarifying his musical forays (Appendix 2), and to our Italian colleagues for allowing me to reprint their tribute to Peter (Appendix 3).

### **References**

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## Appendix 1 (My comments in italics)

### Interesting early papers by P. J. Van Soest

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- Van Soest, P. J. 1963. Ruminant fat metabolism with particular reference to factors affecting low milk fat and feed efficiency. A review. *J. of Dairy Sci.* 46: 204-216. *Peter's first review paper – a classic paper demonstrating his approach to scientific understanding*

### Important Papers and Books by P. J. Van Soest

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## Appendix 2

### Comments from Peter's daughter, Anne Van Soest, to clarify his forays into music

"Peter was an accomplished musicologist and music historian. He taught himself the recorder and he collected and played all instruments in the recorder family (bass, tenor, alto, soprano, sopranino and even the Garklen-Flotlein). It was impossible for him to play the latter as it was only 6 inches long and his fingers were too big. His favorites were the alto and bass. There are some lovely photos of him playing the bass in the lab as a young man. He was particularly fond of the recorder concertos by George Frederick Handel which he practiced at the family home.

In terms of ensembles, Peter organized a group at his church in Washington and again at the episcopal church at Cornell. He wrote, arranged and conducted music for whatever musicians were available. The period of music was baroque and renaissance. Peter was adept at arranging parts for the available instruments as well as the player's ability. He was keenly aware of fingerings and/or string crossings so as to avoid awkward or unplayable passages. These were not just transcriptions but artful arrangements. At

the height of the group's heyday in the early 70's the group played various Terpsichore dances by Michael Praetorius.

He had a lifelong love of music and art, which he instilled in his children. The family can recall many listening sessions on his audiophile quality hi-fi system. His favorite composer was Franz Joseph (aka Papa) Hayden, who is often referred to as the father of the symphony and the string quartet. I think Peter saw Hayden as a kindred spirit because of his groundbreaking innovations in the world of classical music.

Just moments before he left us for the last time just after 8:00am on Sunday, I played for him Hayden's string quartets known as "the sun" opus 20 no. 4-6. It cannot be overlooked that Peter died on Johan Sebastian Bach's 336th birthday. Bach was another favorite of Peter's due to Bach's mathematical and artful genius in counterpoint, canon and fugue."

### **Appendix 3 Memoriam by Italian Colleagues**

Peter J. Van Soest, one of the greatest scientists ever in animal nutrition, left us. He changed the way of looking at feeds, fiber and its analysis, ruminants and their nutrition and ecology and who determined a turning point in the study of ruminants, bringing it to the level of great science compared to a previous prevailing empiricism. However, our intent is not to summarize his career, his studies, his discoveries; they are too many and would distract us from the man and scientist that he was.

Capable of furious battles with some colleagues whose ideas, but even more the scientific spirit, he did not share, he was always available to motivate young people, whether they were his students or not, and found ways to make them feel important and stimulate their scientific curiosity. He transmitted in a simple way, that sometimes could appear naive, his immense intelligence and passion for knowledge, his availability and human generosity and his will to study and explore science always in a free and critical way.

He was an eclectic and highly cultured man, a master of animal science, ancient music, art, ethnic cuisine and much more. It was hard not to love him, as you can only love a dear relative, for those who had the opportunity to know him well and be close to him. His numerous students scattered all over the world and all those who had the chance to meet him, even occasionally, by listening to a lecture at a conference or a chat with breeders (whom he loved and by whom he was loved), have a very dear memory of him, clearly visible from the moved and not formal participation that his death has aroused all over the world.

As Italian scientific community we are particularly grateful to him. Many researchers, professionals and breeders had the good fortune to know him personally during his many visits to Italy, where he was at home, albeit his second home, and where, perhaps for this reason, he left a very strong scientific imprint. Italy has recognized his

greatness conferring him an Honorary Degree (Laurea Honoris Causa) of the University of Milan and the honorary citizenship of the city of Ragusa, in Sicily. Many Italians have also had the opportunity to study with him at Cornell University. Even a few months in his laboratories, following his courses and participating in his jovial after hours, were enough to understand, amazed, his greatness and be marked indelibly.

In reality, we are all a little bit his students. Even those who did not know him personally, have certainly breathed deeply his thought and research in their university studies at all levels, in their research or technical activities.

We therefore say goodbye to him, as Italian scientific community of animal science, with great emotion, comforted by the thought that his human and scientific legacy will keep his memory vivid forever.

Antonello Cannas  
Stefania Carpino  
Giuseppe Licitra