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Rheology Bulletin

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A photo taken by Monty Shaw of a bench in Christ Church Cemetery, Philadelphia, Pennsylvania USA. Monty's comment: "Amazing what can happen in 250 years." (His estimate, based on nearby tombstones.)

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Bingham Medalist 2011: Eric Shaqfeh

Profile by Ron Larson, Susan Muller, Bamim Khomami

Eric S. G. Shaqfeh received his B.S.E. degree in chemical engineering in 1981 from Princeton University (summa cum laude) and an M.S. (1982) and Ph.D. (1986) from Stanford University, where his dissertation research on buoyancy-driven convective flow was supervised by Andy Acrivos. Following a postdoctoral year at the University of Cambridge working with G. K. Batchelor and E. J. Hinch, Eric joined AT&T Bell Laboratories (Murray Hill, NJ USA) as a member of technical staff in 1987. Eric moved to academia in 1990 joining the faculty at Stanford University and rising to full professor in 1999. Among various awards Eric has received the NSF Presidential Young Investigator award (1990), the Camille and Henry Dreyfus Teacher-Scholar Award (1994), and the ASEE Curtix W. McGraw Research Award (1998), as well as numerous honorary lectureship positions. Eric is a fellow of the American Physical Society, associate editor of *Physics of Fluids*, and on the editorial board of three other journals.

When Eric began his research career at AT&T Bell Laboratories, his research was in theoretical fluid mechanics and suspension mechanics. Since that time, the scope of his research interests has steadily expanded, first to combined experimental and theoretical suspension rheology, then to viscoelastic fluid mechanics and stability theory, to the dynamics of dilute flexible polymers, and now to entangled polymer dynamics, polymer turbulent drag reduction, polymer biophysics, and even blood rheology .

Eric is particularly well known to the rheological community for his body of theories of transport in suspensions of rods, including non-local interactions. This work was responsible to a significant degree for his being awarded the Frenkiel Award of the American Physical Society for research in fluid mechanics by a young researcher. A particularly important contribution in this area is Eric's analysis, with Glenn Fredrickson, of hydrodynamic interactions in fiber suspensions using slender body theory. This work marked a milestone of rigor in this important area, extending the work of Batchelor, and allowing for calculation of effective rotational diffusivities in non-Brownian suspensions resulting from multi-body hydrodynamic interactions. He and his group also produced a beautiful theory, with supporting experiments, on stochastic dynamics of flow through a fixed bed, including the effects on polymer dynamics of such flows. Eric has continued his work on suspension dynamics up to the present, with his recent studies of sedimentation dynamics of colloids, and his rigorous treatment, with Jason Butler, of the hydrodynamics of beadrod chains.

While still at Bell Labs, Eric began writing a series of papers on dynamics and fluid mechanics of dilute polymer solutions. His work in these areas began with a collaborative study of purely elastic instabilities in polymeric fluids, including work co-authored with Susan Muller and Ron Larson on the Taylor-Couette instability, and continued in his own group with analyses of purely elastic instabilities in the Taylor-Dean flow, eccentric cylinder flow, and continuing with analysis of the effects of inertia. He also produced the most significant body of work world-wide on Brownian dynamics simulations of flexible polymers, eventually collaborating with Steve Chu to perform wonderfully elegant and important experiments on long DNA molecules in various flows, including extensional, shear, and mixed flows. In an experimental tour de force, Eric and coworkers were able to create a mixed flow in which real-time microscopic observation of a single stained DNA molecule could be achieved. This work showed the transitions between polymer stretching and tumbling present in such flows, and, when combined with Brownian dynamics simulations, provided an essentially complete experimental and theoretical understanding of the molecular dynamics of dilute flexible polymers in general velocity gradients. Even more spectacular was Eric's work with Steve Chu on extensional flows of super-long (1 mm long) DNA molecules. These studies confirmed the prediction made long ago by de Gennes that long polymers should show quasi-hysteresis in plots of chain stretch versus extension rate. That is, there should be two quasi steady-state values of polymer stretch at each value of extension rate, for a range of extension rates near the critical value for a "coil-stretch transition." This prediction has beautiful analogies to phase co-existence in thermodynamics,

where the coiled and stretched states are the two "co-existing phases," and there are "nucleation" events required to transit from one state to the other. Not only did Eric and his colleagues finally perform the definitive experiment on this topic (published in *Science*), but Eric's group followed this up with a comprehensive theoretical and computational analysis that included predictions of magnitude of the hysteresis, the time scales required for barrier hopping between coiled and stretched states, and the development of computationally cheap coarse-grained dumbbell models that capture the behavior of the much more sophisticated fine-grained models. This body of work, on its own, qualifies Eric as one of the pre-eminent molecular rheologists in the world.

Another very important rheological contribution by Eric Shaqfeh is the development of a greatly enhanced understanding of the mechanisms of polymer drag reduction. In this work, Eric's group carried out direct numerical simulation (DNS) of turbulent flows of viscoelastic fluids and determined the structures of drag-reduced turbulence for both flexible and rigid polymers and particles. In some of the most comprehensive and insightful DNS studies of full turbulence yet, Eric developed insights into the differences between modest and maximal drag reduction and the importance of biaxial extensional velocity gradients in the drag-reduction mechanism.

Eric has recently developed a powerful experimental program in the area of dynamics of entangled flexible polymers, again using stained DNA molecules and elegant flow geometries to directly visualize the relevant polymer dynamics. In his earliest work, he discovered, among other things, a new relaxation time in the relaxation dynamics of entangled polymers under flow, which was apparently not anticipated in any existing theory in this field. Very recently, Eric and his group have used so-called "slip link" simulations to explain one of the major mysteries of extensional rheology of entangled polymers, namely the -1/2 power-law extension-thinning regime seen at extension rates above the inverse reptation time by Ole Hassager and coworkers. Eric's work indicates that this regime results from flow-induced disentanglement of polymer chains, an idea much discussed, but never convincingly demonstrated theoretically or computationally. This break-through illustrates the speed with which Eric is able to move to the forefront of a deep, well-studied, and complex area.

Eric's recent computational work is on margination of platelets in circulating blood flow. Eric's group is using advanced computational methods to track red blood cells under flow through a capillary, including their shape deformations, their hydrodynamic interactions, their migration across the capillary, and their effect on other blood components, specifically platelets. These remarkable simulations have set a new standard in computational rheology, demonstrating that rigorous simulations are now possible even for fluids as complex as blood. Eric's findings correlate well with experimental data and provide deep insights into platelet transport, with implications for wound healing.

As should be evident from the above account, not only is Eric a deeply insightful researcher, but also an excellent and valued collaborator. Outside of research, Eric is also an excellent organizer and manager. He emerged as the leader of the Stanford team in the DARPA-sponsored drag reduction research program, managing 5-10 faculty and students in a complex project involving experiments and simulations of phenomena ranging in scale from molecular to ocean-going vessels.

Eric is a devoted family man, sharing his life with his wife Terhilda Garrido and their children Stefan and

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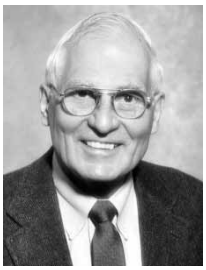
Shaqfeh and his 2011 research group, left to right: Vivek Narsimhan, Arash Abedijaberi, Andrew Spann, Sourav Padhy, Hong Zhao, Shenghan Yan, Shirin Ghaffari, David Richter, Amit Kushwaha, Eric Shaqfeh, Travis Walker, Shikha Somani, Byunghang Ha, Guihua Yu.

2011 Metzner Early Career Award: Richard Graham

Dr. Richard Graham has been chosen to receive the *2011 Arthur B. Metzner Early Career Award*, which is given to a member of the Society who is younger than 35 who has distinguished him/herself in rheological research, rheological practice, or service to rheology.

In choosing Graham for the Metzner award, the Committee cited his work in developing the most advanced non-linear theory of entangled polymer dynamics and rheology ever produced, as well as his work with experimental physicists and with chemists in developing his theoretical advances all the way into a unique "Neutron Flow Mapping" technique that resulted in a multi-author paper in Science in 2003, and in a series of publications in top journals since then.

Richard Graham is a lecturer in the School of Mathematical Sciences, University of Nottingham, UK. His first degree, awarded in 1999, was in Theoretical Physics from the University of Leeds. His PhD, also from the University of Leeds, was supervised by Tom McLeish and Oliver Harlen and was completed in 2002. McLeish describes Graham as "one of the most able, imaginative, and transformative students I have ever supervised." In his thesis work Graham developed new non-linear flow models of entangled polymers and validated his models' predictive capabilities against stress measurements and neutron scattering data. This comparison addressed several long-standing questions on entangled chain dynamics. Much of this experimental support was provided by the Micro Polymer processing project, and Graham took a key theoretical role in the project's 2003 flagship paper in *Science*. Graham was awarded the Vernon Harris Doctorial prize by British Society of Rheology in 2004 and co-authored the article that received the *Journal of Rheology* Publication Award in 2005.



Following his studies at Leeds, Graham did post-doctoral work with Ron Larson at the University of Michigan (USA). At Michigan Graham uncovered wide-ranging analogies between DNA electrophoresis and rheology. He recently proposed and validated the mechanism by which oscillating electric fields stretch entangled DNA.

In 2005, Richard returned to Leeds to work with Peter Olmsted on flow-induced crystallisation in polymers. This extremely challenging field impacts strongly on both fundamental and industrial rheology. His recently derived molecular model was able to quantitatively capture nucleation measurements during flow, as described in articles in *Physical Review Letters* and the *Faraday Discussion Journal*. Graham continues to pursue global collaborations in this area and has attracted UK funding to build a group around his research program.

In 2007 Graham gained a permanent position at the University of Nottingham. In addition to his core rheological research, Graham is applying his skills in molecular simulation, learnt in rheological modelling, to solve a key problems in the viability of carbon capture and storage. His current position also involves undergraduate teaching, PhD supervision and student mentoring. He leads several schemes assisting undergraduates into PhDs, including the School's undergraduate internship program. Richard Graham is the third recepient of the *SOR Metzner Early Career Award*.

The *SOR Early Career Award*, established in 2009, was named for Art Metzner, distinguished rheologist, university professor, editor of the *Journal of Rheology*, and Bingham medalist.

Come to Cleveland!

83rd Annual Meeting of The Society of Rheology Cleveland, Ohio USA 9-13 October 2011

The Society of Rheology will host its 83rd Annual Meeting in Cleveland, Ohio, 9-13 October 2011. The technical program will take place in the modern InterContinental Cleveland, just minutes from Case Western Reserve University, the Cleveland Clinic, and downtown Cleveland. The meeting is being held in the University Circle area, a neighborhood that boasts more than 50 scholarly institutions ranging from the beautiful Cleveland Botanical Garden to the Cleveland Museum of Art. SOR attendees will find something for everyone should they want to escape momentarily from the technical sessions.

For the evenings, an exciting social program is planned and is designed to give attendees and their significant others a fun and intellectually stimulating experience.

Cleveland is easy to get to, with Cleveland Hopkins International Airport hosting most major airlines and serving as a hub for Continental Airlines. From the airport, you will be able to take a quick cab or cost-effective train to the Intercontinental Hotel and Conference Center. Octobers in Cleveland are beautiful with the onset of autumn and associated foliage color changes, temperatures hovering the "nippy" range of 50-55 °F (10 – 13 °C), so plan to bring sweaters and jackets. For more information, visit *www.positivelycleveland.com*.

Photo courtesy of (c)www.positivelycleveland.com

Conference registration (ranging from members, early $140 to non-members, late $280; see *www.rheology.org/sor/annual_meeting/2011Oct/*) includes access to all technical sessions and the vendor display, program and abstract booklets, and all receptions and coffee breaks. On-site registration will be held on Sunday, October 9th from 3pm to 7pm and throughout the meeting in the Lobby Foyer of the InterContinental Cleveland.

All attendees are encouraged to attend the annual business meeting of The Society of Rheology. This year the business meeting will be held during the lunch break on Monday, October 10th. This meeting will start at approximately 12:15 pm immediately following the morning technical session and will be held in Room 207. Boxed lunches will be provided.

The Bingham Award Reception and Banquet in honor of 2011 Medalist Eric Shaqfeh will be held on Tuesday, October 11th, in the Terrace Club of Progressive Field – home to the Cleveland Indians baseball team. The reception will beginning at 7pm in the adjacent Terrace Club Pub. The reception will be followed immediately by the Bingham Award Banquet at 8pm in the Terrace Club. This exciting location will provide a unique visual experience while dining with friends, old and new. The reception is open to all meeting participants at no extra charge. Banquet tickets can be purchased with the meeting registration. More information about the meeting may be found at *www.rheology.org/sor/annual_meeting/2011Oct/*.

We look forward to welcoming you to Cleveland!

Pat Mather, Local Arrangements Chair

Course on Rheology of High-Interface Systems

The Cleveland meeting will be preceded by a two-day short course on the rheology of high-interface systems. This course is aimed at the rheology and structure of foams, emulsions, and blends as well as the rheology of interface-dominated systems from biology where the behavior of phospholipid monolayers and bilayers control the mechanical response of lung surfactants, cells, and vesicles. Registration for the short course may be completed online after June 15 (*www.rheology.org/sor/short_course/2011Oct/default.htm#Registration*).

The short course instructors are **Gerald G. Fuller** (Stanford University, USA), **Jan Vermant** (Katholieke University Leuven, Belgium), and **Andy Kraynik** (Sandia Laboratories, USA, retired). Gerry Fuller has conducted research in the areas of optical rheometry and interfacial rheometry for more than 30 years. Jan Vermant's research focuses on bulk and interfacial rheology and relations to flow-induced structures in complex fluids and interfaces, particularly for colloidal dispersions. Andy Kraynik has been involved in research on liquid and solid foams with emphasis on a microrheological point of view since 1976.

Course Outline: *Saturday Morning (all instructors)*
The syllabus begins with a presentation of capillarity and wetting. The concepts of surface tension, wetting, contact angles, and capillary forces are discussed. The Young-Laplace equations are developed and the stresses imposed by curved interfaces are predicted. Marangoni stresses arising from surface tension gradients are described. The molecular structure of surfactants, amphiphilic polymers, and proteins are described and their manner of attachment to fluid interfaces is explained. The attachment of colloidal particles to interfaces is also described. The phase behavior of complex fluid interfaces is explored along with the techniques to measure them. These include Langmuir troughs and Wilhelmy balances, Brewster angle and fluorescence microscopies, pendant drop, and du Nouy tensiometers.

Saturday Afternoon (Kraynik)
Foams are complex fluids in which gas bubbles are dispersed in a small amount of liquid. Applications include foods and beverages, froth flotation, petroleum production, fire fighting, and polymer foam processing. Foams exhibit a wide range of rheological properties (shear modulus, yield stress, non-Newtonian shear viscosity, slip at the wall, and expansion viscosity) that strongly depend on their microstructure (cell size and liquid fraction), which can evolve by various mechanisms (foam expansion, diffusive coarsening, and foam drainage). Techniques for characterizing foam structure and measuring foam rheology will be reviewed. Models of foam structure ranging in complexity from the regular honeycomb in two dimensions to random polydisperse foams in three dimensions will be discussed. The connection between macroscopic foam properties and cell-level structure and flow mechanisms will be illustrated with many examples.

Sunday Morning (Fuller)
The rheology of emulsions and blends depends on the interfaces (composition, deformation and orientation) that divide the dispersed and continuous liquid phases. Morphological processes, such as deformation, different types of break-up and coalescence will cause the interfacial contributions to the rheological behavior to depend on the flow conditions and history. The base case of immiscible mixtures with Newtonian components will be reviewed first. The evolution of the rheological properties in combination with *in-situ* observations of the microstructure will be compared to the predictions of continuum models. The effects of a presence of interfacial agents and the role of their interfacial rheology will subsequently be addressed. Both systems compatibilized by surfactants and block-copolymers, as well as particle stabilized systems (Pickering systems) will be addressed. It will be discussed how the morphological processes which control the rheological properties are altered by the presence of interfacial agents.

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WARDMAN PARK HOTEL
WASHINGTON, D.C.

Management
United Realties, Inc.

WARDMAN PARK HOTEL
WASHINGTON, D.C.

CARLTON HOTEL
WASHINGTON, D.C.

1929

The Society of Rheology
Constitution and By-Laws

Constitution.

Article I

The Name of this organization shall be the Society of Rheology

Article II

The object of this society shall be the advancement of Rheology and its applications. Rheology is here defined as the science of the deformation and flow of matter. The object shall be promoted (a) by meetings (b) by the publication of a journal designed to increase & disseminate knowledge of rheology (c) by other appropriate means.

The original constitution of The Society of Rheology is preserved in the collections of the Niels Bohr Library and Archives of the American Institute of Physics in College Park, Maryland, USA. Handwritten on the stationary of the Wardman Park Hotel, which is now a Marriott hotel, this document lists the objective of the society as the "advancement of Rheology and its applications." The Wardman has been restored and remains one of the grand hotels of Washington, D.C.

Joachim Meissner

1929 – 2011

Joachim Meissner was born in 1929 in Sehma/Annaberg, a small town in Germany. When he graduated from high school in 1947 there was no longer a single Germany, and he found himself in the then Soviet sector. After a short apprenticeship as an electrician, he moved to Stuttgart, then West Germany, in 1948, with his belongings consisting of three packs of cigarettes. He obtained his doctorate in physics at Stuttgart in 1958 with a thesis on the plasticity of Ni-Co single crystals.

He joined BASF AG, Ludwigshafen, in 1958. The curious melt flow behavior of polyethylene caught his imagination, and two years later he was asked to set up a rheology research laboratory. Joachim made his first international appearance at the 4th International Congress of Rheology, Providence, Rhode Island USA in 1963. His paper on the shear-stress dependence of the flow activation energy of branched polyethylene is still relevant today. He was a notable presence at these conferences for many years after that, in later years accompanied by his wife Lilo.

An early major contribution to rheometry was Joachim's elaborate modification of a Weissenberg Rheogoniometer for the measurement of transient rheological properties of molten polyethylene and viscosity at extremely low shear rates. To this day, no one has matched this remarkable achievement. His most ingenious idea was the rotary clamp for molten polymers, first described in 1969. This inspired the development of a series of ever more elaborate and accurate elongational rheometers, which was the basis for the 1981 Annual Award of the British Society of Rheology to Meissner and his coworkers, Laun, Münstedt, and Wagner. Joachim was always trying to bridge the gap between research and application. A fine example of this is his organization of the IUPAC working party project on "Basic parameters, melt rheology, processing and end-use properties of three similar low density polyethylene samples."

His fruitful cooperation with Prof. Arthur Lodge began during a 1971/1972 stay as Visiting Professor at the Rheology Research Center of the University of Wisconsin. The photo on page 15 shows him listening to Arthur at UW. (Other prominent UW rheologists can also be seen.) This extended visit resulted in the articulation of the Lodge-Meissner relationship relating normal and shear stresses in a step-shear experiment.

In 1974 Meissner was invited to the Swiss Federal Institute of Technology (ETH) in Zürich to take the Chair in Polymer Physics. Joachim created a course of study for material engineers and was instrumental in building up the Materials Science Department to seven professors graduating 40 to 50 material engineers each year by the time of his retirement in 1996. Joachim also found time to organize the Swiss Group of Rheology in 1990.

At the ETH Meissner and his students developed ingenious rheometers for the measurement of the response of melts to biaxial extension. He turned a commercial shear rheometer into a useful device for measuring both normal stress differences, and he showed how interfacial tension in polymer blends can be determined by shear or elongational rheometry. With the ultimate goal of understanding melt fracture in mind, Joachim and his students

Arthur Lodge lecturing to Meissner during Meissner's industrial sabbatical to the Rheology Research Center at the University of Wisconsin, Madison (RRC). Meissner is in the corner, beside John Schrag (glasses). Milard Johnson is in the foreground, nearest the camera. Robert Armstrong and Ole Hassager are together across the table, Hassager in the thin tie. Photo courtesy of the Rheology Resarch Center.

measured velocity profiles in contraction flows, first by Laser-Doppler velocimetry and, more recently, by tracing particles in a flowing polymer melt with video cameras. Whenever he finished an instrument or a chapter of his unfortunately never finished book, he realized that there was a better way to do it and started over again. His famous advice to rheologists was: "Ask the material how it deforms, because only the material knows." After more than 20 years at the ETH, the relationship between Joachim and Switzerland was still a bit like that between Switzerland and Europe: each one being in the center of the other, inseparably interwoven, but somehow unwilling to really fit in, notoriously standing out like a rock of the surge.

His last public appearance was in 2006 at a conference in Wales to honor the career of Arthur Lodge. He is shown in the photograph on page 14 giving a hilarious dinner speech entitled "My Life with Arthur." The text was published in the *Bulletin* of the BSR. Meissner continued to come to his office several times a week until October of 2010 to work on his book. Joachim was a stern taskmaster with his students, but many of them attended his memorial service, and it was obvious that they appreciated his efforts to help prepare them for professional careers. After the memorial service for Joachim his wife Lilo was heard to say: "When you ask where he, a Saxon living in Switzerland, was at home, the answer will be: his real home was truly rheology."

Manfred Wagner
Hans Christian Öttinger
John Dealy

Daniel D. Joseph

1929-2011

Daniel D. Joseph, a world-renowned expert of fluid mechanics for more than four decades, passed away on 24 May 2011 at the University of Minnesota Hospital in Minneapolis. He was Professor Emeritus and Russell J. Penrose Professor Emeritus of Aerospace Engineering and Mechanics at the University of Minnesota.

Dan was born on 26 March 1929 in Chicago, Illinois. He earned an M.A. Degree in Sociology from the University of Chicago in 1950, and during the next several years he worked as a semi-skilled machinist in different factories. Regarding this early experience he once jokingly said: "In those days, I was a flaming radical motivated by some mix of idealism and stupidity. I suppose the gradual realization that there was more stupidity than idealism involved led me to conclude that sociology was not my strong suit. Besides, sociology, unlike engineering, is a subject about which ordinary people think they have expert opinions, leading to a certain lack of respect". Therefore, he went back to school at the Illinois Institute of Technology (IIT), earning his bachelor's degree in mechanical engineering, a master's degree in mechanics, and his Ph.D. degree in mechanical engineering in 1963.

He began his academic career during 1962 as an Assistant Professor of mechanical engineering at the Illinois Institute of Technology (IIT). In 1963, he joined the faculty of the University of Minnesota in the Aerospace Engineering and Mechanics Department as an Assistant Professor where he remained until his retirement in 2009. He became a Full Professor in 1968 and was the Russel J. Penrose Professor from 1991 through 2001, and Regents Professor during 1994-2005. In addition, he was a Distinguished Adjunct Professor of Aerospace and Mechanical Engineering at the University of California, Irvine, and an Honorary Professor at Xi'an Jiaotong University of China. During his illustrious career, he held 10 US patents, was author or coauthor of more than 400 journal articles and 7 books, edited 6 more books, and consulted with various companies including Pillsbury, Gillette, M&M Mars, and many petroleum companies around the world. He was a sought-after speaker at conferences.

At the beginning of his research career, Dan studied various fluid flows in geometries with permeable bounding surfaces. Together with Gorden Beavers, he proposed and experimentally verified a "slip" boundary condition at the interface of a porous medium and a clear fluid, analogous to that in a rarefied gas flow, which is referred to as the Beavers-Joseph boundary condition.

During the late sixties and early seventies, Dan's work was more mathematically oriented. He did research on the stability of fluid motions which led to a pair of well-known monographs, and on the theory of bifurcation which was summarized in a popular textbook on this subject written with G. Ioose. Dan is especially known for these ground-breaking works on the energy theory of stability.

In the late seventies Dan developed an interest in rheology. He advocated an approach for analyzing slow and slowly varying flows in which the flow and constitutive equations for the viscoelastic fluids are perturbed together, independent of viscoelastic models. Together with his co-workers and using his method of domain perturbations for free-surface problems, Dan developed a theory for the Weissenberg effect governing the rise of the free surface in the neighborhood of a rod rotating in a viscoelastic fluid. He also showed how to develop a rheometer based on this phenomenon. During this period of time, Dan, working with his colleagues, classified the equations of viscoelastic fluids and found that the unsteady vorticity equation is hyperbolic, giving rise to waves of vorticity. His research group subsequently solved many problems in which the governing equations involve a "change of type" from region of elliptic to that of hyperbolic, as in transonic flow. He also invented a device to measure the speed of a shear wave in the fluids, and showed that the measured speed correlated with the delayed die swell data, as well as with the tilt angle of sedimenting long particles.

In the eighties, Dan did ground-breaking experimental and theoretical work developing an understanding of the underlying physics of flow-induced particle microstructures in particulate flows. He devised simple experiments to understand the particle-scale mechanisms for these flows and came up with very-simple explanations. For example, he and co-workers noticed that in fluidized suspensions the inertial effects associated with wakes are very important. They noted that particles continuously rearrange, and that in this process "Two local mechanisms are involved: drafting and kissing and tumbling into stable cross-stream arrays. Drafting, kissing and tumbling are rearrangement mechanisms in which one sphere is captured

in the wake of the other. The kissing spheres are aligned with the stream. The streamwise alignment is massively unstable and the kissing spheres tumble into more stable cross-stream pairs of doublets which can aggregate into larger relatively-stable horizontal arrays." Because of Dan, drafting-kissing-tumbling phenomenon has now become one of the standard test cases in the validation of direct numerical simulation techniques for particulate flows. Dan also identified that the particles falling in viscoelastic fluids draft and kiss, but instead of tumbling, they form chains along the streamwise direction.

These photos, supplied by Chris Macosko, were taken at the University of Minnesota rheology short course banquet in June 1993, the year Dan won the Bingham award. Bill Russel, Matt Tirrell and Chris presented Dan with a medal to wear around his neck; a ketchup bottle was attached to the medal in honor of his Bingham award.

Another project that Dan liked greatly was the water-lubricated transport of heavy viscous crude oil, in which the oil travels within a sheath of water along the pipeline, thus reducing the power required for pumping. He explained this technology in anthropomorphic terms "High viscosity liquids are lazy. Low viscosity liquids are the victims of the laziness of high viscosity liquids because they are easy to push around.

Dan realized that experimental tools alone were not sufficient to understand the complex physics underlying particulate flows. He devoted the 1990s to the development of new computational approaches that could provide the details of the particle-level physics of suspension flows. In this effort he led a multi-institution team to develop efficient direct numerical simulation methods that could simulate the time-dependent motion of large number of solid particles for sufficiently long-time durations from which the complex physics of these systems could be analyzed. He used these techniques to develop novel models for the lift force on a particle in dense suspensions, which was a hitherto difficult problem.

In the past decade, Dan worked on what he sometimes called one of his "legacy work". While the viscous effects in an irrotational flow have been assumed to be small, Dan realized that this may not be actually so. Consequently he set out to show that this is not the case for a range of problems, and computed the error that occurs because of this approximation. Many of these results are published in a book which he and his co-authors have recently published. In recent years Dan was intrigued by the problem of dispersion of small particles which disperse violently when they first come in contact with a liquid surface, and was working on the modeling of the coal gasification processes.

The hallmark of Dan's body of work has been to pursue fundamental enquiry (he would say "pick low lying fruit") and to extract practically relevant models that can be useful in engineering practice. This led to broad impact of his work in multiple fields. He was a rare blend of a gifted mathematician and a brilliant engineer. The spectrum of prestigious awards that Dan received is a testimony to this fact. Dan received many awards including membership in three national academies: the National Academy of Engineering, the National Academy of Sciences and the American Academy of Arts and Sciences. He was a Guggenheim Fellow, and was awarded the G.I. Taylor Medal of the Society of Engineering Science, the Timoshenko Medal of the American Society of Mechanical Engineers, the Schlumberger Foundation Award, the Bingham Medal of the Society of Rheology, the Fluid Dynamics Prize of the American Physical Society, Professional Achievement Awards from Illinois Institute of Technology and University of Illinois, and the Distinguished Service Award from the U.S. Army.

Dan was lover of classical music, opera, and the Rolling Stones. In mid life he became a marathon runner. Beside his family, he took pride in the 48 students whom he directed toward a PhD and who are now working throughout the world. The principles of his laboratory were "have some fun, tell the truth, and do good research." After retirement as a Professor, he continued to do research with

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Society Business

NEWS

Society Elections: Report of the Nominating Committee

This year is an election year in The Society of Rheology, and our Constitution/Rules spell out the procedure. The Nominating Committee reported on their nominations, and the membership was informed on 22 April 2011 of their selections, as outlined below.

President: A. Jeffrey Giacomin
Vice-President: Michael Graham
Gregory B. McKenna
Secretary: Albert Co
Treasurer: Montgomery T. Shaw
Editor: John F. Brady
Members-at-Large:
Shelley Anna
Ole Hassager
Chongyoup Kim
Gareth McKinley
Jai Pathak
Norman J. Wagner

Balloting will take place electronically; members in good standing will receive instructions on how to cast their ballots by email. The Constitution specifies that balloting will begin at least 80 days before the annual meeting, and thus for 2011, balloting will begin 21 July 2011 and will end 10 September 2011.

Travel Grants Available for Cleveland 2011

The Society of Rheology is offering student-member travel grants to support the cost of attending its 83rd Annual Meeting in Cleveland, Ohio. These grants are available to any graduate student who is a member in good standing of the Society as of 24 July 2011 and whose faculty advisor is also a member as of that date. In addition, the student must coauthor a paper or present a poster at the meeting, and stay in the official meeting hotel, InterContinental Cleveland. We anticipate that each grant will cover up to a maximum of four nights lodging at the conference rate (sorry, no funds are available for registration or travel costs to and from the meeting). Only students who have not received a travel grant for an SOR meeting in the past are eligible (students who have only received a travel grant for the International Congress of Rheology in the past may apply).

To apply, the student must write a letter requesting the grant; and the student's advisor should add a letter of support, certifying that both the advisor and the student are members of the Society and indicate the title and session of the submitted presentation abstract (or poster) and that the student will be the presenter. Only one application per faculty advisor will be accepted for this meeting. Letters from the student and advisor should be uploaded as ONE PDF file onto:

www.che.udel.edu/SOR-STG-2011

starting 1 June 2011 and by 24 July 2011. Inquiries can be sent to the following e-mail address: SOR-STG@udel.edu.

2011 Roy W. Tess Award in Coatings Announced

Dean C. Webster of North Dakota State University, Department of Coatings and Polymeric Materials will receive the Roy W. Tess Award in Coatings for 2011. The announcement was made by the Officers and the Award Committee of the Division of Polymeric Materials: Science and Engineering (PMSE) of the American Chemical Society.

Dr. Webster began his career in the coatings industry in 1984 working initially in corporate R&D and later for the Consumer Division of Sherwin-Williams in Chicago, IL, where he was involved in resin development for industrial coatings as well as long-range research in new resins and crosslinking chemistry. In 1993 he moved to

Eastman Chemical Company where he led project teams in the areas of application development for new monomers, new chemistry for coatings systems, and polymer development for coatings. In 2001 he joined the Coatings and Polymeric Materials Department of North Dakota State University as Professor.

Dr. Webster received his Ph.D. in Materials Engineering Science at Virginia Polytechnic Institute and State University in 1984. Prior to that, he received his B.S. degree in Chemistry at Virginia Polytechnic Institute and State University.

A New Edition of the Rheology Handbook

The third edition of *The Rheology Handbook* has appeared. The new edition is completely revised and describes the principles of rheology in practical terms. This reference book has been expanded to includ the topic of the rheology of additives in waterborne dispersions and surfactant systems. The new publication covers the areas of quality control, production and application, chemical and mechanical engineering, materials science, industrial research and development.

The Rheology Handbook
3rd Revised Edition by Thomas G. Mezger
ISBN 978-3-86630-864-0, Vincentz Network

Secretary's Report

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Treasurer's Report

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(continued from Short Course, page 11)

Second Afternoon (Vermant)
In many applications, the interfaces themselves respond nonlinearly to deformation and flow. The non-Newtonian rheology of these two-dimensional systems is a consequence of strong interactions and cooperative behavior of molecular amphiphiles and particles residing at the interface. In analogy to their bulk counterparts, two-dimensional polymer melts, gels, liquid crystals, and suspensions can assemble at fluid interfaces and strongly affect the stability and bulk rheology of emulsions, foams, and blends. Interfacial rheology plays an important role in controlling coalescence and Oswalt ripening. The rheology of important classes of complex fluid interfaces is discussed and measurement techniques are discussed. These include interfacial shear and dilatational rheometry and the use of flow-microscopies to image nonlinear interfacial flow responses.

(continued from Bingham Medal, page 4)

Elena. The family enjoys traveling together, having recently taken family trips to Peru, Mexico, Death Valley California, and Greece. Eric has a broad range of non-scientific interests and talents including chess, skiing, golf, and racquetball. Finally, Eric enjoys cooking and good wine, as well as a good joke even when he is the butt of it, often skewering himself with relish. A gathering with Eric is a sure opportunity for fun. A sincere and hearty congratulations to Eric on receiving the Bingham medal this year.

(continued from Dan Joseph, page 17)

his students and colleagues. The funeral and burial were held in Philadelphia, PA on 26 May 2011. Dan was preceded in death by his son, Michael Joseph. He is survived by wife Kathleen Jaglo Joseph, his sons Charles Joseph and Samuel Guillopé Weissler, his daughter Shifra Chana Hendrie, and 13 grandchildren. A memorial is planned for later this fall in Minneapolis. Memorials are preferred to the scholarship fund at the Institute of Technology at the University of Minnesota.

Howard Hu, University of Pennsylvania,
Neelesh Patankar, Northwestern University
Pushpendra Singh, New Jersey Institute of Technology

(Calendar, continued from page 24)

ro2012/)

5-10 August 2012
XVIth International Congress on Rheology, Lisbon, Portugal, João M. Lopes Maia (every four years)

19-24 August 2012
XXIIIrd International Congress of Theoretical and Applied Mechanics ICTAM 2012; Beijing, China (every four years)

2013

9-10 February 2013
SOR Short Course on Rheology (topic TBA), Pasadena, CA USA

10-14 February 2013
84th Annual Meeting of The Society of Rheology, Pasadena, California, USA, John Brady

12-13 October 2013
SOR Short Course on Rheology (topic TBA), Montreal, Quebec, Canada.

13-17 October 2013
85th Annual Meeting of The Society of Rheology, Montreal Quebec Canada, Marie-Claude Heuzey, Paula Wood-Adams.

2014
4-5 October 2014
SOR Short Course on Rheology (topic TBA), Philadelphia, Pennsylvania USA

For other meeting notices, see also
www.rheology.org/sor/info/Other_Meetings.htm
http://www.rheology-esr.org/Meetings.php
www.appliedrheology.org/(click on conferences)

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American Institute of Physics
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Melville, NY 11747-4502 USA

CALENDAR OF RHEOLOGY CONFERENCES AND COURSES

2011

13-15 July 2011
Short course on the *Rheology of Polymers, Dispersions and Gels*, Golden Gate Polymer Forum, Mountain View, CA USA - Christopher Macosko *(www.ggpf.org)*

18-20 July 2011
Short course on *Introduction to Coatings Composition and Specifications*, Missouri S&T Coatings Institute (*coatings.mst.edu/index.html*)

5-9 September 2011
13th European School on Rheology, Leuven, Belgium - Christian Clasen *(cit.kuleuven.be/ltrk/rheoschool/)*

7-9 September 2011
Ibereo2011: Rheology Trends: From Nano to Macro Systems, Caparica, Portugal. Maria Teresa Cidade (*www4.fct.unl.pt/ibereo2011/*)

19-23 September 2011
Short course on *Basic Composition of Coatings*, Missouri S&T Coatings Institute (*coatings.mst.edu/index.html*)

25-27 September 2011
6th Korean-Australian Rheology Conference (KARC2011); Daejeon, Korea - Do Hyun Kim (*www.rheology.org.au/*)

8-9 October 2011
SOR Short Course on *Rheology of High-Interface Systems*, Gerry Fuller, Jan Vermant and Andy Kraynik, Cleveland, Ohio USA

9-13 October 2011
83rd Annual Meeting of The Society of Rheology, Cleveland, Ohio USA, Pat Mather

10-14 October 2011
Short course on *Introduction to Paint Formulation*, Missouri S&T Coatings Institute (*coatings.mst.edu/index.html*)

2012

5-10 February 2012
Gordon Research Conference on Colloidal, Macromolecular & Polyelecrolyte Solutions, Ventura, California USA, Norman J. Wagner and Andrey Dobrynin (*www.grc.org*)

10-13 April 2012
6th International Symposium on Food Rheology and Structure (ISFRS 2012); Zurich, Switzerland, Peter Fischer *(www.isfrs.ethz.ch)*

24-29 June 2012
MACRO 2012: World Polymer Congress, Blacksburg, Virginia USA - Timothy Long (*www.cpe.vt.edu/mac-*

(Continues, page 23)