At that time I was working on criteria defining the stiffness characteristics of aeroplane wings necessary for avoiding wing flutter and loss of aileron control due to wing twisting. Wallis came to see me and said, in effect, "Tell me how stiff to make my Wellesley wing and I will make it that stiff and no more". I told him and he did indeed achieve the minima I prescribed with a structure which was extremely light. The structure weight he achieved was well below what was being achieved in wings of more conventional construction.

I have never been convinced that Wallis's geodetic system was intrinsically superior to more conventional systems. It was superior in practice because he designed extremely efficiently to the prescribed limits. I have no recollection of any other designer of those days seeking at the outset of his design to discover the stiffness limits to which he should design. Even if I do dare to doubt the intrinsic superiority of geodetic construction however, I certainly do not deny its elegance. It had moreover a tremendous advantage in battle. The fact that strength and stiffness were, so to speak, distributed in what was almost a skin of geodesic mesh meant that the structure had few weak points, and gunfire from the ground and from the air might knock great holes in the structure without wrecking it. So triumphant was it that one might well ask why it did not persist as a basic system for aircraft construction. The answer is that the whole trend of design was away from frameworks covered with fabric and towards all metal monocoque construction. That is why the Wellesley and the Wellington were never emulated, even by Wallis himself.

The Wallis I knew was never the arrogant prickly person we of the R 101 design team were led to visulise. Certainly his was a strong character, certainly he was firm in his views, but equally certainly he knew his limits and did not hesitate to seek help in areas beyond them — as when he sought my aid on wing stiffness — and I am sure he sought Pierson's aid, particularly on the aerodynamic side of his designs. He was indeed sometimes critical of others working in his own areas of expertise, but who is not? I always found him supremely articulate, subtly persuasive and invariably polite, all in a voice it was a pleasure to listen to. I found him, too, appreciative of the work of others. I recall that it was with some trepidation that I took him, at his request, to Hucclecote to see the drawings of the Gloster E 28/39 which Carter was designing for the first flight of the Whittle jet engine. I thought there might be questions of the "Why didn't you do it this way?" kind. There were not. Carter was completely open — he displayed all his ideas and Wallis had nothing but commendation then and afterwards.

I had no contact with Wallis on the Mohne and Eder dambusting bomb nor its massive successor. But I was in touch, as an occasional visitor to Weybridge, with his ideas on the swing wing or variable geometry aeroplane and bitterly disappointed at the lack of support for his ideas. The swing wing has been with us for some years now, but had it been adopted in practice when Wallis showed the way this country would have had a commanding technological lead in a new field: once again, we threw away a golden opportunity.

In his office on the old Brooklands track, and after his retirement from Vickers in his home, he always worked out his ideas himself on his drawing board. Obviously, on his great projects, he directed the work of others. But the intricacies of joints in geodetic meshes, the details of the pivot of a swing wing, were elucidated on his own board. It was the same to the end: when I last saw him in his house at Effingham he was working on his board on very high speed vehicles indeed. I can only hope his efforts to bring these last visions to reality will not be wasted.

I have made no attempt in these notes to chart the long life of Barnes Neville Wallis, from his birth on 26 September 1887, to his death on 30 October 1979. The fullest account, up till 1970, is Mr Morpurgo's biography[1]. I do not agree with quite all of Mr Morpurgo's judgements — nor indeed with quite all of those he attributes to Wallis — but factually it is a vivid and accurate account of a great man's life and I hope the biographer will add a chapter to complete the story. In that book we can read the true account of how Wallis was awarded by the Royal Commission on Awards to Inventors £10,000 for his dambusting bomb, and how he applied that sum to the creation of a foundation at his old school, Christ's Hospital — of which he was Treasurer from 1957 to 1970. This splendid act illumines facets of Wallis's character with which the world in which he became famous was unfamiliar — his loyalty, his generosity, indeed his unselfishness. In total he was a great and good man. We who knew him were greatly privileged.

Kings Norton

1. Morpurgo, J.E. *Barnes Wallis: A Biography.* (Longman, London 1972).

Wolfgang Yourgrau

Wolfgang H.J. Yourgrau died suddenly at his home in Denver, Colorado, USA, on 18 July 1979, at the age of 70, shortly after returning home from an extended tour of lecturing and research in Europe. His passing marks the disappearance from the world of physics and the philosophy of science of a colourful scholar and humanist, whose diverse talents and activities have left enduring imprints far outside the field of his speciality.

Wolfgang Yourgrau was born on 16 November 1908 near Berlin of a Belgian father and a German-Jewish mother. He attended the Werner-Siemens Realgymnasium in Berlin and subsequently studied theoretical physics, mathematics, and biology at the local von Humboldt University, at a time when celebrated physicists such as von Laue, Einstein, and Schrödinger graced its Faculty. Serving first as a tutor in natural philosophy and then as an assistant to Schrödinger, he earned his Dr phil. *magna cum laude* in 1932, the terminal year of the Weimar Republic.

The next year saw the ascendancy to power of the Nazis, and Yourgrau, who got their attention as an organizer of the S.A.P. (an offshoot of the German Social Democratic Party), fled Germany after being severely beaten up by the Storm Troopers. In exile, he remained on the move while lecturing on the evils of fascism in Latvia, Poland, and other European countries, until he was allowed to enter Palestine, then a British mandate, as a political refugee.

Appointed a lecturer with the educational and cultural division of the *Histadrut* (Jewish Federation of Labor), he travelled widely inside Palestine and became drawn into discussions on the intractable problems of this territory. But Nazism, its devastation of the cultural values in which his family had been rooted for centuries, and then the daily progress of World War 2 remained foremost in his mind. In the Spring of 1942 he acquired from the British authorities a license to publish *Orient,* an independent German-language weekly, with himself as Editor-in-Chief and Arnold Zweig, the renowned novelist-dramatist and a fellow exile, as co-publisher. Under Yourgrau's direction, *Orient* — which has lately become the subject of detailed analyses by some literary historians — declared war "on every fascist movement, every attempt to restrict the right to free expression of opinion . . . ." But it was a subsidiary point on the programme of *Orient*, touching on the complex internal politics of Palestine, which made the journal a centre of intense controversy. Boycotts and threats against businesses connected with *Orient* and finally destruction of the premises of its fourth printer caused the financially plagued journal to close down for good in 1943, one year after its inception.

Yourgrau lost no time in assuming a more active role in the war against the Axis Powers, which was then increasingly being fought in the Mediterranean theatre. At first, working from an office of the Palestine Information Office, this only meant preparing the news bulletins in

German that emanated daily from Jerusalem Radio. But after the American Office of Strategic Services established its Middle Eastern Headquarters in Cairo, Yourgrau also was recruited to serve with that organization, vitally assisting it in its planning of some intelligence operations behind enemy lines, details of which are only now being declassified.

At War's end Yourgrau redirected his phenomenal energy into the resumption of his academic career and the pursuit of his pre-empted research. He became Head of the Department of Logic and Scientific Method at the School of Higher Studies in Jerusalem and subsequently Acting Dean of its Faculty of Arts and Sciences. At the request of the Colonial Office he went to Cyprus in 1948 to determine whether a branch of the University of London should be opened on that island. ("Under no circumstances!" his report concluded after 4 months of investigation.) In the same year Yourgrau emigrated to South Africa, having previously married South African-born Thella Garber. For a decade he taught and continued his writing and research at the Universities of Cape Town, Witwatersrand, and Natal.

In 1959 he moved to the United States, first to accept the position of Research Professor at the Minnesota Centre for the Philosophy of Science, and then to become Chairman of the Department of History of Science at Smith College in Northampton, Mass. In 1963 he accepted a permanent position as Professor of History and Philosophy of Science at the University of Denver.

The scope of Yourgrau's publications was prodigious. Ranging from the political editorials in *Orient* to papers on general relativity, they made him known to an exceptionally large spectrum of scholars, a fact that is attested to by the scheduled appearance in 1981 of a memorial volume of essays in his honour written by a diverse and distinguished panel of more than 30 of his academic colleagues. Although most of his papers are devoted to problems in theoretical physics, a large fraction deals with philosophical issues, while some others treat matters of a biographical, literary, or political nature. Of the many books he co-authored or co-edited, *Variational Principles in Dynamics and Quantum Theory* and *A Treatise on Irreversible and Statistical Thermophysics* are perhaps the best known. In 1969 he founded, with Henry Margenau of Yale University, the international journal *Foundations of Physics,* which he co-edited until his death. He was the recipient of numerous distinctions and honours, which included the Swiss Einstein Medal, awarded to him in 1970.

Gregarious and extrovert, his forthrightness and lack of false modesty endeared him to some, made enemies of others. His co-workers and many friends in different parts of the world enjoyed his unique kind of humour, were buoyed by his passion for life, and stimulated by his enthusiasm for intellectual pursuits. Sentimental and deeply emotional, he was intensely loyal to individuals whose friendship he valued, expecting the same degree of allegiance in return. But perhaps the most enduring impression will be his automatic reflex to side with, and concretely support, human beings — whether fellow students in Germany, penniless intellectual exiles in Palestine, or anyone else who crossed his path — who were treated unjustly or were in need of help. He is survived by his wife, a daughter, and three sons, to whom we extend our profound sympathy in their great personal loss.

Alwyn van der Merwe

David Scott Gilbert

DAVID SCOTT GILBERT was born in Ithaca (N.Y.) on 6 November 1940. He majored in mathematics at Harvard University (1959-63) then, perhaps because of a biological tradition in his family, joined D.H. Fender at the California Institute of Technology, where he gained his doctorate on visual acuity and eye movements. His postdoctoral work was with the late Trevor Shaw at Queen Mary College London, where he later became a lecturer in zoology before joining, in 1973, the Medical Research Council Cell Biophysics Unit at King's College London. He died suddenly of viral pneumonitis on 11 December 1979.

While working with Shaw on sodium transport across the membranes of giant axons, Gilbert became interested in the structural properties of axoplasm and thus concerned with problems of the determination and maintenance of the shape of nerve cells. His first paper on axoplasmic structure in 1972, (*Nature, New Biology* **237**, 195-198) was remarkably stimulating and procedurally elegant. Using polarised light microscopy he showed that the giant axon of *Myxicola* (a marine fan worm) can be described in terms of three levels of helical organisation. The axoplasmic fibrous proteins are arrayed in parallel 'ripple' helices, which are twisted into a larger 'segmental' helix. They form a cylindrical gel that can coil, when the worm shortens during contraction, to form a yet larger 'gel' helix. Gilbert recognised that this axon consisted of essentially one structural component, the neurofilament, and therefore it provided an unparallelled opportunity for experimental study. The demonstration of the helical organisation led to a model in which the filamentous protein forms into twisted strands like a rope and, although the protein content of the axoplasm of *Myxicola* is no more than about 4%, the yarn gives it significant mechanical strength and stability; and it can shear to form branches.

Many earlier observations of axons had been interpreted as demonstrating them to be a viscous soup, rather than this kind of stiff gel, and had led to the supposition that the mechanical properties were due to the membrane and associated connective tissue. Gilbert and his colleagues found the neurofilament gel to be solubilised by a very rapid enzymic autolysis triggered upon the entry of calcium ions into the axoplasm; the technique of very quickly extricating the axoplasm in air had avoided exposure to the calcium ions of physiological saline or sea water. This method enabled Gilbert (1975) unequivocally to determine many of its bulk chemical and physical properties (*J. Physiol. Lond.* **253**, 257-319). Thus the preparation provided an important standard of reference for working on the biochemistry and structure of filaments (10nm filaments, *Nature* **272**, 557-8) and formed a firm basis from which a long-needed attack on axonal structure at the molecular level could begin.

Gilbert was leading the developments on a wide experimental front at the time of his death. Fortunately much of his work with that of colleagues is drafted for publication. Using mammalian as well as cephalopod and annelid nerve cells they have uncovered a wide variety of different neuorofilament proteins. To examine their homologies they have developed a new high resolution system of gel electrophoresis and are beginning to show by fingerprinting techniques that the variety of neurofilament chains in several species, including some mammals, conceals an underlying simplicity. With a view to uncovering the biochemical as well as the structural features of neurofilaments Gilbert and his colleagues have assayed their modification by the action of axonal proteases and of endogenous kinases and phosphatases. At the same time data from X-ray and solution studies are leading to the development of a detailed molecular model of the neurofilament.

Gilbert had a keen critical intelligence and an uncommon ability to choose significant and clear-cut biological problems. He mastered a wide variety of techniques and brought to them exceptional manipulative skill. In our laboratory his broad interests and strong grasp of physical principles made him much in demand for discussion and advice. He was infallibly helpful and generous. We, his colleagues, are impoverished by his death, which will grievously set back the development of this kind of neurobiology in Britain. David had an essential humility and natural friendliness that enabled him to enjoy an easy relationship with a wide variety of people. We mourn him as much because we have lost a friend, as because a young scientist of distinction has vanished from the international scene.

B.B. Boycott