K.A.P. Edman (1926-2022)

K.A.P. Edman, always known as Paul, was one of the most highly respected investigators of the mechanical properties of single muscle fibres. His scientific work was admired for being of the highest standard, and his publications and talks were models of clarity. Paul published more than a hundred papers, continuing research and publishing for several years after his official retirement. His last publication was in 2017 at the age of 91.

Like many of his generation Paul came to research through medicine. Paul's first scientific contact was Ernst Bárány (Pharmacology) during his medical course (1947-1955) at the University of Uppsala, Sweden. Paul received his Doctoral degree in 1959 having already published several papers, most of them as sole author. His early publications concerned the effects of drugs and electrolytes on the viscosity of acto-myosin solutions and relaxation of glycerol-extracted muscle fibres.

In 1960-61 Paul worked as a guest researcher at University College London (UCL) with H.O. Schild (Pharmacology) working on smooth muscle. Paul flourished in London. He liked to recount that he polished his English vocabulary by reading the three editorials in *The Times* every day (his English was superb). He was also chuffed to encounter A.V. Hill (Physiology,

UCL and Nobel Prize 1922) on the way to their local pillar box to post letters. The time in London resulted in the first of his many publications in UK based journals, mainly the Journal of Physiology. It also marked his first research on skeletal muscle, a collaboration with D.W. Grieve (Physiology, UCL) making recordings of resting and action potentials and force produced by individual fibres in isolated skeletal muscle from frog (1).

Paul returned to Sweden to the University of Umeå from 1962 until his move to University of Lund in 1964 where he worked until his official retirement in 1992.

Paul quickly developed techniques for dissecting, stimulating, and recording from single fibres dissected from frog muscle. His first publication on single fibres, "The relation between sarcomere length and active tension in isolated semitendinosus fibres of the frog", was published in 1966 (2). From that point, the single fibre from frog muscle was his "signature preparation" and the mechanics of skeletal muscle contraction was his main focus.

In the late 1960's Paul worked as a guest Professor in Physiology at UCLA, where he and D. Cleworth (a post-doc with Wilfred Mommaerts) used laser diffraction to detect changes in sarcomere length (SL) during isometric contraction of single fibres (3,4). Again, a visit abroad launched him on a favourite topic; this time SL changes. He developed other methods for detecting such changes including markers attached to the surface of the fibre. Perhaps the most memorable markers were "Hector hår" (small pieces of hair from Hector, the family's pet Black Labrador Retriever). These were used in many studies of the different phases of isometric contractions. Surprisingly large and consistent SL changes were found during relaxation.

Paul also made important discoveries about shortening, for example, that the relation between force and velocity for frog fibres was more complex than the single hyperbolic relation famously described by A.V. Hill in 1938. He showed that the relationship covering the full range of forces was best described by two hyperbolae, one for forces less than about 80% of the isometric force and the other for higher forces. There were also publications on force enhancement during and after stretch of active fibres. One of his

most influential “inventions” was the “slack test”, an ingenious method which allowed the shortening due to filament sliding to be separated from shortening due to series elasticity. Thus, the maximum velocity of shortening due to the sliding of filaments could be measured, uncontaminated by the faster shortening by the series elasticity (5).

Paul broadened his skeletal muscle research to include intracellular Ca^{2+}-transients and their interaction with the mechanics of contraction. He continued research on cardiac muscle contraction with collaborators, often adapting approaches he had developed for skeletal muscle fibres.

Paul was very much an experimentalist devoted to lab work and not attracted to making theoretical models nor to building a lab empire funded by big grants. These factors along with his excellent science attracted a steady stream of students and visiting researchers from all over the world. They found in Paul’s lab superb facilities, space, and technical support. The working environment and the daily coffee breaks in the library were friendly. Paul and his wife Anna Greta were wonderfully hospitable both in their home in Lund, which was a short walk from the Dept, and their “croft” in the beautiful Swedish countryside. There was an air of calm and stability about Paul and his lab (very welcome to visitors from the more frenetic world capitals). Thus, there was time and space to think, discuss experiments, as well as, history, literature, politics and much else and to seek Paul’s wise advice.
For us along with many other colleagues it was a privilege and an honour to share with Paul many hours in the lab where we learned, not only experimental skills, but also rigor and dedication to science.

Nancy Curtin, Carlo Reggiani, Alf Månsson and Fang Lou

We thank Åke and Ruth Edman (Paul’s son and daughter) and Anders Arner for the very helpful information they provided.

(1) Edman, KAP & Grieve, DW. J Physiol. 1964, 170(1):138-52. doi: 10.1113/jphysiol.1964.sp007319. PMID: 14135589; PMCID: PMC1368743.

(2) Edman KAP. J Physiol. 1966, 183(2):407-17. doi: 10.1113/jphysiol.1966.sp007873. PMID: 5942818; PMCID: PMC1357585.

(3) Cleworth D, & Edman KAP. Science. 1969, 163(3864):296-8. doi: 10.1126/science.163.3864.296. PMID: 5762610.

(4) Cleworth DR, Edman KAP. J Physiol. 1972, 27(1):1-17. doi: 10.1113/jphysiol.1972.sp010016. PMID: 4539586; PMCID: PMC1331259.

(5) Edman KAP. J Physiol. 1979, 291:143-59. doi: 10.1113/jphysiol.1979.sp012804. PMID: 314510; PMCID: PMC1280892.