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Preface

Why grana?

‘To change the way we think’ is one of the most direct, readily understood ‘mission statements’ of creative human endeavour. Whether in art, literature or scientific research, this six-word accolade is not conferred lightly. Very few manage to collect the accolade on a regular basis. Jan Anderson has done so, and appreciation of her contribution over a lifetime of research in photosynthesis was signalled at several conferences in Europe in 1998.

One of these, a small gathering held in Schloss Arnsberg, near Kipfenberg, Germany following the 11th International Congress on Photosynthesis in Budapest, had for its theme the simple question ‘Why grana?’ It stimulated discussion on many unresolved issues in photosynthetic structure and function. Some of the contributions presented there, and papers from others who were unable to attend, are collected in this special issue. Other contributions remain memorable for statements such as “now you all remember I first said that in Arnsberg”, as well as for reconciliation and synthesis of some long-standing differences.

A highlight of the meeting was an after-dinner address from Bertil Andersson, co-author of the paper that established the concepts of lateral heterogeneity of the photosystems and other components between granal and stromal regions of thylakoids. Bertil’s account of the origins of one of Jan’s paradigm shifts is a superb illustration of the ways in which science advances. It is reproduced here as a reminder, in these days of ‘research management’, that the initiative of individuals, the trust of mentors, and serendipity are, above all, the greatest ingredients that advance understanding.

*Barry Osmond,
Chairperson,
Editorial Advisory Committee*

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Dear Bertil,
 So Jacob visits - my least
 that on Thurs.
 Things really great here
 with To-Yan gone — but got a little
 noisy for sleep TA /pat the unit

Anderson and Andersson; an Australian–Swedish team

The 4th International Congress held in Reading, UK in 1977 may not have been the most exciting of the congresses that have been held so far, but it exerted a crucial influence on my scientific career. During the Thursday afternoon tea break I got my act together enough to introduce myself to Jan Anderson, and to ask if there was any possibility that I could do a post-doc in her research group at the CSIRO in Canberra. Jan was very positive indeed, but she asserted that her support from the CSIRO was in no way enough to finance a Swedish post-doctoral fellow. However, after I had convinced Lennart Philipsson, the chairman of EMBO, that Australia was the promised land for molecular plant sciences, the financial issue was solved.

How does one account for my determination to join Jan Anderson's team in Canberra, in the process resisting several generous offers from the United States and Germany? The early work of Anderson and Boardman, using digitonin for subfractionation of thylakoids, had been a guide from the start of my time as a graduate student in Sweden, working on a project using polymer two-phase partitioning for separation of thylakoid membranes. However, Jan's 1975 review in BBA was probably the most important factor. That review dealt in an excellent way with the organisation of the thylakoid membrane by putting it into a Singer-Nicholson perspective. To me, this was biochemistry — it made sense, it was inspiring. Photosynthesis became more than a Z-scheme of electron transfer components. I read the review over and over again, just like a good novel. In one paragraph Jan wrote that inside-out membranes could not be isolated from chloroplast thylakoids. This statement was a real challenge! One year later in Sweden, Hans-Erik Åkerlund and I obtained thylakoid vesicles that could pump protons in the wrong direction upon illumination — inside-out thylakoids could indeed be obtained. Chance had once again favoured the prepared mind.

In 1979 I came 'down under' for the first time, and Jan was transformed from an inspiration at a distance to an every-day (even every-hour) inspiration at the lab bench. I was taught photosynthesis from an impressive source of knowledge. Among other things, Jan introduced me to state-of-the-art techniques for analysis of chlorophyll-proteins and enlightened me with many more photosynthetic organisms such as spinach

Our plan was to use the inside-out vesicles to determine the trans-bilayer organisation of the chlorophyll-proteins in the thylakoid membrane. So we did, but was also found that membranes derived from the appressed grana regions had only residual amounts of the chlorophyll proteins belonging to photosystem I. Based upon our observations and previous published data, including results from our previous work in

Sweden, we proposed that there was an extreme lateral heterogeneity in the organisation of the thylakoid membrane. Photosystem I and the ATP synthase were confined to the stroma-exposed thylakoid regions while photosystem II was mainly in the grana-appressed regions. This was heresy and against current models on bipartite and tripartite super-complexes in the organisation of the two photosystems. Only Jim Barber, with his 'whities and blackies' representing the two photosystems, was thinking along the same lines.

The paper with our observations and the lateral model was easily accepted, which in retrospect was surprising considering that controversy of the subject, and published in BBA at the end of 1980. Although, to Jan's great dismay, the model was recommended for the wastebin during the next Photosynthesis Congress in Halkidiki, it was gradually accepted over the next two years. It has now been introduced into most textbooks of biochemistry and plant sciences. I felt very satisfied with my Australian post-doc and on the plane back to Sweden I brought with me experimental results for several papers, a long-lasting friendship with Jan and a baby daughter (Matilda), born in Canberra.

Back in Sweden, long-distance inspiration from Jan persisted, not only through the literature as before, but through frequent letters (that are still arriving). These letters could be constructive ("we must perform this experiment"), supportive ("nice talk, Bertil"), frank ("I cannot understand how you could get that awful paper accepted") or just giving advice ("stay away from Hoo-ha"). Hoo-ha is, according to my understanding, a synonym for bureaucracy and is only one example of the novel words introduced by Jan to enrich the English language. Furthermore, Jan's handwriting has its own very distinct style (Fig. 1) and always needs expert deciphering. Over the years I acquired some skill in deciphering her 'pattes de mouches', so much so that colleagues have frequently forwarded their letters from Jan for interpretation. Unfortunately, my service is being rendered obsolete through electronic mail, or at least nearly so.

Jan has kept close links with Nordic research in photosynthesis through visits of several Swedish and Finnish scientists to her laboratory and by taking sabbaticals herself in Sweden. However, her visits have been complicated by her limited ability to cope with our slippery and icy roads. Each visit has resulted in broken arms and bandages, so by now she is an expert on Swedish Medicare. Jan has become a *Professor Emerita*, but knowing her passion and devotion to science and photosynthesis, she will continue to be active for a long time, and I will continue as her devoted disciple. So, returning some of the advice I received several times from my Australian mentor — keep at it Jan!

Bertil Andersson