

protein, and for instance on finding out whether it belongs to or resembles the semaphorin families of growth-cone-collapsing proteins which have a critical role in directing developing neurons to appropriate targets⁶. Subsequent issues will be that of the best way to neutralize its activity in patients, and whether human recombinant versions of the neutralizing IN-1 monoclonal antibody used by Bregman *et al.* can be engineered (and, if they can, whether they will be able to get to the inhibitory protein along deep fibre tracts in the human spinal cord below a lesion). An alternative approach may well be to modify the reaction of the growth cone to this inhibitory signal by interfering with receptors or signal transduction mechanisms reducing the effects of inhibitory

or repulsive signals⁶. We also need to understand why embryonic neurons implanted into the adult CNS find myelinated fibre tracts permissive for axonal growth⁷. Is it because they do not express the receptor for the myelin-associated neurite inhibitor?

Many promising research avenues beckon. But again, given that so much is at stake for patients with spinal injury, if one must err it should be on the side of caution. No effective therapy is in immediate sight. And it should be remembered that not all axonal regeneration is functionally adaptive; that a rewiring of spinal circuitry resulting from the growth of sensory axons after nerve injury in the adult may contribute to chronic pain⁸; and that it is quite possible that the encouragement

of growth may not always recapitulate the connections made during development, with consequent functional problems. □

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1. Bregman, B. S. *et al.* *Nature* **378**, 498–501 (1995).
2. Schnell, L. & Schwab, M. E. *Nature* **343**, 269–272 (1990).
3. Richardson, P. M. & Issa, V. M. K. *Nature* **309**, 791–793 (1984).
4. Aigner, L. *et al.* *Cell* **83**, 269–278 (1995).
5. Xu, X. M., Guenard, V., Kleitman, N. & Bunge, M. B. *J. comp. Neurol.* **351**, 145–160 (1995).
6. Puschel, A. W., Adams, R. H. & Betz, H. *Neuron* **14**, 941–948 (1995).
7. Davies, S. J., Field, P. M. & Raisman, G. J. *Neurosci.* **14**, 1596–1612 (1994).
8. Woolf, C. J., Shorthand, P. & Coggeshall, R. E. *Nature* **355**, 75–77 (1992).

OBITUARY

Gérard de Vaucouleurs (1918–95)

GÉRARD de Vaucouleurs, who died in Austin, Texas, on 7 October 1995, came into extragalactic astronomy 45 years ago from outside the mainstream, at a time when there was little interest in understanding galaxies and the physics of galaxies. He was no theorist, but he knew what galaxies looked like and how they appear to be distributed. Modern astronomy needs more like him. By now we have moved to the other extreme, a situation in which we have many theorists and others trying to build models and understand galaxies who have never looked at the optical or radio images in any detail, and thus are unfamiliar with what they really need to explain.

De Vaucouleurs, who took the maiden name of his mother, was born in Paris and educated at the Sorbonne. In 1950 he came to England and worked for a period for the French Section of the BBC in London. I remember his enthusiasm and his dedication to astronomy at that time, and these characteristics were to endure.

In his early career de Vaucouleurs was extensively involved in popular astronomy, astronomical photography and science writing. His main interests professionally were in the planet Mars, and in the extragalactic Universe. Very early on he wrote an extensive monograph on the planet Mars. In 50 years he published about 400 papers, and many books and popular articles. But the contribution for which he will be remembered was to the study of galaxies. In the 1950s, when de Vaucouleurs began his work, a large part of astrophysics was concerned with the structure and evolution of the stars, and comparatively few astronomers were working on galaxies. This is a great contrast to the situation today

when extragalactic astronomy and cosmology are some of the most active areas of research, with hundreds of investigators.

Above all, de Vaucouleurs was a collector of data, with an extraordinary knowledge of the galaxies. He knew the galaxies — he classified thousands of them, and as a cataloguer he was with-

cases new photometric observations. De Vaucouleurs revised and refined the original Hubble classification of galaxies by introducing a three-dimensional scheme which was valuable, if perhaps a little too complicated at times. He also worked on the distance scale of the Universe and the determination of the Hubble constant. In the 1970s and 1980s he argued for a large value for the Hubble constant, around $100 \text{ km s}^{-1} \text{ Mpc}^{-1}$, as compared with the small value of about $50 \text{ km s}^{-1} \text{ Mpc}^{-1}$ advocated by Sandage and Tamman. This debate is still going on.

He worked extensively on the Magellanic Clouds and on the Local Group of nearby galaxies. In 1959 with Frank Kerr he obtained the first reliable mass estimates of the Magellanic Clouds. He carried out detailed surface photometry on galaxies and was particularly well known for his work on the luminosity distribution and structure of elliptical galaxies.

Late in his career, de Vaucouleurs' abilities and his work were recognized by his peers. One of his most important feats was to persuade the community of the reality of the local supercluster of galaxies with the Virgo cluster as its nucleus. This concept of the local supercluster, and its extension to other large superclusters, was strongly resisted for many years by other established extragalactic astronomers, but has now become widely accepted.

In appearance he was small and always impeccably dressed; after he moved to Texas he often dressed accordingly. He is survived by his second wife Elysabeth. Geoffrey Burbidge

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out peer, although, as he would freely admit, he was not an astrophysicist.

Probably his most enduring contribution lay in providing huge amounts of data for three *Reference Catalogues of Bright Galaxies* published in 1964, 1976 and 1991. This, like much of his other work, was carried out jointly with his first wife, Antoinette, who died in 1987, and with others at the University of Texas. Production of these catalogues involved a prodigious amount of data handling, analysis and in many