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biochemical and chemical studies into the catalytic mechanism of OT, as well as the function of each of its subunits [7].

The pharmaceutical industry's perspective

In summary, *USA/Japan Glyco 2004* provided an exciting snapshot of the state-of-the-art in the field of glycobiology. Glycomics, the system-wide analysis of glycosylation, is maturing rapidly through the use and further development of standardized high-throughput microarray and MS methodologies adapted from cDNA profiling and proteomics. Although most of the cutting-edge basic research in glycobiology is still being done by academics, the potential of glycosylation to improve pharmacokinetic and pharmacodynamic properties of existing recombinant therapeutics has thus far been the focus of pharmaceutical companies (e.g. Amgen,

Neose and Seikagaku). However, the industry is rapidly becoming aware of the potential of glycosylation in drug discovery, specifically glycan-derived drugs [Arixtra™ (Fonda BV), neuraminidase inhibitors and selectin inhibitors] and vaccines (malaria vaccine and 2G12 epitope of HIV gp120), glycosyl and sulfotransferase inhibitors, therapeutic antibodies to disease-relevant carbohydrate epitopes (glycotopes) and unnatural carbohydrate precursors for use in imaging and cell-targeting. Much of this work is being pioneered by small 'biotech' startups, including Abaron Pharmaceuticals (CA, USA), Ancora Pharmaceuticals (MA, USA), Glycomimetics (MD, USA), Selexys (OK, USA) and Thios Pharmaceuticals (CA, USA). We wait with anticipation for the next annual meeting of the Society for Glycobiology, which is to be held 9–12 November 2005, in Boston (MA, USA).

References

- 1 Venter, J.C. *et al.* (2001) The sequence of the human genome. *Science* 291, 1304–1351
- 2 Varki, A. *et al.*, eds. (1999) *Essentials of Glycobiology*, Cold Spring Harbor Laboratory Press
- 3 Prescher, J.A. *et al.* (2004) Chemical remodeling of cell surfaces in living animals. *Nature* 430, 873–877
- 4 Dimitroff, C.J. *et al.* (2003) Glycosylation-dependent inhibition of cutaneous lymphocyte-associated antigen expression: implications in modulating lymphocyte migration to skin. *Blood* 101, 602–610
- 5 Yuki, N. *et al.* (2004) Carbohydrate mimicry between human ganglioside GM1 and *Campylobacter jejuni* lipooligosaccharide causes Guillain-Barré syndrome. *Proc. Natl. Acad. Sci. U. S. A.* 101, 11404–11409
- 6 Schofield, L. *et al.* (2002) Synthetic GPI as a candidate anti-toxic vaccine in a model of malaria. *Nature* 418, 785–789
- 7 Yan, A. and Lennarz, W.J. Unraveling the mechanism of protein N-glycosylation. *J. Biol. Chem.* In press

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A soft approach to hard science?

In a recent article [1], I dealt with the penetration of cartoons into the field of science, the backgrounds of several science cartoonists and their endorsement by eminent scientists. I also alluded to the use of cartoons in the teaching of science. The two tenets on which this is based are: (i) a picture is worth ten thousand words; and (ii) every picture tells a story. Hence, it would be expected that to be successful in this means of visual communication would require an intimate knowledge of both the art of cartooning and the science behind the subject matter. An analysis of the work of an expert in this area should provide some answers.

Larry Gonick

Probably the most well-known and respected of cartoonists who have applied their craft to unravelling the mysteries of science is Larry Gonick. Born in 1946, he originally studied mathematics at Harvard University, obtaining an MA in 1969. He then spent an academic

'Uncovering the mysteries of science with cartoon guides'

year at the Tata Institute of Fundamental Research, Bombay, India, and another year teaching calculus at Harvard before leaving to take up cartooning. After a series of jobs in newspapers in the early 1970s, during which

A thought-provoking tonic on the lighter side



Column by Raymond C. Rowe,
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Please note that these are the personal opinions of the author and do not necessarily represent those of AstraZeneca.

he produced comic style columns explaining politics and history, he decided to commit himself to creating a series of non-fiction comic books or cartoon guides. Over the intervening years, he has worked with co-authors to produce the highly successful cartoon guides to genetics (1981) (Figure 1),

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physics (1991), statistics (1993) and environmental science (1996), as well as his own series of cartoon histories of the universe. In addition, in the science field, he produced a bimonthly two-page cartoon feature reporting on science for *Discover Magazine* and a series of scientific and mathematical classroom comic-strip posters for the magazines *Math* and *DynaMath*.

Style and content

Let's face it, textbooks are generally boring. They do not appeal to the senses and are written in a style that is both stilted and not easy to read. All this creates inertia, which is difficult to overcome, particularly if the textbook is on a subject that is thought to be difficult to understand. Cartoons can be used to gain, and retain, attention by helping to make the leap from apprehension to understanding. However, in cartoons, space considerations are often tight, but, by taking advantage of the human instinct to read a great deal of emotion in the body language of rudimentary illustrations, Gonick in particular has been able to convey detailed explanations in small digestible portions.

Of course, cartoons can also be a good way of covering up a lack of clear understanding with humour. Gonick has overcome this by working with respected co-authors in the field, including Woollcott Smith (statistics), a professor of statistics at Temple University (PA, USA), Art Huffman (physics), a senior lecturer in physics and astronomy at the University of California (Los Angeles, USA) and Mark Wheelis (genetics), a senior lecturer in microbiology at the University of California (Davis, USA). All the co-authors were active in research and had previously published papers and books in the 'orthodox' scientific literature. It is interesting to note that when interviewed on the aspect of collaboration, Gonick has always stated that he defers to the co-author for structure because there is a necessity for this to be factually correct. Of course, nobody has ever claimed that Gonick's books will take over from textbooks and create experts. The idea is to provide a basic grasp of the subject for those new to the subject and a supplement to the basic textbooks.

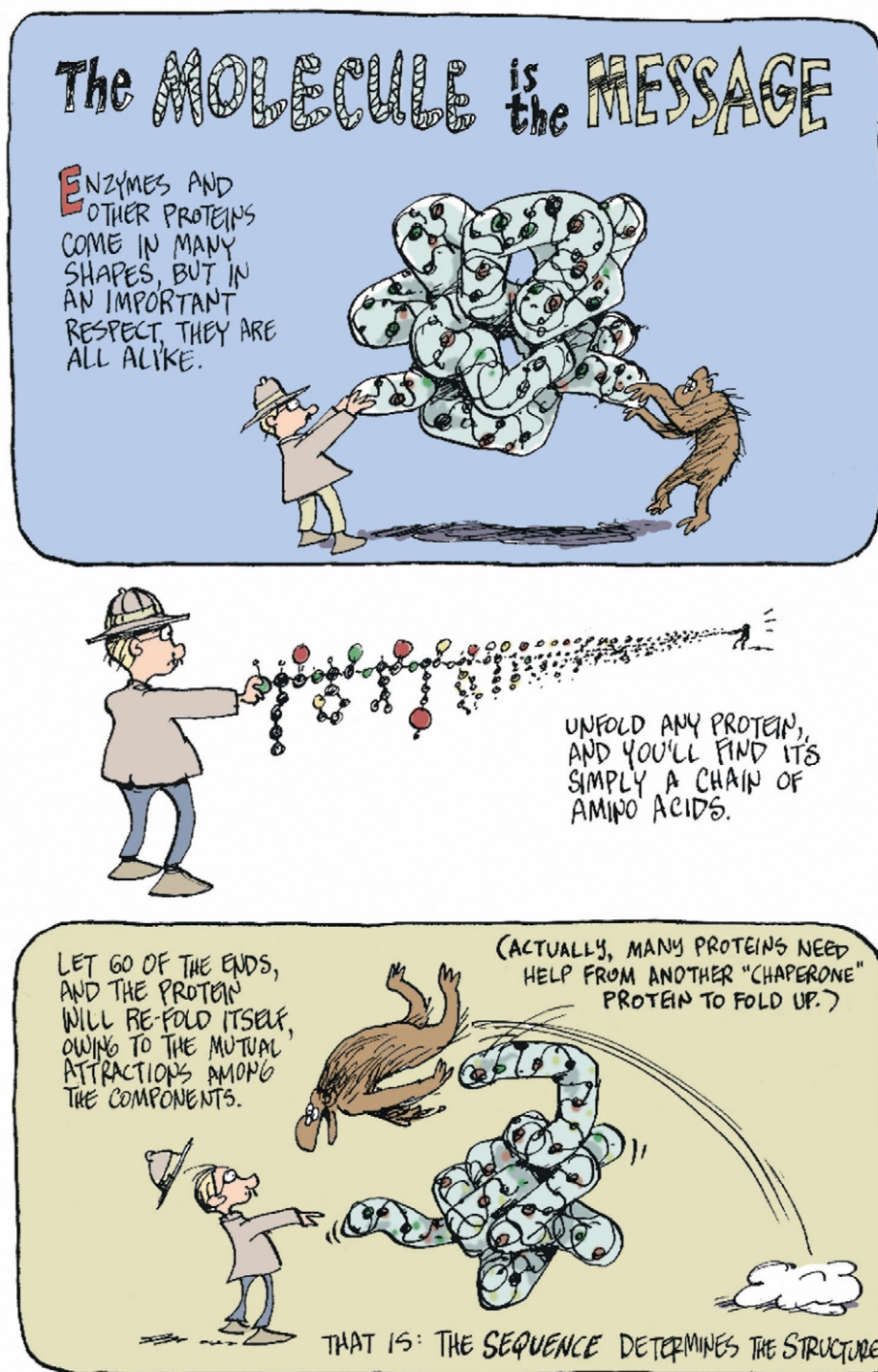


FIGURE 1

This cartoon is taken from *The Cartoon Guide to Genetics* [2] and was kindly supplied by Larry Gonick (www.larrygonick.com). ©Larry Gonick and Mark Wheelis. All rights reserved.

Peer endorsement

Gonick's books are required or recommended reading in over 60 universities and colleges world-wide, including, in the USA, the Massachusetts Institute of Technology, Harvard,

Yale, Carnegie Mellon and numerous State Universities, in the UK, the Universities of Edinburgh, Lancaster, Liverpool and Leicester and, in The Netherlands, the University of Utrecht. Matthew Meselson, the Thomas

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Dudley Cabot Professor of the Natural Sciences at Harvard University and co-discoverer of the 'one gene-one protein principle', fully endorses *The Cartoon Guide to Genetics*. He is reported as saying that 'it puts textbooks to shame' [2]. Arno Penzias, co-recipient with Robert Wilson of a half of the Nobel Prize for Physics in 1978 for the discovery of the cosmic background radiation left over by the Big Bang, has stated openly that he really likes the books as 'pure entertainment' but 'found them to be helpful teaching books as well' [3].

To create a good guide in this format, it is necessary to strike the right balance between a textbook and a cartoon, educational in

providing facts but not too boring to be a good cartoon. If done correctly, the result is something memorable that will withstand the passing of time. Berke Breathed, the American journalist, wrote of comic strips in *Time* magazine on 25 December 1989 'once established, their half-life is usually more than nuclear waste' [4]. An exaggeration? Perhaps! However, if the history of Gonick's cartoon guides is to be taken as representative (the earliest is still in print after more than 20 years, far longer than the half-life of articles in most scientific journals), this must be one of the best ways to communicate scientific concepts and keep them alive. Do I detect the

stirrings in a reader to go to press with a cartoon guide to drug discovery?

References

- 1 Rowe, R.C. (2003) Science with a smile – cartoon capers. *Drug Discov. Today* 8, 919–920
- 2 Gonick, L. and Wheelis, M. (1991) *The Cartoon Guide to Genetics*, Harper Perennial, New York
- 3 Gonick, L. and Huffman, A. (1991) *The Cartoon Guide to Physics*, Harper Perennial
- 4 Andrews, R., ed. (1996) *Cassell Dictionary of Contemporary Quotations*, Cassell, London

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Novel opportunities for the treatment of brain diseases

The Esteve Foundation, set up in 1983, stimulates progress in pharmacotherapy through scientific communication and discussion by, for example, organizing international symposia on topics of interest.

The 11th Esteve Foundation Symposium on Drug Transport(ers) and the Diseased Brain was held 6–9 October 2004 in S'Agaró, Spain. The topics centred on strategies to overcome brain barriers to deliver (biopharmaceutical) drugs to the brain to treat central nervous system (CNS) disorders, including Alzheimer's disease, Parkinson's disease, multiple sclerosis, lysosomal storage diseases and brain tumours. The work presented showed that we are at the edge of a new era on the delivery of particularly large (biopharmaceutical) drugs such as enzymes, short interfering RNA, and genes to the brain to treat brain diseases. The proceedings of the symposium have been edited by A.G. de Boer and will be published in the International Conference Series 1277 by Elsevier, The Netherlands.