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F Pragst, M Herzler, S Herre, B-T Erxleben and M Rothe, **UV Spectra of Toxic Compounds, 4th Edition**.

Happenheim: Verlag Dr Dieter Helm, 2001.
1042 pages hardback. Hardback £180
ISBN 3-923032-13-7

Reviewed by Professor Tony Moffat, Royal Pharmaceutical Society of Great Britain, London, UK

It is surprising that, in the age of the wide usage of high-performance liquid chromatography (HPLC) using photodiode array detectors (DAD) in toxicology, there are few published collections of relevant ultraviolet (UV) spectra in book form. Those involved in the analysis of toxic compounds (medicinal drugs, drugs of abuse, drug metabolites, pesticides and environmental poisons) will therefore welcome the new edition of this book.

The book contains 2682 UV spectra run between 195 nm and 380 nm under isocratic HPLC conditions. Only one column was used, a Lichrospher RP8ec, 5 μm, 250 × 4.0 mm column using two different mixtures (A and B) of acetonitrile and phosphate buffer pH 2.3 (37% and 62.5% acetonitrile, respectively). Relative retention times to standard compounds (5-(4-methylphenyl)-5-phenylhydantoin for eluent A and 4-phenylbenzophenone for eluent B) are also given with most compounds being eluted within 30 minutes using eluent A. This gives a robust, relatively fast screening system for the detection and identification of toxic compounds, which could be appealing for those who wish to set up such a system.

Comparisons of these spectra with those run in other acetonitrile/pH 2.3 phosphate buffer combinations showed very little difference. Thus, this collection of UV spectra could be used with other isocratic or gradient HPLC systems provided that the pH is maintained at 2.3. However, differences between these spectra and those run at more acidic pH values (e.g. 0.1 M sulphuric acid) are to be expected for some acids with low pK_a values. The great advantage of these spectra is that they go down to 195 nm (using acetonitrile).

The spectra are conveniently arranged in alphabetical order by their international non-proprietary name. Each entry also gives the drug's structural formula, CAS number, its pharmacological group, HPLC relative retention time, and UV maxima and minima. The authors have recognised that some drugs do not have sufficient UV absorption above 195 nm to be detected so they have included a list of 206 such compounds so that they may always be considered as possible identities. Strangely, they have not included a list of UV maxima to enable the identification of an unknown UV spectrum.

There is a useful introduction of 55 pages of how to use the UV and HPLC data. This includes a valuable section on selected up to date references about the use of HPLC-DAD in toxicological analyses.

For those who wish to compare spectra electronically, there is also a CD-ROM version priced at €2500 (+VAT and shipment). It contains spectra for each compound using three DAD detectors – Bio-Tech DAD 540, Hewlett-Packard HP 1090 and Shimadzu SPD-M10AVP. There are also data in ASCII format for importation into other manufacturers' software. This greatly enhances the value of the collection to chromatographers as the complete spectral characteristics of compounds may be compared accurately.

The authors have agreed to the use of these UV spectra and HPLC relative retention times in the forthcoming Third edition of *Clarke's Isolation and Identification of Drugs*. This will enable their data to be placed alongside existing standardised spectroscopic and chromatographic data, making it much more useful and accessible to those involved in toxicological and pharmaceutical analyses.

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Gerald H Pollack, **Cells, Gels and the Engines of Life**

Seattle WA: Ebner & Sons, 2001. 305 pages
Hardback $49.50, Paperback $27.95.
Hardback ISBN 0-9626895-1-3,
Paperback ISBN 0-9626895-2-1

Reviewed by Richard J. Schmidt, Barnoldswick, UK

This is no ordinary book. And it is not really a reference book. Its title gives very little away and may even be sufficiently meaningless as to fail to excite the interest of a passing eye. However, the sub-title shouts out its message quietly and confidently: 'A new, unifying approach to cell function'. This book is a crusade!

It is the nature of scientific progress that historical findings are built upon and extended by contemporary researchers. There is simply no time in the publication-driven production line of academic research to revisit and question the basis of work already done. The peer-review process, despite its recently exposed shortcomings, continues to provide warmth and comfort for groups of like-minded individuals working in broadly the same field and feeding from the same trough that is their source of research funding. It simply would not be right for any such individuals to question the underlying science in their field because that would be a guaranteed way of causing their flow of research funding to dry up. But Gerald Pollack dares to go where few would care to lead and questions long-established scientific tenets. What he has written will make uncomfortable reading for some. And being of a thoroughly cynical disposition, I fear that those individuals who really should read this book will find several reasons why they shouldn't bother.

Let us approach this from another direction. Every research scientist should acknowledge that experiments designed and carried out even 20 years ago are likely to be regarded as unsophisticated by today's standards. So, what about those experiments carried out 30 or 50 years ago? Even more unsophisticated? Yet those experiments carried out before most current researchers had even taken their first breath form the foundations upon which today's understanding is based. And if certain experimental observations reported in the literature 50 years ago had been overlooked or conveniently ignored by the researchers of the time because they did not seem to fit into the emerging paradigm, how can contemporary researchers possibly become aware of their existence in this fast-moving age of online databases, the coverage of which does not extend back to the days of valve radios? Indeed, why should you even suspect that researchers of the time had, through their acts or omissions, suppressed experimental observations that they did not like? There is a natural tendency for this to occur in laboratories where individuals try to prove rather than disprove their hypothesis; this is amongst the gravest of errors that can be made in scientific research. So, if you have ever written or uttered a phrase that expresses the sentiment "Our work proves that [X] happens because of [Y]", you really should consider obtaining a copy of Gerald Pollack's book.

Gerald Pollack has drawn attention to experimental observations made many, many years ago that simply do not fit with current understanding of some rather important concepts as promulgated by basic undergraduate text books, university lecturers who use these books because they can often get free copies for evaluation, and of course those who go on to undertake research in these areas. Take, for example, the sodium pump. To be fair, Gerald Pollack is only the messenger as far as what he has written about the sodium pump is concerned. He actually tells a story that was originally written by Gilbert Ling. I had to obtain a copy of one of Gilbert Ling's recent publications (*Physiol. Chem. Phys. & Med. NMR* 29: 123–198 (1997)) to gain a glimpse of the turmoil that has existed in the sodium pump field for about 50 years! Gilbert Ling carried out some simple experiments (simple in terms of what he was trying to observe; complex in terms of experimental design) as part of his Ph.D. work. His observations did not fit with the then current understanding of the sodium pump. He writes that he was quietly advised that the sodium pump was a 'Holy Cow' and that he should stay away from it. He didn't. His research funding dried up. His research students fled for fear of becoming unemployable. A smear campaign was instigated to blacken his name. But his results are clear: if you poison frog sartorius muscle with sodium iodoacetate, and/or provide a nitrogen atmosphere and/or cool the muscle preparations down to 0 °C, ATP production should cease and the sodium pump should stop working. This should result in intracellular sodium levels rising as the sodium pump fails. But that is not what happens. If you want to see how Gerald Pollack tells the story, get his book. Suffice it to say that the sodium pump may well use ATP to do something that results in the movement of sodium and potassium ions in opposite directions across membranes, but

that something has little if anything to do with maintaining potassium at a high level and sodium at a low level intracellularly. You don't need a sodium pump to achieve this end because it happens spontaneously! If you are troubled by this observation, you should get Gerald Pollack's book.

So how does the cell manage to keep intracellular potassium levels high and intracellular sodium levels low? The title of the book contains a clue to the answer: gels. Well actually, the structured water that gels create. Gerald Pollack's book is about how water makes things happen in cells. Yes, water. It is about 'vicinal' or 'interfacial' water. You have to read some more recent work by Philippa Wiggins (*Physica A* 314: 485–491 (2002)) to really begin to get to grips with the story that Gerald Pollack is telling. According to Philippa Wiggins, water exists as 'two state water', containing microdomains of high density liquid (HDL) and low density liquid (LDL). Surfaces induce segregation and structuring phenomena which result in HDL and LDL forming distinct layers at the surface/bulk water interface. Experimental evidence shows that HDL and LDL are in effect two different liquids, and therefore solutes exhibit partitioning effects between these two states of water. When you then read that potassium ions, L-amino acids and D-sugars prefer to dissolve in LDL whilst sodium ions, D-amino acids and L-sugars prefer HDL, you should begin to realize that vicinal water is a subject that cannot be ignored, especially by those whose work involves trying to understand and manipulate biological molecules and processes. And that means most, if not all, biomedical scientists. If, after reading this, you also realize that biological experiments involving a phosphate-containing buffer prepared from, for example, NaH_2PO_4/K_2HPO_4 may produce different biological outcomes if KH_2PO_4/Na_2HPO_4 is used instead, then you are following what I have written and you are beginning to acknowledge the contribution to your future research that Gerald Pollack's book is already making.

But there is much more to Gerald Pollack's book than a wish to revisit the sodium pump and to focus, for a change, on the water in living systems rather than on the proteins, carbohydrates, phospholipids, salts, etc. He develops a story that eloquently moves the reader towards a single unifying hypothesis built around phase transitions that occur in the structured water environment of living cells. The same phase transition phenomena can, it seems, provide mechanistic explanations for a multitude of intracellular events that are currently understood only in terms of the words that describe the observable phenomena. Consider, for example, what it is that you actually understand by the phrase 'secretion of a neurotransmitter'. You could probably describe what is actually observed during this process, but could you explain mechanistically how secretion happens? Or how cell division happens? Or how muscle cells contract? Or how action potentials propagate (yes, I too have read the undergraduate textbooks, but the story about action potentials as it is commonly told, like the sodium pump story, contains rather significant omissions)? Or how transport of substances occurs through the gelatinous mass that is the intracellular environment (this is, I would submit, of fundamental significance to our understanding of intracellular therapeutic targeting of bioactive molecules)? Or how ATP works (yes, yes, I too have read the undergraduate textbooks and lectured on the subject)? Gerald Pollack attempts to do all of this and more. And I have to say that I find the case he makes compelling.

Gerald Pollack's book is a monumental piece of work. For most of the areas he discusses, he is on the outside looking in. This is a difficult place to get to and a dangerous place to be because those on the inside may be tempted to close ranks and defend themselves with utterances to the effect that Gerald Pollack cannot possibly know what he is talking about. A similar fate befalls anyone who tries to obtain a research grant to work in a new area, but that is another story. Indeed, I too can tell that his understanding of areas with which I have some familiarity is at best superficial. But the question I then asked myself was whether the new insights he brings to that area are based on robust experimental observations that have a fundamental bearing on the subject matter in question. This is about recognizing that experimental data are not all equal – everything depends on whether individual pieces of data form part of the fundamental framework or the downstream documentation of noise or chaos. The strength of his approach lies in the fact that he has put missing pieces into the fundamental framework and this has enabled him to formulate a unifying hypothesis that brings together several areas to produce a coherent and simplified whole.

Our understanding of the world is essentially just a story that is consistent with the currently available set of experimentally-derived data. New experimental data may either add colour or detail to the picture or they may expand the boundaries of the picture . . . but sometimes, and only very rarely, new data may require that the picture is erased and redrawn in a different way. If you have bothered to read this review to the end, you will probably also want to read Gerald Pollack's book. I would commend it to you. We will then need to look for volunteers to rewrite the standard undergraduate biochemistry/cell biology textbooks . . .

Dr Richard J. Schmidt spent almost 20 years teaching pharmacognosy, biochemistry and pharmaceutical chemistry at the Welsh School of Pharmacy in Cardiff. His research interests addressed redox processes in skin in the context of prohapten activation in allergic contact dermatitis and the development of new biomaterials for use as modulators of the redox environment in the treatment of chronic ulcers. After a couple of years with Johnson & Johnson Medical, he now works as an intellectual property realization consultant and locum community pharmacist.