

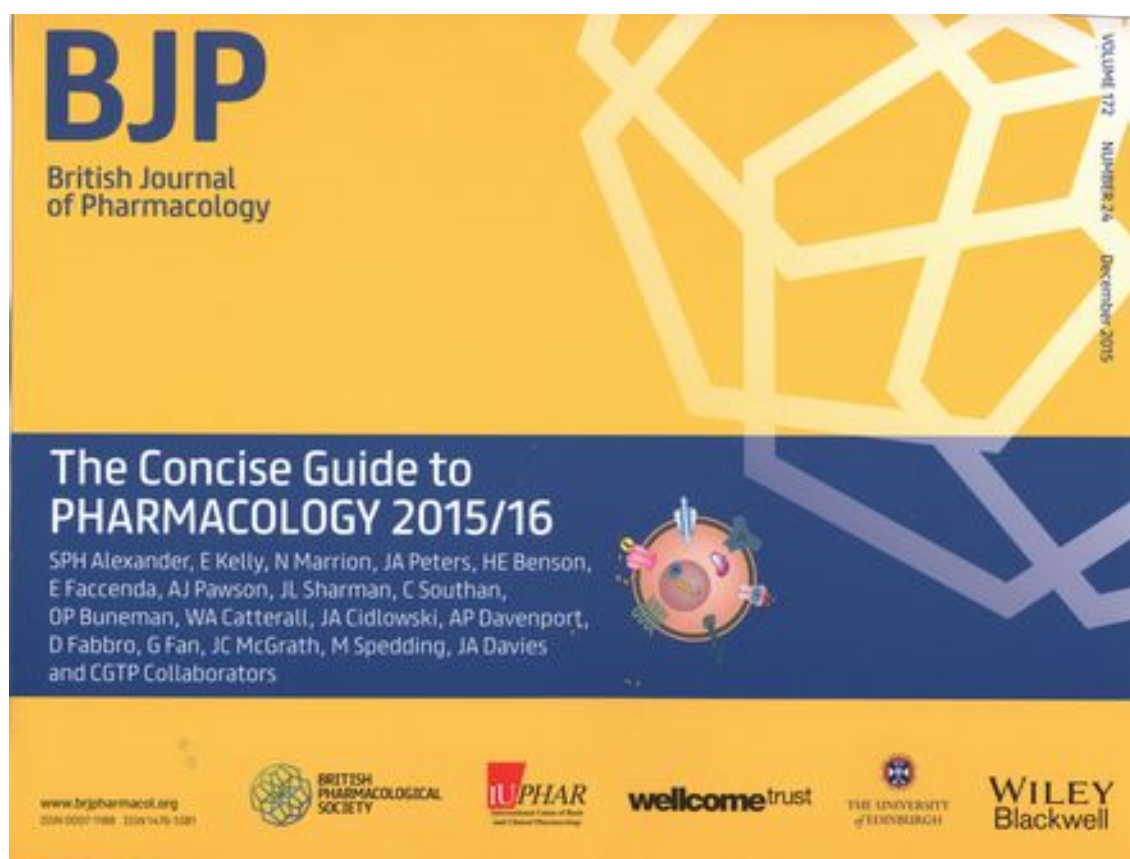
Automatic writing

Traditionally, the phrase “automatic writing” connotes an alleged psychic ability to produce writing with no intervention of the conscious mind. This piece has nothing to do with that, and any reader who feels that my own writing seems not to have benefited from any conscious thought can keep that opinion to himself, thank you very much. Instead, it is about our recent publication of 8 review papers that together assemble into the chapters of a special issue of the British Journal of Pharmacology, by a method that had almost all of the 'writing' done directly by a set of computer programs. To turn the computer-generated output into the final manuscripts, human contributors has to do little more than write some introductory remarks and make some changes to the layout for aesthetic reasons. And, to be clear, these are not papers in one of those semi-fraudulent, pay-to-publish, journal-in-inverted-commas things that have disfigured the internet so much in recent years. Instead they appear in one of the world's most highly respected journals of pharmacological research, the editors of which were most encouraging of what we have been doing. Let me, briefly, tell the story...

My laboratory hosts, develops and maintains a comprehensive database on drugs and their targets, on behalf of IUPHAR (the International Union of Basic and Clinical Pharmacology) and of the BPS (British Pharmacological Society), with generous funding from these and from The Wellcome Trust. The database is called the Guide to Pharmacology, and anyone can access it freely (see 'links' section below – though I should point out that it is intended for experienced scientists and clinicians, and it may be a little baffling for complete outsiders to the field). The data themselves are collated from research papers, patents, clinical trials etc, and are passed to the IUPHAR's expert committees – a combined membership of about 900 senior pharmacologists – for detailed, critical evaluation before being added to the database. That is what makes the resource so valuable – subject experts can provide a warning that a particular piece of data is an outlier that is not supported by other studies. That does not necessarily mean it is wrong, but warnings like this can be very valuable and are not apparent when one simply reads one paper in the primary literature and gets too excited about what may be a very atypical result. The committees can also recommend particularly useful drugs for particular types of experiment. The data are curated and analysed by a team of three knowledgeable pharmacologists and chemoinformaticians in the group (Dr. Elena Faccenda, Dr. Adam Pawson & Dr. Chris Southan), and the database itself is developed and

supported by two talented software specialists (Dr. Simon Harding & Dr. Joanne Sharman), all very ably supported by our hard-working secretary (Veronika Divincova). The result of all of this is a reliable and useful central source for pharmacological information, including 8500 drugs and just under 3000 drug targets, that is much used throughout the world (19,000 separate users generate over 90,000 page views per month).

By a long tradition, the British Journal of Pharmacology has produced 2-yearly summaries of the interactions between drugs and their targets as a special issue of the journal. Since the contents of BJP's guide and the contents of the old IUPHAR database merged to form the Guide to Pharmacology database, the special issue – the Concise Guide to Pharmacology as it is been called in recent years – has been created by distilling the most important items from the much larger online database. We felt that there must be better ways of turning information already in a computer database into textual information on an electronic copy of a journal manuscript than typing on one screen with the database open on another, and that is how our recent experiments with automatic writing came about.



The front cover of the special issue (the paper version).

One of the great advantages of working in Edinburgh is the range of expertise available in a university like this one. In particular, the University is consistently rated as one of the world's foremost centres for the research into informatics and computing and the Informatics building is just along the street. In that building lurks Professor Peter Buneman, a much-honoured senior computer scientist with a strong academic interest in the theory of databases. Fortunately, for us, Peter has been a very good friend to the Guide to Pharmacology project since its inception and has been interested in using us as a test-bed for methods to extract the contents *and structure* of a database into archivable formats that allow later reconstruction of the database in new computer architectures. Peter and his team worked with Jo and Simon to create an archivable version of the sections of the database corresponding to those needed for the Concise Guide, and with the publishers they worked on scripts to turn this into files suitable for desk-top publishing. It mostly worked! There was more of a need for manual editing than we hoped, to make tables look elegant, and a few other tweaks were also needed. Everyone involved learned from the experience, and have plans for a much better system next time (which is I am not going into too much detail here). Nevertheless, it remains true that most of the content of these papers was generated directly by computer.

The experience raises interesting questions about how much scientific writing can be automated, and how much should be. On the negative side, it would obviously be a great loss if the human touch were to be lost from reporting and analysis of long-planned and carefully considered, novel experimental reports. On the positive side, allegations of biased presentation in commercially critical fields such as drug testing might be avoidable if the 'writing' of raw data from standardised tests into final report tables and tests were to be done by agreed, standard automated processes. The conclusions would still require careful judgement, but comparisons between different papers, and meta-analyses in particular, may be greatly facilitated by this approach. Ironically, automatic writing may reduce the need for us all to be psychic.

Jamie Davies,
Edinburgh,
December 2015

Links:

The Guide to Pharmacology database (free and open to all): <http://www.guidetopharmacology.org>

Free pdf copies of the chapters in the Concise Guide:

- Overview: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13347/pdf>
- Voltage-gated ion channels: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13349/pdf>
- Ligand-gated ion channels: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13350/pdf>
- Other ion channels: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13351/pdf>
- Transporters: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13355/pdf>
- G-protein-coupled receptors: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13348/pdf>
- Nuclear hormone receptors: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13352/pdf>
- Catalytic receptors: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13353/pdf>
- Enzymes: <http://onlinelibrary.wiley.com/doi/10.1111/bph.13354/pdf>

IUPHAR: <http://www.iuphar.org/>

BPS: <https://www.bps.ac.uk/>

Peter Buneman: <https://royalsociety.org/people/peter-buneman-11163/>