

Blues for the lecture theatre – the pharmacology songbook

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*In 2005, we were able to digitally record the so-called pharmacology songbook; a set of songs with lyrics devoted to pharmacological topics. A CD was prepared entitled *The Beta-blocker Blues* and its contents are now all freely available in mp3 format from our web page (Ewen MacDonald and friends 2005). The web page also contains the lyrics and videos. These songs can be used to spice up a lecture; not only do they also describe certain aspects of basic pharmacology in a humorous manner, they also provide students with easy-to-grasp illustrations of difficult concepts (e.g. the problems associated with prophylactic use of risk-reducing medications in large numbers of people, most of whom will never suffer the actual disease). We examined whether students could learn basic pharmacology knowledge simply by listening to a CD with the songs. After listening to the CD on the weekend prior to the start of their pharmacology course, our novice students more than doubled their performance on a multiple-choice examination (from a pre-CD score of 30% up to 65% after the CD; $p < 0.001$). We conclude that these 'pharmacological blues' are a useful teaching resource for basic pharmacology students.*

Introduction

Some years ago, in an attempt to quieten down the lecture theatre at the start of the actual lecture, it was decided to play a short piece of music with lyrics appropriate to the up-coming content. The hope was that students would be sufficiently curious about the music and the lyrics on display that they would terminate their chatter. In fact, this strategy did work and proved to be a sophisticated alternative to loud coughing from the lecturer or straightforward demands for silence. However, finding suitable lyrics for every lecture proved at first difficult, and later impossible, when the course moved on to topics not normally included in the repertoire of modern popular songwriters.

Rather than going back to the authoritative demands for silence, one of the authors (EMD) started to write lyrics appropriate to the up-coming lecture. The first such song was entitled *The Beta-blocker Blues* and gradually over the years, a body of material was created which could be called 'the pharmacology songbook'. The response of the students to incorporation of the songs into lectures has been very positive; often students would mention the songs as one of the highlights of the course and spontaneously state how helpful they were in remembering pharmacological facts.

It seemed intuitive to us that students would find music to be an effective way of learning. We all remember the lyrics of popular songs of our youth, the so-called soundtracks of our lives. Pre-school children are taught almost exclusively via musical nursery rhymes (Trehub and Trainer 1988) but by the time the kindergarten students reach university, music is no longer a mode of instruction, though most students spend large parts of their spare time listening to music and much of their money on festival tickets. While, the incorporation of music into a lecture may be considered as a gimmick, it was our belief that this could well be an alternative teaching method, helping our students to learn some basic pharmacological facts. There are only a few relevant citations on this topic. In one study, medical students showed better recall of anatomical details if these were sung rather than spoken (Panksepp and Bernatzky 2002) and in the 1970s in Loyola University, Illinois, medical students were introduced to different types of personality disorders via the lyrics from popular songs (Egan 1977). This study was designed to determine whether students could actually learn some basic pharmacological facts simply by listening to the words and music of our 'pharmacological blues'.

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Material and methods

In 2005, it became possible to record these songs in a professional studio so that they could be made available in digital form not only to our own students but via our musical lecture web page to students and teachers of pharmacology all over the world (Table 1; Ewen MacDonald and friends 2005). When the songs became available in digital format, it was possible to examine whether, in fact, students could learn useful pharmacological knowledge simply by listening to the songs a few times.

The effectiveness of the music was tested in four different student populations; second year medical students (n=12); second year pharmacy students (n=10) and graduate chemistry students enrolled in a basic pharmacology course (n=8). None of these students had received any formal lessons in pharmacology and the CDs were distributed on the week prior to their introduction to the subject. The final student group consisted of fourth year pharmacy students (n=10). All of these fourth year students had completed basic pharmacology instruction; had spent at least six months working in a community pharmacy and were now starting advanced courses.

Table 1. The titles of the songs in the pharmacology songbook with a summary of their salient points

Title	Teaching aims
<i>Zero Tolerance for You</i>	Pharmacological definitions - described in terms of human relationships
<i>Messrs. H & H</i>	Henderson-Hasselbach equation; pKa values; absorption of weak acids and bases
<i>Drug Dosage Forms</i>	Unusual dosage forms from sublingual tablets to plasters, instructions on how to insert suppositories
<i>Down to Five</i>	Strategies to reduce plasma cholesterol levels, the concept of prophylactic drug therapy - and its disadvantages
<i>Beta-blocker Blues</i>	Side effects of beta-blocking drugs (cold feet, cold toes cold fingers - ice cold beta-blocker blues)
<i>Nicotine Replacement Therapy</i>	Dosage forms used to supply nicotine in smoking cessation; symptoms of nicotine withdrawal
<i>Cancer Chemotherapy</i>	Mechanisms of action of some cytostatic drugs, especially those derived from natural sources, taxols, vinca alkaloids etc.
<i>Potentol Rag</i>	Polypharmacy, wanted and unwanted effects of drugs, male potency medications
<i>Moonface Blues</i>	Side effects of prolonged glucocorticoid treatment
<i>Alzheimer Blues</i>	Pathogenesis of Alzheimer's disease and its drug therapy
<i>Growth Hormone Hero</i>	Erythropoietin and growth hormone as doping agents in sports
<i>Mr Miller's Magic Panacea Pills</i>	Side effects of over-the-counter medications, using one drug to treat symptoms evoked by another

There were two similar multiple choice examination questions, called here examination A and examination B. Each examination consisted of 13 multiple choice questions (one correct answer from five options) on topics covered by the song lyrics. Students were invited to the department to pick up their copy of the CD and at that time completed one exam. They were instructed to answer all of the questions, if they did not know the answer, then they should try to guess the answer. They were asked to listen to the CD at least once, preferably also reading the lyrics (printed on a booklet inside the CD cover). At the start of the course on the next week, the students were given the second exam during a break in the first day's lectures. This was arranged such that if they had answered examination A before, they now were given examination B and vice versa. Fourth year pharmacy students simply came to the departmental office at some point in the next week and took the second examination.

A two-tailed paired Student's *t*-test was used to compare the performance of each individual student before and after listening to the CD. The difficulties of examinations A and B were compared with unpaired Student's *t*-test and differences between different student populations were compared by ANOVA with Scheffe's test to compensate for multiple comparisons. In all tests, a *p*-value less than 0.05 was considered statistically significant.

Results

All of the student groups improved their performance after listening to the CD (Figure 1). Before listening to the CD, the novice pharmacology students (i.e. the second year medical and pharmacy students plus the graduate chemists) had average scores around 30% (26% chemists; 30% medics; 32% pharmacists), slightly better than the 20% that would be achieved on a pure chance basis. Their initial scores were all statistically worse (*p*<0.01) than the fourth

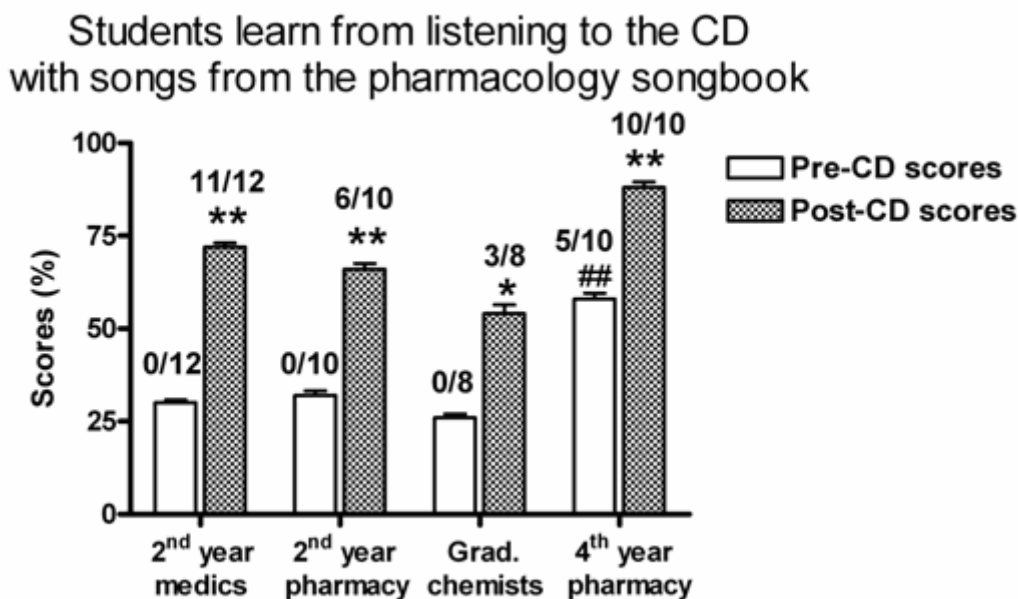


Figure 1. The effectiveness of the CD as a teaching resource. Results are means \pm s.e. mean. All student groups improved after listening to the CD (* = $p < 0.05$; ** = $p < 0.01$; Student's paired t-test) (## = $p < 0.01$; significantly different from all novice student groups; Scheffe's test). Above each column is the proportion of students who would have "passed" the examination i.e. obtained a score of at least eight questions correct out of a total of thirteen.

year pharmacy students who achieved a mean score of 58%. After listening to the CD, all but one of the students improved their performance. This meant that all of the novice groups at least doubled their average scores (54% chemists; 72% medics; 66% pharmacists). Though the best scores were achieved by the fourth year pharmacy students (84% correct), their post-CD scores were not statistically better than those achieved by the second year students.

Another way to interpret these results is to examine how many would pass the exam. Our second year students are offered mid-term examinations with similar types of multiple-choice questions and a pass mark of 60% (i.e. in our exam that would mean eight out of thirteen questions correct). Using this criterion, none of the novice students would have passed prior to listening to the CD, but after listening, two out of every three would have passed. All of the fourth year pharmacy students would have passed the exam after listening to the CD.

The two exams had equal degrees of difficulty (scores for novice students taking exam A were $30\% \pm 3\%$ compared to $28\% \pm 3\%$ for those taking exam B first). However, we did note that certain questions were answered correctly more than would be expected on a pure chance basis (i.e. one correct out of five). The medical students were aware that seborrhoea was greasy skin and the graduate chemists and the second year pharmacy students most often knew what the pKa value referred to and the sites in the gastrointestinal tract favouring absorption of a weak acid.

Discussion

All but one of our students had better test scores after listening to the CD than their original efforts. The single

student whose performance deteriorated (a graduate chemist) admitted that though she had played the CD, she had used it to lull her baby to sleep and she herself had not really paid careful attention to the lyrics. The questions in the quizzes related to basic pharmacology but were focussed around topics covered by the lyrics. Thus, students were asked about the side effects of beta-blockers, corticosteroids, dementia medications i.e. topics covered in the *Beta-blocker Blues*; *Moonface Blues* and *Alzheimer Blues*. The questions were arranged on areas which would be examined in the final exam; our fourth year students who had already taken and passed the course, scored significantly better in the pre-CD course than the pharmacology novices i.e. they already knew the side effects of beta-blockers and corticosteroids etc. However, even these advanced students improved their performance after listening to the CD. For example, the more complex questions such as which receptor is blocked by yohimbine (mentioned in the *Potentol Rag*) or the mechanism of taxanes (described in the song *Cancer Chemotherapy*) were answered correctly by the advanced students (but not the novices) after listening to the CD. These questions were too esoteric for the novice students; the lyrics on their own were not sufficient to clarify these difficult concepts to students only embarking on pharmacology studies. In contrast, there were questions which even the novice pharmacy students could answer correctly before listening to the CD, such as the meaning of the pKa value (described in the song *Messrs H & H*).

Humour is also an important element of most of these songs; if they are to be effective, students have to listen and if they do not find the songs amusing and interesting, they will not waste their free time listening to them. It could be argued that the time could be better spent reading the textbook, but students already spend hours revising for

examinations, reviewing lecture material and preparing for seminars etc. The songs are a true alternative to this hard work and most students said that they had listened to the CD a couple of times, not simply the single time requested in the instructions. As one student stated in his/her course critique "Anything at all which lightens the burden of this heavy course is to be welcomed. It is much easier to remember facts when they are associated with pleasurable events". Another student remarked "I find these songs extremely useful especially for remembering the side effects of drugs – it is so easy to learn by listening to music".

Most of our songs are written as blues, which proved to be a very suitable medium. The lyrical structure of the blues is sufficiently flexible to allow a variety of permutations, students are well acquainted with blues music and perhaps most importantly, the demands on the vocalist are not excessive, though blues aficionados, such as the music critic of a Finnish blues magazine, may disagree (Walamies 2005). The blues has an honourable history as a flexible teaching tool; some of its greatest exponents such as Blind Willie Johnson and Reverend Gary Davis sang the blues to preach the Gospel; in our own profane way we are continuing that tradition.

There are many ways that these songs can be incorporated into lectures. They can be downloaded in mp3 format from the web page (MacDonald & friends 2005) and inserted directly into a PowerPoint presentation (using 'insert' > 'movies and sounds' > 'sounds from file'). Lyrics to all songs are available as PDF files from this same site and there are also some simple videos of the band performing the songs. In addition to spicing up individual lectures by inclusion of an appropriate musical interlude, we have devoted an entire hour to performing the songs live in conjunction with an interactive quiz. This has proved to be extremely memorable and it is our belief that the use of this form of "edutainment" can help students cope with the stresses of studying today (Guthrie, Black, Bagalkote, Shaw, Campbell and Creed 1998). Students develop a positive attitude to our course; fun should not be an offence or offensive (Howarth-Hockey and Stride 2002). It is essential to find ways to make a task like learning a fact-filled subject such as pharmacology less of a chore and more of a pleasurable experience.

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