Barbara Sahakian

Born 1952. Professor of clinical neuropsychogy.
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1. Introduction

The following introduction was archived in 2021, with acknowledgement and thanks, from Wikipedia.

Barbara Jacquelyn Sahakian, FBA, FMedSci is Professor of Clinical Neuropsychology at the Department of Psychiatry and Medical Research Council (MRC)/Wellcome Trust Behavioural and Clinical Neuroscience Institute, University of Cambridge. She is also an Honorary Clinical Psychologist at Addenbrooke's Hospital, Cambridge. She has an international reputation in the fields of cognitive psychopharmacology, neuroethics, neuropsychology, neuropsychiatry and neuroimaging.

Professor Sahakian is a Fellow of Clare Hall, Cambridge. She is currently President of the International Neuroethics Society (INS), of which she is a founder member. She is Past-President of the British Association for Psychopharmacology (BAP), having served as President from 2012 to 2014.

Education

Sahakian completed her PhD in Psychopharmacology at Darwin College, Cambridge in the Department of Psychology at the University of Cambridge. Following this, Sahakian studied for a Diploma in Clinical Psychology and became a Chartered Psychologist.

Career

Sahakian is best known for her work on cognitive enhancement using pharmacological treatments, early detection of Alzheimer's disease,

cognition and depression and neuroethics. Sahakian's research is aimed at understanding the neural basis of cognitive, emotional and behavioural dysfunction to develop more effective pharmacological and psychological treatments.

The focus of her lab is on early detection of neuropsychiatric disorders, differential diagnosis and proof of concept studies using cognitive enhancing drugs and cognitive training.

In her research, Sahakian uses techniques such as psychopharmacological, neuropsychological and neuroimaging (fMRI and PET). Key research areas for her group are Alzheimer's disease, Attention Deficit Hyperactivity Disorder (ADHD), Obsessive Compulsive Disorder (OCD), substance abuse, depression and mania.

In 2007, Sahakian raised concerns regarding the ethics of using drugs intended to help dementia and Alzheimer's sufferers to instead enhance cognitive function in healthy people. In May 2014, Sahakian published an article on the subject of achieving brain health for a flourishing society within the next decade. In this article, she included a list of experts from a range of areas, including neuroscience, innovation and technology. Sahakian was asked to write this article for Sir John Beddington, Chief Scientific Adviser to the UK Government.

Sahakian has published over 400 papers covering these topics in scientific journals, including many publications in the prestigious scientific and medical journals Science, Nature, Nature Neuroscience, The Lancet, and the British Medical Journal. She is an Associate Editor of Psychological Medicine. The ISI Web of Science database credits her with a Hirsch (h) Index of 100.

Sahakian is co-author of 'Bad Moves. How decision making goes wrong and the ethics of smart drugs', published by Oxford University Press in 2013. She is also co-editor of 'The Oxford Handbook of Neuroethics', published in 2011 by Oxford University Press.

In addition to her Presidencies of the BAP and INS, Sahakian is also on the council of the International College of Neuropsychopharmacology (CINP) and on the European College of Neuropsychopharmacology (ECNP) Review Board.

She is also a London Imperial Affiliated Professor and a Distinguished Research fellow at the Oxford Uehiro Centre for Practical Ethics. Previously, Sahakian has been a member of the MRC Neurosciences and Mental Health Board (2006–2010) and a member of the Society for Neuroscience (SfN) Committee on Women in Neuroscience. Recently, a Royal Institution article named Barbara Sahakian amongst the top women in science.

Inventions

Sahakian's research uses neuropsychological tests, such as the Cambridge Neuropsychological Test Automated Battery (CANTAB) tests, which she co-invented in the 1980s. CANTAB is now used at over 700 research institutes worldwide and is backed by over 1,200 peer-review articles. Sahakian serves as a Senior Consultant to Cambridge Cognition, a spin-out of the University of Cambridge. Cambridge Cognition now provides CANTAB.

The CANTAB PAL touchscreen test, which assesses visual memory and new learning, received the highest rating of world-leading 4* grade from the Research Excellence Framework (REF) 2014. Following this award, CANTAB and CANTAB PAL were highlighted in the Medical Schools Council 'Health of the Nation' 2015 publication, which described CANTAB as a boost to the UK economy.

Neuroscience and mental health policy

Sahakian is a lead on many high-impact international neuroscience and mental health policy reports, including the National Institute of Mental Health (NIMH) funded report on Grand Challenges in Global Mental Health and the UK Government Foresight Project on Mental Capital and Wellbeing in 2008. The latter project emphasised good brain health and wellbeing throughout the life course and highlighted important concepts, such as cognitive reserve and resilience to stress.

Sahakian recently presented on neuroscience and mental health policy at the World Economic Forum (WEF) 2014 in Davos, Switzerland. She is a Member of the WEF Global Agenda Council on Brain Research.

Press

Sahakian frequently engages the public in science, appearing on programmes such as BBC Newsnight, and on both The Life Scientific and the Today Programme on BBC Radio 4. She has also taken part in numerous newspaper interviews, such as The Sunday Times and Forbes Online. In 2012, Sahakian contributed to the catalogue and appeared in a video for the Wellcome Trust Superhuman Exhibition. In May 2014, she took part in a Reddit Ask Me Anything (AMA), fielding questions on a range of subjects, such as depression and cognitive enhancing drugs.

In July 2014, Sahakian dispelled the myth that humans only use 10% of their brains in regard to the plot of the film Lucy. In March 2015, she advised on the 'You have been upgraded' event at the Science Museum in London, which featured demonstrations by members of her Laboratory. In the context of presentations on neuroscience, brain health, cognitive

enhancement and neuropsychiatric disorders, she has frequently stated the importance of understanding brain health and disease.

Honours and awards

Since 2004, Sahakian has been a Fellow of the Academy of Medical Sciences. She is also associated with the Human Brain Project. Sahakian is also a Member of the International Expert Jury for the 2017 Else Kröner-Fresenius-Stiftung Prize.

Sahakian was he was appointed to the F C Donders Chair of Psychopharmacology at the University of Utrecht in 2005 and the Distinguished International Scholar Award at the University of Pennsylvania in 2009. In 2010, she received the International College of Geriatric Psychoneuropharmacology (ICGP) Senior Investigator Award. In 2008, Sahakian gave the Alfred Deakin Innovation Lecture in Melbourne, Australia.

In 2015, Sahakian was awarded a Doctor of Science degree from the University of Cambridge, which is the highest degree awarded by the University for distinguished research in science.

In July 2017, Sahakian was elected a Fellow of the British Academy (FBA), the United Kingdom's national academy for the humanities and social sciences.

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2. Interview with Jim Al-Khalili

The following is a transcript archived in 2021, with acknowledgement and thanks, from the interview by Jim Al-Khalili (above) of Barbara Sahakian in his BBC Radio 4 series The Life Scientific. It was broadcast in May 2012.

JA: Barbara Sahakian, my guest today, is Professor of Neuropsychology at Cambridge University. She ran one of the first memory clinics for people with Alzheimer's and, together with her husband, developed a test for early diagnosis of the condition. Early diagnosis of mental illness is important to make the most of therapies that are, or could become available in the future.

But neuroscientists need to think carefully about the ethics involved. Treating conditions like Alzheimer's and Attention Deficit Hyperactivity Disorder with drugs that protect the brain or modify behaviour means that psychopharmacology is a science which holds great promise. But it is also controversial, as it modifies cognition - our thinking and memory skills. So how far should we go, and how far can we go. Is it OK to take drugs which will improve our performance in exams? Could we even change aspects of our personalities? And is cosmetic neurology something we should even be aiming for?

Welcome Barbara. Barbara, what do you think is the potential for neuro-pharmacology?

BS: Well it's extremely important and it has already shown a lot of potential in terms of the treatments that we currently have. We are talking about drugs that modify cognitive function. So for instance they affect chemicals in the brain like Dopamine that are known to improve or affect cognition in different ways. It holds more for the future as well.

JA: Should it only be treating mental illness? Or is it going to be used more widely?

BS: Well this is the interesting thing. Because there is already an increasing lifestyle use of the cognitive enhancing drugs or smart drugs as they are called. So it may be that we are moving into a society that will be using these drugs more.

JA: We are going to come back to this later, but what do you consider are the main ethical issues in neuropharmacology?

Barbar Sahakian at the Hay Festival 2013.

BS: As a society we need to think about where we are moving to. I talk to students about cognitive enhancing drugs, and a lot of students take them for studying for exams. But other students feel angry about this; they feel those students are cheating. We have no long term health and safety studies of healthy people, and we really need those before people start taking them.

JA: You grew up in the States, in Boston, and both your parents were ministers in the church, which I suppose is a little unusual. How do you think growing up in a religious household influenced you?

BS: Well I guess both my parents were very interested in helping other people. So I've always had a kind of way of looking outside myself and not just thinking about myself, but thinking about how I might be able to make things better for society. And that's been a big influence in my life. My mother was one of the first women to get a theological degree from the Boston University School of Theology. So that's had a big influence on me too. I had a very good role model there.

JA: And did you inherit from them the Protestant work ethic?

BS: Yes, I think I did. I have a high energy level. I look for big problems. I look for treatments. Something that will make a substantial difference to the quality of life. For me it has been neuroscience and mental health issues that have been the big thing.

JA: I know you worked at a number of institutions on either side of the Atlantic. Originally as a psychologist. But you first came to the UK and to Cambridge to do your PhD in the 70s. I guess it's not so different today to what it was like when you first arrived there?

BS: It was really quite different. I remember when I came into the Department of Experimental Psychology. Oliver Zangwill (right) was the head of it then; a very bright and smart man. But when I asked if I could have Ms on my postbox I was told no, it has to be Miss or Mrs. I was the first woman in the laboratory and the first American.

JA: Your supervisor was a woman, Susan Iverson. So it's not as if you were breaking the mould by going and working in that field in Cambridge at that time?

BS: Yes, she was a very good role model. She had a family and was very dedicated to her work. And it was a very positive experience. But when I got there it was quite funny, because I was the first woman in her laboratory I was actually put in a sort of private office, so I wasn't sharing the common room with the boys. I was put in a separate room!

JA: Were they scared? What did they think was going to happen?

BS: I don't know! I think they just weren't used to it.

JA: Eileen Joyce was also a student in Professor Iverson's lab. These were very early days in topics like neuropharmacology, and understanding neuro transmitters - the chemicals that send messages to the brain.

Eileen Joyce (right): The atmosphere in Susan Iverson's lab was very exciting. It was full of PhD students and post-doctoral students all working on different systems but towards the same aim. So it was a very exciting time for everybody. These were pioneering days, because for the first time people were trying to understand how neurochemical systems in the brain modulated or led to different forms of

behaviour, and how this might be applied to understanding different kinds of mental and neurological illnesses. I thought Barbara was very exotic. She was one of the first people from North America that I had met. She was very dynamic and vivacious, and a great person to be around.

JA: Was it somehow exotic to be an American in England in those days?

BS: I think it was. When I came over I didn't really know any English people, so I had a lot of new friends to make. And I'll tell you what. We loved it. There was always somebody there. Whatever time of the day or night you went in, there were always people working, because we were so enthusiastic about our work and we were always so enthusiastic to see each other. We had fun.

JA: Did you feel you were part of something new and exciting, something pioneering?

BS: I did. I did. I started out with an interest while working in America, prior to doing my PhD, with children in the classroom who were hyperactive, and they were taking stimulant drugs for that hyperactivity, to help treat them and supposedly calm them down. And I got fascinated by that. Why would you treat hyperactive children with a stimulant drug?

JA: And the idea that conditions like Alzheimer's or ADHD could be treated with drugs only became a possibility because people were starting to understand about neuro transmitters in the brain - chemical messengers. Can you explain quickly how neuro transmitters work?

BS; Well basically they do send messages, and they can modulate your memory or attention.

JA: And by modulate what do you mean?

BS: I have been working recently with the drug Modafinil, and it is a very interesting cognitive enhancing smart drug, which I am sure we will talk about later in terms of healthy people's use. Basically that will improve that particular function, so that while you might be doing quite well, you can actually do even better. For example these will have massive effects on sleep deprivation, where your performance may be impaired. Or if you have a neuropsychiatric disorder, a brain injury, you can boost your function with these drug treatments which will improve the transmission in certain pathways.

JA: And, as is almost always the case in science, things aren't that straightforward. There are different kinds of neuro transmitters, aren't there?

BS: That's correct. So for instance some transmitters are important for function in hyperactive children, whereas if we look at Alzheimer's disease

we know that areas of the brain like the hippocampus are a very important area of the brain for memory function. It is one of the first areas affected by Alzheimer's disease and this affects what we call episodic memory. That is a type of memory where, suppose you come in in the morning and you have to park your car in a multi-storey car park. Then four or five hours later you come out if work and you think, where did I leave my car in this car park. That's episodic memory.

JA: Which I hope you are going to say everyone suffers from!

BS: But also the neuro transmitter in the brain, the chemical in the brain, can be kept at the best possible level with appropriate drugs.

JA: They are not repairing anything in the brain, if the connectivity between different parts of the brain is lost during Alzheimer's. They are just making sure that where those connections are still made they are as efficient as possible?

BS: That's exactly right. So that's why it's useful to have the drug treatment early for these neurodegenerative conditions.

JA: You have done a lot of work with Alzheimer's. You were one of the first people to run memory clinics. They are I suppose quite established now around the world?

BS: Yes, I worked with Raymond Levy and others at the Maudsley Hospital at that stage on the psychiatry. It was very frustrating, because people would come into the memory clinic, and they knew something wasn't quite right. You could test them, but the tools we had at that stage weren't sensitive enough, so you'd say, oh well they don't look quite right, but they're not outside the normal range. You would say come back in six months or a year's time and we will check again. And when they came back you would see decline. But I felt that wasn't good enough. We needed more sensitive tools where we could actually detect at that very early stage that there was a problem.

JA: As a result of this work you have developed a set or battery of these neuropsychological tests for the diagnosis of Alzheimer's together with your husband Trevor Robbins, who's also a neuroscientist. These tests are non verbal, and the results show how an individual is particularly affected by the condition.

Trevor Robbins: You have to remember that cognition isn't one thing, it's many things - perception, memory, attention, planning, decision-making, controlling your behaviour - all of these things. So you need different tests to isolate these different elements. There are now about fifteen tests. They engage different parts of the brain, different neural systems. So it's like an exercise kit for the brain. It can outline a profile of deficits. You might

have very good memory but rather poor attention, for example. Like all neuropsychological batteries - it's not unique - they pick out a profile of your cognitive abilities.

JA: Now Barbara, you've brought the Cantab test with you on your Ipad, so I am hoping that I can have a go myself.

BS. Yes. So we'll set you up then. You can press 'Run Test'.

JA: So there's all these avatars of people lined up in a row, colour coded. So I'll say I am just above average in memory. Now it's going to test my memory. There are six white boxes, and when they open up there will be a pattern in one box, and I have to remember which box it is in. Each box reveals itself for about a second.

BS: And now you get to the more difficult level, which is sensitive to Alzheimer's disease. Your performance was very good, you haven't got a problem!

JA: Oh good. When the tension was building up I got worried that you would diagnose me with early Alzheimer's. I feel relieved enough to carry on now!

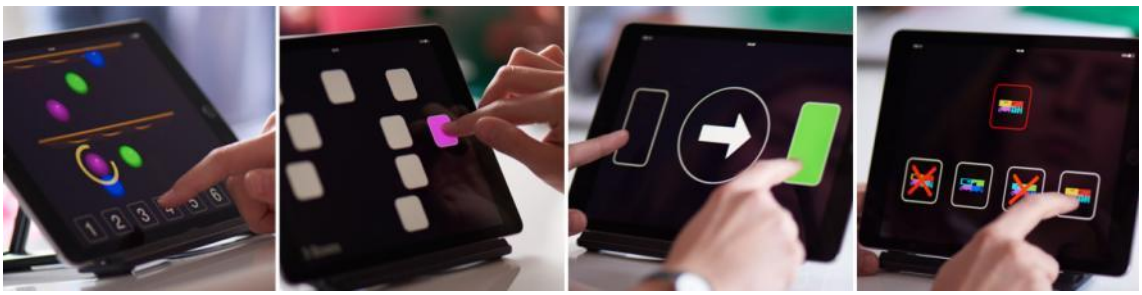
BS: The important thing here is that if you are healthy and elderly you should not have a problem doing that six box level. You might not do it the first time around, but you will do it the second or third time. But if you have Alzheimer's disease you really have trouble because it is a very challenging task.

JA: So that particular test is specific for Alzheimer's?

BS: Yes, that's correct.

JA: And other tests would test for other functions in the brain. Now you've generated a spin-out company from your work. Something that governments of all persuasions are keen for scientists to do. Do you worry that you run the risk of losing any scientific credibility, or objectivity, when profits start to matter?

BS. Well, we consult for the company, so we are not actually within the company in that way. Now I think there is a risk. But on the other hand, if you are trying to make sure that your inventions are actually used globally, this is really the only way forward as far as I can see. I am currently working on games to improve cognition in patients with schizophrenia, and also helping people with mild neuro cognitive impairment to drive that circuitry and improve their cognition. I hope that will also be a spin-off in time.



CANTAB tests developed by Barbara Sahakian and Trevor Robbins.

JA: And do you still work closely in research with your husband?

BS: Yes we do. We have some projects that are separate and some projects that are joint.

JA: Can I ask how you first met?

BS: We met in the lab. They all said 'Wait till you meet Trevor Robbins, he's very interested in the same things that you are interested in'. But he was off doing some research in Copenhagen at the time, so he wasn't there. Later he came back, and I was working in the lab, and he walked into the lab, and there was this big smile, and I think there was a connection right away. I had never heard the name Trevor before, so I thought he was Danish. The name Trevor was new to me, and he was wearing these trendy Danish clothes he had purchased over there.

Professor Trevor Robbins.

JA: I want to get back to the science. Having developed these tests, at what point did you begin to think it might be possible to treat people with

Alzheimer's with drugs? Did that come before or after developing these cognitive tests?

BS: That actually came before developing the tests. I actually started an early memory clinic. I went back post-doctorally to the University of Massachusetts Medical Centre and we set up a memory clinic there. And we began to work on the idea that a system in the brain was down in Alzheimer's disease, and it needed to be boosted. It's very important for attention concentration, and we knew that the system was affected, so we wanted to boost it up, so there are drugs that would do that. But the problem was that we needed to give them to people very early on, and we needed early detection.

So when I came back to the UK, and was working at the Institute of Psychiatry with the memory clinic there, we started to do these drugs on Alzheimer's patients. And then we moved on because the inhibitors were developed and we could studies that we published in the Lancet early on.

JA: And then of course you developed these tests to test Alzheimer's. Was the idea that clinical trials for drug development could use the results of these tests to monitor the efficacy of the drugs?

BS: Yes. First it was for the early detection. But secondly it was to say: Are we able to then improve say the memory test with these drugs. So interestingly what we found, and what we reported, was that there were very good improvements in attention with the inhibitors, but we could not get improvements in episodic memory very strongly. So we knew that we needed better treatments for Alzheimer's disease which would address these memory problems. Now they've got neuroprotetive agents which are in clinical trials at some of the drug companies. So hopefully that will stop the underlying disease process itself, and not just address the cognitive symptoms. But that's something to look forward to in the future.

JA: And early diagnosis of Alzheimer's has been somewhat controversial. Because many people say it's really only of benefit if there are acceptable treatments available. How effective are available drug therapies?

BS: Certainly I would want inhibitors for myself if I was in the early stages of Alzheimer's disease. I have seen for myself that the data is very secure from all the published work that they do improve concentration and attention, certainly in the early stages. In fact Rob Howard at the Institute of Psychiatry recently showed they even work in the more moderate to severe cases of Alzheimer's disease to improve function.

JA: But is it the case that they only work for a limited period of a few months?

BS: Well, the things is they will only work while the circuitry is there in the brain, and obviously as these plaques and tangles get greater in the brain they disrupt the circuits they can work on. So eventually they will fail.

JA. I am wondering how much better they are then getting people to do, say, crossword puzzles every day to keep your mind active?

BS: I think that's very important too. And we might get a bigger effect with both.

JA: If diagnosing mental illness early without new effective treatments remains controversial, the idea that people who aren't ill could enhance their performance by taking what are called smart drugs opens a whole new area of ethical considerations. It's apparently quite common for students to take cognitive enhancers to help them with their exams.

Sunday Times journalist Fern Britton decided to take the smart drug Modafinil to experience the effects for herself.

Fern Britton (right): The ostensible reason was in the name of research, because there was this trend among students for taking smart drugs to boost their productivity before exam time or dissertation writing. But obviously I had a personal curiosity to see if I could boost my own brain power. When I took Modafinil I was waiting for this great shock to the system. Actually it was quite subtle, mercifully. There were three key effects. One was that my attention was much more sustained. I didn't experience that four o'clock fog that I am prone to. Secondly I had a constant, very mild, dry headache. The kind of brittle effect of too much coffee. And thirdly, and most intensely, I noticed that when my head hit the pillow that night I could not sleep. I didn't sleep a wink all night. And actually that was very annoying and somewhat outweighed the previous effects. The day after, after a night of no sleep, I felt heavy, wooden, leaden. I felt worse than I did before I started taking the drug. So it didn't really pay.

JA: Not a really ringing endorsement, is it? Barbara, would you take, or have you taken, a cognitive enhancer yourself to improve your concentration?

BS: I haven't, except for caffeine and coffee of course. But I have to think how would I feel if there was a very safe and effective cognitive enhancing drug, where they had done the safety studies with healthy people in the

long term. Would I be tempted then? Perhaps not now, but if we are going to go on working much older, would I be tempted to do that to keep up with younger colleagues?

JA: And as you say, a lot of people will take coffee as a stimulant for this reason. But you were involved in research into the effect on surgeons taking this drug instead of caffeine to improve their concentration and steady their hands. Surely a much more sensible solution would be to make sure that surgeons are well rested before they go into surgery?

BS: With Imperial College we looked at whether doctors would perform better with Modafinil, because some of the doctors were using caffeine to stay awake and alert for these very long operations. Also you can develop tremors as a common side effect of that, and that's certainly not good in a surgeon. So we looked at sleep deprived doctors and we gave them Modafinil or placebo and we found that Modafinil was very good at improving their cognitive flexibility, so that if they had to problem solve they were much better at doing this under Modafinil. Sleep would be the best thing, but we do know there have been a number of accidents recently with bus drivers falling asleep or pilots falling asleep. We do need to think that there may be occasions when this could be very useful.

JA: You're saying that accidents like that, of a coach driver falling asleep at the wheel could have been avoided had he taken something like Modafinil.

BS: This is possible. Certainly it is used by shift workers to try to keep them awake and alert to try to reduce accidents.

JA: But coming back to the surgeons study, I guess if I were a patient going to have an operation I wouldn't want to hear my surgeon saying, Don't worry, I'm fully focused, I have taken some smart drugs, I haven't slept for three days but there's no way this is going to go wrong. I am going to be worried!

BS: Well exactly. We don't want to accelerate into a 24/7 society. That would be a very poor use of these drugs. Interestingly, the Academy of Medical Sciences, in their 2008 report, said that taking performance enhancing drugs could lead to a 10% improvement in A level grade, or degree class. So there is a lot to play for here with small effects.

JA: But the example of the students having advantage if they have taken the drug. I think here is where some real ethical issues come to light.

BS: I agree. And certainly the students agree. Because you have a competitive situation there. And you do have the risk of coercion on other students. But Nature did a survey after or Professor's Little Helper paper, and they found that one in five of their respondents, and they had 1400 respondents, was using these cognitive enhancing drugs. So there does

seem to be an increasing lifestyle use, and as a society we have to discuss this will change society, how it will affect it. And also what should the government do?

JA: The questions is, how far would you push this. You have done research looking at the brains of entrepreneurs. Do you think you can make more people have this entrepreneurial spirit or personality?

BS: Well, it does seem that entrepreneurs are very fast at making decisions. They show incredible cognitive flexibility. They are also very risky. So there are ways that you can manipulate those sorts of behaviours with drugs. So it may be possible to enhance that entrepreneurial spirit with some of these drugs.

JA: Presumably you could also use cognitive training to make people more self confident, less averse to taking risks.

BS: Yes, that's right. And it does seem that our risk taking changes with age. So we might be able to capture people at the time that they are quite risky, and then train them how to make good flexible decisions that are beneficial for entrepreneurialism. And that would be a better way, I think, to progress.

JA: Where's the line between treating illness and really changing someone's personality?

BS: I think that's a fascinating areas. And this comes up in other areas, such as ADHD. Some of the children with ADHD report that when they are taking Ritalin they feel the drug enables them to realise the person that they really are. They are doing well in the classroom, have friends in the classroom. Whereas other children feel they are the person they are when they are off the drug. So they prefer the summer holidays when they perhaps come off the drug because they don't need it for their behaviour in school. So it's a very interesting question about how the way these drugs modify the way we view ourselves and our personhood. As drugs are developed we can perhaps enhance ourselves not just cognitively, but also in other ways.

JA: Now, Barbara Sahakian, you've been a highly successful researcher. You've published hundreds of papers that have been cited by many thousands of others in your field. By any measure this makes you a remarkable prolific scientist. You've mentioned your early years at Cambridge and the number of female scientists there at the time. But a huge issue is that there are still not sufficient numbers of women at the very top. Is this something that concerns you?

BS: It does concern me. I know that there are some women scientists who prefer just to be called scientists. I quite like that I am a woman scientist. I

hope that I am a role model for younger scientists. I hope they see that you can have a good career and you can have a family and you can enjoy yourself, and can contribute to society - and that's very important.

JA: And you certainly influenced your two daughters, who have both gone into science themselves.

BS: Yes, I am very pleased that they are scientists.

JA: And do you think a career in science for them will be easier than it was for you? Have societal attitudes towards women in science changed?

BS: I think so. But science is a very competitive area. And it's also very difficult for my male colleagues to progress to the highest levels. But I think it is better for women.

JA: Presumably women can share common rooms with men now, for instance! Finally is there one big outstanding question in your field that, given sufficient research funding you would like to find an answer to?

BS: I very much hope that we will have good neuro protective agents for Alzheimer's disease soon. I think we are understanding the mechanisms of Alzheimer's disease very well, and that would be terrific. And I think if we begin to understand the basic mechanisms of these disorders from a neuroscience perspective, we will be able to find more effective treatments. And we really need more effective treatments in this area.

JA: Let's hope we get there soon. Barbara Sahakian, thank you very much indeed.

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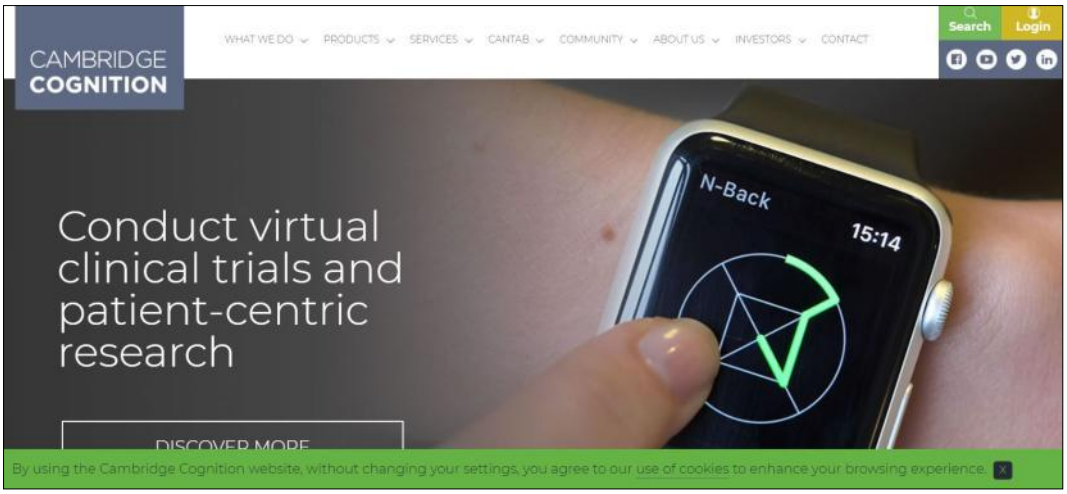
3. CANTAB Tests



The front page of the Cambridge Cognition website in April 2021.

The CANTAB cognitive assessment tools, developed by Barbara Sahakian and Trevor Robbins, and supplied through the company Cambridge Cognition. They are described thus on the Cambridge Cognition website:

Introduction

Cognitive assessments are invaluable tools for understanding the role of specific brain functions across a range of disorders and syndromes; giving insight into underlying causes, identifying ways to detect the earliest symptoms and evaluating the effects of interventions designed to improve brain health.

Originally developed at the University of Cambridge, the Cambridge Neuropsychological Test Automated Battery (CANTAB) includes highly sensitive, precise and objective measures of cognitive function, correlated to neural networks.

CANTAB tests have demonstrated sensitivity to detecting changes in neuropsychological performance and include tests of working memory, learning and executive function; visual, verbal and episodic memory; attention, information processing and reaction time; social and emotion recognition, decision making and response control.

CANTAB cognitive tests are:

- Suitable for all areas of research in CNS, neurology & psychiatry
- Validated by 30 years of global neuroscience research
- Published in over 2,400 peer-reviewed papers
- Used extensively in global pharmaceutical trials and academic research
- Recognised as an international gold standard

The tests show high sensitivity to positive and negative pharmacological, genetic and environmental effects in healthy individuals and patient populations across all areas of research.

CANTAB is language-independent, culturally neutral, non-invasive and require no technical knowledge or prior familiarity with computers making them suitable for large, multi-site studies and diverse participant groups.

The original computerised cognitive assessments

CANTAB cognitive assessment technology has been designed for use on digital devices to focus task outcome measures on specific brain circuits and neurochemistry. The tests have been continually refined to increase specificity and sensitivity whilst maintaining scientific validity.

Fast, easy and efficient

With CANTAB, studies and assessments are quick and easy to set up, administer and report on - saving costs, reducing data errors and increasing the quality of study results. Automated computerised test delivery ensures every participant is assessed consistently, removing the possibility of any rater variance and allows non-specialist study staff to administer tests.

Highest quality data

Participants are guided through assessment with voiceover instructions, available in over 35 languages, making CANTAB simple to administer and complete. Study data is automatically quality checked at source and results are instantly calculated and scored, ensuring clean data and preventing human error.

Translational neuroscience

CANTAB tests have translational utility meaning that data can be compared directly to preclinical findings and have been adapted and used in conjunction functional neuroimaging to identify brain circuitry and neurochemical systems involved in task performance.

The world's most sensitive cognitive tests

CANTAB is sensitive to pharmacological and environmental effects in both healthy individuals and patient populations. The tests use non-verbal visual stimuli for use across all languages and adaptive modes allow investigators to change the difficulty of the tests dependent on user age and ability for use in healthy volunteers, impaired patients and children.
