

**COMMUNITY DEVELOPMENT AND JUSTICE
STANDING COMMITTEE**

**INQUIRY INTO THE ADEQUACY OF SERVICES TO MEET THE
DEVELOPMENTAL NEEDS OF WESTERN AUSTRALIA'S CHILDREN**

**TRANSCRIPT OF EVIDENCE TAKEN
AT PERTH
MONDAY, 6 APRIL 2009**

Members

Ms A.J.G. MacTiernan (Chairman)

Mr A.P. Jacob (Deputy Chairman)

Mr I.M. Britza

Mr A.P. O'Gorman

Mr T.G. Stephens

Hearing commenced at 11.02 am

BURNS, DR MARTHA
Professor, Northwestern University, Chicago, USA,
examined:

The CHAIRMAN: Welcome, Dr Burns. Thank you very much for coming in today. My name is Alannah MacTiernan. I am the chair of the committee. I have with me Tom Stephens, Tony O’Gorman, Albert Jacob, who is the Deputy Chair, and Ian Britza. We are all members of the Legislative Assembly. We are a formal committee of the Legislative Assembly, and this hearing today is considered to be part of the formal processes of the Parliament, so it is a serious and formal matter. You will have seen a copy of the terms of reference of the committee.

Dr Burns: Yes.

The CHAIRMAN: So you will understand what it is that we are very interested in determining. You have been given a form titled “Details of Witness”. Have you completed that form, and was that all very clear to you?

Dr Burns: Yes.

The CHAIRMAN: Good. Hansard is formally recording these proceedings. You will be given a copy of the *Hansard* transcript and an opportunity to correct any errors that you may see within that, but that will be explained to you when the copy of the *Hansard* comes out. We have your curriculum vitae here. You may wish to start with an opening statement about what you think is the most significant issue that we may be confronting here in relation to the issue of children between the ages of zero and three not having their developmental needs adequately met.

Dr Burns: Yes. My expertise, as you know, is in neuroscience—the development of the human brain—and is essentially on the effects of poverty and the effects of parental stimulation on how the brain develops during what we consider to be the critical period in the development of the human brain; that is, from birth to about four or five years of age. There are two issues here, really: what can you do, in terms of your terms of reference going forward, to change some of the effects of poverty on the developing brain and the parental effect, but also what can be done about those individuals who have gone through the critical period—their brain has formed—and how we can change those individuals so that they have an increased learning potential. That is really what I am here to discuss today.

The CHAIRMAN: Okay. You are focusing on poverty. Is poverty really the only indicator of a social disability? Obviously this developmental vulnerability is compounded at the lower end of the socioeconomic scale, but there is some evidence to suggest that there are other social indicators that might be leading to children being developmentally challenged.

Dr Burns: Yes, that is correct. From the research that I have been involved in, and also from the research that I study and teach, there are really three primary factors that affect the development of the brain. As you say, they seem to increase in situations of poverty, but they do not necessarily have to be tied to poverty. One of those is purely quantitative. It is how much language is in the home—how often the parents speak to each other, and how often they speak to the child. Two authors—Hart and Risley—published some research in the late 1990s showing that in the United States, children in lower socioeconomic classes, which generally speaking would be poverty, have about a 30 million word gap. That means that parents in lower socioeconomic classes provide children quantitatively with 30 million fewer words than do parents who are educated and in our professional classes.

The CHAIRMAN: This is over what period?

Dr Burns: From birth to four years of age. In the United States, a child who is born into a home in which one of the parents is a professional—a teacher, a lawyer or a nurse—is exposed from birth to four years of age to 45 million words. A child who is born into a home in which one of the parents is on welfare is exposed to only about 15 million words; that is, the child is exposed to 30 million fewer words than a child who is born into a home in which one of the parents is a professional. There is not only a dramatic quantitative difference in the language that is used in the home—that is, how much the parents talk to their children. There is also a qualitative difference—that is, what the parents say and how they talk to their children. If one of the parents is a professional, the parents would have a tendency to ask the child questions and ask the child to respond. The questions that the parents would ask the child are about information that the parent would know: “What colour is that, Billy?”; “How do you know that that is a cup and not a glass?” The parents are asking the child these kinds of questions all the time. In homes in the United States in which the parents are on welfare, the language that is used to the child is more punitive: “Don’t do that”; “Stop doing that”; “Be quiet”. The language is less instructive. There is not this kind of interchange of sharing questions. Therefore, when the child goes to school, if the teacher asks the child a question that the child thinks the teacher knows, the child does not understand that. The child does not understand why an adult would ask a child something that the adult already knows. So, school becomes a place that is very confusing for these children. Therefore, one issue is the quantitative and qualitative differences in the language that is spoken to children.

Another very important piece of research that has come out is the effect of poor medical care on children. If children during the first four years of their lives have chronic colds or upper respiratory infections, they tend to get fluid in their middle ears, and that blocks the speech signal that those children get—it makes it degraded, is the term we use.

[11.10 am]

When children are exposed to a degraded speech it not only affects their development of language, it also has a permanent effect on their ability to read, because they cannot learn how to attach sound to a letter, because they have trouble perceiving the internal detail of words. They hear words as a whole; they do not hear all the component parts of words that, of course, we call phonics. So they have trouble learning phonics; they have trouble learning to decode in addition to the differences in their language.

A third area of research was just published in the journal *Nature Neuroscience* within the past couple of months, which is a British journal. It has been shown that a third issue is how parents parent, if you will; how they pay attention to children; how much touching goes on between the parent and the child; how much fostering; and whether there is neglect. This is not necessarily socioeconomic, although it does have socioeconomic overtones, but when parents neglect children or are abusive to children, the children actually have genetic changes. Their genes that regulate certain neurotransmitters in the brain are altered, so the children have a difficulty responding to stress in a positive way. The children are very reactive in stressful situations.

The CHAIRMAN: Can I just get this right? You are actually saying the genes change.

Dr Burns: The genes change.

The CHAIRMAN: Not the RNA but the DNA.

Dr Burns: The DNA. It is called epigenetics. It is a new field.

The CHAIRMAN: Isn’t that RNA rather than DNA?

Dr Burns: Epigenetics is the environmental effect on the DNA. You actually have DNA changes that result. Some of it is RNA, some of it is how the genes are expressed, but what they are also finding is genetic mutations, actual changes in a very specific gene that affects the neurotransmitter

associated with stress, which is called cortisol, and that gene becomes altered when children are neglected and abused during the first four years of life, so they are more prone to suicide—that was the most dramatic effect of the research that came out—and severe depression, chronic depression that is not amenable to medication.

The CHAIRMAN: I am sorry. What research was this, Dr Burns?

Dr Burns: I have it on my computer. It was in *Nature Neuroscience*, and the author is McGowan. It came out in, I want to say, December 2008, just a couple of months ago, but if you would like the exact reference, I can open up my computer and get it.

The CHAIRMAN: We will ask you for that afterwards, if that is okay.

Dr Burns: Okay, sure. It is very new research. Researchers in the area of epigenetics, which is the environmental effect on how genes are expressed, have known for about two years that in the animal population where they studied this in a controlled way—and this was done with rats—mothers that do not lick their babies a lot and do not feed them with what is called archback nursing have rats that are prone to anxiety disorders, if you will. They cannot react to stress; they cannot adapt to stress. This was the first study that looked at that same genetic change in humans. So the effects that we see in children based on how parents parent is profound, all the way from quantitative factors, qualitative language, the effects of not having medical care, on the ability to read academically and then, finally, how these individuals spend the rest of their lives and their response to stress.

Mr A.P. O'GORMAN: If you get to four years of age and you are past the developmental stage and you have not had the benefits of being spoken to properly and those other benefits given to you, can it be fixed?

Dr Burns: Yes, that is the \$64 000 question actually. I am a neuroscientist and one of the areas that neuroscience is looking at is: is the brain plastic enough that we can go in with neuroscience-based exercises; that is, exercises that have been designed specifically to enable the brain to reorganise itself and rebuild itself differently, so you are actually going back in time with the brain and you are trying to ask the brain to reconstruct itself. There is one company called Posit Science and one group of research that came out of the University of California, San Francisco. It shows that for adults you can actually get a substantial improvement in their memory skills by exercising working memory. There is research out of the University of Michigan that shows you can actually improve what is called the fluid intelligence of an adult by up to 20 points. Fluid intelligence is part of IQ testing; it is a kind of testing where you are looking at an adult's ability, or anyone's ability, to solve a problem they have never seen before, so you are looking at the ability to solve novel problems. The University of Michigan just released a study—and the researcher's name is Jaggi—in August 2008, showing that if you trained adults 19 sessions, 19 days in a row, on working memory tasks, those adults who went through that training had an almost 20 point gain, going from an average IQ of a group of 97 up to IQ of 117, in 19 days of working memory exercises. Working memory exercises have also been shown to decrease ADHD symptomatology, not only the attentional problems, but also the hyperactivity. Finally, there is a study at the University of Oregon that has shown that students for children who are seven to nine years of age, neuroscience-based activities actually improve their language skills and also significantly improve their ability to attend in a classroom compared with students who do not go through the training. It does not matter whether the students have language problems or not. They had three groups: one was a control group, one was a group with language problems and one was a group without. The students that were called typically developing, that did not have language problems, and the students who had language problems showed significant changes in their ability to attend in a classroom. Actually, the research was done with electrophysiological testing so that it was non-biased; they could actually get electrophysiological measures of how well the students were attending. What they did in the study was to have distracters. They had students listening to stories and they had distracters

auditorily being presented. The students who had gone through the training were able to totally ignore the distracters.

Mr A.P. O’GORMAN: When you are referring to attending, it is actually attending the class and participating and learning something from that class.

Dr Burns: Attending to class, especially language, and attending to stories being read in the case of this research. The other study that was done with working memory inattention looked at how much hyperactivity there was before and after the working memory training and then how those attentional skills were rated by teachers being asked if the student was attending better. There are really two good studies there.

Mr A.P. O’GORMAN: You went back to seven-year-olds. Is there any advantage in starting that process earlier?

Dr Burns: Yes, the sooner you start it the better actually, but the brain is remarkable plastic. We have the research of the group at UCSF and the University of Michigan that has gone to adults and even aging adults, and then we have research of school-age children. Obviously, the advantage of working with children when they are younger is that they do not have years of failing in school. Our goal, and, of course, your goal too, is how to prevent that chronic difficulty in school that is associated with having less exposure to language and having a degraded language signal when the child is young, and then this other issue of parental attention and parental fostering or paternal care.

[11.20 am]

Ms A.J.G. MacTIERNAN: You have demonstrated that the brain is plastic and it can be trained to perform better, but what is then the consequence of the genetic change? You were saying that some of the neglect et cetera actually leads to a genetic change in the brain —

Dr Burns: Right.

Ms A.J.G. MacTIERNAN: Is that reversible?

Dr Burns: That research, because it was only published a few weeks ago, I do not think there has been any research on cortisol per se because that is what that gene regulates, so the question in that is a very important question. The question is: can we use the same neuroscience technology? We know that we can use the neuroscience technology to improve attention. The neurotransmitter associated with attention is called acetylcholine, and we can increase that. We can increase dopamine through exercises. Dopamine is the neurotransmitter associated with learning. I call it the “save button” of the brain’s computer. When dopamine is released when you learn something new, what you learn sticks. We know that neuroscience can alter that. There is a hypothesis that neuroscience will also be able to have exercises that can mediate this response, this cortisol response—that seems to be the effect of the changed gene. But that has not been tested empirically yet. The assumption is that neurotransmitters can be changed. You can change what I call the chemical cocktail in the brain through very specifically designed exercises. It is pretty exciting, actually.

Ms A.J.G. MacTIERNAN: Where is this work being done? Where are these programs being delivered?

Dr Burns: There are several different groups. There is a group that is interested in ageing. There is a commercial product associated with that group, but the research has come out of University of California, San Francisco. The commercial product is called Brain Fitness and Cortex InSight, and the company is called Posit Science. I have just, so you know, no relationship with them whatsoever. The group at University of Michigan, who is working on working memory exercises, there is no commercial product associated with that yet. The task that they have used is called an N-Back task. It is a working memory task that several people are hoping to make available actually at

no cost, on the internet. You would need someone to help you do it correctly, some kind of a professional.

Ms A.J.G. MacTIERNAN: Are there schools or preschools that are implementing this science, I guess we are interested in?

Dr Burns: Yes. In the United States we have the Portland study on attention. That study studied a product called Fast forWord. Fast forWord has been used in about a million and a half children in the United States, very successfully, in the schools. There is Brain Fitness for adults, there is Fast forWord, and then there is another company —

Mr T.G. STEPHENS: What are the characteristics of Fast forWord?

Dr Burns: The characteristics of Fast forWord is it trains working memory, it trains speech sound discrimination, it enables the brain to perceive internal detail of words, and it improves or it is designed to exercise processing speed—the efficiency with which the brain can handle especially auditory information.

Mr T.G. STEPHENS: That is a program that your name is strongly connected to?

Dr Burns: Yes. That is a company that I consult with.

Mr T.G. STEPHENS: Our research team have got some questions, which I think are interesting questions. I hope you do not mind me plagiarising their work and pretending they are my questions! The work where you describe the problems of up to 73 per cent of American preschoolers at risk of reading problems and the factors that are contributing to that in America—have you got some quick commentary on that?

Dr Burns: Factors contributing to the large number of reading failures?

Mr T.G. STEPHENS: Yes.

Dr Burns: One thing we know for sure is that reading problems are affected when a child enters school without adequate language skills. “Adequate” is defined quantitatively by how much language the child has —

Mr T.G. STEPHENS: So language-rich environment?

Dr Burns: Right; language-rich environment.

Mr T.G. STEPHENS: Are there any other factors?

Ms A.J.G. MacTIERNAN: The disease that you were talking about?

Mr T.G. STEPHENS: The disease—is that it?

Dr Burns: Yes. Hearing loss is very influential, or not hearing loss but —

Mr T.G. STEPHENS: Physical.

Dr Burns: Yes. There is a problem associated with having a degraded signal when a child is young, if they have middle ear fluid, and that is called auditory processing disorders. There is an estimate that probably 90 to 95 per cent of children in the United States who are reading below grade level in the third grade have language and/or auditory processing problems. Those two coincide; they tend to go together. Sometimes auditory processing problems seem to be genetic, that is, it does run in families, but it is exacerbated by having degraded signals. It is exacerbated and there are two lines of research: one is by having fluid in the ear, or glue ear; the other factor that can cause this auditory processing disorder would be the genetic predisposition that runs in families.

Mr T.G. STEPHENS: I accept what you are saying, but I puzzle about some of the exceptions to some of this stuff. The exceptions for me include there are some families culturally that are non-verbal families for a large part of the day. I have lived with a traditional Aboriginal family where the whole day can be wordless but it is the evening camp fire that is a very rich verbal setting that

offsets that. I have also recently been exposed to profoundly deaf families where there are children that come out of that verbally intact.

Dr Burns: Yes. Actually there was some other research—there has been a line of investigation along those lines. Elizabeth Bates is a researcher who has been very interested in sign language—what sign language does and gestures do to the development of a language system. It turns out that when parents gesture—there was another study just published in the “Journal of Science”, again about a month and a half ago, where Elizabeth Bates has seen where parents gesture a lot it is associated with increased language skills in children. The new study that came out showed that the more parents use not only language but also hand gestures when they speak, the more language the students get. It looks as though, from the standpoint of the brain, that sign language is just as good of a language as auditory language if the child is getting some language. So the issue is not what kind of language in terms of is it sign or auditory, it looks like it is quantitative and the quality of the language itself—how rich is the language; how much interaction is there with the child; how much is the child being talked to, whether it is sign or auditory verbal language.

Mr T.G. STEPHENS: I do not want to verbal the Chair, but both the chair and I have experienced populations that have got a lot of problems in low socioeconomic groupings without language acquisition going on that is of great concern to the school environments in which they fall and then to us as policymakers. It is hard to put the words on exactly what is contributing to this entirely, whether the area of the risk and danger of the young child’s environment is creating —

Dr Burns: It is contributing as well. I think we have multifactorial issues that occur. What we have just seen, with the effects of abuse and neglect on children and how it can have genetic effects which actually can even alter the genetic makeup, would suggest that we have to look at all of these factors with children. We need to look at the exceptions because, as you said, in the Aboriginal families—of course your Aboriginal heritage is a story-telling heritage. It is a heritage of families that would, as you said, sit by the camp fire and tell stories rich in —

Mr T.G. STEPHENS: The rich word has moved to a different part of the day.

[11.30 am]

Dr Burns: Yes; which I think is fine but I think these are all areas we want to investigate. But right now, there is a preponderance of evidence that suggests that the sooner we can get language to these children, the sooner we can help parents with parenting and learning how to parent. I think one of the other issues that has come out of abuse and neglect research is that it is not just language; it is the whole complex of raising children—the whole nuclear family, the whole interactive pattern.

Ms A.J.G. MacTIERNAN: I think the very interesting point here today is the fact that we have actually got some quantification of that. Certainly, the volumetric stuff alone goes to some way of explaining why it is not just in the lower socioeconomic groups as well; that with parents working and whatever, children are put in front of television and not being spoken to.

Dr Burns: It is a concern to many in my profession. I have a lot of concerns, not even about television but also of video games—the fact that children are interacting for hours and hours in front of a screen with a video game instead of talking, listening and responding to a human being talk and tell stories and then, of course, read.

Mr A.P. JACOB: With regard to TV, there is a 30 million gap from 15 to 45. I imagine that a lot of the 15s, although anecdotally, would probably be watching a lot of TV during the day, so they would be picking up a lot of words there also?

Dr Burns: That is a very interesting question. Patricia Kuhal is a researcher in child language and development of the brain in Seattle, Washington and she found that children do not learn language from TV. She did a marvellous study in which little 18-month-olds were exposed to an Asian language, either with the speaker playing the games with them and using the Asian language or what is called “parallel talk”: the child is playing the games with another adult and they are hearing

the Asian language over a TV. The children who heard it over the TV did not learn any of the Asian language. The children who heard it from the person playing the games with them learned the Asian language. So there is something about television—either the signal is not clear enough or it is not interactive; it is a screen—that means it does not seem to have the power to change the brain the way a human being talking to a child does.

Mr T.G. STEPHENS: It does not augur very well for a young couple of teachers I saw whose child was shoved in front of the TV showing a program called *Brainy Baby*.

Dr Burns: *Brainy Baby* very much concerns me and *Baby Einstein* concerns me.

Mr T.G. STEPHENS: They were too busy preparing their lessons for school next day, so the kid was shoved in front of a screen.

The CHAIRMAN: Do you think that to some extent parents are a being bit deceived because those sorts of programs parade themselves as educational?

Dr Burns: Exactly.

The CHAIRMAN: We have seen some evidence, Brian, from material you produced that says that in France, for example, they have banned television programs that are aimed at children between nought and three. Is that right?

Dr Burns: Yes. In the United States, the American Academy of Paediatrics has come out with a statement asking parents not to expose children under three years of age to television or to try to keep it minimal. Another bit of research you are probably aware of is that—I think it is out of the United States, and I do not know the author but I can get it for you—children from birth to three exposed to more than two hours a day of television have a much greater likelihood of having attention deficit disorder. So there is caution against that kind of technology with very young children. The irony is that technology is the way we fix the problem when people become older. But there is something about the young brain that does not respond to a screen in terms of having a powerful effect on the way the brain prepares itself for our educational system, which is to build that left hemisphere.

The CHAIRMAN: It is incredible stuff when you look at the ubiquity of television. One of the other things we have been trying to get a handle on, because the poor have always been with us, is that we get a sense that the problems of developmental vulnerability appear to have got worse. The anecdotal view of teachers is that there are now more children aged about four or four and a half who do not have the basic precursors to reading that they need. Is there any evidence that we are seeing a deterioration in that?

Dr Burns: Yes. I can tell you specifically that in the field of autism, ADHD and—I have spoken to researchers but I do not know the research per se on this—bipolar disorder. They are the three disorders that seem to be increasing dramatically. Most of the researchers are looking for EppA genetic factors. Probably a lot of it has to do with the change in the nuclear family; that is, the mother does not have time to spend with her child the way she used to. Even 100 years ago poverty was very different. In a hunter-gatherer community there was still someone devoting time to raising the children and someone else devoting time to getting food. In an organisation, a community would still have a tremendous amount of emphasis on being with the young children. I think our society has put such pressures on poor families, but it can happen to families in which poverty is not an issue where neither of the parents are in the home very much because they are working, and when they are in the home they are exhausted. When they are exhausted, they just want to put food on the table, get the clothes washed and go to bed. So they put the children in front of the television as a baby sitter. I think there are issues with the nuclear family that have changed because of the complexities of our society that were not issues even 100 years ago when we had agrarian societies and when we had much smaller communities that were organised in a way that someone was always with the children interacting with them at some level.

The CHAIRMAN: Would you argue that even 30 or 40 years ago there were bigger families, so there would have been more volume of language? Is that part of that?

Dr Burns: It is possible. I do not know of any research along those lines. My father was a farmer and came from a family of 10 children. The older children raised the younger children; that was their job. Even though they were farmers and were very busy and had a large family, there was a tremendous amount of interaction among the older and younger siblings.

Mr I.M. BRITZA: You said bipolar was the third result; what were the other two?

Dr Burns: ADHD, autism—spectrum disorders—and bipolar disorder.

Mr I.M. BRITZA: I am still back at the genetic change. That has taken me by surprise?

Dr Burns: It is pretty frightening, actually.

Mr I.M. BRITZA: Yes. Where there has been no place for that to be readdressed, what is the process on to the next generation?

Dr Burns: That is very interesting. The research in EppA genetic shows that it does not have a genetic effect on just one generation but it actually has an effect on the next generation and sometimes the generation after.

Mr I.M. BRITZA: Meaning?

Dr Burns: Meaning that when those individuals with that ultra gene have children, that ultra gene will be passed on to their children as well.

The CHAIRMAN: It is showing Lamarck was as right as Darwin was.

Dr Burns: Yes.

The CHAIRMAN: One of the issues we have looked at to some extent is what happens in utero and the degree of antenatal care. Some of this EppA-genetic stuff has been focussing on the in-utero experience?

Dr Burns: Yes EppA-genetics is very interesting with regard to EppA genetic changes. EppA genetic meaning, again, that things that affect the gene, change the genome. Pregnancy is one time when our genes are very vulnerable to changes and they are concerned about exposure to chemicals in the environment—this onslaught of chemicals that never existed even 10, 20, 30 years ago—as well as diet and the amount of stress in the mother.

[11.40 am]

In the animal world, when a mother is under stress it has an EppA-genetic effect on her babies when she is pregnant. Also, the diet the mother is fed can have an effect. The group doing that research is at Duke University, and the researcher's name is Randy Journal. He has introduced biphenyl A, which is a chemical found in plastic, into the diets of mother rats. It affects a gene called the Agouti gene that predisposes the babies to being obese, having tumours, and also having diabetes. If they simply put soy in the diet of those mothers, it completely reverses the effect of the biphenyl A on the genome.

The CHAIRMAN: You add soy to the biphenyl? You have still got the biphenyl A in there, but you have added soy?

Dr Burns: Soy is rich in methyl groups. Methyl groups are what wind around a gene and keep the gene from expressing itself. In the animal studies the soy tends to—but you have to be careful with soy because it can have other effects—specifically decrease the effects of what are called xenobiotic chemicals, of which biphenyl A is one, which affect the sex-linked aspects of our genes. In humans it is assumed that xenobiotic chemicals are causing the increase in prostate tumours in men, and ovarian cysts and ovarian tumours in women.

Mr A.P. O’GORMAN: You talked about the diet of the mother whilst the baby is in utero, but what about afterwards when the children are born and they go on through; does the bad diet also make it worse?

Dr Burns: Yes; that is being studied. Soy is one thing that is being studied; they are also looking at a diet rich in omega fatty acids, as opposed to trans fats, especially in the early postnatal years. They are looking very carefully at exposure to chemicals. I came upon an example of one fascinating bit of research that I did not even realise: Parkinson’s disease did not exist before 1920. It first started to appear when DDT was being used as an insecticide in farming. It looks as though we have a lot of diseases that may even present themselves in adulthood that have these EppA-genetic origins. The EppA-genetic exposure might have been prenatal or. That is where all the research is going right now in EppA-genetics. Randy Journal is looking very carefully at chemical exposure, but also diet.

The CHAIRMAN: In considering obesity and just how big and fat people have become, and, dare I say it, particularly in your country—

Dr Burns: Yes, especially in our country.

The CHAIRMAN: — and it cannot just be through eating. It just seems beyond —

Dr Burns: One of the theories is that two or three generations ago our African-Americans were slaves and were not getting adequate nutrition, and that we are seeing the effects of that three generations later in that community. That may have caused EppA-genetic changes that predisposed a human to be able to build fat faster from less food. That is theoretical; I cannot tell you that is research. You are asking the exact questions that the research community is asking and that are a concern to the research community. We have two issues, it seems to me: we have exactly what you are interested in, which is getting to parents and educating them on the importance of what they eat, the importance of reducing stress in the home through things like physical exercise, enabling the parents as well as the children to get adequate exercise, eating adequate diets, exposing to children to language, and as much language as possible during the early years. But then we have that other group of individuals who that has already happened to them. It might have been a generation ago, or two generations ago, but they are still suffering some of the effects of neglect or abuse. To address those issues, in the United States we are very concerned about those issues in our correctional facilities. At least a third of individuals in correctional facilities in the United States have undiagnosed learning disabilities. One very positive thing that we could do for adults who have the effects of these early prenatal and postnatal experiences is to provide interventions that can change their brain and enable them to be more effective learners and more effective in their use of information, better at reading, and enable them to get better jobs and to overcome some of the effects that have been going on for generations.

Mr I.M. BRITZA: Has there been any pre-birth study that shows the mother’s effect on a child before birth?

Dr Burns: Only in animals.

Mr I.M. BRITZA: You are saying you cannot get away from the benefits of mum and dad talking to the kids and spending physical time with them?

Dr Burns: That is what I believe, and that is what the research suggests. If I could have any effect by doing something tomorrow, it would be to communicate to parents of young children how important what they do with their children is: playing with them, talking to them.

The CHAIRMAN: I think we have all come to the conclusion that this is a massive problem, and that people actually are not aware of this —

Dr Burns: I think that is right.

The CHAIRMAN: — and things that we think people instinctively do, they do not necessarily instinctively do. You may have a new baby and for some reason or another you may not know this, whether it was a deficit in your own home life or just all of the other pressures. I think this is why this volumetric thing is so interesting and this notion of the question is interesting. I think we are all pretty much on target that what we have to do is somehow or other put the resources in to educate parents and skill them up. But we are not always going to be successful with that, so when a child presents at school at four years old, if we were trying to get this absolutely right what sort of screening program should we have? Should we have a screening program when a child enters school?

Dr Burns: I would say yes. I think the most positive screening program you would have would be the vocabulary level of the child. There is a test called the Peabody Test of Receptive Vocabulary. There is another test called the Expressive One-Word Picture Vocabulary Test that measures expressive vocabulary. Those look like those are the two most powerful measures of language level as a student enters school. That then becomes correlated with reading and maths ability as they go through school.

The CHAIRMAN: How long would it take to apply that test?

Dr Burns: The Peabody takes about half an hour to administer, and the Expressive One-Word Picture Vocabulary Test is about half an hour, so we are talking about a total of about an hour of testing.

The CHAIRMAN: For each child?

Dr Burns: For each testing. You could probably get it down to 45 minutes.

The CHAIRMAN: How well trained does a teacher have to be to do this?

Dr Burns: The Peabody is very easy to administer. In the United States, speech and language pathologists—speech therapists—administer the Expressive One-Word Picture Vocabulary test, but I believe anyone could learn to do it pretty easily. They are both standardised, and Peabody has been around for 60 years or 70 years. It is a test that has sustained time very well and is correlated with language skills and is predictive of reading achievement later on, and it is also correlated with IQ. It is a very rapid way to look at whether the child has had enough language to support the educational system.

Mr T.G. STEPHENS: As well as that test, based on the analysis that you have that 73 per cent of Americans are putting up with poor reading and language capacity, what else does it require the school environment to do, other than test it on arrival? What do you do about the pedagogy of the school environment?

[11.50 am]

Dr Burns: Where neuroscience is going, and certainly the company that I work with and these other groups that I have talked about—University of Michigan, Seattle and UCSF—are all looking at short term interventions, administered at the very beginning—within eight weeks—of a child entering the school system. Interventions that will boost their language, their working memory and those —

Mr T.G. STEPHENS: Do you mean administered to the individual child who is picked-up with a problem or to the whole-of-class environment?

Dr Burns: I would recommend—and we have lots of schools in the United States that are—doing it with every single child who walks in and looks like they are at-risk for reading and learning problems.

Mr T.G. STEPHENS: Just those that look like they might be at risk rather than—

Dr Burns: Yes. We have some school districts in which the test is administered to everyone. I have a superintendent in one school district who calls it a vaccine. He says, "I am going to do this training of language and attention and working memory with every child, so I do not have to guess which ones might be problematic." You cannot always tell by language alone because there are, as we said, other issues—for example, ADHD or issues associated with bi-polar disorder. A lot of the schools say it is expensive. However, if we can test the children early and identify those who are most at risk and at least get those children to have an eight-week intervention that will boost these skills —

Mr T.G. STEPHENS: Is it possible to have a mandatory pedagogical approach to a child's arrival in school, in the early years, so that interventions or external programs are not necessary but instead all children would arrive and we would do the same thing to secure language intervention whether the child is or is not at risk.

Dr Burns: Theoretically it should be possible. I would say that that is what our educational system has sought to do for many, many years but that it has not been able to do it. I think, the difficulty is that you have one teacher to 10, 15 or 20 students so bombarding them with that—I mean, imagine the difference between a parent interacting with the child. A parent saying, "Oh Billy, what is this? What is this? You want your ba-ba? Is this your ba-ba? It's your bottle! It's your bottle! Do you want your bottle?" The child responds "Ba-ba" and the parent says, "Bottle; good for you—great! Bottle!" That is the type of interaction a parent can have with a child whereas a teacher has 20 or 30 students and there is not as much reciprocity; that is the child does not have a chance to respond because the children take turns. One thing neuroscience is trying to do is put a child in a situation in which the therapist is getting thousands of responses in an hour of training. The child is listening-responding, listening-responding, and listening-responding. You bombard the brain with the type of stimulation that very specifically and deliberately builds language, memory and processing skills. A study by a gentleman called Ron Gillam in the United States compared one-on-one speech therapy with the neuroscience program called "Fast ForWord". He found that two hours of one-on-one speech therapy is equivalent to the neuroscience-based program Fast ForWord. However, the problem is that two hours of one-on-one speech therapy is required five days a week for eight weeks because the classroom diffuses it and it becomes —

The CHAIRMAN: Yes; and you would find that more talented children would also tend to respond and that you would replicate the relative disadvantages.

Mr A.P. O'GORMAN: When you deliver these programs is there any indication that the outcomes are not as beneficial if the child's home environment is still not ideal? Do we have to change the parents as well?

Dr Burns: In the United States, the results show that because the student is in school six hours a day, the outcome depends more on what is going on in the classroom than what is going on in the home. Now, home affects other issues. It affects behaviour. It affects some other issues to do with the child's ability to sit in a chair and to respond socially. There are all sorts of social ramifications, about which we have not yet talked, when we see the child go home to a non-productive parenting environment and all the same problems. That is a whole other issue. In terms of language, our research shows that what goes on in the classroom is much more important. If a child can have an intervention and then listen to the teacher and be successful in the classroom six hours a day, five days a week, that child can be one that breaks-out from the home environment and go on to excel. School can be their safe haven.

Mr A.P. O'GORMAN: But does that not defeat the end purpose? We really need the parents to teach the child in the first place.

Dr Burns: Ideally you want both, but if you cannot have both I would take education first—at least.

The CHAIRMAN: Yes; we cannot abandon those children for whom it is too late. Dr Burns, this has been fascinating. We are very mindful that we have taken a lot of your time and we have other matters on the agenda. It has been absolutely fascinating and we have really, really appreciated you appearing before the committee. I think we have found the session both interesting and useful. If you agree, we would like to ask Brian and Jovita to follow up and make sure that we have all the proper references for those —

Dr Burns: Yes; I would like to send you the references to which I alluded. You will want those to back-up anything that you decide to do.

The CHAIRMAN: Yes; that will be fantastic. Thank you very much. We have really enjoyed meeting with you. You will receive a *Hansard* transcript that you can proof.

Dr Burns: I probably should mention the name of the organisation that brought me to Australia—Sonic Learning. As the Western Australian experts in the field, it will also have access to much of this information.

The CHAIRMAN: Thank you, very much.

Hearing concluded at 11.55am.