Cellfield

What claims does the company make / what does the programme target?

The programme claims to be suitable for children 8 years and over who:

- have a reading age that does not seem to be increasing and is falling behind their chronological age;
- have dyslexia;
- have been diagnosed with a language disorder;
- show difficulty in repeating orally given instructions;
- have poor reading, spelling and writing skills;
- have adequate phonological skills but not the required reading fluency, accuracy and comprehension;
- read at an age-appropriate level but cannot recall what they have read;
- feel discomfort/suffer from fatigue during reading;
- feel uncomfortable when looking at black letters on a white background;
- have problems controlling eye movements.

Cellfield also claims to be effective in improving several abilities, including attention, cognition, working memory, executive function, as well as auditory, ocular motor, visual, spatial and sequential processing. The company also declares that Cellfield can achieve average gain ratios of more than 20 in comprehension and word identification, 40 in decoding, more than 20 in reading accuracy and in a higher level of comprehension (note: gain ratios = increase in months per month of schooling; e.g., an improvement in reading by two months for every month of schooling is a gain ratio of 2).

The company also alleges that children who participate in the follow-on programme retain initial gains and improve at twice the learning rate of typical readers.

Evidence for efficacy:

Prideaux et al., 2005:

Limitations: no comparison group was used. The generalizability of results are a problem: the authors noted that a convenience sample was used (i.e. those seeking intervention for reading difficulties) and that Cellfield also requires financial investment from the child's parents, thus participants in this study typically will not be representative of those who come from low income families or who are not interested in ameliorating reading problems. One of the authors, Dimitry Caplygin, is the inventor and Director of Cellfield, and therefore the study is not independent.

262 Australian school children aged 7 to 17 years participated in 10 intervention sessions at a Cellfield clinic for an average of 26 days between pre and post-treatment. 51% of these children were considered to be at risk of dyslexia, based on the Dyslexic Screening Test. Reading related skills were assessed using the Wide Range Achievement Test 3 (Reading and Spelling) and the Woodcock Reading Mastery Test-Revised (Word Attack and Passage Comprehension). Oral Reading Proficiency was measured using the third edition of the Neale Analysis of Reading Ability, with measures taken on reading speed, accuracy and comprehension. Measures of participants' visual performance in relation to their foveal position, foveal sensitivity and contrast sensitivity was scored prior to and following treatment by an experienced orthoptist.

Results:

- Reading Related Skills: a repeated measures MANOVA revealed that, on average, participants improved on all measures (reading, spelling, word attack and passage comprehension) from pre-test to post-test. A subsequent analysis accounting for dyslexia status found that while those at risk of dyslexia generally obtained lower scores on all measures than those not at risk at both pre- and post-test, both groups made the same relative gains. However, when controlling for verbal IQ, the study found that the change from pre-test to post-test for spelling scores was no longer significant (but remained significant for the other measures). Significant age norm increases for reading, word attack and passage comprehension were 1 month, 23 months and 12 months, respectively, for one month of intervention. Grade norm increases for word attack was 2 grades and 1.5 grades for passage comprehension.
- Oral Reading Proficiency: paired t-tests with Bonferroni corrections were conducted to analyse the data. The study found that there was a significant decrease in reading speed from pre- to post-test. In contrast, reading accuracy and comprehension significantly increased following treatment. This indicates a speed/accuracy trade-off. Observational records did note that following Cellfield, children did slow down and try to actively sound out the words in an attempt to decode them, and also engaged in more self-corrective behaviour.
- Ocular Measures: chi-square tests revealed that post-test frequencies for left and right eye foveal position, foveal sensitivity and contrast sensitivity significantly differed when compared to the expected frequencies, which were based on pre-test values. 90% of those who were assessed as having a foveal position off centre at pre-test were considered centred following treatment; averaged across left and right eyes, participants were 12 times more likely to be assessed as having a centred foveal position at post-test than at pre-test. 65% and 93% of those who had recordings of foveal instability and abnormal contrast sensitivity, respectively, prior to treatment showed readings within the normal range following Cellfield. Participants were 7 times more likely to show normal foveal stability and 19 times more likely to show normal contrast sensitivity at post-test than at pre-test.

Evidence against efficacy:

Cellfield appears to be based on the magnocellular theory of dyslexia. This theory postulates that there are magnocellular abnormalities in sensory pathways in the brain (auditory, visual and tactile), and also argues that the cerebellum (and thus motor control) is impacted as it receives considerable input from several magnocellular systems (Ramus et al., 2003). The advantage of this theory is that it manages to account for all the deficits present in dyslexia. However, Ramus et al. note that this theory has received some criticism. Auditory deficits are not always present in individuals with dyslexia and do not appear to underlie their phonological processing problems. Similarly, visual deficits are not always present in dyslexic individuals, and those with visual impairments have appear to have problems with a range of stimuli, including those that do not tap into the magnocellular system. Therefore, the theory that Cellfield is based on is debatable (see Ramus et al., 2003 for more details).

The study by Prideaux et al. (2005) is the only peer-reviewed study about Cellfield. For an intervention programme to be scientifically valid, it needs to be based on theory *and* empirical results. One study is not sufficient in providing the programme with empirically- validated results, and thus we cannot comment on the programme's efficacy. Cellfield's lack of peer-reviewed research is a major limitation.

Price:

Set prices for the programme were not available from the Cellfield website or from any Cellfield provider. A Cellfield pre-test appointment at a Hawkes Bay optometry clinic costs $295 (http://www.shattky.co.nz/visionlink/testimonials/cellfield/index.htm),

What it involves:

Cellfield is based on the view that dyslexia arises possibly due to a combination of causes, and consequently targets several deficits concurrently. These deficits include phonological, visual and visual to phonological processing problems. The programme involves predominantly language tasks, and is computer-based, using computer game elements in its design. These tasks claim to employ reading related skills as well as attention, working memory and focus.

The Cellfield programme consists of ten one hour sessions over two weeks, which allegedly targets neural redevelopment. These sessions are generally comprised of ten exercises. Some exercises target phonological processing, and require concurrent activation of visual and auditory processing. Other exercises involve decoding and encoding activities e.g. finding text embedded in continuous random text with no spacing.

Cellfield also provides additional ten one hour sessions over a period of ten weeks, with supplementary guided reading at home. The programme involves "repetitive reading, tuition by exception, novelty and reward". These sessions aim to target consolidation and the transition into reading fluency. Children with more advanced reading disabilities may have to repeat Cellfield at a higher level 6 to 12 months after completing the initial intervention (there appear to be three levels to Cellfield: low, middle and high).

It is required that children who participate in Cellfield have at least some basic knowledge and skills (e.g. reasonable letter/sound correspondence skills). The company recommends that children who do not have these skills undergo conventional tuition prior to participating in Cellfield.

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Cellfield targets auditory, visual and visual to auditory processing problems. To improve these processing problems, letters, words and sentences that are presented on screen correspond to aural tasks that participants hear through earphones.

Additionally, approximately 30% of each session involves matching rhymes from a four word choice. Target rhymes are presented acoustically and visually for the first five sessions and only acoustically for the last five sessions. The target rhyme is also altered and presented with a stretch. This allows children with auditory processing problems to hear the word clearly. The degree of stretch is progressively reduced until children can clearly hear the words at normal speed for the last two sessions.

Each intervention session also allegedly includes exercises using "Pidgin English", which involves embedded text, and an exercise for homophones. Short, non-verbal exercises are also present in all sessions, and increase in difficulty during the duration of the programme. These components of Cellfield are said to be influenced by research indicating that visual and phonological factors play a role in developmental dyslexia (Prideaux, Marsh, & Caplygin, 2005).

Visual processing problems are addressed by motion graphics that are constantly moving across the screen, the design of which are based on an understanding of the neurophysiology of the transient vision system (Hart, as cited in Prideaux et al., 2005). The motion graphics are characterised by a complex combination of "contrasting edges, changing motion, velocity, dimensions". This is designed to stimulate the magnocellular pathways in the brain and is incorporated into each session.

Initially, the motion graphics are translucent and are constantly superimposed onto the letters, words and sentences on screen. When children reach the halfway point in the programme, the motion graphics become opaque and act as moving masks. Consequently, the tasks become more complex as they can only be performed by what is seen between the moving gaps. According to Cellfield, the motion graphics are designed as such to enhance the transient vision of the participants and to improve eye movement control, working memory, sequencing, peripheral vision and visual persistence.

Eye movement control has been linked to reading problems through deficits in fixation stability, where both eyes are aligned such that the centre of vision coincides with the fovea (Prideaux et al., 2005). There is fixation eccentricity (inability to achieve alignment) and fixation instability (able to achieve alignment but not hold a steady focus). Prior to participating in Cellfield, subjects undergo an orthoptic examination. Those who are found to show visual fixation/instability then use red lenses for some of the intervention sessions, as well as monocular occlusion for some of the initial sessions.

References:

Prideaux, L., Marsh, K. A., & Caplygin, D. (2005). Efficacy of the Cellfield intervention for reading difficulties: An integrated computer-based approach targeting deficits associated with dyslexia. *Australian Journal of Learning Disabilities, 10*(2), 51–62. doi: 10.1080/19404150509546789.

Ramus, F., Rosen, S., Dakin, S. C., Day, B. L., Castellote, J. M., White, S., & Frith, U. (2003). Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults. *Brain, 126*(4), 841–865. doi:10.1093/brain/awg076.

Website / for more information see:

http://www.cellfield.com/