

Working together to eliminate cyanide poisoning, konzo, tropical ataxic neuropathy (TAN) and  
neurolethyrism



# CCDNN News

**Cassava Cyanide Diseases & Neurolethyrism Network**

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### Editorial

#### **Activities towards prevention of Konzo in DRC at The Australian National University: Maintaining the legacy of Dr Howard Bradbury**

Dr Howard Bradbury's passing in November 2016 was a major loss to the CCDNN community. At the Australian National University, we are working to maintain Howard's legacy and to continue his efforts to preventing konzo in Africa and in particular in the DRC.

A team comprising Professor William Foley, Ms Jan Elliott and Ms Uschi Wiedemann will work part time on various activities towards prevention on konzo following a 5 year plan that Howard and William drew up prior to Howards' death. William Foley has a background in poisonous plants in ecological research, Jan Elliott was formerly the Senior Technical Officer in the Research School of Biology and will continue work on konzo through retirement and Uschi Wiedemann provides the technical skill to continue the manufacture of the cyanide and thiocyanate analysis kits that are used by many members of the CCDNN community.

The Australian National University ran a very successful fundraising programme for Konzo prevention in 2016 as part of their annual Day of Giving. This programme raised more than AUD\$100,000 towards prevention of Konzo. In addition, strong links with other potential donors were established.

Taking over the programme from Howard has not been straightforward since his deep knowledge and passion was such a major factor in its success. But we hope that with co-operation of partners, old and new, we can maintain many of these successful activities and develop new ones.

Our plans are as follows:

1. **Manufacture of kits:** We are continuing to prepare the kits for the analysis of cyanide and thiocyanate. We have re-vamped the website

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<http://www.ugent.be/we/genetics/ipbo/en/networking/ccdnn/overview.htm>

and protocols and the details on the kits are available at:

[http://biology-assets.anu.edu.au/hosted\\_sites/CCDN/](http://biology-assets.anu.edu.au/hosted_sites/CCDN/)

We will continue to provide kits free of charge to workers who do not have access to research or industry funds.

2. **Direct interventions to teach the wetting method in further villages in BoKo Health District in DRC.** We aim to continue the programme of interventions in specific villages with JP Banea's team. At present, we are waiting to identify suitable sites and to ensure we have the funds on hand to carry out interventions because this approach remains the gold standard for the success of the wetting method in preventing konzo.
3. **Education:** We are working with INCEF (International Communication and Education Foundation) in DRC to produce educational films in local languages about konzo and the use of the wetting method to prevent the occurrence of konzo. The interventions in specific villages carried out by JP Banea's team in which the wetting method is demonstrated and its contribution to preventing konzo is re-enforced is the ideal. However, we cannot reach every village and so improving our educational reach with the help of experienced local partners such as INCEF is one way of bridging the gap.
4. **Global Awareness:** We aim to improve the knowledge of the success of the wetting method to agencies involved with Global Health initiatives in order to attract more partners and to ensure that the wetting method is a key part of initiatives to prevent konzo throughout Africa.

We are looking forward to maintaining the spirit of Howard Bradbury's work with partners. We can be contacted at < [konzo@anu.edu.au](mailto:konzo@anu.edu.au) >

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#### Articles

#### **Remembering Vapniarca (Sept. 1942-May 1943), doctor Kessler (1903-2000), Professor dr Dan Cohn (1931-2017).**

The highest incidence of neurolathyrism ever recorded was in a Rumanian prisoner of war camp during the Second World War. The Russian cavalry had evacuated the area and left behind a stock of 'horse feed' consisting of grass pea seed (*Lathyrus sativus*). This cheap nutrition was given to the prisoners who were mainly Rumanian Jews. After several months on this diet, more than 60% of the inmates developed various degrees of neurolathyrism.<sup>1</sup> One of the inmates was a medical doctor who, on scraps of paper found in this

forced labour camp, wrote down the details of the diet and the symptoms he observed. Dr Arthur Kessler, himself also a neurolathyrism victim, could make the link between the grass pea diet and the symptoms of spastic paraparesis of the legs and scissor gate of the increasingly disabled inmates. Dr Kessler made several risky protests to the camp authorities and the grass pea diet (400 g of boiled grass pea and 160 g bread made from barley and chaff) was discontinued after more than four months (129 days). Dr Kessler's son David described his father's life.<sup>2</sup> Details of the camp experience were published posthumously "Ein Arzt im Lager". This was partly translated and commented by Dr Enneking in CCDNNews 25.<sup>3</sup> After the war he emigrated to Israel where he cared for former Vapniarca prisoners with neurolathyrism. Of the about 800 people who contracted various degrees of neurolathyrism in the Vapniarca camp, 300 immigrated to Israel. Dr Kessler published several scientific papers with his findings on occurrence and development of neurolathyrism as listed by his son.<sup>2</sup>

Dr Kessler later collaborated with a younger neurologist to care for the Vapniarca patients in Israel. Dr Dan F. Cohn (1931-2017) had narrowly escaped the horrors of WW II as his family moved to Palestine the day before the start of the war. At a very young age he had decided to become a medical doctor and with this purpose in mind he attended the prestigious Herzlia gymnasium in Tel Aviv. After three years of military service he then went to Vienna for his medical studies. When he returned to Israel in 1960, he started working at the Ichilov hospital, a teaching hospital of Tel Aviv University. He continued his career in neurology in Ichilov hospital well into retirement age. His main research topic was neurolathyrism and he cared for the neurolathyrism patients that came from the Vapniarca camp, in collaboration with Arthur Kessler.<sup>4</sup>

As a neurologist, the first interest of Professor Dan Cohn was to understand neurological aspects of neurolathyrism. His attention went beyond this and he also studied cognitive functions, longevity and skeletal abnormalities in neurolathyrism patients. He published his studies in Hebrew, German and English.

Dan Cohn and colleagues examined 20 neurolathyrism patients with electromyography and found lesions in the central as well as peripheral motor neurons. In 4 cases also muscle atrophy was seen.<sup>5</sup> He also participated in the only available anatomo-pathological study of the central nervous system of a 67-year-old man with neurolathyrism. Light- and electron microscopy were used to study in detail the lumbar spinal cord. Alterations were found that correlated with spastic paraparesis and a mild degree of degeneration of anterior horn cells.<sup>6,7</sup>

A major endeavour of Dan Cohn was the clinical examination of 200 former prisoners in Vapniarca who contracted neurolathyrism and moved to Israel after the war.<sup>8</sup> The main symptoms were spastic paraparesis and a neurogenic bladder. In addition, 14 patients showed lower motor neuron involvement with muscular atrophies, simulating amyotrophic lateral sclerosis. A number of those patients complained of bone pains and were examined in more detail.<sup>9</sup> X-ray examination demonstrated some abnormal skeletal findings in 2 patients who were 19 and 20 years when they were on the grass pea diet in Vapniarca. These patients showed absence of union of secondary ossification centres in some areas of the skeleton, including vertebral bodies. This was the first description of patients suffering from neurolathyrism who also had symptoms relevant to osteolathyrism.<sup>10</sup> Professor Cohn was also instrumental in identifying osteolathyrism in a few Bangladeshi patients with neurolathyrism. I remember showing him X-rays of those patients in his hotel room in Addis Ababa, where we both attended a “Lathyrus/lathyrism” conference. He confirmed the presence of osteolathyrism in a small number of neurolathyrism patients who declared to have consumed grass pea seedlings before adulthood.

Dan Cohn also studied the potential correlation of physical disability due to neurolathyrism with cognitive abnormalities or decline in 30 patients of over 65 years. Only one showed signs of dementia but there was no statistical difference with age-matched controls.<sup>11</sup> There was also no effect of neurolathyrism on longevity of the patients.

Besides his keen and life-long interest in neurolathyrism, professor Dan Cohn studied various other neurological problems. The Science Citation Index lists 50 high level scientific papers authored or co-authored by Dan F. Cohn. Dan and his wife Nina were married 50 years and formed a lovely couple. Their Emails to friends were always signed with “DANINA”.

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### **Where can I get some cassava ”mbeu” (seed) to plant this year? *Reflections from the field with farmers in Malawi***

#### **The Science and Practice of Cassava**

In 2016 I co-authored a book with two colleagues, Sarah Andersson Wamala, Linley Chiwona-Karlton and Pauline Ocaya titled “*Unstoppable Women – does education matter.*” In this book each one of the authors chronicles their story of how education, more precisely how higher education has enabled them as women, to be in places which might never have been possible. In my story, I end with the following thoughts:

“Now, seriously, who would have thought that soaking cassava in *ingumbe* (earthenware pots) in Chisenga with my grandmother would one day lead me to studying cassava and making a career out of it?” (*Unstoppable Women – does education matter. Page 92*)

It was in 1993 that I first conducted a qualitative interview with farmers, specifically farmers growing cassava in Malawi. Hans Rosling, the renowned professor who first described the disease spastic paralysis in Mozambique from the consumption of improperly processed cassava, wanted to understand more deeply “Why farmers grew or preferred to grow bitter cassava”. As his doctoral student, we set out to answer this question in Malawi. It was critical that the question be asked in the local language with no in-between translation so that the exact words for *bitter* could be described in depth in the English language. This fieldwork conducted in 1993 -1995 was to result in my first publication the *importance of being bitter – a qualitative study on cassava cultivar preference in Malawi*. Through these studies I have learned that

for many farmers in Malawi, particularly resource poor farmers:

1. Farmers make trade-offs when selecting cassava varieties to ensure food security. Both women and men, acknowledged that food security for the household was determined by the women
2. Women are more informed and able to identify cassava varieties by name because selecting varieties meant distinguishing between bitter and non-bitter varieties
3. When it comes to thinking of household food security, bitter varieties are the preferred varieties. To put it in their own words:

*"We grow bitter, toxic cassava because it gives a certain level of food security, kuvikilia. If we are to grow sweet cassava, look at our neighbours! Their whole field was harvested by thieves while they slept and now they have no food. Nobody wants to die from hunger".*

4. Peeling and pounding cassava roots is a drudgery and especially for women, a mill that can grind dried cassava roots in a way that produces high quality flour in the rural area would save time and enhance their lives
5. No matter how hard they preserve their cuttings or source new planting materials, there is always a shortage either due to diseases, weather or low yield
6. Thus the demand is always larger than the supply

#### **Mobilising farmers in making cassava planting materials available and sustainable within the Domasi community**

By 1999 my research had progressed and while presenting a paper at a conference in Athens, Greece, I met a self-made woman entrepreneur by the name of Chrissie Katundu, from Domasi, Malawi. Chrissie ran a small-scale bakery making half-loaves made from wheat flour. She had stopped making whole loaves because the price of wheat made it too expensive for local people to buy her products. I shared with Chrissie the good news that The International Institute of Tropical Agriculture (IITA) had been testing the substitution of wheat flour with cassava flour in bread and that she should try this. Chrissie returned back to Malawi and in 2000 when I visited her in Malawi she was in full operations making 100% cassava bread. Her problem was not having enough supply of cassava roots to make the flour.

In 2002 with funding from the Swedish International Agency for Development (SIDA) – Swedish Research Cooperation (Sarec) an action research Project on participatory cassava varietal selection was initiated. The aim was to mobilise farmers in making cassava planting materials available and sustainable within the Domasi community and to move farmers from being price takers to price aware farmers. It took three years to establish the farmers group Chinangwa ndi Mbatata Roots and Tuber Enterprise (CMRTE) [www.cmрте.org](http://www.cmрте.org). This would not have been possible, without the commitment, engagement and above all voluntary attitude of the farmers. Above all it was the astute leadership of Chrissie Katundu that saw the farmers group grow from hardly having any cassava varieties to being a household name in Malawi with interviews on Malawi Television, African Business Magazine, The Nation, The Times, Svenska Dagbladet, Syd Svenska, The South Africa Sustainable Development Conference in 2002.



Between 2002 and 2004 the farmers group from Domasi visited other farmers in Mulanje district to learn about cassava, and more specifically about the various varieties that the Mulanje farmers were growing. Through this farmer to farmer exchange, the Domasi farmers, mostly women, increased their knowledge of cassava varieties. These visits were conducted together with the researchers, a multidisciplinary team of scientists comprising, breeders, social scientists, nutritionists, food scientists, agricultural economists, extension workers, community workers, chiefs, local councilors, national agricultural research systems as well as the International Institute for Tropical Agriculture (IITA). With time it became increasingly apparent that the research component could not address all the issues that dealt with sustainability, there was a need to collaborate with a development partner. A proposal was written to the Centre for Tropical Agriculture (CTA) and between 2005 – 2010 CMRTE received support from CTA.

#### **Sustaining cassava production and seed supply**

With the support from CTA, CMRTE farmers

received training and travelled to other countries to learn more about cassava but also about working in groups. They travelled to Nigeria, a trip that was supported by CTA and the IITA where for the first time they saw the potential of cassava beyond just being a subsistence crop. From 2009 CMRTE was well established as a farmers group that could provide and sell good quality cassava planting material. Other farmers from as far away as Mozambique and as local as Nkhota-kota would come to visit CMRTE to learn about their model. What exactly was this model?

Simply told, it was based on the local traditional practice of “*kugwirizani ndi kuzipeleka kuonesana zochitika*” (working together, voluntarily and showing each other how things work). Once a week on a Tuesday farmers would meet to work together in their communal cassava garden or demonstration fields. Tuesday was selected to be a free day for many because on the other days it could be market days, Muslim prayer day or Christian prayer day. Members, predominantly women, would voluntarily come together to work towards having a sustainable supply of cassava for consumption, marketing as well as having a steady supply of planting material. The cassava group received support from the national agricultural research systems, researchers and most of all the local community support from the chiefs in the form of land. At the helm of this success was the indomitable Mrs Chrissie Katundu.

The challenge for the CMRTE farmers with time was how to sustain “*kugwirizani ndi kuzipeleka kuonesana zochitika*” (working together, voluntarily and showing each other how things work). As new funding opportunities availed to the group the model of operation changed and members became disillusioned. As a researcher, I ask myself “*why do we intervene in functional systems that work without first understanding how things work?*”.

It is incomprehensible to hear that farmers that were self-sufficient in cassava planting material continue to ask:

*Where can I get cassava mbeu (seed) to plant this year? Year after year.....*

#### Looking ahead

There are many factors that intervene with cassava seed systems. I am also aware that for the first time in Malawi, there is an official cassava seed programme that is supported by the government. From my experience with the CMRTE farmers in Malawi, there is need for continuous training, and more training, follow-up and more follow-up. Farming in resource poor rural Malawi is no longer what it was. There are several donor funded Africa wide programmes looking at cassava agronomy, cassava fertilizer trials, cassava weed management, etc.. It is difficult to convince resource poor farmers

that fertilizing cassava is necessary and will produce more vigorous plants given the many competing needs. With so much emphasis and policy support given to the cereal crop maize in Malawi to sustain the cassava seed system will require a formidable effort and long term commitment. Cassava will require champions, like the formidable Mrs Chrissie Katundu. A self-made entrepreneur, farmer, mother, wife and above all role model and mentor for the many women and farmers in Domasi and well beyond.

#### For further reading

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#### Continuing rehabilitation needs for konzo patients in Nampula Province, Mozambique

In 1981, Nampula Province in northern Mozambique was the site of the first large konzo epidemic in Mozambique during a severe drought. Over 1100 cases were recorded, the majority in Memba District. In 1992-1993, a second large epidemic with over 600 cases occurred in Mogincual District, associated with war. Along the years since 1981, smaller epidemics and sporadic cases have been reported (Cliff et al, 2011). Nine other districts have also recorded konzo cases: the overall recorded total for the province to the end of 2014 is 2279 cases.

Konzo causes lifetime irreversible paraparesis (weakness) of the lower limbs. Between 2012 and

2014, an intervention to prevent konzo by teaching the wetting method of processing cassava flour in three of the worst-affected communities, had revealed a continuing burden of disability. 72 cases of konzo were found, with a mean konzo prevalence of 1.2% (Nhassico D et al, 2015). The communities were isolated, mostly beyond the reach of the health services.

Conscious of this large burden of disability, in 2015 and 2106 we carried out a programme of physical rehabilitation in ten of the worst-affected konzo communities in Memba and Liupo (previously part of Mogincual) Districts. The programme was led by the provincial health department's physiotherapy team. Nutritionists collaborated in giving education on prevention.

A mobile team of physiotherapists visited the known worst-affected communities, where community leaders mobilized those with difficulty in walking to come to a central point. They then collected demographic details and information on year of onset, took a clinical history and examined the patients. Finally, they made a diagnosis of the causative disease, and assessed the rehabilitation needs of each patient.

They found that konzo was the overwhelming cause of motor disability (difficulty in walking) in these communities. Of 225 patients with a motor disability, 196 (87%) suffered from konzo. In Memba, 125 konzo victims were found in just three communities. In Liupo, 71 victims were found in seven communities.

In Memba, most patients had onset during the epidemic of the early 1980s, and in Liupo during the epidemic of the early 1990s. Otherwise, the onset was spread along the years with a small peak in Liupo in 2010, that may represent an artefact. No new cases were recorded in these communities in 2015 and 2016. Cases may have occurred in other konzo-affected communities, as they are mostly isolated, extremely poor, out of reach of the health services, and there is no notification system for konzo in place. Three of the communities had been sites of the intervention to teach the wetting method, of those patients with konzo, 84 (43%) were female, and 11 (6%) were under 15 years of age. The mean age was 37.9 years, the youngest patient was five and the oldest 92 years of age. In epidemics, konzo mostly affects children and women of reproductive age. The preponderance of male victims among the survivors may reflect a reluctance of women to present for rehabilitation or a higher mortality.

Forty- three disabled patients were of school age (7-20 years); none was in school.

Of the total of 225 disabled patients, 32 were classified as mild (able to walk without support), 164

as moderate (needs support to walk) and 29 as severe (unable to walk). 193 (86%) needed mobility aids. By the end of 2016, mobility aids had been distributed to 139 (73%) of those needing them. The remainder will be distributed in 2017, and the programme will be expanded to other affected communities in the same districts, and to a further district.

### Lessons learned

1. Konzo has caused a heavy burden of disability in the worst-affected communities.
2. Konzo victims need lifelong rehabilitation and most need disability aids.
3. Konzo prevention and rehabilitation programmes should go hand in hand.
4. Konzo should be included in neglected diseases programmes.
5. Konzo should be a notifiable disease.
6. Konzo-affected areas should be a priority for community-based rehabilitation programmes.
7. Disabled children in konzo-affected communities are not attending school, a problem that needs to be addressed by education authorities and local schools.

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