The C.H.I.M.P.P. Group: A Multi-disciplinary Investigation into the Use of Medicinal Plants by Chimpanzees

To date, various sources of evidence have been cited to suggest that certain plant foods containing toxic secondary compounds are selected by chimpanzees for their medicinal value. The first suggestion came from observations of a peculiar habit of Gombe and Mahale chimpanzees (western Tanzania), first reported in 1983 by Wrangham and Nishida: chimps swallowed whole the leaves of plants of the *Aspilia* species. The presence of powerful bioactive compounds isolated from the leaves by Eloy Rodriguez and his colleagues suggested the possible medicinal value of these plants for chimpanzees.

Since then, a growing body of new evidence supporting the possibility of self-medication by animals has given a burst of momentum to the new field of 'zoopharmacognosy' (the term was coined by Rodriguez and Wrangham), or the use of medicinal plants by animals. From 1988, in close cooperation with researchers in Japan, Tanzania, France and Great Britain, I have begun to test hypotheses about medicinal plant use developed from my own observations and those of colleagues at several field sites across Africa. We call ourselves "The C.H.I.M.P.P Group" (Chemo-ethology of Hominoid Interactions with Medicinal Plants and Parasites). The Group has members in the fields of ecology, ethology, ethnomedicine, natural products chemistry, parasitology, pharmacology and pharmacy. My interest in starting the group began in November 1987, when I observed an ailing female chimpanzee's use of *Vernonia amygdalina* (Del). The adult female, Chausiku, meticulously removed the leaves and outer bark from several young shoots and chewed on the exposed pith, sucking

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out the extremely bitter juice. By the afternoon of the next day, 23 hrs later, she had made a full recovery from her lack of appetite, severe malaise and constipation, typical symptoms of parasite infection. According to my Tanzanian coworker, game officer Mohamedi Seifu Kalunde who was trained in the use of medicinal plants by his kin, the rate of recovery (20 to 24 hrs) is comparable to that of his people, the Tongwe, who use the bitter leaves or roots of this plant as a treatment for similar symptoms. In fact, this plant is widely prescribed across subSaharan Africa for stomachache and intestinal parasites.

The similar consumption of this plant by humans and the ailing Chausiku seemed almost unreal to me, and warranted further investigation. At the time, I felt that Chausiku suffered from some kind of gastrointestinal upset, possibly caused by parasites. However, in order to demonstrate this I had to find out what kind of parasites Mahale chimpanzees harbor and whether the plant pith actually contains the secondary compounds necessary to rid them of those parasites. As I began to formulate my hypotheses, it quickly became apparent that the investigation could not possibly be done alone. As luck would have it, a team of natural plant product chemists at Kyoto University, headed by K. Koshimizu and H. Ohigashi, were working on the isolation, structural determination and activity testing of chemical compounds extracted from tropical African flora. When I visited their laboratory in 1988, bringing with me from Tanzania large plastic bags of plant samples and my account of the sick chimpanzee Chausiku, they were keen to help me with the analysis. Apparently they had come across *V. amygdalina* the previous year in Cameroon, and were interested in it because of its use there as a tonic called 'Ndole' (eaten with meat and plantain, it is said to restore lost energy). We agreed to collaborate and laboratory investigations began in early 1988.

In the fall of 1989 I began collecting fecal samples at Mahale along with focal animal observations, and *ad libitum* observations on as many individuals as possible. The feces were analyzed by S. Gotoh, a parasitologist in the Laboratory Primate Center of Kyoto University's Primate Research Institute. Based on this preliminary survey, which also included samples from three other sympatric primates (yellow baboon, vervet, and redtail monkey), several parasite genera stood out as ecologically important models to test the antiparasitic properties of this plant.

Meanwhile, analyses of the plant revealed the presence of compounds known for their bioactivity: the sesquiterpene lactones (The antiparasitic activity of the sesquiterpene lactones had previously been reported by Dr. G. Balansard and his colleagues at the University of Marseille.) To our surprise, a new class of compounds was isolated, and named the 'steroid glucosides'. I began to search the literature for other reports on the chemical activities of this plant. In Great Britain, a group represented by J.D. Phillipson and Colin Wright at the University of London School of Pharmacy, and G.C. Kirby and D.C. Warhurst at the London School of Hygiene and Tropical Medicine were not testing *V. amygdalina,* but were using new methods to test the bioactivity of other tropical African plant species. In Japan, Dr. M. Kawanaka at Tokyo's National Institute of Health had also developed a new method for testing the antischistosomal activity of plant compounds. All the investigators involved were contacted, and by mid-1991 we had outlined the scope of our future collaboration, chosen parasite models for the tests, and actual testing began. *In vitro* tests of bioactive compounds found in the pith of *V. amygdalina* showed significant antiparasitic activity. Further tests at labs in Marseille and London have yielded good results.

In October 1991 Koshimizu and his team joined me at Mahale to collect specimens of an additional 15 plant species with possible relevance to the investigation. During this trip a second detailed observation was made of the use of *V. amygdalina* by a chimp with apparent gastrointestinal upset. Analysis of fecal samples collected approximately 1 hr and 20.5 hrs after ingestion of the plant's pith revealed a notable drop in the degree of infection by one species of parasite. Assay of the plant consumed by the chimp confirmed that two bioactive constituents were present. The estimated ingested amount of one compound was approximately equal to that contained in a tradition Tongwe medicine prepared from a cold water extract of the leaves

and used to treat gastrointestinal disorders in human patients.

The study described above provided us with three new types of key evidence: verification of the presence of a bioactive compound from a sample of the ingested plant, a clinically measured biological effect on the subject who ingested the plant, and a quantitative chemical comparison with a prescribed dose of the compound known effective in the relief of similar symptoms in humans. We have set this as the standard for future data collection, and anxiously await similar work from other researchers across Africa.

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Ed. note: The above article is based on previously published work of Mike Huffman and his colleagues, who welcome requests for reprints (M. Huffman, Dept. Zoology, Kyoto University, Sakyo, Kyoto 606, Japan). Mike, who returns soon from Tanzania, writes that he has made good progress in his current investigation there.