

# THE STUDY OF PRIMATE SELF-MEDICATION

A collection of multidisciplinary research work by  
members of The C.H.I.M.P.P. Group\*  
(the first 18 years, 1987 – 2005)

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## About this document

The following compilation of scientific research papers and articles is the result of the first 18 years of fruitful collaborations from people of many nations, ideologies and cultures. These collaborations have provide not only new insights into the wonder of nature's complexities, but has personally been a rewarding path to the understanding of the absolute necessity and importance of the multidisciplinary approach and of the significance of cultural diversity in science. Science is indeed the universal medium of our collaboration, but no single country our discipline was more important than the others.

More than anything else, I am grateful to all who have shared in this work for their enduring friendship and graciousness. For the results compiled here would not have been possible had it not been for their overwhelming generosity in the sharing of valuable expertise, time and resources. Their names are too many to mention, but the majority of them appear in the following papers that make up this document.

Given the diversity of disciplines which have been involved in this research, key collaborators from the beginning, and treasured friends, Hajime Ohigashi, Koichi Koshimizu and I have thought for some time that is was necessary to put the growing number of papers together into one volume, not only to provide a near complete record of this work, but to provide access to papers published in journals that no single reader would be familiar with or would not normally come across in the literature of their own discipline. Admittedly there is overlap in some of the review papers, as they were written on request or where published as proceedings of a variety of different academic societies and congresses inviting us to share our research with them. In spite of this overlap and the expense of weight, I have included most of them here to provide as close of a complete record of our activity as possible.

There is still so much to do, as we have really only begun to scratch the surface. In collaboration with students and colleagues from around the world, we have begun to compile a database of the feeding lists of representative primate species ranging from prosimians in Madagascar, monkeys of the Neotropics and Asia to the great apes of Africa and Southeast Asia. From this we have begun to assess through the literature, and our own research, the complimentary nutritional and medicinal properties of 'food' and its importance in primates in an attempt to expand our understanding of the breadth and depth of self-medication and health maintenance behaviors and to identify promising new animal and plant targets for research. It is our strong desire that this document encourage those who read it to pursue this line of research and to expand it above and beyond what we have done.

In the first page of each paper you will find the many institutions that have been involved and supported each of us generously with facilities and the means of a nurturing grounds for our academic development or the support of our livelihoods. In the acknowledgements there within you will also find the many sources of funding and facilities in the countries where field research was carried out during this period. The list would be too long and cumbersome to include here. To all of you we give our sincere appreciation and deepest gratitude.

The printing of this document was made possible through research funds provided to Michael A. Huffman (■ 号 C16570193) from the Ministry of Education, Science, Sports, and Culture, Japan. My warmest appreciation goes to Fumie Naito and Reiko Nagata for their kind help in scanning many of the papers included here within onto PDF files, which made the final printing easier. Any mistakes or omissions are solely my responsibility.

Michael A. Huffman, Inuyama, Japan, January 2, 2005

**Every study has a beginning, and this is ours.**

*November 21, 1987, 4.50 am: The booming pant-hoots of a lone chimpanzee break the pre-dawn stillness and wake me from a comfortable sleep. It is still nighttime in Mahale, but the sun has already begun to rise over the Indian Ocean on the Tanzanian coast some 1000 km to the east, poised to begin its push across the expansive savannah woodlands of the interior. The rays of early morning light will not reach Kansyana camp for at least another hour and a half. The Mahale Mountains are the last hurdle that the sun must overcome before its welcome warm rays finally cover all of Tanzania.*

*Over the next two hours, the lone male urgently continues to call out in hope of getting a reply from his scattered companions. Typical of Mahale chimpanzees during the rainy season, they have begun to split into smaller groups in search of limited patches of food. Now, at the beginning of the rainy season members of the Mahale M-group are not always so easy to find.*

*At around 6:50, the male quietly passes through camp on his way north. There is light enough now to see and I recognize him as Ntologi, M-group's alpha male since 1979.*

*At around 7:50, Mohamedi Seifu Kalunde, my friend and research assistant, arrives at camp coming from Kasiha village. We waste no time and head north in the same direction as Ntologi did. The first hour is spent moving north and just climbing up the steep slopes of the mountain to a high vantage point on the ridge where we are most likely to hear chimpanzees in the Mpila river valley-basin down below.*

*At 9:36, during our traverse of the forested G-ridge, we again hear the familiar series of pant-hoots from a single male. Almost instantaneously thereafter, his pant-hoots are met by a rally of replies in kind from a small party further up the river, followed by yet another small group still further up the mountain. From their calls, we know that the chimpanzees are split into small groups spread all across the forest, probably in search of fruits.*

*As quickly as they announce their presence, they are they swallowed up once again in the silence within the thick dark green landscape.*

*Between 9:50 and 12:41, we find several individuals and begin to record their behavior, noting who is in the group, what they are feeding on, which females are sexually receptive and so on.*

*This basic data has been accumulated on a daily basis since 1965 when the research first started.*

*Moshi Bunengwa, another of our team's research assistants, comes with the news that he has seen Ntologi who is now traveling with two young males, Nsaba and Hito. Like ourselves, Ntologi has successfully made contact with other group members.*

*Alone or in small groups, chimpanzees sit quietly in the canopy or hang one-handed from branches, plucking out the red wax-membrane coated seeds of Lulumasia, a relative of the nutmeg, from the thick yellow husks clustered together like grapes. We first detect this small party of chimpanzees only from the sound of discarded husks falling to the ground with a light thud. Chimpanzees on the ground are even harder to spot but they can be heard as they pull up stalks of Itungulu--African ginger or Iswe--elephant grass. Sometimes also protruding out of the ground at the base of the stalks are the oblong red fruits of Itungulu, a welcome treat for chimpanzees and humans alike. Throughout the morning, individuals join and split from the group we are watching.*

*At 12:41, Mohamedi and I hear a round of pant-grunt greetings and screams in the distance. We intercept the group as they descend along the Mpila River. We find a group of eleven*

*individuals including two adult males, Lukaja and Kasangazi, the then young adolescent male Jilba, three adult females Chausiku, Wantendele and Wakilufya and their four dependent offspring Chopin, Masudi, Maggy, and Ashula.*

*The three adult females, all immigrants from the now extinct Kajabala-group often travel together when not sexually receptive. They have continued their friendships and help watch over each other's young in Mimikire-group. They, no doubt, find solidarity amongst themselves in a society where newcomer females are harassed by more dominant females in competition for valuable food resources and possibly mates.*

*Wantendele, Wakilufya, and the adult male Lukaja are three of the target individuals in my study this season. Mohamedi and I begin our real work for the day at last. We start by following Lukaja, the lead member of the group as he quickly moves down the river-bed-obstacle-course of large slippery boulders in the Mpila riverbed. The rest of the chimpanzees follow closely behind. Lukaja and his two male companions are lost after only 16 minutes of contact. They leave the females behind as they double back and disappear into thorny dense bush in the direction of pant-hoots from a larger group up on the ridge the same place from where we first heard chimpanzees calling this morning.*

*We continue to follow the females as they quickly move into the forest then pause to listen to the large group up on the ridge. They decide not to follow and begin to move at a leisurely pace in the cool shade of the trees, in search of something to eat.*

*With extremely acute vision, Wantendele spots a cluster of ripe yellow Ilombo fruit high in the canopy. She swiftly climbs up with Maggy clinging to her back. Her son, Masudi continues to wrestle with Ashula and Chopin on the ground. Chausiku climbs up only a short distance and rests. A hunch tells me that Chausiku does not seem to be feeling well.*

*She constructs a sturdy daybed by weaving live branches into a stable platform in the fork of a large branch. She listlessly stares up into the canopy at her two-and-a-half-year-old son, as he precariously dangles from a branch by one hand. Masudi and Maggy tug at his feet in an attempt to solicit play. If a young infant fell from such a height, it could easily be injured. A mother is usually nearby to retrieve her infant and scold its older playmates, but today Chausiku pays no attention. She appears weak and lacking in energy.*

*By 13:20 our initial group of eleven has dwindled down to only two adult females, Wantendele and Chausiku, and their three offspring.*

*At 13:22, Wantendele moves south with Maggy and Masudi to feed on figs and more Ilombo. Mohamedi and I decide to follow them. Wantendele doubles back and returns to the base of the same tree where we left Chausiku 30 minutes earlier, as if she expects her to still be there. She is and has not budged from her bed. Chopin continues playing alone higher up in the branches.*

*At 14:02, Chausiku climbs down to the ground and meets Wantendele who has patiently been waiting for her. They all start to move south. Chausiku's progress is painfully slow as she frequently stops to rest. The others continue on ahead, pausing occasionally to feed on the pith of Iswe and Itungulu, always remaining in sight of Chausiku.*

*At 14:13, Chausiku goes directly to and sits down in front of a shrub and pulls down several new growth branches about the diameter of my little finger. She places them all on her lap and removes the bark and leaves of the first branch to expose the succulent inner pith. She then bites off small portions and chews on each for several seconds at a time. By doing this, she makes a conspicuous sucking sound as she extracts and swallows the juice, spitting out most of the remaining fiber. This continues for 17 minutes, with short breaks as she consumes the pith of each branch in the same manner.*

Not being familiar with this plant, I ask Mohamedi, as we continue to watch Chausiku, what it is called in the local Tongwe vernacular. He replies, "Mjonso". Mohamedi has worked here with the Kyoto University chimpanzee research project since it started in the early 1960s and is widely acknowledged by researchers and fellow Tongwe tribesman for his vast knowledge of the flora and fauna in the area.

While Chausiku continues to feed, Wantendele sits nearby feeding on Iswe but shows no interest in the Mjonso. Chopin does seem interested, however, and begs for a piece of pith hanging from his mother's mouth. He picks up a piece, which falls from her mouth and a section of the discarded leaf and bark from the ground. After putting these things in his mouth for a brief second he quickly discards them and continues chewing on a piece of Iswe.

Not having seen chimpanzees eat this plant before, I next ask Mohamedi if chimpanzees consume it often, and add that I have not seen them show any interest in it before today in my ten months of observations here. He nods and replies that, indeed, it is not eaten frequently. He adds that K-group chimpanzees also ate the pith, but that chimpanzees probably do not eat too much because it is very bitter. Interested in the customs and material culture of his people, I next ask him if the Tongwe use it for anything. He smiles and says matter of factly, "Yes, it is very strong Dawa (medicine)." "What kind of Dawa?", I ask in amazement. He replies saying it is most commonly used for malaria-fever, stomachaches, and intestinal parasites.

My mouth drops open as the details of our observations of Chausiku over the last hour and a half flash through my mind. I become consumed with an urgency to know just what the outcome of Chausiku's behavior will be and I am filled with a rush of adrenaline. Without speaking, we agree that we will follow and watch her closely. As time progresses, the severity of her illness becomes more apparent. Her lower back appears painful because of the careful and slow way she walks, sits down and climbs trees. She is also weak and has little appetite. At one point we also note the unusually dark color of her urine as she relieves herself off the side of her daybed.

Wantendele does not leave Chausiku for the remainder of the day as they slowly make their way south to the northern foot of G-ridge.

At 15:01, Wantendele climbs up into a Lwago tree and feeds on its fruits. Chausiku slowly and with obvious effort climbs up and makes a new daybed below Wantendele. Thirty minutes later, Wantendele climbs down and sits on the ground. Chausiku raises her head, then slowly moves out of her bed and climbs partway down the tree, but stops and builds another daybed. After a few minutes of hesitation, Wantendele climbs back up into the tree and builds a daybed herself at 15:33; she remains there until Chausiku finally comes down at 16:49 after another long rest.

Once again they set off south and Chausiku follows but quickly begins to lag behind the others. After several stops, a drink of water and brief nibble on ginger pith, Chausiku catches up with the others at 17:29. Wantendele, Maggy, and Masudi have already climbed up into the trees for the night. Chopin sits waiting on the ground for his mother to arrive. In a last struggle, Chausiku slowly climbs up into a tree and builds her last bed for the day at 17:44. Chopin climbs high up into the tree and explores on his own. We stay with them until around 18:00 then head back to camp before it gets too dark.

On several occasions today we had the impression that Wantendele coordinated her activities to keep an eye on Chausiku. The main group was occasionally within hearing distance and probably less than a mile from us all afternoon. Nonetheless, Wantendele made no attempt to leave her friend to join them.

Back at camp, our story is met with both excitement and disbelief by some of the senior members of our research team. They had, of course, seen chimpanzees use this plant, known

by its Latin name as *Vernonia amygdalina*, but had neither associated its use with sickness nor were they aware of the plant's medicinal value to the Tongwe. Their healthy skepticism encourages me even more strongly to follow this through to the end.

The next morning between 7:00 and 8:00, a small group of three to four chimpanzees pant-hoot on the mountain side Southeast of camp, as they find their first meal of the day. Mohamedi and I head north.

By 9:00 we make contact with our first group of eleven chimpanzees. To our joy we find Chausiku and Wantendele with them, only 60 meters from where they made their beds last night. Besides Chausiku, Wantendele and their offspring, included in the group is the higher ranking adult male, Kalunde, the adolescent male Jilba, a recent immigrant, the young adult sexually receptive female Patty, and another adult female Gwekulo (born ca. 1962 in K-group).

Today Gwekulo seems to have the job of looking after Chopin. This is not the first time for Gwekulo to watch over Chausiku's infants in times of sickness. Such associations are known as 'baby-sitter relationships' in which young adult females travel together with a particular mother-infant pair and act as a playmate for the infant and a travel companion for the mother. When these young females are sexually receptive, however, they usually travel within groups, which also contain males. Gwekulo never had the luck to have children of her own. Thus, even nowadays she very often moves around with other females and their offspring.

While Chausiku is lying down off to the side of the group, Gwekulo sits nearby Chopin, watching over him as he wrestles with Ashula and Masudi. Occasionally, Patty solicits Chopin to copulate. At 9:59, the group moves south. Chopin follows after Patty. Chausiku slowly follows behind the group for less than a minute before she separates from Chopin and the rest for the next 38 minutes. She still appears quite weak, frequently stopping to sit and rest.

At 10:42 she is seen to eat for the first time today. Chopin is now traveling with his mother again and between 11:03 and 11:31 they slowly follow behind the group feeding on small amounts of Kasolyo figs and Lulumasia.

Chausiku catches up with the rest of the group and they all stop for their habitual midday nap.

At 12:49, after a long 72 minute sleep, everyone awakens in a commotion of pant-hoots and screams as if a fire station alarm had just gone off in the middle of the night and is up and on the move. Mohamedi and I are caught off guard. As they disappear into the tangle of thorny vines, we crawl on hands and knees, sometimes squirming on our bellies, to keep up with them.

At 13:06, we succeed in getting through the worst of it to find the group nonchalantly resting again. Chausiku, Chopin, and Gwekulo, however, immediately get up and leave the rest of the group behind as they head southwest.

Following behind at a half running pace just to keep up with Chausiku, it becomes clear to us that her condition is improving. She pauses occasionally, this time looking behind her, to see if the others are keeping up. Chausiku seems irritable and distracted, slapping the ground and grunting when Chopin refuses to follow close behind. Gwekulo stays behind to wait for Chopin to catch up while Chausiku continues to move on ahead.

Finally at 13:51, they all end up in an open semi-swamp grassland area filled with three to four meter high elephant grass. Chausiku continues to eat steadily, consuming the succulent pith of elephant grass and ginger, the small semi-sweet red figs of Kankolonkombe and the

tangy baseball-sized yellow fruits of Ilombo. We terminate our observations at 16:05, when we can no longer keep up with her.

What Mohamedi and I witnessed over these days was to be the beginning of a study that has continued for the last decade. Since this time we have observed other sick individuals consume the bitter pith of Mjonso and we have found still other plants like *Aspilia* that may be used in other ways as medicine by these chimpanzees.

The production of toxins, drugs and other compounds, called secondary metabolites by the chemists who study them, is considered to be an evolutionary adaptation to help plants fight off predation from insects and herbivores. These compounds therefore greatly influence what plants animals can select as food and animal ecologists have focused a great deal of their research on understanding how animals can cope with such compounds.

Mohamedi, during my years of field work at Mahale, has been a very valuable friend and collaborator. He was taught herbal medicine by his mother and grandfather--babu Kalunde; both were traditional healers of his community. Had it not been for the knowledge and investment made by Mohamedi's family in him, I am sure that the story I have just told you would never had happened.

Mohamedi once told me that when he was a boy, babu Kalunde told him a story about how he acquired an important new medicine for humans by watching the behavior of a sick animal.

The story goes that babu Kalunde had taken in a young porcupine after its mother was caught and killed in a snare. Shortly afterwards, the young porcupine became sick, and suffered from diarrhea and lethargy. It wandered off from the village and babu Kalunde followed him. The porcupine dug up the root of a plant the Tongwe call Mulengelele. Noting that the baby porcupine recovered from its illness, babu Kalunde decided to collect some of these roots and try them out on people in his village, who, too, had fallen ill. After that experiment Mulengelele became an important plant for the treatment of parasites amongst the Tongwe.

Over the history of humankind, people developed elaborate health-care systems based on experimentation and observations of nature. We in the 'developed world' have much to learn from the people of traditionally living cultures as well as from our primate cousins who continue to live closely with nature.

What Mohamedi and I witnessed over those two days in 1987 was the beginning of a very productive study that has continued to this day and promises to go on for a long time to come. I have continued to expand the scope of this research and I am now collaborating with colleagues working at a number of other field sites throughout Africa and Asia. The laboratory side of this research now includes collaborations with pharmacologists, parasitologists, veterinarians, physiologists, botanists and others in countries around the globe such as Japan, Tanzania, Uganda, United States, Canada, United Kingdom, Australia, France, Holland, Denmark, Germany, Saudi Arabia, and the Czech Republic. Our goal is not only to better understand how animals deal with illness, but also to search for new medicines and ecologically sound strategies for the treatment of major parasite diseases like malaria, schistosomiasis, leishmania, and others.

*Vernonia amygdalina* has proven to be a very important plant in this endeavor. It is our goal that the research will lead to the development of new strategies for treating human and livestock parasite disease based on adaptive behaviors which have proven the test of time in the struggle for survival between host and parasite. (An excerpt taken from Hofer, Huffman & Gunter 2000 MAHALE- A photographic encounter with chimpanzees. With a Forward by Jane Goodall, Sterling Press, NY pp. 110-117.



Mohamedi, Huffman and Luhembe Ishamili at Kansyana camp (December 1995).



Meeting with our colleagues in the Department of Chemistry, University of Dar es Salaam. Left to right: Koichi Koshimizu, Cosam Joseph, Huffman, Mayunga H.H. Nkunya, Hajime Ohigashi, Hideo Hayashi (October 1999),



**This volume is dedicated to the memory of Chausiku (ca. 1958 - 1990), my first mentor in chimpanzee self-medication, and a teacher to many of us who have had the privileged of sharing time with Mahale chimpanzees. (photo by M.A. Huffman, Nov. 1987).**

## Contents

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