The chickens of our neighbour and some ideas concerning Parkinson’s Disease

Our neighbour kept chickens. I still remember very well how I was the hesitating witness of the last moments of their life. On the chopping block they were stripped of their heads, protesting loudly. With an axe it was. I try to remember the technique he used, but while other memories are quite vivid, I seem to have missed this one. The next thing I recall is that he throws a couple of chicken legs to me, while laughing joyfully. He once showed me that the claws could still move if you pulled the tendons. I found it in fact rather distasteful but with such a moving claw you could impress the sea-scouts who occassionaly visited the remote place where we lived at the time. And so I stood in front of those macho boys, chicken leg in my hand. Make sure the claw is open and than pull the tendon, hardly missing a nose, causing a nervous laughter.

Kinesia paradoxa, thus called Oliver Sacks the phenomenon that people with Parkinson’s, who could not move under normal circumstances, were able to catch a ball thrown at them. Mohammed Ali comes running into the ring with his well-known ali-shuffle dealing blows to the cameraman and other invisibly foes. If the show is over, he stiffens. A tennis tournament for parkies. Picking up the balls is more difficult than playing. Sometimes if I can no longer walk I’m still able to run back home.

Dopamine, serotonine and acetylcholine are examples of neurotransmitters. These chemical compounds influence the way signals travel through our nerve system. In a way they function like a series of switches in a railroad system. To simply transfer one single signal you wouldn’t need a neurotransmitter. A direct electrical signal to the proper nerve would be sufficient. A neurotransmitter however opens certain pathways, and closes others. This way, for example, certain muscles are grouped and behave in the same coordinated manner. A mode is set. This doesn’t only apply to musclesgroups but also to other nerve driven systems and thus it also influences our way of thinking. Lots of drugs function as neurotransmitters and as such change the way we think. While we perceive the same things, the way we interprete this information changes.

What is the difference between hitting a ball and picking it up from the ground? If you pick up a ball or if you make any other refined movement, some muscles are contracted (agonists) while others are released (antagonists). This all happens with a certain timing. When hitting a ball or dealing a blow certain muscles are contracted, but there is no controlled release (unproven assumption). The function of the antagonist muscles is done by the slowness of the tissue. This way of moving resembles the way those chicken legs move using the tendons.
Using different neurotransmitters, you can define different groups of the same nerves. This gives a very complicated structure with a fragile balance.

At highschool I had to cycle eight kilometres to school and then again eight kilometres back. It happened one day that I forgot to lock my bike. I thought about it only when I was in the classroom. After the lessons were done I ran to the cycle shed to see if my bicycle was still there. Fortunately it still was there. So I tried to pick up my bike only to find that it was locked. And the keys were gone! Some funny nose had locked my bike and had taken my key too. So I decided to drag my bike along. But anyone who has tried this before will confirm it. If you drag a bike that is locked, the rear wheel will start bouncing.

One of the symptoms people with Parkinson's disease have, is the cogwheel phenomenon. This rythmic pattern of changing resistance can be observed when you move the joint of an arm of a person with parkinson's disease. If a movement is initiated supposing the antagonist will release, and it doesn't do that, the resistence of this antagonist has to be overcome. My bike illustrated that this makes the wheel bounce. Resistance is always overcome in shocks.

Resistance also is dependent on the speed of the movement. That's why it is often easier if movements are performed fast. Slow movements always have a lot of friction. The antagonist muscles can help to overcome the friction, by forcing a movement in a different direction.

Experiment:
Tie a long rubber band to the ear of a cup. Tie the other end to the table using some tape. Make sure there is so much tension on the rubber band that the cup just doesn't move. Also tie a piece of rope to the ear. If you gently pull that rope in any direction, the friction will be overcome and the cup will be pulled in by the rubber band. This way the antagonist (the rope) will help to overcome the friction for the agonist (the rubber band).

I'm playing tennis and want to pick up a ball. My cramped lower back muscles have to give way, but they don't. I try to bent my knees instead but allthough gravity is on my site I have to use the musclepower to force my leggs in a bended position. After I have picked up the ball, I have to get up. This happens in a very cramped way too. My lower back muscles are contracted at full speed just like the muscles that straighten my legs. The result is that I get up with a sort of jump.
What goes wrong with Parkinon's disease, is not so much the contracting of the agonist muscles, but rather the releasing of the antagonists.

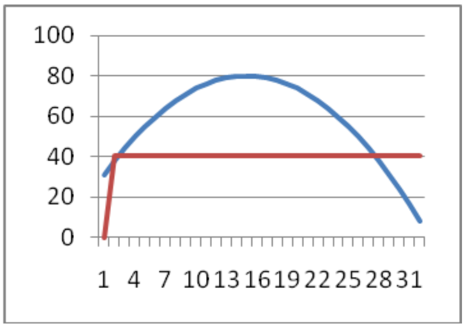
If the system of cooperation of two opposing mucles doesn't work properly, there is still a way to give some relief.

Sometime in evolution a species needed a more sophisticated way of moving. The simple system with one muscle contracting no longer could meet the demands. To make small and precise movements, the friction had to be overcome gradually. To accomplish this task the antagonist, who already had been developed to drive movement in the opposite direction, was now used to overcome friction. Actually we know two kinds of transmission, one fast and one slow. The slow transmission is responsible for what is also called neuromodulation.

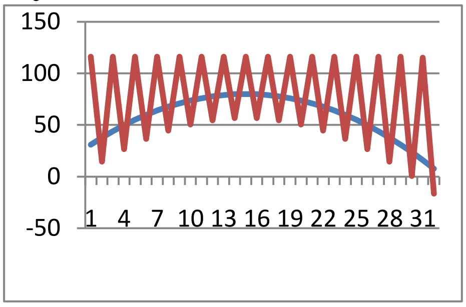
Friction is the main problem in performing precise movements. This could also explain why whole-body-vibrations have a positive effect on some of the parkinson's symptoms especially rigidity (Christiaan Haas, The effects of Whole-body-vibrations on motor control in Parkinson's disease).

Experiment:
This is a variation of the experiment with the cup and the rubber band. This time you don't use a cup but a vibrator. Pull the rubber band and note how far it must be stretched before the vibrator starts sliding. Then repeat the procedure with the vibrator switched on. The difference will be enormous.

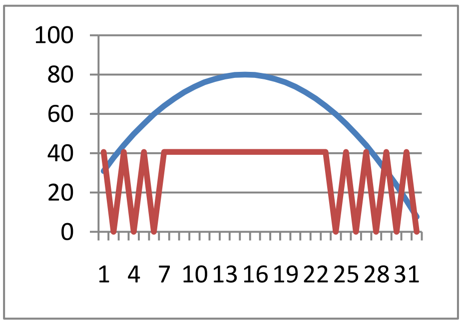
To clarify this you may see a movement situation with friction as a buffer system. A buffer is a unit where a variable input leads to a constant output. If for example you try to push a heavy block on a table, it will not move initially. If you increase the



force, suddenly a the block will give way and move.
In the figure on the left, there is a blue curve that represents the force that is used to move the block. The red line represents the friction between the block and the table. In this way, a variable input, leads to a constant output. If you try to maneuver precisely you would want the output to correlate with the input. The friction force is directed against the movement force, so it will influence the movement.
We know from experience that if we turn a cork when we try to pull it out of the bottle it will not be released so suddenly. Turning it makes it easier to control the release.
If you tie a vibrator to a rubber band, and place it on the table, you have to stretch



this band a certain distance before the thing starts to move. If however you turn on the vibrator, you need only stretch the band a much shorter distance before it starts moving.
In a spreadsheet you can calculate what happens if you add an oscillating force to the original input signal. This is illustrated in the second graph. The red line represents the input force that was modified by an oscilating force. If you use this modified force as input in the third graph, the red line representing the friction graph has much more of the characteristics of the original input force. This corresponds to the fact that you can move a working vibrator on the table, much more accurate than a vibrator that is switched off.
To test this concept I wrote a small program in which a user tries to move a vursor



with the keys of the keyboard. For this movement I used the following algorithm:
Situation 1:
The force by which the cursor is moved is gradually increased if the right cursor key is pressed. The friction force is increased together with the movement force until a friction quotient is reached. Moving the cursor this way is very challenging. The movement starts suddenly and when you try to slow down the movement speed, the cursor tends to come to a complete halt,
Situation 2:
Situation 1 is used, but an oscillator is added. The only thing this oscillator does is either add some movement force or to substract some movement force. And here comes the great wonder! It is suddenly much easier to move the cursor or slow it down.

I'm not saying that friction is the cause of parkinson's disease. The solution to master friction by antagonist action, that doesn't function properly, might be the cause of parkinson's disease

After having used levodopa medication for several years, for most PWP the moment comes that the medication causes dyskinesia's. This phenomenon somehow resembles to me the movements of someone who is on the ice for the first time with skates on. Any little movement tends to slide through. There is too little friction! This makes it hard to move. What the Parkinson medication seems to be doing is to eliminate the friction. This makes movements more accurate in the early stages of the disease, but it probably does not solve the problem that the neurotransmitter interaction is disturbed. Generally what Parkinson medication does is to replace a flexible situation with a fixed situation. For example there is a system where dopamine must be transported to synapses. There must be a reason why this connection isn't a fixed connection like an electric wire. That's why I think levodopa-like medication or a deep-brain stimulation of the subthalamus nucleus will only partly relief parkison symptoms.