

No 17 Rudolph Magnus (II)

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1. Last time, I introduced you to the neurophysiologist Rudolph Magnus who worked in the University of Utrecht in the Netherlands. Today, I am going to continue with him.
2. He was the scientist who basically worked out the neuroscience of posture. His particular importance to us is the influence his findings had on the development Alexander's ideas on the head-neck relationship.
3. Long before there was any word of Magnus' work, Alexander had recognised the central importance of the head-neck relationship to the way we use, and misuse ourselves. But when he learned of Magnus work in 1925 it seemed to crystallise his thinking and it was at this time that he began to use the phrase "*primary control*".
4. As for sources, I mentioned in the previous talk that Magnus' major work on posture had been published in German in 1924 and had not been translated into English at the time.
5. So you can imagine how pleased I was when a couple of years ago I discovered a copy of a relatively recent English translation from an extremely unlikely source. The translation is called *Body Posture* and it was published in India in 1987 on behalf of the United States Department of Commerce, from whom I obtained it.
6. I have now been told that it can be downloaded from somewhere on the internet. So this is always an option if you find you have nothing better to do some wet weekend.
7. There is also a very badly written biography by his son which was only published in the year 2000. This was somewhat delayed given that Magnus had died seventy-three years earlier, but it adds some detail on Magnus' life and reprints some of his papers.
8. The most accessible English-language sources for his work are the lectures he gave in Britain after the publication of his major work. In 1925 he delivered a special invitation lecture at the Royal Society in London. It is called the Croonian Lecture and he gave it at the invitation of Sir Charles Sherrington who was President of the Royal Society at the time.
9. The lecture is called *Animal Posture*. If you go along to the library in the Royal Society, you can get a copy. It's a very nice

place to visit and full of history. The Royal Society was founded in 1660. Among its early members were Christopher Wren and Isaac Newton. It occupies a splendid building in Carlton Terrace, overlooking Green Park.

10. Magnus also gave two lectures, called the Cameron Prize Lectures, in the University of Edinburgh in 1926, which were subsequently published in the medical journal the *Lancet*. You can get these from the Wellcome Institute Library on Euston Road. This is a fantastic source of information on everything related to the history of medicine and is free.
11. There is also a book published by Stanford University in California which reprints three draft lectures Magnus was scheduled to give there in 1927 but he died before he could do so.
12. Two of these are about subjects other than posture and show that Magnus kept up his wider research interests but they are outside our scope of interest.
13. The third is quite philosophical and is called *The physiological a priori*. This obviously reflects Magnus' interest in the German philosopher Immanuel Kant.
14. The lecture is a draft and reading it one can only feel an immense regret that Magnus did not live long enough to develop his ideas further.
15. There is also a little gem of a book by Walter. This was written in 1950 and was published in 1994 by STAT books. It also deals with Professor George Ellett Coghill whom I will be looking at after Magnus.
16. This is an extremely useful publication and I thoroughly recommend it. It is in the library – and there may even be some copies for sale.

The question of posture

17. A fairly obvious question is why anyone might want to study posture, let alone why it should be important in the early development of neuroscience.
18. But as AT teachers, even if there had been no scientific studies of it, we know that the question of posture is central to what we do. We are very cautious about using the word posture, not because it is unimportant, but because it is important and is so widely misunderstood.

19. We all know the reaction we get when we mention to people that we are Alexander teachers. They stiffen themselves up and stick out their chests and say *“Must watch my posture when I’m with you.”*
20. In fact, posture is extremely subtle, complex and dynamic. It is how we are when we are awake, alert, and in repose. It is about the disposition of the body parts relative to each other when we are not actively doing something.
21. Sherrington felt posture provided a very useful entry point into the study of the whole neuromuscular system. In his book *The integrative action of the nervous system* he wrote:

*...much of the reflex reaction expressed by the skeletal musculature is postural. The bony and other levers of the body are maintained in certain attitudes both in regard to the horizon, to the vertical, and to one another...Innervation and co-ordination are as fully demanded for the maintenance of a posture as for the execution of a movement.*¹
22. It was the complexity of posture and the promise that studying it would lead into a deepening understanding of the neuromuscular system that attracted Magnus. From the time he spent his Easter working with Sherrington in 1908, up to his death in 1927, the question of posture was Magnus’ dominant scientific interest.
23. Between 1908 and 1925, apart from the years of the First World War, Magnus and his team carried out hundreds, if not thousands, of experiments on cats, rabbits, guinea pigs, dogs and monkeys to see what was involved in posture and how the brain controlled it.
24. Essentially, what they did involved very precise and skilful brain surgery. Just as Sherrington had done on his own experimental animals.
25. As we saw, the last time, the connection between the brain and the rest of the body runs down from the cerebral hemispheres through mid-brain and the brainstem into the spinal cord. This provides a two-way channel of communication from the body to the brain and from the brain to the body.
26. It also means that if there is a break or a transverse cut, through this communication channel, there is no passage of

¹ Sherrington (1906)p339

nerve signals between the part above the cut and the part below the cut.

27. We see the effects of this when people who suffer injuries to their spinal cord find the brain has no control over the parts of their body below the cut.
28. Similarly, if the cuts are made inside the brain, the part of the brain that is above the cut cannot be involved in whatever is happening in the body below the cut.
29. Basically, by making cuts at various levels in the brain, Magnus and his team investigated which aspects of posture are controlled at which levels in the brain.
30. In all cases they made the cut below the level of the cerebral hemispheres. This is because they were interested in automatic or reflex – as opposed to learned or volitional behaviour.
31. This had another important and merciful consequence in that when the thinking and feeling part of the brain, is missing, it is impossible to feel pain. So the work was not as cruel as it looks. But it is, nonetheless, distressing to see the photographs.

Magnus' Findings

32. We now come to the results. Sherrington and Magnus had no contact during the First World War on which they were on opposite sides. Sherrington was, in fact, very anti-German but they became friendly again in 1922.
33. The Croonian lecture was Sherrington's way of giving Magnus the chance to put his work before an English audience.
34. For the purpose of this lecture Magnus chose to look at posture under four headings, describing different aspects of what is going on. There is a very Alexandrian feel to all of them.
35. The first of these he called "*Reflex Standing*". About this, he says:

In order to carry the weight of the body against the action of gravity, it is necessary that a certain set of muscles, the 'standing muscles' should have by reflex action a certain degree of enduring tone, to prevent the body falling to the ground.²

² Magnus (1925)p339

36. In other words, when we stand quietly, when we let standing happen, there must be a sufficient level of tone in our standing muscles to resist the downward pull of gravity so that we do not collapse in a heap on the ground. You will remember that tone or tonus is the level of tension in a muscle when it is keeping its shape but not actively doing something.

37. The second aspect of posture Magnus called “*The Normal Distribution of Tone*”. He says:

*In the living animal not only do these standing muscles possess tone, but also the other muscles of the body, especially their antagonists, the flexors. Between these two sets of muscles a certain balance of tone exists so that neither set of muscles gets too much or too little tone.*³

38. So, it is not sufficient for proper standing that we should be quiet. We could be doing that and be completely stiffened up with our extensors and flexors madly competing with each other. Proper standing requires an appropriate balance between the extensors and the flexors, with all the muscles doing just enough to keep us in a nicely relaxed state of balance.

39. The third aspect of posture Magnus called “*Attitude*”. About this he says:

*The position of the different parts of the body must harmonise with each other; if one part of the body be displaced, the others parts also change in posture, so that different well-adapted attitudes, evoked by the first displacement, will result.*⁴

40. If when I am standing quietly, I move a bit of me – if I lift my arm, or twist my head – there is an automatic adjustment and harmonisation of my overall posture. Quite a few of our games are explorations of such quiet and gentle changes in what Magnus calls “*Attitude*”.

41. The fourth aspect of posture Magnus called “*The Righting Function*”. About this he says:

If by its own active movements or by some outside force the body of an animal is brought out of the normal resting posture, then a series of reflexes are

³ Ibid. p339

⁴ Ibid. p340

*evoked, by which the normal position is reached again.*⁵

42. This is a more dynamic aspect of posture. He means that if someone comes and gives me a push, or if I do something which takes me out of my balanced standing posture, the righting function takes me back into this balanced standing posture again – if I simply allow standing to happen.
43. So the whole business of posture is dynamic. It takes place as a result of a lot of activity in the neuro-muscular system. As we are standing quietly there are nerve impulses being sent out to muscles all over the body, adjusting their tone so they are in continuing harmony with each other.
44. At the same time, there is a continuing huge input of sensory data into our nervous system. This comes from the various sensing systems and organs throughout the body.
45. We have the labyrinth in the inner ear which responds to the position and movement of the head. We have the muscle-spindles, tendon organs and pressure sensors which tell us about the amount of tension in our muscles and joints. We have the pressure-sense organs in our feet. These various sensors are called proprioceptors – they tell the brain about what is going on in the body itself.
46. We also have what Sherrington calls the teleceptors, the sensors which tell us about things outside the body. In our case the most important teleceptors are the eyes, but for dogs, the nose is equally if not more important. Other animals depend much more heavily than we do on their sense of hearing.
47. Both the proprioceptors and the teleceptors are providing constant streams of impulses into the nervous system, telling it about the internal muscular state of the body and how it is in relation to the external world.
48. So there is a huge data-processing task involved in handling all this incoming data and processing the results so that the appropriate signals can be sent to the various postural muscles to maintain the body in a continuing state of harmonious posture.
49. What Magnus said was:
In fact a very finely elaborated central apparatus is needed to combine and distribute all these afferent

⁵ Ibid. p340

*impulses, depending on and adapted to the always changing circumstances of environment.*⁶

50. He went further than this in *Body Posture* and buried deep in the book he says:

*The result of the present study is that in the brain stem, from the upper cervical cord to the midbrain, lies a complicated central nervous apparatus that governs the entire body posture in a coordinated manner. It unites the musculature of the whole body in a common performance.*⁷

51. We will come back to how this *central apparatus* relates to Alexander's *primary control* in the next talk.

52. For now, I want to focus on the extremely important point made by Magnus that this central apparatus is in the brainstem. In other words, all this brain-processing relating to posture is carried out without any involvement by the cortex, the conscious thinking part of the brain.

53. This, at first sight, is rather odd since it is normally taken for granted that the cortex should be involved in the more important activities of human beings.

54. Given the importance people attribute to "good posture" it would seem obvious that it should be subject to the conscious control of the cortex. But Magnus argued precisely the reverse and says:

*It seems to be of the greatest importance, that the whole central apparatus...is placed subcortically in the brainstem and by this means withdrawn from all voluntary action.*⁸

55. The reason is that when we consciously do something, the motor cortex sends out signals and the muscles tighten up in the order and to the degree required to perform the action.

56. But when the action is over, Magnus says:

*"The brainstem centres... restore the disturbance and bring the body back into the normal posture so that the next cortical impulse will find the body prepared to start again."*⁹

⁶ Ibid. p340

⁷ (Magnus 1924)p653

⁸ Magnus (1925)p349

⁹ Ibid. p349

57. In other words, when we have completed the action and are no longer interfering with the operation of the inbuilt reflex postural mechanisms, they do their job and get things back to the normal resting position again. We are back in tune with ourselves and ready to do the next thing.
58. Magnus uses the nice analogy of the piano, saying:
*This is the apparatus on which the cerebral cortex plays, as complicated melodies are played on a piano, according to principles which are partly known and which now can be investigated from a new point of view.*¹⁰
59. At a more obvious level, we might say that it is only when one has stopped playing one piece on the piano that one can properly begin to play the next one.
60. As I have said before, there is a highly Alexandrian feel to all of this. When we use Walter's phrase "*Allow standing to happen*" we are creating the conditions for the postural reflexes to do their job.
61. The fact that Magnus showed if we can succeed in leaving ourselves alone – in stopping our active interference with ourselves – postural harmony will automatically be restored by our reflex systems is an interesting piece of scientific underpinning for what we do.

References

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¹⁰ (Magnus 1924)p653