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Food for Thought

Ingredients to become a scientist: curiosity, enthusiasm, perseverance, opportunity, and a good pinch of luck

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Writing a 200-word abstract about the life of a 76-year-old scientist, in which luck played a significant role, is not an easy task. Even knowing this scientist well (for I am talking about myself) does not make it any easier. When you notice something is not right, do not fear changing your major (I changed twice before settling on Fisheries and Marine Science). For my PhD in neurobiology, I changed again. Grab opportunities when they arise. Join field trips and expeditions, attend conferences, and spread your interests widely. Spend time in different countries, learn new techniques and languages, and always stay curious. Remain humble. I carried out speleological research in Jamaica and France, participated in a 4-month South Atlantic Fisheries Research Trip and a 3-month Bioluminescence Expedition to the Moluccas, and pioneered comparative physiological and functional anatomical research in Antarctica and the Arctic. Be adventurous. My ethnobiological field work took me to Papua Niugini, NE-India, and Central Australia. Having lived in Australia, Finland, France, Germany, Jamaica, Japan, and New Zealand (I am a New Zealander currently living in Korea) and having spent sabbaticals in Brazil, India, New Caledonia, and North Korea, I consider myself a global scientist. You can become one too.

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Preface

When Howard Browman invited me, and others before me, to contribute an essay to this "Food for Thought" series, he hoped that, if we were to share some of our experiences and career histories with young would-be scientists, it could help the latter with their own careers. But will young scientists be interested in what we older ones have to say? It is, after all, not uncommon for young people to have to listen to tedious advice like "just follow your dreams" or "hard work, perseverance and belief in yourself will get you there". Do they believe that, and would that actually "get them there in the end"—even if there is not also some luck on their side and they had not missed some golden opportunities? Scientists ought to be honest about this, and ever so often the

Food for Thought articles are essays in which the author provides their perspective on a research area, topic, or issue. They are intended to provide contributors with a forum through which to air their own views and experiences, with few of the constraints that govern standard research articles. This Food for Thought article is one in a series solicited from leading figures in the fisheries and aquatic sciences community. The objective is to offer lessons and insights from their careers in an accessible and pedagogical form from which the community, and particularly early career scientists, will benefit.

dream that a budding scientist has remains a dream, unless—and this is my point—luck plays a part.

The early years: the foundation

Why do I consider luck to be so important? It is your parents that you got your genes from, your "nature", and they got theirs from your grandparents. You had no control over that and simply had to be lucky to get what you have got; you could not choose your parents and neither could they choose you as Harari (2015) so aptly reminds us. Similarly, school and teachers: either you were lucky that your parents could afford or find a good school for you and you were fortunate enough to be taught by dedicated teachers who liked you, or you missed out. Finally, there are people who can facilitate or hinder your career other than your teachers and, if, by chance or sheer good luck, you happen to become friends with supportive and influential people, it can help your career no end. Whether at university you accept a research topic suggested to you by that new and flamboyant young lecturer or choose to work under the guidance of that old and grumpy but experienced professor—you take your chances and with luck you may have made the right choice. The big question is: can one learn to recognize when luck knocks on your door?

Campana (2018) holds the view that "good luck comes from within and often reflects past choices". If this were so and, as the saying goes "fortune favours the bold", is not that a contradiction to my view on the role of luck in someone's career? And does boldness not include confidence and a sense of adventure? Since confidence grows with knowledge and knowledge comes from hard work and dedication to learn, are we not back to square one: are not hard work, perseverance, and belief in oneself the keys to success (Colvin, 2008) or is it all just due to your "selfish genes" (Dawkins, 1976)? The debate whether "nature or nurture" has the upper hand has been raging for decades, but it is a futile controversy, for there is also the role that epigenetics plays and ultimately the balance between all three forces varies in different people. What is, however, universally accepted is that the formative years in a person's life are years 0–8 (UNICEF, 2019), and that is why I feel it is important that I very briefly explain how these early, and with regard to me, lucky years must have affected my life and determined my career.

The first lucky occasion in my life came when my parents decided that their newborn's registered address of domicile should be that of the mother's parents. The reasons were the unbombed house of the maternal grandparents and the rule that a child would have to attend the local district's school. Despite the huge number of burnt-out and destroyed houses near the area the grandparents lived (https://en.wikipedia.org/wiki/Bombing_of_Hamburg_in_World_War_II), their district rather than that of my parents' domicile seemed the better choice. I owe my grandparents for what became of me; not only did they look after me as if I were their youngest child but later in my life, after my parents got divorced (of which as a 7- or 8-year old I noticed absolutely nothing), officially adopted me. I acquired the family name "Meyer-Rochow", which had come into use in 1905 when my great-grandfather, a Bremen jeweller and watchmaker by the name of Meyer, was officially granted permission to combine his name with that of his wife to create the family name Meyer-Rochow. My birth-mother, therefore, became my big sister (which raised a few eyebrows when I mentioned to others that my mother was my sister). Because of her engagement for some years as a coloratura soprano by the name of Edith Meyrow at the Tivoli in Copenhagen, she had to leave my education to her parents. My biological father, of whom in the years to come I saw little, became a kind of feared and occasional visitor, who as a psychologist had lost a finger planting a self-made bomb at the entrance of some German barracks as part of his own struggle against the Nazi regime. He dropped some more or less useless advice about how I should lead my life, but he did support my hobby by buying me a simple microscope, giving me a chemistry set that I had asked him for, and handing me money to buy equipment for my aquariums.

It had been my grandparents' observation how even as a toddler I had enjoyed insects, spiders, anything small and moving, which is why my grandfather gave me my first little aquarium with two male and one female guppy when I was 6. I still remember the intense joy and amazement when the next morning, instead of the three fish that had been there before, there were suddenly lots of tiny nearly half-centimetre long baby fish swimming around. I must have screamed with joy. It was my grandfather (who had unpacked his hidden picture of the US Coat of Arms and pinned it over his desk when the British had arrived to liberate Hamburg), who took me weekend after weekend first on walks around our area and later when the train systems had been restored to nearby forests, to the Altona Museum of Fisheries, to the famous Hagenbeck's Zoopark, to the port of Hamburg and many other fascinating places. It was he who showed me how to pluck even the largest orb web spiders from their webs and hold them in my hand (something no other child dared to do and which gave me a high standing in the hierarchy of my class mates); it was he who caught the first green treefrog (*Hyla arborea*) for me and who told me about newts and salamanders, the life cycle of the eel, the whales in the oceans, and animals in faraway countries. He also told me that the Germans were all criminals, which seemed paradoxical as he and my grandmother were both born in Germany. Apart from the US Eagle on the coat of arms above his desk, I remember two other permanent features of his workplace: a photo of David Ben Gurion and a terrarium with a big spider that was occasionally fed a caterpillar or some other insect.

However, he was not the only one who had an impact on my career. Owing to the shortage of housing after the war, one of our rooms was rented out to a man from Thailand who had wanted to become a doctor in Germany but was sidetracked by the war and did not return to Thailand until 1962. In addition to him, one of my uncles also lived with his wife and son of nearly my age in our apartment. This uncle was a keen sports fisherman, an "angler", who introduced me to his passion. He won several championships in fly fishing contests and started to build his own trout hatchery miles away from Hamburg simply as a hobby, supported basically by my grandfather who earned his keep by importing tea from Ceylon and India and dry fruit from the Levante. We had relatives in the United Kingdom and the United States (one of my cousins was a US citizen, who like the man from Thailand could not return to the United States until after the war), and later when I was around 9 years of age, there were visits nearly every year from our overseas relatives, of whom some had dropped the "Rochow" part of our name and become "Meyer" again, while others had discarded the Meyer and were now simply Rochows. However, even before those relatives' visits, visitors from India and Ceylon occasionally came to our home and once we even had a black gentleman from Trinidad for dinner (which was something quite sensational for a little boy like me at the time).

The nice thing was that my grandparents never talked about money (although we never had much), never gossiped, never argued, but shared with me lots of their memories of the time they had lived in the United States. My grandfather had emigrated to New York in 1907, having visited Cuba and some other places as well and later living in Galveston. My good fortune was that they never put any pressure whatsoever on me to do well at school or to work harder. I grew up in my "own world", had my aquariums, collected stamps, coins, match boxes, pressed leaves, comic books, and lots more, and dreamed about wanting to become an explorer. The earlier frequent walks in the forests (which had made me feel like an explorer) and our visits to various museums, the zoo, the annual poultry show, etc., became less frequent as I grew older. However, trips along the Elbe River downstream to the extensive region of fruit orchards and further down to the North Sea coast and the island of Heligoland (a British possession until 1890) then became our more regular weekend activities outside the winter months. During these Elbe River trips, my greatest joy was to "fish" in the drainage ditches, observe the animal life in them and take home and observe in my aquarium newts, tadpoles, sticklebacks (even the rare nine-spined species), water scorpions, caddis fly larvae, freshwater polyps, dragon fly nymphs, backswimmers, etc., you name it. Even now I cannot imagine a greater joy for an adolescent boy than peering into what seemed a wonderful and beautifully balanced system of peaceful grazers like snails, filter feeders like waterfleas, sneaky aggressors like *Dytiscus* larvae, and dragonfly nymphs or outright dangerous attackers like sticklebacks and newts. To become a "part of this alien water world" was so amazing that I could lie on my tummy for hours on the little wooden bridge across one of those drainage channels observing and learning from the fascinating world below me in the water.

But it was not just the world in the water that intrigued me. For the many animals I kept at home in my room or on the balcony of our flat, I needed to find food. And in the bare and undeveloped areas that were left after the rubble of the burnt-out houses and the ruins had been cleared away, there were other discoveries to be made. Turning over stones, I learned to appreciate centipedes, earwigs and their nests, ants, different species of carabid beetles, maggots, grubs, and pupae and I had learnt from my grandfather how to break open rotting tree trunks and find an amazing variety of occupants in them. My happiest literature at home was "Meyer's Konversationslexicon"—an encyclopaedium of 1909, all 20 volumes, and even in those days exceptionally well illustrated with photographs and colour plates. However, too much knowledge can also lead you into trouble, which I learned when attending the 2-week ability test (in those days compulsory for 10-year olds, who had applied to enter high school 2 years before other children). This kind of testing took place in a different setting from the usual school, involved different teachers, and unfamiliar class mates. In one of the lessons (there were always two teachers: a female and a male), the lady teacher asked us children to name parts of the human body she would then enter into a sketch of a human on the blackboard. "The heart" was one of the immediate responses; this was followed by "bones", the "tummy", and, after a pause, the "brain". When the teacher asked: "Isn't there anything else", I felt that now my time had come and I shouted "ovaries" (I had seen the drawing of a human in the encyclopaedia with the organs inside the body labelled). I was ignored. I shouted louder: "ovaries"; and a third time, even louder: "ovaries" and finally the lady teacher said: "Right, the lungs" and entered them into the drawing of the human on the blackboard. To this day, I feel cheated, for I had not shouted "the lungs", I had shouted "ovaries".

High school and university education: the learning phase

With some of my classmates I obtained a fishing licence and ever so often I got up early in the morning and went to the nearest canal before school and caught the occasional roach, bream or even an eel. At my Boys' High School there came the time when we had to decide if we wanted to spend the last three of our school years in a branch specializing in the humanities and Latin, or if we preferred the science branch. It should have been obvious for me to join the sciences, but my biological father advised me to choose the humanities, arguing that I was already interested in science and should focus on what I was less interested in. That was the wrong advice. My grandmother noticed how unhappy I was (not only because I was missing science, but also because I did not like my new teachers) and went to speak with the Senator of Education of the City State of Hamburg; as a result, I was transferred to the sciences. She was advised that I had probably missed so much, especially in mathematics, that I would most likely have to repeat 1 year. However, I was lucky again, because with teachers I really liked, I became a very good pupil, excelled in music, joined the school band as a trombone player, had fun at the school rowing lessons on the Alster Lake, and loved mathematics and the sciences to such an extent that one of my ideas was to study mathematics and biology. It is difficult for children with many interests to decide what to do with their lives and after 1 year in an "Experimental Science" project group, in which my topic had been food chemistry, I decided I wanted to become a food chemist. However, later at university the course in physical chemistry, which I had to take as part of the curriculum, was not at all to my liking and after 1 year I quit and changed to fisheries and marine biology, a unique subject only available at Hamburg University at the time.

During the long summer semester breaks, I worked as a sailor on cargo ships and in this way, without having to pay anything, managed to see some of the world that I had heard and read so much about. In fact, I even earned some money as well, wrote up what I had seen in those faraway places, and got my observations printed in various little magazines, thereby learning how to prepare manuscripts and publish them. The work as a sailor also introduced me to a different section of society, namely professional seamen. Because of my summer trips to South America, the West Indies, and East Asia, I realized the value of speaking different languages, started (but very soon quit) Portuguese, but then took up the Japanese language as an additional subject at Hamburg University. A year later, after a move to Kiel University, I added a course in Human Genetics. My move to Kiel was prompted by my dissatisfaction with my MSc supervisor in Hamburg, who had given me a project to examine sperm longevity of *Merluccius capensis*, a commercially important gadid, while participating in a 4-month fishery research trip to the South Atlantic with visits to places like Senegal, Angola, Namibia, and South Africa and islands like St. Helena, etc. The expedition was an "eye opener" for me—not just scientifically, because of the many weird creatures we brought up from the depths of the ocean or, on one occasion during survival training, swimming in the ocean over 6000 m of water (!)—but also because of the behaviour of the

academics on board. For students like me it was a bit of a shock to see scientists intoxicated and one of them joyfully clapping his hands when our ship docked in Luanda (Angola), exclaiming "and now off to some black beauties; where is the nearest brothel?" Perhaps it was a joke, but then again academics are "human" too.

How I was chosen to participate in this South Atlantic Fisheries Expedition of FRV "Walther Herwig", led by Dr Andres v. Brandt, is another story worth mentioning, because it shows to young would-be scientists that you never learn anything in vain: whatever it may be, it could come in handy one day. When two female students [who became the first ever German females to go on a long research trip helping to measure body lengths of hake caught off the South African coast (see also third paragraph in: https://bioforthebiobuff.wordpress.com/2017/05/06/the-power-of-appetite/)] informed me about the expedition and urged me to apply (perhaps they liked me), I made some inquiries and was told that there was only limited space on board and that already many more senior scientists had declared their interest in participating. As an afterthought I was then asked if I had some experience with photographic dark room work, because there would be a need for someone loading films into cameras and developing and printing images from negatives. Luckily, I had been a member of a photography club for several years and knew all about developing, fixing, printing, and loading films. That sealed it; I was accepted and decided to combine the work on that research vessel with collecting material for my MSc thesis.

Anyway, this MSc supervisor of mine back in Hamburg had apparently never worked on a research vessel and, therefore, must have been ignorant of the fact that because of the ship's engine there would always be some vibration, which at a magnification you need to study a sperm's movements made it impossible for me to tell whether the sperm jittered actively or passively due to the ship's vibration. I therefore did totally different things on board like studying eel larvae or lighting a cigarette with a jelly fish (https://bioforthebiobuff.wordpress.com/2016/06/04/jellyfish-lights-cigarette/) or collecting deep sea fish and trying to keep them alive for a while. In any case, I let my supervisor know that the research he had wanted me to carry out was silly and unworkable: a conversation that he must have taken very personal, because when a different professor put my name forward for one of Germany's most prestigious fellowships and I, naively, suggested that earlier MSc supervisor as one of my referees, he apparently "shot me down" with the most negative comments one can imagine. Sometime later I was shown his "recommendation" letter by Professor Bernd Heydemann, the person who had put my name forward for the prestigious fellowship. As I mentioned earlier, academics are only human.

As I never really felt at home in Germany, this event was the trigger for me to seek a way to emigrate and, having already been to many places in the world and even been offered a job in South Africa, I thought I had to try to continue somewhere else after gaining my MSc. First, however, I accepted a job with the Education Program of the German Channel Three TV and produced a film on "Plants that Prey" (carnivorous species). Because I knew some Japanese, I was also given the task of editing and putting a German text to a three-part series on Japanese fishing methods, to comment on a documentary on the Ainu and to work with a colleague on a series about the Canadian "Netsilik Eskimos of Pelly Bay" by Asen Balikci and Quentin Brown. I spent a long time translating a beautiful BBC documentary on spiders, only to learn later that my supervisor on the TV channel was named as the person responsible for the German translation of the documentary, when in fact she had done nothing to justify her appearance as the one responsible for the German text. That was the last straw and I applied for PhD scholarships overseas. I resolved that if I should ever become a professor, I would always have the name of a Master's student or a technician on an eventual publication as a co-author while PhD students, I felt, should always be first author or even be allowed to publish their work independently.

In those days of the late-1960s, it was not as easy as it is nowadays to obtain information about overseas scholarships and chances to study abroad for a higher degree. I therefore used the Times Educational Supplement at the main library to locate opportunities. I sent letters to Hong Kong institutions, to Canada, to Jamaica, etc., and received immediate encouraging responses from Canada and Australia. The University of Victoria in Canada needed some letters of recommendation, but with my earlier negative experience I was not sure whom I could suggest. Luckily the Australian National University's Neurobiology Professor George Adrian Horridge FRS was willing to accept me based on my academic record and without any letters of reference. Therefore, by chance, I joined the ANU in Canberra and did not end up in Hong Kong or Canada or somewhere else.

In Australia, I found myself in the Department of Neurobiology where almost everyone, including three or four people with German roots, worked on eyes, i.e. photoreceptor structure and function. I remember well Professor Horridge's tongue-in-cheek remark that an Englishman would be best to direct and supervise the research, that Germans should carry out the research, and that Australians could finance it! With my background until then in Marine Sciences and Fisheries, I was terribly unhappy at the beginning, but realism prevailed and I decided to make the best of the situation. Still continuing to work on the material I had collected during the South Atlantic expedition on the fishery research vessel "Walther Herwig" (see Supplementary Material—"Walther Herwig work"), I nevertheless gave in to my PhD supervisor's wish to examine the eyes of certain beetles and other insects (see Supplementary Material—"Terrestrial Arthropod Vision work") and to learn to master two important and very useful techniques, which accompany my work to this day: transmission electron microscopy and electrophysiology. Exploring the Australian environment and finding fascinating and unfamiliar species wherever I looked, I suggested to my supervisor that I wanted to study acceptance angles and sensitivity of the visual cells in the tiny eyes of sawfly larvae (because the latter were available and abundant even during the cold Canberra winter), but he reckoned I would not be skilful enough and told me I should concentrate on the eyes of beetles. However, while he was on sabbatical, I did work on the larval sawfly eyes and, in 1974, was probably the first person ever to successfully obtain intracellular recordings in response to flashes of light from the photoreceptive cells of the tiny eyes of caterpillars.

In 1972, when everyone in our department was busy with preparations for the World Entomology Conference to be held in Canberra that year, Professor Horridge was desperate to use up field trip money that his department had received. He asked for volunteers who would be sent to Papua New Guinea to carry out 2 months of field work. Apart from myself, nobody was willing to go. The places I wanted to investigate were: the Trobriand/

Kiriwina Islands (famous because of Bronislaw Malinowski's 1929 book "The Sexual Life of Savages"), Mount Hagen (the home of the New Guinea Highlanders first contacted in 1932), and the Tropical Ecology Station in Wau. I did spend some time in all three of these places, but something totally unexpected happened on my first day in the country. On that very day, having lunch at the University of Papua New Guinea in the capital Port Moresby, I happened to sit next to the American Tom Ernst, a PhD student in anthropology. He told me of his stays among the "Onabasulu", homosexual cannibals of the Southern Highland near Mt Bosavi (Ernst, 1991), one of the rainiest places in the world, and that he would love to invite someone with a camera (his was damaged) to join him, but he knew of nobody who could join him.

Never one to miss an opportunity, and having had time on my hands, I suggested to Tom that I could accompany him. Thus, I became his companion and photographer. Taking a four-seat plane to a remote field station, we selected our native guides and porters, hiked for 2 days through leech-infested rain forest, crossed the territory of the Etoro tribe, waded through raging rivers, and then stayed among the Onabasulu for 2 weeks. I recorded the names they had for the insects that they consumed (something that I also did in 1973 on a trip with Prof. Randolf Menzel to Central Australian Aborigines of the Pintubi tribe) and, of course, I took photographs. I remember Tom, who spoke the Onabasulu language after having spent already 1 year with the tribe, asking one man if they obtained the strength or cleverness when they were eating their enemies and he then received the reply "when you, white man, eat a bird, can you fly?" Tom, who passed away in 2016, later concluded that the consumption of an enemy was the ultimate insult: that person was no longer a human being, but an animal and was treated as such. I certainly had an unforgettable time (not least because, as a person 183 cm tall I had lost almost 20 kg in 2 weeks and was weighing a mere 54 kg and was very weak, when after a 2-day walk out of the forest we at last reached the missionary station we had started from and from where we flew back to Mt. Hagen). After my return to Canberra, I continued to work on my PhD, submitting my thesis in December 1973. The famous Cambridge University Professor Vincent B. Wigglesworth was one of my examiners.

What can the research student or early career researcher take away from all this? Blindly following your supervisor's orders is not always the best idea. If you feel that you can do something different, and have the time to explore whether your own idea works out, do it. Be adventurous and do not miss opportunities; gain experience in publishing your observations, and then "step up" and try to get your results published in better and better international journals. Do not be disheartened when you receive rude or stupid comments by reviewers: that happens to everyone. And here luck plays a role again, for as an author you usually have no control over whether your manuscript will be scrutinized by competent or incompetent reviewers. Use clear and catchy, sometimes perhaps even "witty" or humourous titles, accept the reviewers' supportive comments and, when your manuscript is rejected, resubmit a revised version to a suitable journal. Review articles will often give you the largest number of citations and can establish you as someone with a broad overview of a particular field, which is something you want to consider.

The postdoctoral years: the time of corroboration

After reluctantly rejecting a fine offer to spend a postdoctoral fellowship in Japan and accepting instead the more prestigious Queen Elizabeth II. Fellowship in Marine Sciences, I moved to the University of Western Australia in Perth with my young family. I continued with electrophysiological and electron microscopic work and focused on sensory aspects of rock lobster biology like vision and sound production. Together with Dr John Penrose, we described the stick-and-glide sound producing mechanism in rock lobsters (Meyer-Rochow and Penrose, 1976), a discovery for which later Patek (2001) appears to have got the credit despite the fact that the mechanism had already been described by us several years earlier. This seems a common occurrence that most scientists have experienced: their work initially does not receive the attention it deserves, or worse still, is ignored. In that case it helps to shrug off the disappointment and say in Japanese しょうがない (= so be it/it cannot be helped). It has happened to me not once, but a few times. For example, the current world-wide interest in using insects as human food to ease the problem of global food shortages goes back to my 1975 (Meyer-Rochow, 1975) article titled "Can insects help to ease global food shortages?" in the journal "Search" of the Australian and New Zealand Association for the Advancement of Science. My discovery and first description of Antarctic lake-ice bubble communities in 1979, unsurprisingly, did not reach the wider scientific world (despite its scientifically exciting nature) because it appeared in German in a little known science magazine by the name of Mikrokosmos that had published my very first science article in 1962 under my name of birth (Schulz) co-authored with my high school teacher Dr Werner Ruppolt. That magazine was chosen by me, because I knew that it would publish my work immediately without much delay and that is what I had wanted. Getting some interesting results out quickly can be smart, but it's got to be in the right language if you want it to reach a wider audience (Meyer-Rochow, 1998).

Back to my Canberra time, just before leaving in 1974, I was invited by Prof. Horridge to participate in the 1975 RV "Alpha Helix" Bioluminescence Expedition to the South Moluccan Islands that he and Prof. Jim Case were joint leaders of. I accepted the invitation and spent almost 3 months in Indonesia. Our base camp was on the island of Banda Neira, where I learned that you always need a plan "B" (which some of the participants did not have when it was clear that the electricity needed to run some sophisticated equipment was not available all the time). However, immediately setting up two aquariums and observing the spawning of *Photoblepharon palpebratus* (one of the two bioluminescent species in the area) and recording the gradual fading of the light in starved *Anomalops katoptron* due to the decreasing number of the symbiotic luminescent bacteria in the light organ, I published some nice observations (see Supplementary Material—"Fish work"). I still mention in my lectures on bioluminescence that I could sit in front of my aquarium at night and read a book with only the light emitted by the fish.

I also went scuba-diving a lot and saw sharks for the first time circling around me; I collected sea cucumbers and their "cargo" (which gave me an entry in the Guinness Book of Animal Records as the world record holder of finding 15 fish in a single holothurian: Wood, 1982) and concluded "what an orgy must have taken place inside the sea cucumber", quoting Trott (1970)

that some carapid fish might enter sea cucumbers for reproductive reasons. I collected, fixed, and embedded for later study by electron microscopy the eyes of various mid and deep-water fishes and crustaceans (see Supplementary Material—"Crustacean work"), but also terrestrial arthropods, namely whip scorpions. The material I prepared on that trip obviously kept me busy for a long time and gave me something to work on even years after the expedition just like had happened with the RV "Walther Herwig" material. Therefore, a good piece of advice is to accept the challenge of experiencing something new like, for instance, scuba-diving with sharks. Also, collect as much material as possible and make as many observations as you can when on a field trip or expedition. Time is precious: do not waste it, because you may not have a second chance!

As my two postdoctoral years of the Queen Elizabeth II. Fellowship in Perth drew to a close, I needed to look for some more permanent job and out of the blue, without applying for a position, I was asked if I would be interested in a Senior Lectureship in the Department of Human Biology of the University of Western Australia. This was obviously because I had spent more time in that department using their electron microscopy equipment than at the Zoology Department, which did not have any, and because of my earlier course in Human Genetics, my involvement with editing the German screenings of the documentaries on Ainus and the Netsilik Series by Asen Balikci and Quentin Brown and my trips and subsequent publications to various tribal peoples of Papua New Guinea and Central Australia. However, without a degree or much research experience in human genetics I did not feel confident enough to accept the offer and instead decided to accept a position I had applied for at the New Zealand University of the Waikato, a relatively new university that needed a comparative physiologist to teach electrophysiology, which I duly did. I accepted in the belief that a small university meant less work and more time for research, but I was quite wrong (and here is again something for a budding scientist to learn): I was loaded with lectures and course work in fields as diverse as Parasitology, Comparative Physiology, General Zoology, Ecology and Evolution, and Marine Biology! The positive side of all this was that I had to remain "flexible" and informed in many fields of Biology. The downside was that there was little time for research and no electron microscope, my major tool until then. The problem was solved with a visit to the campus of the Meat Industry Research Institute of New Zealand not too far away on the "Ruakura Campus" in Hamilton and the permission by the Director that I could use their transmission electron microscope and ultramicrotome whenever I needed them.

At last: the university position

An extremely positive development was that my new university, the University of Waikato, had a very active Antarctic Research Programme and in 1976 was keen to send a team to the southern continent for which they still needed participants: I volunteered of course. I do not like missing opportunities when they knock at my door. Once in Antarctica, I managed to experience, on my very first trip, environments as different as the South Pole, the Dry Valleys, Lake Vanda, and the Onyx River, the summit of the active volcano Mt Erebus, the Erebus ice-tongue with its ice caves, and the Adélie penguin rookeries around Cape Bird and Cape Royds. I stayed for nearly 3 months and had taken with me all the necessary chemicals, glassware, pipettes, syringes, etc., one needed to prepare specimens for observations under the transmission electron microscope. There was of course no such microscope at Scott Base or the nearby McMurdo Station at that time; there was no ultramicrotome either and under really the most trying (and I should say "primitive") conditions using Scott Base's bathroom as a wet laboratory and a cooking pot with lid on a hotplate as an oven, I managed to prepare fantastically well-fixed material of a variety of marine organisms caught in traps lowered to the seafloor through holes in the 2.5-m-thick sea-ice. You have got to be adaptable: moaning or complaining will not help. The material, fixed and embedded in Antarctica, was later sectioned by some Master students and myself and examined by electron microscopy with results ultimately published in excellent international journals (see Supplementary Material—"Antarctic and Polar work"). After that initial and very successful trip I decided I would be back a few more times with more students and collaborators from other countries, whom I was able to invite to focus somewhat more on Antarctic and southern hemisphere fish species (see Supplementary Material—"Antarctic and Polar work" and "Fish work").

Serendipity and luck are not the same, and if I had wanted to study effects of pollution by sewage on Antarctic organisms, the occurrence I am about to describe would have been a lucky break. However, my project at that time had nothing whatsoever to do with sewage pollution in Antarctica and its consequences for marine life under the ice. What happened was this: Scott Base effluents had to be discharged into the Antarctic ocean some distance away from the base, but owing to an unusual barrier of sea-ice the effluents could not disperse and be carried away by the currents. Instead they drifted to the area from which seawater was pumped into the Base to be processed further and/or to supply our aquariums directly without further processing. It is easy to imagine what happened: a smelly brown "brew" of water began to fill our aquariums and panic over what to do ensued. Now comes "serendipity": instead of lamenting and frantically trying to save some animals, I used that unexpected incident to record how long different species of Antarctic organisms in my aquarium survived and compared bacterial counts of the polluted water with those of an unpolluted sample taken from an ice hole 1 km off Scott Base on the same day as the accident. That research was not planned, but it resulted in a publication that even in 2009 was quoted by Smith and Riddle (2009) with the words "With the exception of a study of an accidental exposure of captive Antarctic marine fauna to sewage in an aquarium (Meyer-Rochow, 1992), no studies have shown a direct causal link between station-sewage micro-organisms and pathogenic effects... [and]... remains largely unstudied for a variety of Antarctic wildlife". To satisfy the animal rights people I ought to add: I did save one of my three fish (a *Trematomus bernacchii*) before it too would have died of asphyxiation and released it through an ice-crack into the ocean.

Over the years I have made several additional trips to Antarctica and have visited the southern continent ten times altogether, including five voyages on cruise ships as an "on-board lecturer". I got these "winter jobs" (= summer in Antarctica), when I saw an advert about a "Millennium Cruise" to Antarctica and simply wrote to the company, mentioning my background and experience regarding Antarctica. That first trip then led to follow-up cruises. On one such trip, I had to argue with a passenger who lectured me that even a child would know that "cold makes things contract" (after I had tried, in a presentation, to explain that ice expands as it gets colder). Another passenger

insisted that he had seen a penguin fly and that he had proof of it, because he had filmed it. And on one occasion, I asked an Austrian gentleman, whom I felt sorry for, why he was always sitting in the corner of the restaurant, never going out to watch the penguins or the seals or the icebergs. And what did he answer in his distinct Viennese dialect? "Dös intresiert ma net" (= it does not interest me). And when I asked why not, he replied that he was a postman and had won the trip in a lottery and simply had to go. Upon hearing that I felt even more sorry for that poor fellow! Anyway, a personal highlight was the first (and only) Jamaican Antarctic Expedition with my assistant Walton Reid in 1993 (which led me to be introduced to Queen Elizabeth II when she visited the University of the West Indies in Kingston, Jamaica). When asked by "The Queen" if it hadn't been very cold in Antarctica and she inquired about how our work had benefitted society, I replied that, of course, it had been a little cold at times and regarding our results, they had made the "book of human knowledge" just a tiny bit thicker (I am not a believer that all research must immediately be seen to be applied).

You have really got to keep your eyes open and retain a childish curiosity (curiosity may kill the cat, but for a scientist it is an essential ingredient: another piece of advice) and, when I saw (and photographed) pooping penguins, I immediately wondered about the pressure that these not exactly tall birds generate to propel their faeces up to 50 cm away from their nest's edge. The research on this immensely important aspect of penguin biology, conducted with my research assistant Dr Joseph Gal, led to an Ig-Nobel prize from Harvard University, which quite honestly was very helpful to me in Japan and many other countries (as I, erroneously, was often announced to the audience as a "Nobel prize winner"—well, of sorts).

Despite all of the preceding, I never gave up on my other interests: entomology and ethnology. In 1991, my last sabbatical before joining the University of the West Indies (UWI) in Jamaica, I spent 3 months in North-East India at NEHU, the North East Hill University's "Sophisticated Instruments Laboratory" in Shillong. It was there that I had gone for a honey-moon with my new Indian wife Sulochana (an electrophysiologist) and got to know several Naga people with whom I shared my interest in edible insects (see Supplementary Material—"Ethnobiological work"). When I mentioned this interest of mine to Professor Darlando Khathing, he smiled and said "really?" The next day he reminded me of what I had told him that my interest was and asked me if it was true what I had said the day before. When I replied in the affirmative, he pulled open the drawer of his desk and handed me three fat caterpillars with the words: "if you'd like to try . . .". These contacts developed into an increasingly deeper involvement with the cultural uses of insects and other arthropods and culminated in my being awarded a D.Sc. in 2004 from the Australian National University (my "alma mater"), for the ethnobiological research I had pioneered in Papua New Guinea, Central Australia, and North-East India.

But while in New Zealand and attached to Waikato University from 1976 to 1991 before taking up a professorship at the University of the West Indies in Jamaica, I had the most generous sabbatical arrangements imaginable and cumulatively spent at least 2 years at Yokohama City University, working with Prof. Eisuke Eguchi on the effects of UV and bright light on insect and crustacean photoreceptors (see Supplementary Material—"Terrestrial Arthropod Vision work" and "Crustacean work"). But not only was I interested in working in Japan or carrying out research in Antarctica: ever since having had a chance to explore caves on Kiriwina Island in Papua Niugini in 1972 and 1974, I was interested in what lived in them, e.g. glow-worms in New Zealand and Australia, and in organisms that produced light. This interest resulted in several publications with Master's students Henry Waldvogel, Alan Liddle, and Stephen Moore (see Supplementary Material—"Bioluminescence and Cave work") and encouraged me to also carry out speleological work in Jamaica with Prof. Ian Stringer, for Jamaica is riddled with limestone caves. In 1995, I received a Fulbright Professorship to study eye regression of cave insects in Hawaii with Dr Howarth but decided to relinquish it, give up my position at the University of the West Indies in Jamaica, and move to Finland (which left one of my colleagues baffled, shaking his head and remarking "There are Fulbright and Half-bright scholars"). The stay in Hawaii would have been for 1 year and I would have had to return to Jamaica, but rightly or wrongly I thought my children might find growing up in Europe easier. My two daughters were born in Jamaica, and possessing New Zealand (because of me), Jamaican (because of their birth), and Finnish citizenships (because they grew up in Finland) plus having the option of becoming registered as Indian (because of their mother's Indian origin), they are truly global citizens.

In Finland, Prof. Juhani Leppäluoto succeeded in getting me attached to Oulu University's Institute of Arctic Medicine and for 2 or 3 years I was on the Editorial Board of the "International Journal of Circumpolar Health", during which I published some articles in it and managed to solicit contributions from Australia, Chile, and Japan to help our journal become truly international. At that time, collaborating with Dr Magnus Lindström and also still with Prof. Eguchi, I worked on the damaging effects of UV radiation and bright light on the visual systems of crustaceans and insects; research in other words that I had earlier been involved in while on sabbaticals in Japan (1981/1982) and Finland (1985/1986). It is helpful to have a good memory, to remember skills you once learned, and to be able to connect events you experienced, read, or heard of in the past with something you may be able to pursue years later.

There was one problem: I did not have a permanent position and fearing that sometime an extension of my contract might not be possible, I rejoiced when I obtained a Full Professorship at the International University Bremen (IUB) in 2000, for at age 55 to be selected was not a foregone conclusion. Being truly bilingual helped of course, because the language of instruction was English at the IUB, which later changed its name to Jacobs University. One of the academics who sat on the interviewing panel was Professor Gotthilf Hempel, whom I had admired as a student during my Hamburg time but had never communicated with. At the IUB/Jacobs University I pioneered research into miniaturization of arthropod photoreceptors with my PhD students Stefan Fischer and Carsten Müller, something I had already begun 35 years earlier but had not continued, and I carried out work into the sexual dimorphism of compound eyes of winged male and wingless female moths with PhD students Stanley Ting Fan Lau from Hong Kong and Monalisa Mishra from India (see Supplementary Material—"Miniaturization work"). Antarctic and ethnobiological work also continued and, with my PhD students Marina Zieger (née Bobkova) and Oksana Tuchina from Russia, we tackled questions related to the structure and function of gastropod eyes.

Occasional trips to other countries because of sabbaticals, field work, and/or conference attendances or invitations to Greenland,

Spitzbergen, Papua New Guinea, China, North and South Korea were made and there was, of course, also the research I was engaged in with scientists like Prof. Jharna Chakravorty of Rajiv Gandhi University in Arunachal Pradesh (North-East India), Prof. Taka Hariyama of Hamamatsu Ikadaigaku in Japan, Prof. Silvana Allodi of the Federal University in Rio de Janeiro, and Prof. Gabor Horvath of the Biological Physics Department of Eötvös Loránd University in Hungary. Therefore, when in 2013, I was told that because of my age (I was approaching 70), I needed to retire, I was lucky enough to have plenty of acquaintances, scientific colleagues, former collaborators, and students in the world, who agreed with me that I was "too young" (and too restless) to retire. Undoubtedly, being part of a network is of tremendous value.

And at the end: years of no retirement from the year of retirement

Being invited by Prof. Yuichi Oba of Nagoya University as a guest speaker to address the delegates of a Bioluminescence Conference on the Japanese Pacific island of Hachijojima in 2013, I got to know the charming and "untypically informal" Japanese life of this island of about 8000 inhabitants, who until a few decades ago had their own dialect (actually ranked as a distinct Japonic language known as "Hachijo", based on the criterion of mutual intelligibility). I learnt from Mr. Yamashita that the administrators of the island were looking for a Managing Director of their Bioluminescence Research Institute and, being "free", this piece of information at that time of my life seemed a stroke of luck. Feeling like a scientist without a home (and this is exactly what it says in the subtitle of my book of short stories: Meyer-Rochow, 2020), I immediately applied for the position.

I got the job and subsequently spent a wonderful and highly productive 4.5 years on this island paradise of great opportunities for a person with an open mind. Whatever I looked at, studied, or found seemed to be unexplored and worthy of study (see Supplementary Material—"Hachijojima work") and it helped, of course, that I had lots of ideas and a wide range of interests and could communicate in Japanese as very few of the island's residents spoke English. It also helped that I had a lot of time not only to play my trombone and to join the local table tennis club but also to write up and publish earlier research results (see Supplementary Material—"Hachijojima work"). I always remembered my grandmother's saying "Wer rastet, der rostet!" (= those who rest will gather rust) and sincerely urge you to be as active as possible even when "officially" retired: you have only got this one life, do not waste it.

It was another matter of sheer fortune that, on one of the three trips to Andong National University in South Korea, invited by Prof. Chuleui Jung to give some lectures in Entomology and some seminars in the Anthropology/Folkloristik Department, I met a "young" (47-year old) widow, who asked me if it was not possible for me to move to Korea and give up my job in Japan. And there it was again: luck and chance. She had studied French literature for 5 years and spoke little English; I, on the other hand, had always tried to maintain the French that I had learned for seven long years at high school. As I mentioned before: you never learn anything in vain. I met the person who became my trusted partner purely by chance (we were accommodated in the same guest house in Andong) and she had been brave enough to ask me to give up my job on the little paradise island I had learned to love. I did quit my job (and the famous French movie of 1956 "Et Dieu ... créa la femme", directed by Roger Vadim, rings a bell and explains the "why"!). I accepted a 2–3 year Visiting Professorship at Andong National University's Agricultural Science and Technology Research Institute and moved to Korea: was luck on my side and did it, as Campana (2018) asserts, reflect past choices? Well, I just learned that the institute on Hachijojima that I had been the Managing Director of will close this year for the lack of financial support from Tokyo. And I certainly had not had the slightest idea that this was going to happen when in November 2018 I decided to leave Japan and work in Korea.

In Korea, I joined a group that I had already been associated with for several years, carrying out studies on the chemical composition and acceptability of edible insects (see Supplementary Material—"Ethnobiological work"). At the annual Ecology Meeting in Korea in 2019, I got in touch with people from Korea's Polar Research Institute, visited their fantastic facilities in Incheon and gave a seminar on my Antarctic work. The visit and discussions, to my own great surprise, led me to become once again involved in Antarctic fish research and one publication has already appeared (Traczyk and Meyer-Rochow, 2019), a second is in press (Traczyk *et al.*, 2020) and a third has been submitted. As I said earlier: hard work, perseverance, belief in yourself, etc., all of that is very nice and important, but honestly, what would it really be without a pinch of good luck!

Supplementary data

Supplementary material is available at the *ICESJMS* online version of the manuscript.

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