



How science runs, by Eric J. Mittemeijer, Springer Nature Switzerland AG 2022

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This book will appeal to anyone interested in how science has been pursued in two famous scientific institutions and why the German system has been so successful for the past 50 years. Prof. Mittemeijer was born in the Netherlands and retired as a Max Planck Director in Germany. The book is a mixture of family history, the history of science, an insight into the politics of science, impressions of the publishing world, etc., and switches between them repeatedly. It is a memoir (in the American sense), even though Prof. Mittemeijer might argue that it is not; it is not just a life story—it is much more. It has more detailed science than Robert Cahn's memoir [1], but many personal recollections are there too. There are concise descriptions of the science that formed the basis of the author's career, and real insights into the German system of funding research, which can avoid making the scientist spend a third of his/her time raising money just to support his/her junior colleagues.

Having spent perhaps a total of 2 years of my life in Germany, knowing and admiring many German and Dutch scientists, working on Materials Science for over 50 years myself, loving TEM and those magical moments of discovery that the TEM gives, I recognize so much of what Prof. Mittemeijer is saying. This is a book (not a booklet as he claims) that exudes personal honesty, and that makes it very special. Prof. Mittemeijer held the Chair that Prof. W.G. (Willy) Burgers had occupied; he was given Prof. Burgers' records by the family when WGB died. Just reading about the Burgers brothers in Chapter 10 would justify my buying this book. I have already read that chapter several times. I hadn't even read W.G. Burgers's paper 'How my brother and I became interested in dislocations' [2] before I read this book: This part of the book is a treasure and a map for finding other treasures.

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Prof. Mittemeijer (I'll refer to him here onwards as EJM) was firstly (and perhaps most importantly, though he might not say that) a Professor in Delft (the home of Delft pottery, Jan Bart Le Poole [3] and the Burgers brothers) and recently retired from being a Professor in Stuttgart. He has a long and distinguished research record, having advanced several areas of metallurgy, and he has served his profession in other ways, including being Editor-in-Chief of an important journal; so he writes from a position of real experience.

The text starts with parents George Mittemeijer and Annie van Campen. These pages give a view into EJM the person and his growing up in the Netherlands. It is very personal and includes many perceptive insights. He grew up at a time when some students in the Netherlands would have to learn 3 languages in addition to Dutch (P24). He comments on how some Dutch people, when speaking German, just use Dutch words and constructions when they don't know the German; the English know this technique well.

The book has some nice asides: for example, mentioning Hannie Schaft, her education, her heroism and her red hair (!)—saying his hair used to be red too—no longer red but at least it is still there! He remembers a few special teachers and gives comments on some textbooks saying: 'that is baloney, of course' (p22), and 'teaching pupils blatant nonsense is unforgivable.' He is blunt and honest. Sometimes, he switches to speaking of himself in the 3rd person, which is a little confusing. ('Eric continued studying....' P25.) Piano playing was and is his recreation; he tells us that he was once advised to be a professional piano player, but decided he preferred materials science as a career, keeping piano as a hobby.

His discussion of models on p32 is refreshing—as he says, observations are immutable, models can change. He mentions that his 2021 textbook and theory discussed insight and educated guesses [4, 5]. He opines about physical laws versus political laws, comparing 'physical laws,' like Fick's and Hooke's and 'man-made' laws in a very broad chapter. In chapter 6, we read some of the author's thoughts on publishing papers and the journals he has edited. Two of his most highly cited papers were published in the Journal of Materials Science. [6, 7] Did no one tell IJMR that putting 'International' in front of the name of another well known established journal's name is a classic indicator of something other than 'international' (i.e., predatory)? [8] IJMR is really the

very distinguished 'Zeitschrift für Metallkunde.' Books can be written on this topic, but he is right, of course, when he writes that numbers like impact factor and h index are readily misused by lazy administrators who know that 20 is a larger number than 10, without bothering to know what they are counting. Garfield [9] recognized this very early on and now there is a whole discipline concerned with Scientometrics and bibliometric research.

Chapter 9 'Young versus Old' is different. The chapter gives 3 examples where a 'junior' researcher had to combat a more senior scientist. The examples involve Dan Schechtman, Ernest O. Kirkendall, and Ken Jack. The chapter is thought provoking—you have to read it even if you heard it before, and encourage students to read it.

Chapter 10 'On Burgers Chair,' my favorite chapter, discusses both Wilhelm (Willy) Gerard Burgers (August 16, 1897—September 24, 1988) and his brother Johannes (Jan) Burgers (January 13, 1895 – June 7, 1981). (Readers can learn more about Jan elsewhere [10]: two impressive brothers.) There are many interesting comments on the academic life, especially for those who are not living one. Brother Jan published 2 papers on dislocations in 1939 and 1940—they remain his most cited papers. He introduced the Burgers vector (who named it that?), the screw dislocation, and the idea that low-angle grain boundaries are arrays of dislocations. Jan moved into fluid mechanics and finally, at the age of 60, emigrated to the USA with his wife and joined the U of Maryland. (p137) At one celebration of WGB's achievements, EJM tells us that Willy exclaimed 'c'est le vecteur de mon frère, c'est le vecteur de mon frère!!' Willy still benefitted from the Burgers vector and surely justifiably so; he was the crystallographer! (He acknowledged being the uncle of the dislocation if his brother was the father.) Willy retired in 1967. There is a super photo of him on p141 with his ping-pong balls, which makes you remember Bragg, Nye and Lomer with their bubbles. WGB died in 1988 at the age of 91. EJM had the privilege of dealing with the contents of Willy's office.

There is an extensive discussion of the considerations that led to EJM leaving Delft and hints as to what a Max Planck Director can do that almost no researcher in the USA can dream of doing. We return to this topic in the last paragraph on P160 which begins 'a University should....' and is followed on p161 by 'the following tale....'. Perhaps the system of funding

science in the USA is captured in the ‘tale’; some readers might compare the US model of funding science with the mechanism used to ‘fund’ healthcare in the USA; a lot of money never reaches its target.

Almost as an aside, there is an interesting discussion of line profile analysis, but the real point is the discussion of who gets credit for research (P148); Rosalind Franklin is not a unique case. The statement at the top of p152 is nonsense, but it makes the reader think, and then we go into a specific example of materials science! (I’m still thinking about that sentence though.)

There are throw-away sentences like ‘the sometimes very sloppy way present-day scientists consult the preceding literature and thereby ignore the results already obtained by their predecessors’ (P155), which are so right (as any Editor knows) and then on p156 he gives an example of the failure to reference. Both instances remind us that EJW has extensive experience as an Editor himself.

Chapter 11 on ‘tarnished science’ selects 3 examples of corruption in the practice of science. There must be books on this topic, but science students are not taught about the history of science—it is thought of as history not science. We all know the name Kirkendall, but also that of Rietveld and not Loopstra—this is actually how science ~~runs~~ goes. This chapter is followed by ‘Mistakes, Deceit and Fraud in Science.’ The chapter is less than 20 pages but is a good reminder that scientists must always question what they read, especially if they are looking to build on previous work. (A colleague of this reviewer recently found out why an earlier result could not be reproduced—it was all fake. The good part is that it could be proven to be fake. It wasn’t ‘fake science,’ it was simply provable fraud, but it cost a young researcher 2 months work.) Jan Hendrich Schön wasted much more time and money. EJM gives Schön as one example; he connects such fraud to the valuable resource Retraction Watch. If you think this is not so important, look into what Elizabeth Bik has been writing about [11]. These are not isolated rare instances of fraud in science.

By far the longest chapter in the book is chapter 13; it focuses on EJM’s years as a Max Planck Director and Professor in Stuttgart. (p197 to 262). For those of us who have spent time in Stuttgart, this is a fascinating chapter! I wish I could have read it before I went there for 3 months in March 1998, but EJM only started his position in ~ January 1998 and we never met. My host

for this part of my Humboldt Fellowship was Manfred Rühle, another distinguished, former MPI Director and Professor at the University, and EJM’s future co-Editor on the IJMR (ZfM?). As you will read, Stuttgart’s MPI itself has now moved out to Büsnau. This chapter gives a brief overview of the history of metallurgy and materials science and the role that the occupants of Seestrass played in making this a world-class center. You’ll also get some hints of the philosophy of the Max Planck Society and why world-famous centers can disappear when the Director retires. Fittingly then, the final chapter is a 4 page Epilogue which describes EJM’s final lecture in Stuttgart and his departure with Marion to Heidelberg.

The present reviewer invited several scientists to review the book before deciding (when there were no acceptances) who should write it. The book probably won’t be read by new students or even senior graduate students, even though it could be an invaluable read for them. It probably won’t be read by mid-career scientists—unfortunately they have to concentrate on raising money to support their research. Physicists and chemists won’t read it because it really does emphasize Materials Science and that is their loss. It is recommended reading for researchers at all levels who are interested in materials-science research, funding and politics. Yes, the book needed an Editor who would actually correct the English and modify the title (too late now). We don’t go anywhere ‘by feet’; we read that ‘anorganic’ chemistry had a negative effect on Eric (P36); it did on me too, but these miswrites do not detract from the reading.

Remember, this book is part of Springer’s book package. All students have free access to it if their library subscribes. This book is a gem. A gem in the rough perhaps, but all the more genuine and valuable (to many) for that.

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