

Environmental Pollution and Professional Responsibility: Ibsen's *A Public Enemy* as a Seminar on Science Communication and Ethics

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ABSTRACT

Dr Stockmann, the principal character in Henrik Ibsen's *A Public Enemy*, is a classic example of a whistle-blower who, upon detecting and disclosing a serious case of environmental pollution, quickly finds himself transformed from a public benefactor into a political outcast by those in power. If we submit the play to a 'second reading', however, it becomes clear that the ethical intricacies of whistle-blowing are interwoven with epistemological issues. Basically, the play is about the complex task of communicating scientific (notably microbiological) data to lay audiences. This becomes even more apparent when we realise that Stockmann was a contemporary of real 'microbe hunters' such as Pasteur and Koch. The play's basic message is that epoch-making scientists (such as Pasteur and Koch) not only produced convincing and reliable data from a scientific point of view, but also acquired the skills and insights needed to enter into a dialogue with their cultural and societal environment.

KEYWORDS

Research ethics, whistle-blowing, science communication, environmental ethics

'The point at issue is not a purely scientific one; it is a complex question...'

INTRODUCTION

Ibsen's play *A Public Enemy* is set in a tranquil Norwegian coastal spa and tells the story of a doctor who discovers that the Baths, on which the livelihood

of the town depends, are contaminated because the water conduit system has been too economically designed.¹ After working quietly a whole winter, analysing both the bathing and the drinking water and sending samples of them to university experts who have the right equipment at their disposal, Doctor Stockmann assures himself that the local bath facilities, about to be visited by health-seekers and tourists, are polluted by *animalculae* or *infusoria* – myriads of mysterious living beings that can only be detected with the help of a microscope. Convinced that he has averted a major public disaster he alerts both town officials and journalists. He regards it as his duty to disclose his discovery to the authorities, notably his elderly brother, the conservative Mayor, who had offered him his present position, but also to the latter's opponents: the liberal press. Moreover, he regards himself as somewhat more than simply a medical officer or local physician. He is repeatedly referred to, both by himself and by others, as a 'man of science', and devoted to the cause of scientific enlightenment and societal reform. Initially he is praised as a public benefactor who simply wants to avoid illness among tourists, but when the public learns that Stockmann's discovery might irreparably damage the town's reputation while necessary improvements of the Baths will greatly affect their income, they turn against him. The necessary repairs seem far beyond their means. Stockmann calls a public meeting but is prevented from delivering his speech and getting his message to the villagers due to a number of tactical manoeuvres by the more dexterous politicians present. Instead, he decides to give a philosophical lecture on the intellectual superiority of the elite in comparison to the unenlightened and prejudiced majority of mankind. As a result of this snobbish tirade by a 'man of science' against popular opinion, the audience brands him as an enemy of the people. They stone his house and we leave Doctor Stockmann 'revelling in his position as a pariah' (Mehra 2001, p. 2).

Usually, Doctor Stockmann is applauded as a champion of science and enlightenment, who runs into conflict with prejudices, hypocrisy and vested interests. By several authors he is presented as the archetypical literary model of a whistleblower. Examples of such unequivocal, one-dimensional portrayals can be found in the comments on Ibsen's play by Bernard Shaw (1891) and Emma Goldman (1914). According to Shaw, the play is about a an honest doctor who insists on exposing the danger that visitors will be infected, and therefore has to face fierce opposition from people who have a pecuniary interest in concealing the truth. And according to Goldman, the doctor is a sincere man of high ideals, a conscientious physician who has the courage to stand alone, a herald of reason who is silenced by force and deprived of his right to free expression. Others, however, are more willing to stress the ambiguities of Ibsen's play. They notice for example how Doctor Stockmann's obsessive and self-centred character keeps him from understanding how anyone could possibly disagree with his scientific views (Mehra 2001). He is unable to respond adequately to or interact with his social environment, unable to cooperate with stakeholders in

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order to find viable solutions for a complicated situation that involves more than lab results alone. By exposing a potentially malignant public health problem, he is undoubtedly doing the town a service in the long run, and he certainly has the courage to stand fast to his beliefs despite overwhelming criticism, abuse and disciplinary measures (such as dismissal as medical officer to the Baths). At the same time, however, he is 'blindly naïve to the implications of his discovery. His slavish devotion to objective truth is so uncompromising that he sees his scientific discovery in a self-absorbed vacuum' (Mehra, p. 2). He is not driven only by zealous dedication, Mehra continues, but also by vanity and a desire to be canonised as a sort of public hero. His ideals are virtuous, but his motives partly selfish and narcissistic. And his final pseudo-scientific speech is a disastrous blunder, a desperate overstep from the scientific realm (where he is at home) into the philosophico-political realm – a move that makes this potentially dangerous antagonist of those in power a very easy target. His scientific discovery becomes mired in (contaminated by) local politics.

Ibsen himself both criticises and espouses his protagonist's attitudes and views. In letters to Georg Brandes and to his publisher, Ibsen makes it clear that Stockman and he have much in common, notably their criticism of both conservative (right wing) and liberal (left wing) politicians, and there is ample evidence that Stockmann was (up to a certain extent) a mouthpiece for the playwright himself. But (subtly in the beginning and more emphatically towards the end) Stockmann is also portrayed as a buffoon-like figure. Indeed, many years later Ibsen insisted that he was certainly not responsible for all the philosophical nonsense his Doctor Stockmann proclaimed (Arpe 1972, Beyer 1978).

I have several reasons for submitting Ibsen's drama to a philosophical analysis. The first reason is the play's topicality. Its key issue, the vicissitudes of a whistleblower, is as up-to-date as ever and Ibsen offers his readers a classical case study in which different roles and perspectives are fleshed-out in a convincing manner. Moreover, the scandal which Doctor Stockmann intends to disclose concerns environmental pollution caused by short-sighted policy decisions, a problem which we are still all too familiar with today. With its lively and far-from-outdated style and atmosphere, the play constitutes rewarding material for educational purposes and is very usable in ethics courses for science students. But the play is of interest for additional reasons as well. Underneath the *ethical* issues involved in disclosing touchy information on hazardous situations to a public-at-risk, *epistemological* issues are present as well. Ibsen stages a dramatic confrontation between the scientific way of seeing and understanding the world and common sense. Moreover, a very discrete and particular *form of science* is represented in Ibsen's drama. Doctor Stockmann's discovery of microscopic carriers of infectious diseases in the bathing and drinking water of a Norwegian spa does not stand on its own. He is a contemporary of Louis Pasteur in France and Robert Koch in Germany.² His research and public performance bears close affinity to contemporary events in the realm of real (that is: non-fiction) science.

The decade between 1879 and 1889 is generally regarded as the 'Golden Era' of (medical) bacteriology and microbiology (Davis et al., 1973, p. 9). In 1882, the very year when *A Public Enemy* was published and performed, Robert Koch published his famous paper on the aetiology of tuberculosis. Subsequently, he and Pasteur (who in 1881 had developed his anthrax vaccine) went to Egypt to hunt the microbes that cause cholera. Moreover, very much as Stockmann did, Pasteur and Koch not only had to deal with the theoretical and technical difficulties involved in microbe research, but also with the problem of how to communicate their findings to journalists, official authorities and public audiences. Stockmann's performance, both as a researcher and as a public figure, reflects (in a compact and concise form) the opportunities and obstacles, the failures and successes experienced by real 'microbe hunters'.

What can we learn from Ibsen's play, notably with regard to science communication and professional ethics? What ethical and philosophical message does it convey? To answer this question, the play will be analysed in three successive steps. First of all, I intend to read it from an epistemological perspective. The focus will be on the clash between science on the one hand and its social and cultural environment on the other, between the scientific worldview and the common sense (or life-world) view. Subsequently, attention will shift to the ethical and political dimension of the play. In this section I will read Ibsen's text as an effort to show what may happen to more or less 'simple' scientific facts regarding environmental pollution when they enter the complex and turbulent social world of interests and values (either moral or economic). I will monitor Doctor Stockmann in his role as a relentless whistleblower who unfortunately lacks the social sensitivity and strategic instincts needed to confront his adversaries successfully, but who suffers a fate that is at times uncannily similar to that of those who nowadays find themselves in similar positions. Finally, I will describe in more detail the similarities between Stockmann and his scientific contemporaries Pasteur and Koch, not only in terms of their scientific performance, but also in terms of the societal import of their scientific discoveries. This will allow me to reflect on the intimate affinity between the ethical and the epistemological dimension of Ibsen's play. In this manner, I intend to clarify how Ibsen's play enhances our understanding of the intricate relationship between science and society, then and now.

1. DOCTOR STOCKMANN AS A *MAN OF SCIENCE*

As was indicated above, Doctor Stockmann regards himself as somewhat more than merely a country doctor. Not only is he repeatedly referred to as a man of science, but he is also a prolific contributor to a liberal (left wing) local newspaper. In this manner, he is rather notorious for his radical and non-conformist political ideas. Before accepting his present position as medical officer of the

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Baths, he worked as a physician somewhere in a remote and sparsely inhabited part of Norway ('up north') under difficult financial and climatic circumstances. In his imagination, he developed grand schemes for making a lasting contribution to the cultural and political transformation of his country (and of his home town in particular) by means of scientific discoveries. And now it seems he has finally made such a discovery. At the same time, he is represented as rather naïve and lacking in practicality.

Ibsen published his play at a time when the typical literary profile of the physician had recently changed. For centuries, in the writings of Molière and others, physicians had been portrayed persistently as buffoons who cared more for grand, obsolete theories and academic disputes than for the well-being of their patients and whose sole expertise seemed to consist (according to a famous quote from Molière) in translating into scholarly Latin what everybody else already knew, namely that the patient was ill. In the nineteenth century Victorian novel, however, the physician had come to play a much more serious role, observing and discerning facts and details that went unnoticed by others. But in Ibsen's drama, we are faced with a serio-comic mixture of these literary stereotypes, a reversion, to a certain extent, into the old comical image.

In ACT I, at the beginning of the play, Stockmann is eagerly awaiting a letter from the university. When the document finally arrives, he knows that he is on the right track. His hypothesis is confirmed by the experts. The letter shows, he exclaims, that we think we know everything, while in fact we are completely blind. Stockmann, the man of science, has managed to labour himself out of Plato's cave, so to speak, and now he tells his fellow human beings what he saw, a message not all of them like to hear. Because the town officials (for financial reasons) refused to construct the conduits in accordance with Stockmann's directions, the waters are being polluted by decaying organic material. Strange cases of illness among visitors gave him the idea that something was wrong, but he wanted to have 'absolute proof'. He meticulously prepared samples and dutifully sent them to the University for a full analysis:

I've made the most careful investigations ... I started to analyse the water ... I hadn't the necessary scientific equipment here, so I sent samples of both our drinking water and the sea water to the University for a complete analysis by an expert (p. 122).

In other words, he obtained a 'second opinion' from an expert. And this gave him certainty. Millions of *animalculae* or *infusoria* are present in the water. 'Used either internally or externally', this water is a positive menace to health.

Let us reflect for a moment on the scientific (or rather: pseudo-scientific) terminology that is being used here. *Animalculae* (or animalcules) was the word for microbes or micro-organisms that Anthony van Leeuwenhoek from Delft had originally used in his letters (that is to say: in the translations of his letters) published in the *Philosophical Transactions* of the Royal Society of

London – the *Anfang* of microbiology (Dobell 1932). In 1683 he had for the first time observed ‘little animals’ in drops of rainwater through one of his self-made microscopes. *Animalculae* was, of course, a rather vague general term encompassing all sorts of sub-visible organisms. Most of Van Leeuwenhoek’s little animals would be called bacteria nowadays (although in current literature experts reject even this term as unsatisfactory), but he also used this term to refer to protozoa (which he discovered in canal water) and spermatozoa. *Infusoria* is also used in a rather vague and obsolete way in Ibsen’s play. Originally it applied to all microscopic organisms found in water. The term came from the practice of infusing substances such as hay into liquids. Later, ‘infusoria’ was used to specifically refer to ciliated protozoa, but nowadays, like animalculae, it is no longer in use in the academic literature. Contemporaries of Stockmann, like Pasteur and Koch, did not use terms like animalculae any more. They wrote about bacteria, bacilli (rod-shaped bacteria), and the like. Professor Ferdinand Cohn from Breslau, Robert Koch’s mentor at the time of his first discoveries, was an expert on bacteria and he had stated that bacteria are minuscule plants rather than little ‘animals’. Thus, in 1882, Ibsen used a scientific idiom that was hopelessly outdated from a scientific point of view. In the 1880s not only had the original terminology (dating from the seventeenth century) become obsolete, but scientists were also far beyond the horror still experienced by Van Leeuwenhoek when he discovered for the first time the presence of little animals in his own oral cavity. The survival of outdated scientific jargon outside academic circles is a very common phenomenon of course. While scientists continuously update their research practices and terminology, the terms and experiences of previous generations (once they have managed to spread to the public realm) tend to persist among the public at large for quite some time. In 1882, more sophisticated terms like ‘bacteria’ and ‘bacilli’ had not yet permeated public consciousness and its idioms, while terms like ‘prokaryotes’ and ‘eukaryotes’ had not yet been invented.

In the 1880s, the omnipresence of micro-organisms was still a novelty the general public had to get used to. The presence of microbes in the environment was not a fact that laymen were very familiar with. On the contrary, evidence concerning the existence and omnipresence of sub-visible living beings caused uneasiness, at times even panic, among lay audiences. One of the reasons was that after the days of Van Leeuwenhoek and Hooke interest in microbiology had declined. For many decades only a few people had studied bacteria (Carpenter 1972, p. 28). Although the dispute over the spontaneous generation of micro-organisms (involving Spallanzani, Needham and others) caused a temporary revival, Linnaeus exemplified the general lack of interest among naturalists when he assigned microbes to the class ‘Chaos’. When Louis Pasteur made his first discoveries, interest in and awareness of the importance of microbes had more or less come to a standstill. Microbes were virtually forgotten, even by the scientists themselves, until Pasteur and Koch rediscovered their existence.

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It took the 'crusading spirit of Pasteur, his zeal and skill as a polemicist, to drag the microbes out of the obscurity into which they had passed once more after Spallanzani died' (De Kruif 1927, p. 79). He brought them back to life again, so to speak. By the time Ibsen published his play, microbes were 'in the air' again and news about research by *visible scientists* such as Pasteur and Koch made the newspaper headlines. Pasteur and Koch initiated an enthusiastic and successful research programme to look into the causes of infectious diseases. But Ibsen's play suggests that this information had not reached everyone in Norway yet. Local sceptics did not believe a word of it and regarded it as a cynical joke that Stockmann used these little animals (that no one could see) to play a trick on his brother:

KILL: I never thought you had it in you to play monkey tricks against your own brother.

Dr STOCKMANN: Monkey tricks?

KILL: What was it? Some animals that had got into the water pipes?

Dr STOCKMANN: Animalculae, yes. Infusoria... Hundreds of thousands perhaps.

KILL: But no one can see them! Wasn't that it? Damn, if that isn't the best thing I have heard from you yet! (128)

It is not only the objects of Stockmann's research (i.e. the microbes) that are looked upon as something odd and strange, the figure of the scientist as such is something the village people also find difficult to comprehend. This notably applies to the scientific ethos, the ideal of disinterested research, for the sake of truth and human well-being alone. From the very onset until the very end, bystanders keep suspecting that Stockmann has personal or financial motives for acting as he does, such as the wish to have his revenge on his hated brother, or simply a desire to achieve a rise in salary. In the end, when Stockmann's shrewd father-in-law goes around the town buying up devalued shares in the Baths, most bystanders are convinced that the prospect of financial gain was behind it all from the very beginning. The disinterested scientist simply did not seem to have a place yet among the stock of Norwegian characters.

Hovstad, the radical editor of the local left-wing newspaper, is driven by political motives, rather than by an interest in science, which he regards as instrumental. He immediately discerns the political significance of Stockmann's discovery.

HOVSTAD: To you, as a doctor and a man of science, this affair of the water supply seems to stand on its own – I mean, you haven't realised that a good many other things are involved... [But to me] it seems that a journalist incurs a heavy responsibility if he fails to seize any favourable opportunity of emancipating the humble, down-trodden Masses!

As soon as he presents his findings to the (right wing) municipal authorities and to the (left wing) journalists, Stockmann's sensitive data enter a complicated and unstable political arena. His facts are no longer simple, clear and neutral. On the contrary, they easily find a place in political schemes and agendas. Water pollution changes from a scientific observation into a political metaphor. From a left wing perspective, society as such becomes a polluted swamp that needs to be cleansed. From a right wing perspective, Stockmann is an educated hooligan who misuses his data and scientific prestige to satisfy his desire for anarchy and turmoil. But even Stockmann himself soon 'contaminates' his scientific data by connecting them with political intentions.

A final word on Stockmann's professional ethos. As a man of science he finds it impossible to subordinate himself to the authorities. He sees it as his duty to truth and humanity to make his discoveries known. Indeed, he emphatically refers to his findings as a *great discovery*, something like a major scientific breakthrough – I have found it, Eureka! And he talks about his four-page manuscript that records it as if it is a masterpiece of scholarly writing. Why did he keep it all so secret? Because as a man of science he wanted to be absolutely sure. And now 'the public' should hear about it as soon as possible. When it comes to apprehending the impact his news is likely to have, Stockmann of course plays the role of unworldly scientist:

Dr STOCKMANN: And if the board [of directors of the Baths] should happen to raise my salary, I won't accept it. Oh, it's wonderful for a man to feel that he's done a service to his fellow citizens (125).

Before long, however, the doctor is made to understand that on the political level a 'self-evident' scientific fact can easily become the object of a fierce dispute, of a struggle between interpretations, as different stakeholders are likely to read scientific findings from different perspectives.

2. DOCTOR STOCKMANN AS A WHISTLEBLOWER³

Doctor Stockmann has dutifully submitted his four-page report to his brother, who not only fulfils the function of Mayor, but also of chairman of the board of directors of the Baths. At the beginning of Act II the Doctor is eagerly awaiting his response. Meanwhile, however, he has informed his family members and the press as well. Thus, the news immediately starts to leak and seep into the community. In his enthusiasm about his grand discovery, Stockmann neglects the discretion and confidentiality which no doubt should have been observed by him. The societal import seems so obvious to him that procedural discretion and constraints can hardly be relevant. In the context of whistle blowing, this course of action (reporting and exposing hazardous situations to different audiences at the same time) is known as the 'shotgun approach'. Although it

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increases the likelihood that corrective action will be taken, the whistle blower may well be accused of having failed to use the proper reporting channels (Miethe 1999, p. 218).

All three audiences respond in their own peculiar manner. His family members, to begin with, support Stockmann's views and strengthen him in his conviction that the course of action he has taken is for the benefit of mankind. Apparently they are accustomed to act in this vein, for Stockmann easily feels offended when he is being criticised in his own house. It happens more often, of course, that personalities who stand up against authorities in public life, act in a somewhat despotic manner themselves within the confines of their own private life.

Hovstad, representing the media, has his own agenda. In his eyes, the findings should be exploited politically right away, at the expense of 'the bureaucrats that rule us'. He insists that the 'myth of infallibility' must be exploded once and for all. The mayor's 'gross and inexcusable blunder' must be brought home to every voter in the place. Hovstad's professional and political ethos forbids him not to exploit Stockmann's information in a political manner. Together with Aslaksen, the more moderate and elderly printer, the young and radical editor offers his political assistance, advice and support, but Stockmann kindly declines:

Dr STOCKMANN: I really can't believe that all these precautions are necessary: it seems to me that the thing would go ahead on its own momentum (135).

Should the authorities refuse to undertake the necessary changes, however, he generously grants Hovstad and Aslaksen the favour of publishing his report, on condition that they handle it as if it was 'written in gold'. The published version must contain no typos or printing errors. This means that Stockmann regards his paper as something more than just a newspaper article.

Finally, the mayor himself pays the doctor a visit. The formal way in which he addresses him makes it clear right away what course he has decided to take:

THE MAYOR: Last night after office hours, I received a communication from you concerning the condition of the water at the Baths... Was it necessary to carry out all these inquiries behind my back?

Dr STOCKMANN: Well, until I had absolute proof, I –

THE MAYOR: Is it your intention to submit this document to the Directorate of the Baths as some sort of official report?

Dr STOCKMANN: Of course. Something must be done about the state of affairs – and quickly, too.

THE MAYOR: As usual, you make use of some very strong expressions in your report. You say, among other things, that what we offer to our visitors at the Baths is consistently poisonous.

Dr STOCKMANN: What else can you call it? Just think – water that's poisonous to drink *and* bathe in?

THE MAYOR: And so you arrive at the conclusion that we must build a sewer to carry off the alleged impurities Etc. (138)

A few remarks. Doctor Stockmann pretends to have written a scientific report, leading from hypothesis to observations and from analysis to conclusions. One gets the impression, however, that his style is not always as scientific and restrained as it should be. He not only expresses himself in vehement terms at times, but uses a very large number of exclamation marks (and insists that they are maintained in the printed version). Perhaps he should also have been more careful in going from observations to 'measures to be taken'. However, as the adjustments he proposes are 'exorbitantly' costly, they are out of the question as far as the Mayor is concerned (who consulted the town's engineer on this matter). And he summarises his conclusion in a beautiful bureaucratic phrase:

THE MAYOR: I have not been able to convince myself, from your report, that the condition of the water at the Baths is as serious as you present (140).

To Stockmann's astonishment, the facts he reported leave room for interpretation, for political hermeneutics. For the Mayor, the question now simply is: how do I silence the medical officer or – should that prove impossible – how do I eliminate him? In any event, the report must be withheld. The matter is to be dealt with 'discreetly' (141). Upon being told that Stockmann already informed the press, he insists that Stockmann agrees to sign a proclamation to contradict his own findings:

THE MAYOR: You have been so indiscreet as to chatter to outsiders about this delicate matter, which should have been treated as an official secret... It will be necessary for you to contradict such rumours, publicly... We expect that, after further investigations, you will come to the conclusion that matters are not nearly so serious or as urgent as you had imagined at first sight. You will publicly proclaim your confidence in the Board of Governors and in the thorough and conscientious steps which they will take to remedy any possible shortcomings (144)

Moreover, he denies his brother the right to form, let alone to disseminate, personal opinions on the matter. Of course he has freedom to speak, but only as long as it does not concern the Baths, since his senior director forbids it. According to the mayor, Stockmann's say is limited to ascertaining the scientific data as such. When it comes to pointing out their significance, or proposing measures and policies, town officials are better equipped:

Dr STOCKMANN: This is too much! I'm a doctor – a man of science...

THE MAYOR: The point at issue is not a purely scientific one; it is a complex question, with both technical and economic aspects (144)

Stockmann refuses to give in, of course, but the Mayor quickly alters the terms of the debate. Instead of discussing the facts as presented to him, he decides to focus on the author of the report. At first he resorts to *ad hominem* arguments

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in order to discredit him (describing the Doctor as a quarrelsome, turbulent, intractable person whom it is impossible to work with) but soon he threatens him with instant dismissal. Stockmann, convinced that his political friends will back him up, decides to allow the press to publish his paper.

Act III, therefore, takes us to the editor's office. Here, revolution seems about to occur, until the Mayor is allowed to display his tactical dexterity and political intelligence. What happens? Initially, Stockmann's discovery seems to fit in extremely well with the stereotypical political fantasies of Hovstad and his colleagues to get rid of those in power – a scenario that inevitably culminates in a rhetoric of beheading ('heads will fall'). Stockmann imagines himself as the leader of a popular uprising against the stodgy forces of aristocracy. The manuscript, apparently a pamphlet rather than a sober report, is to be printed ('Don't cut out any of the exclamation marks!' 155), but this will only be the beginning. Although Stockmann pretends to have written a formal report, to be submitted to the board of directors, it now becomes quite clear that he actually produced a text that belongs to a somewhat different genre and addresses a much broader audience:

Dr STOCKMANN: Well, Mr Hovstad, what do you think of my article?

HOVSTAD: I think it's an absolute masterpiece.

Dr STOCKMANN: It is, isn't it? I'm delighted you should think so – delighted.

HOVSTAD: It's clear and to the point – no need to be an expert to follow it. Take my word for it; you'll have every thinking man on your side (153)

He has written his report in such a way that it can appear in the newspaper just as it is, without any editorial adjustments. He has taken care not to write formally or expertly, but in an accessible manner – the more easily will it achieve political significance. The Doctor will use the newspaper as his headquarters from now on and he will bombard those in power with one explosive article after another. The whole community will be cleaned and disinfected. The lower classes will take control of all the important posts, and a Revolution will be staged in the name of science and conscience:

Dr STOCKMANN: Such endless vistas have opened out before me today. I haven't got it quite clear yet, but I'll soon put that right (154).

After Stockmann's departure, however, it is the Mayor's turn to pay a visit to the editor's office. He arrives with his hat and staff, the symbols of his official status, but uses the back door so that his (highly) unusual visit will pass unnoticed. He does not need as many words as his brother to explain his position, and he expresses himself in courteous, formal language. When he indicates the kind of money the Norwegian village will have to raise in order to cover the expenses, his left wing interlocutors agree that Stockmann's data suddenly appear 'in a different light' (162). The mayor himself has prepared 'a short

statement' on the situation as it would appear 'from a more reasonable point of view' and Hovstad and Aslaksen agree to print it. Then all of a sudden the Doctor reappears. He cannot wait to have a glance at the proofs of his article, and he wants to discuss with Hovstad and Aslaksen what he should do if the village people should decide to organise a torchlight procession or subscription in his honour. The Mayor is forced to take cover, but forgets to take his hat and staff with him, and when Stockmann notices them, he forces his brother to come out from his hiding place. Stockmann makes fun of him, puts on his official hat ('the pinnacle of authority!'), and in a playful manner dismisses him from his post, until it suddenly dawns on him that the situation has changed drastically. It will be his brother's statement, not his own article, that will appear in tomorrow's newspaper. Aslaksen even refuses to print it as a pamphlet at the Doctor's own expense. Finally, Stockmann decides to organise a meeting in order to read his paper to the public.

In ACT IV, the meeting takes place and villagers 'from all walks of life' have come to listen to Stockmann's speech, but the politicians (The Mayor, Hovstad and Aslaksen), reverting to a series of procedural tricks, manage to prevent Stockmann from presenting his paper. Therefore, he decides to give a speech on another important discovery of his – or rather, a revelation – something that had been on his mind for quite some time. His great discovery is that the true obstacle to progress and enlightenment is not the slyness of the political authorities, but the stupidity of the uneducated masses, the mob – common man. 'Now you know!' It is a lie to say, as democrats do, that the majority is always right. The minority is right, the intellectual elite, those who stand at the outposts, far in advance of others:

Dr STOCKMANN: As a general rule, an ordinary ... truth lives – let's say – seventeen or eighteen years ... twenty at the outside. Rarely longer. But ... it isn't till then that the majority takes them up and recommends them to society as wholesome spiritual food. There isn't much nourishment in that sort of diet, I can assure you – and I'm speaking as a doctor (186).

This is the proposition that he intends to prove to his audience 'scientifically'. He does so by explaining that the relationship between common people and men of science can be compared to that between ordinary mongrels and poodles of pedigree stock.

Think of an ordinary, plebeian mongrel... Then put that mongrel beside a poodle with a pedigree going back through generations of famous ancestors – who's been properly reared, and brought up among soft voices and music. D'you really think the poodle's brain won't have developed quite differently from the mongrel's? [They can be trained] to do things that an ordinary mongrel could never learn (189).

He accuses his public of agreeing with him when it comes to dogs, but not daring to apply this train of thought to humans, and following the idea to its logical

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conclusion. And he ends by attributing the intellectual depravity of common people to a shortage of oxygen in ordinary houses.

In ACT V, Stockmann has been dismissed, and the same has happened to his daughter, a teacher. His window panes are broken and his sarcastic father-in-law remarks that now at least he has enough oxygen in his house. By buying up huge amounts of inexpensive shares in the Baths, the latter makes Stockmann's project seem like a concerted plan. Apparently, it was the Doctor's secret design to create confusion on order to take over the Baths. Indeed, it is the villagers' guess that his scientific expertise will allow him to find some antidote or disinfectant. But Stockmann has the final say and announces another great discovery of his: the strongest man in the world is he who stands most alone.

To a certain extent, the sympathy for Stockmann that is voiced almost unanimously in comments on Ibsen's play is justified. Here we have a physician who has discovered a serious case of environmental pollution. Public health issues are at stake and sanitary measures are to be taken. Unlike the town's engineer who is consulted by the Mayor and who limits the scope of his attention to the technical and economical side of things, Stockmann acutely senses his professional responsibility. The mayor's response, moreover, is typical for those in power who find their position suddenly undermined by a whistle blower. The Mayor tries to cover up the contamination and when his brother refuses to go along with his scheme, because of his conviction that such dishonesty would be a crime to society, the Mayor typically resorts to *ad hominem* arguments and force. All this is typical of the whistle blowing complex. As a rule, whistle blowers are supported (for a certain period of time) by the press, but eventually they are likely to lose their jobs and to find their possessions vandalised (Miethe, p. 220). As an employee who reveals dangerous pollution, he soon finds out that his own career is at stake. Because of his loyalty to lofty goals, his personal life is completely transformed, but he is willing to sacrifice his personal well-being as well as his social position to his cause. A marital crisis also belongs to the aftermath of whistle blowing, but we do not know what will happen to Stockmann's marriage after the event.

We should not close our eyes, however, to a number of mistakes the doctor makes. Upon receiving the decisive letter from the university, he immediately informs the press. In view of his position and professional ethic he should not have done so. We cannot say that his disclosure was made in a responsible manner or that it followed upon 'the exhaustion of internal channels of complaint and redress' (Hunt 1998, p. 531). He should have acted more carefully and discreetly.⁴ He vehemently takes sides in a conflict between two ethical styles: the (old-fashioned) ethics of discretion and the (progressive) ethics of openness. He sees his brother as his enemy, rather than as a stakeholder whom he has to come to terms with in order to find a viable solution. It is as if he experiences great relief at finally discovering a way to injure him. But the most important thing is that there is some truth in the mayor's remark that the issue

at hand is not a purely scientific one, that it is rather a *complex* issue, involving technical and economic aspects, besides ethical ones. What the community needs is a comprehensive account, addressing and weighing all the relevant aspects. There is still some time left to consider carefully what measures are to be taken. In other words, Stockmann's view is one-sided. He leaps from fact to conclusion and leaves no room for reflection. Doctor Stockmann is not merely a scientist, moreover. In his view, scientific data are powerful tools in his relentless struggle to reform society. A will to power is behind his will to know. The facts he discovered soon become 'contaminated' by politics, as we have seen. In Stockmann's eyes, they acquire their true meaning when they are set against the backdrop of his ideological vision.

If we follow Sissela Bok (1981) in her assessment of whistle blowing, Stockmann's line of action must be regarded as adequate in some respects, but as inadequate in others. According to Bok, whistleblowers should assure themselves of the accuracy of their reports, checking and rechecking the facts before they speak out – and this is what Stockmann does. He fails, however, to explore and use what she refers to as 'the existing avenues for change within the organisation' (p. 211). Whistle blowing, she argues, has to remain a last alternative because of its destructive side effects, for the person himself as well as for others; it must be chosen only when other alternatives have been considered and rejected. Stockmann, because of his eagerness to communicate his findings to the press, fails to observe Bok's basic recommendation to those who find themselves in his position: 'Try the regular channels first' (p. 211). Moreover, she argues that whistle blowers should be scrupulously aware of any motive that might skew their message. The whistleblower's motives ought to be above suspicion. But in Ibsen's play this is clearly not the case. Stockmann is partly driven by personal motives – such as his extreme desire for recognition for and his feelings (markedly unfriendly) towards his brother. Finally, she stresses that whistle blowers should seek advice before going public. But Stockmann acts on his own accord, without informing or consulting anybody beforehand, and he clearly takes delight in the effect of general astonishment and surprise his unexpected message evokes.

3. DOCTOR STOCKMANN AS A *MICROBE HUNTER*

The plot has its origin in a number of actual incidents (Meyer 1967/1985, p. 523; Watts, 'Introduction' in Ibsen 1882/1964, p. 13). To begin with, Ibsen once heard a story about a medical officer at a spa who, when an outbreak of cholera occurred, felt it his duty to make it known publicly. The season was ruined and therefore his house was stoned. And in 1881 a Norwegian chemist had tried to read a paper disclosing shortcomings of Steam Kitchens for the poor. He was prevented from speaking and forced to withdraw. Moreover, Ibsen had responded

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with indignation at the reception of *Ghosts*, his previous play which caused a scandal because it publicly addressed issues such as euthanasia and venereal disease, and there are hints that Ibsen transferred some of his personal anger to Stockmann. More interesting from a philosophical point of view, however, is the apparent concurrence of Ibsen's play with crucial events in the history of science. Stockmann is the literary equivalent, the literary counterpart of outstanding experimentalists and 'microbe hunters' (De Kruif 1927), of champions of hygiene and public health such as Pasteur and Koch.

To compare theatre with scientific research is not as far-fetched as it may seem at first glance. In comparison to other forms of scholarly activity (such as making calculations or reading books), experimentation constitutes a *dramatic* form of research, a dramatic 'art' (Crease 1993). An experiment is basically a performance. The emphasis is on *doing*, on *acting*, sometimes hidden from view, but often before an audience (of students, colleagues or readers). It is a performance moreover that involves rehearsals, repetitions and practice. Especially experiments with human subjects, such as those performed by social psychologists for example, can be reminiscent of drama in the eyes of those who witness them, but basically the theatrical analogy applies to all forms of experimental research (although sometimes the performance is actually executed by instruments and equipment while the experimenters are more like producers or directors).⁵ This affinity between the literary drama of the playwright and the scientific drama of the experimental researcher will help when it comes to comparing literary figures such as Stockmann with real 'men of science' such as Pasteur and Koch. It is my conviction, moreover, that contemporary events share a certain basic mood or *Zeitgeist* – that they tend to mirror one another. This means that Ibsen's play may allow us to further our understanding of what goes on in the life sciences during the 1880s, while the experiences of the 'real' scientists during that period may deepen our understanding of what happens to Stockmann on stage. The element of drama is what both events (the discovery of animalculae by Stockmann and of the tuberculosis bacillus by Koch) have in common. This is also the reason why I will use one particular monograph on the history of microbiology as my starting point, namely Paul de Kruif's best-seller *The Microbe Hunters* published in 1927.⁶ It presents a rather supportive and protagonist portrayal of scientists as heroes, but with its lively style it emphatically emphasises the *dramatic* element inherent in experimental inquiry. Therefore, although it is perhaps not always the most reliable source when it comes to historical detail (from a purely historical point of view), it does present the achievements of 'microbe hunters' such as Pasteur and Koch as if we witness their performances live on stage, as if we (the audience) are allowed to enter for a moment their laboratories and studies in order to shed a glance on their dramatic performances. The case of Louis Pasteur hardly needs any dramatisation, by the way. He is unanimously described as an actor and a

showman by his biographers, as someone who regarded the disclosure of nature as a 'spectacle' (Davis et al. 1973, p. 4).

In the introduction I have already pointed out that after Van Leeuwenhoek and Spallanzani, interest in microbes eclipsed in favour of other branches of research. According to De Kruif, it took a 'propagandist', a 'missionary', a 'showman' like Louis Pasteur to change the situation. He started a campaign, 'part science, part drama' (p. 84), to put microbes on the map again. He had a strong desire to involve large audiences in his discoveries and he enjoyed 'spouting' his results to the public (p. 95). At Paris he staged a 'scientific vaudeville' to make Emperor Napoleon III, Alexandre Dumas and other contemporaries more aware of the omnipresence of sub-visible species in the environment. Besides that, he loved to fight with colleagues who had attained the status of authorities. His campaign created a storm in the republic of science and got him into dramatic conflicts with Liebig and other powerful men. During a meeting of the Academy of Science in Paris he shouted scandalous remarks and got into a fight with an elderly colleague. He was notorious for transgressing every now and then the limits of scientific discretion by using provocative language and 'unseemly remarks'. Furthermore, according to De Kruif, his head was incessantly inventing new theories and wild guesses and he often jumped to conclusions. In short, Pasteur and Stockmann share the same impulsive character more or less, especially if we study Pasteur through the lens of Paul de Kruif.

One of the highlights of Pasteur's career was the discovery of the anthrax vaccine. It culminated in a dramatic public experiment at Pouilly-le-Fort in 1881 that was broadcasted by newspapers all over the western world. Pasteur accepted the invitation to come to Pouilly-le-Fort, a small provincial town, in order to personally lead the battle against local rural scepticism and prejudice that hindered the emerging scientific view on the aetiology of disease. With his Stockmann-like character he eagerly accepted the challenge.⁷ This event was an experiment and a public performance at the same time, an experimental show. Actually, it was intended as a plot by enemies to lure Pasteur into a dangerous situation, but he succeeded. Pasteur, the 'scientific showman', the 'actor', the maker of 'theatrical gestures' (p. 234) was inspired (in his own words) by 'a passion for progress and truth' (p. 219). He marched into the arena 'like a matador', facing dignitaries, farmers and other visitors from all walks of life – a stage-setting of an experimental drama (p. 214). Bruno Latour describes Pasteur's dramatic public experiment at Pouilly-le-Fort in similar terms, namely as a 'theatre of proof' (1984/1988, p. 85). Pasteur performed his experiments not only live, before a large audience, but also in front of the assembled media who followed and reported his operations meticulously (p. 87). Thus, he was able to interest a large educated public in the 'daily drama' of his trials. The experiment was a grand success and the sceptics were converted.⁸ In this manner he set a model for what Stockmann (albeit unsuccessfully) tried to achieve in Norway.

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Robert Koch, secluded and austere, was the reverse image of his much more passionate French contemporary. Like Stockmann – so to speak – he started as a lone doctor, living and working in almost complete scientific isolation (Brock 1988). He performed his researches in silence, spending his days as a country doctor in villages in Eastern Prussia (notably in Wollstein). Like Stockmann during his early years ‘up north’, he was virtually cut off from the world of science, from libraries and contact with other scientific workers. ‘Never could a man have found himself in a position less favourable for scientific research – poor, humble, unknown, isolated from the scientific appliances which are the necessary tools of the investigator’ (Brock, p. 27). From 1876 onwards, however, Koch managed to rise above his environment and became a major medical and public figure – a visible scientist. With the help of his microscope, he designed careful and accurate experiments to discover the causes of diseases afflicting farm animals (such as anthrax) and patients (such as tuberculosis and cholera). Thus, he has had a tremendous impact on hygiene and public health. As a self-made scientist working in a home-made laboratory, he made his first great discovery – he discovered the microbe that caused anthrax, an illness prevalent among farm animals in the Wollstein district. By means of careful painstaking experimentations he proved scientifically that the bacillus was really what caused the disease. Upon writing a courteous letter to Professor Ferdinand Cohn at Breslau, he presented his results in 1876 by performing a number of experiments before an academic audience. Unlike Stockmann, he was extremely hesitant when it came to publishing his results, but Cohn took care of it. Due to this publication, he immediately soared out of the ranks of anonymous physicians and found himself among the most original researchers (De Kruif, p. 155). Public interest in and enthusiasm over his results was strong. Subsequently, he developed ingenious methods for fixing, staining and photographing bacteria. After he had moved to Berlin in 1880 he decided to investigate the microbe that caused tuberculosis. He patiently and silently performed a great number of experiments in a relatively short time and then he was ready to give his news to the world: the bacillus was discovered. Once again, the scientific proof was presented in a dramatic, performative fashion. On the twenty-fourth of March 1882 he presented his findings to a meeting of the Physiological Society in Berlin. He *showed* his audience a summary of the experiments he had performed in his own laboratory. The meeting was, so to speak, the absolute opposite of the fourth act of Ibsen’s play. When he finished his lecture, there was silence. No applause, no questions, no debate – the audience was simply stunned with admiration. This is how De Kruif describes it:

He told the plain story with no oratorical raising of his voice... At last Koch sat down, to wait for the discussion, the inevitable arguments and objections that greet the finish of revolutionary papers. But no man rose to his feet, no word was spoken, and finally eyes began to turn toward Virchow, the oracle, the Tsar of German science, the thunderer whose mere frown had ruined great theories

of disease. All eyes looked at him, but Virchow got up, put on his hat, and left the room – he had no word to say... In 1882 the news that Robert Koch had found the microbe of tuberculosis trickled out of the little room of the Physiological Society the same evening, sang to Kamchatka and to San Francisco on the cable wires that night, and exploded on the front pages of the newspapers in the morning. (p. 182)

The publication of his paper three weeks later created a sensation throughout the world (in De Kruif's words: 'The world went wild over Koch'). On April 22 1882 the news was brought by the *London Times*, and on May 3 by the *New York Times*. At least an echo of the stir must have reached fervent newspaper readers such as Ibsen.⁹ A few months later, at the *German Exposition of Hygiene and Public Health*, a replica of Robert Koch's laboratory was shown to the public, with the latest equipment for studying infectious diseases. It made his name even more familiar to the general public. Together with Pasteur, Koch initiated microbiology as an experimental science. He was responsible for developing the logical structure of microbiological experiments. But perhaps it would be more accurate to say that his chief interest was in applied ecology: he was interested in the way bacteria maintain themselves in different environments and spread from host to host (Brock, p. 290).

The life histories of Stockmann, Pasteur and Koch confront us with three more or less contemporary events, situated on the borderline between theatre and science. In 1881, Pasteur performs his dramatic public experiment at Pouilly-le-Fort. The atmosphere is tense and Ibsen-like, but unlike Stockmann, Pasteur is eventually heralded as a public benefactor, rather than as a public enemy – for the time being at least. Subsequently, in March 1882, Robert Koch gives his lecture and performs his famous experiments before a scholarly audience in Berlin. The atmosphere is quite unlike the tumultuous scenes of Ibsen's fourth act, but as the news spreads round, he too is heralded as a public benefactor. Finally, later that same year, Ibsen's play is performed for the first time. Stockmann, intent on lecturing on microbes and infectious diseases and hoping to be heralded as a public benefactor too, meets with a completely different, more unfortunate fate, however. Nevertheless, he too is a microbe hunter interested in improving the hygienic conditions of his fellow human beings by using microscopic data and in preventing the spread of infectious diseases by taking sanitary measures.¹⁰

A few years later, when Hamburg was struck by a cholera epidemic, the similarity between Stockmann and Koch became even closer.¹¹ Koch went over to Hamburg in order to investigate the local hygienic conditions. Contrary to some of his colleagues, he insisted that cholera was due to an infectious agent and saw water as the primary mode of transmission. The Hamburg epidemic permitted Koch to prove the relationship between the purity of water and the incidence of infectious diseases. Both Hamburg and the nearby city of Altona obtained their water from the Elbe, but while Hamburg obtained it unfiltered from apparently unpolluted surface water, Altona derived it from the water that had flowed

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through Hamburg, picking up sewage water on the way (Brock 1988, p. 32). Yet, while Hamburg was visited heavily with cholera, Altona was nearly free of the disease since it filtered its water supply by means of sand. Koch provided solid bacteriological evidence for the efficacy of sand filtration by counting bacteria before and after filtration. Thus, he showed engineers the most effective (albeit costly) way to attack the problem, thereby placing sanitary engineering on a firm footing. His work became the basis for government regulations requiring bacteriological examination of public water supplies. In short, Koch set a model for physicians interested in public health like Stockmann. He managed to do what Stockmann failed to achieve, not only by assembling convincing scientific evidence, but also by communicating his conclusions and recommendations to politicians, officials and policy makers in an effective manner.¹² In other words, he not only proved that cholera was transmitted by microbic agents, but he also demonstrated the pivotal importance for scientists involved in ecological research of communicative and socio-political insights and skills.

Bruno Latour (1984/1988) describes the work of Pasteur and other 'microbe hunters' against the backdrop of the much broader hygienist movement of his days. The hygienists' aim was to make the environment (notably the urban environment) healthier for humans. Costly municipal investments (to improve the water supply for example) had already been promoted by them, but microbiology finally offered a *scientific guarantee* that these investments would really prove effective and indispensable. Thus, the microbiologists *displaced* the traditional engineers who had forgotten the microbes in their plans. By making the microbes visible they were able to translate laboratory data into concrete plans and policies. This pattern is clearly recognisable in Ibsen's drama as well: Stockmann tries to overrule the municipal engineer who, by supporting the 'economical' solution, failed to take the animalculae into account. Unlike other microbe hunters, however, he was unsuccessful.

Two basic scripts or typical scenarios are embedded in these biographical stories. The first script concerns the isolated, invisible scientist, working quietly in his home-made laboratory, whose only contact with the world of science consists of an occasional letter to a university expert, and who suddenly experiences his *Eureka!*, his breakthrough, the decisive event that puts him on a level with the other famous 'heroes' of science. The contours of this script can be discerned in Koch's biography as well as in Ibsen's play, but while it works out extremely well in the case of Koch, it completely miscarries in the case of Stockmann. The second script concerns a dramatic public event during which a scientific proof of great import is presented by a scientific hero to a mixed audience. Once again, this scenario is present both in the case of a real scientist (Pasteur) and in the case of Stockmann, but whereas it works out quite successfully in the case of Pasteur, Stockmann faces a dramatic failure. In his play, Ibsen makes full use of the contrast between the quiet, secluded atmosphere of the first script and the tumultuous and dramatic nature of the second. The main reason for Stockmann's

failure, his *tragic flaw* so to speak, is his unwise decision to change genres and to leap from science to political philosophy without preparing himself properly. Instead of discussing environmental pollution and issues of public health, he enters upon one of the typical themes of nineteenth-century philosophy, namely 'mass phobia', or the anxiety (articulated by Le Bon, Mill, Nietzsche and others) over the fact that the avant-garde intellectual, the autonomous individual, the free-thinker is likely to be outnumbered, in a democratic era, by a prejudiced and backward 'majority'. Besides being 'politically incorrect', Stockmann's ideas on this subject are rather confused and his discourse is far from being carefully composed. It reads, rather, like a desperate improvisation. The argument that the environment has been polluted due to mistakes made by blundering and short-sighted politicians is based on a completely different kind of 'scientific proof' than Stockmann's revelation that the majority of people are unable to think rationally and consistently. The latter claim is based on sloppy reasoning and is highly problematic from a philosophical point of view.

CONCLUSION

What can we learn from Ibsen's play; what is its 'message'? As we have seen, Doctor Stockmann belonged to a whole generation of microbe hunters who directed public attention to the presence of microbes in the environment (be it as our benefactors or as our enemies). From a purely scientific point of view Stockmann is of course far from being Koch's equal. While the latter assembled and handled his own equipment for example (indeed: technical dexterity in using delicate tools was part of his genius), Stockmann remained heavily dependent on the tools and expertise of others. But what is important is that none of these researchers were *pure* scientists. They were all very much involved in the process of making the life sciences more relevant for society: Pasteur as a champion of vaccination, Koch as an influential and internationally acknowledged hygiene expert and Stockmann – if only he had succeeded – as an environmental scientist who would have been involved in detecting and solving instances of environmental pollution. The dispute over spontaneous generation that had obsessed previous microbe experts had been purely theoretical. The new microbiology had an immediate and highly significant impact on human existence.

Indeed, the crucial issue at stake here is that the inquiries made by Pasteur, Koch and their followers (such as Roux, Behring, Ehrlich, etc. who became famous in their own right) had an outspoken societal *relevance*. Their research had an obvious link with environmental concerns and public health issues. And therefore, sooner or later, the researchers involved were called upon to go beyond their small subculture of scientific experts and to address broader non-expert audiences: the press, the authorities, the public at large. In other words, these researchers were not only involved in internal communication among fellow

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scientists, but (because of the nature of their discoveries) they also took part in the intricate dialogue between science and society. At first, they would present their findings to small assemblies of scientific experts, as Koch did in Breslau and Berlin. But sooner or later, they would be facing a much broader public (or at least its political representatives). And in order to be successful in reaching this broader audience, the microbe hunters had to switch genres, they had to develop new forms of communication, more dramatic even than experimental demonstrations. They had recourse to more theatrical forms of presentation, such as public speeches or scientific demonstrations before audiences 'from all walks of life'. Like experimentation, the public dissemination of research findings presupposes a considerable amount of skill and exercise as well. Only if the communicative component is professionally done can researchers hope to convey their information on microbes and preventive measures to public audiences – information that lay persons may find very difficult to comprehend at first. Although Stockmann on previous occasions had shown himself a prolific contributor to Aslaksen's newspaper, that is: as someone who successfully popularised the scientific point of view, at this crucial moment (which could have been his 'finest hour') he completely failed to communicate his research findings to the public. This was not completely his fault, of course. His four-page manuscript might have had a tremendous impact on the public had he been allowed to read it, but his adversaries successfully prevented him from disseminating his views. Relying on their political techniques, they managed to transform Stockmann's audience into a fearful, archetypical 'mob'. What we may learn from Ibsen's play, in short, is that real scientific 'heroes' are not only trained in (and not only have developed a talent for) handling microscopes or collecting and analysing water samples, but are also good in addressing broader audiences and in discerning the ethical, social and communicative dimensions of their work.

These communicative talents and skills are especially important when it comes to dealing with the two most important intermediaries that have positioned themselves between scientists and the public at large, namely politicians and journalists. The histories of Pasteur and Koch are interesting because, notwithstanding the striking differences between the two men in terms of strategy and style, they constituted role models that could (and to a certain extent still can) be copied by others, not only in order to become successful experimentalists, but also in order to become successful communicators. Through their work, they established 'best practices' – for laboratory research, but for societal communication as well. Stockmann, on the other hand, is interesting precisely because, as an anti-hero, his story more or less constitutes the reverse image of the performances of the real microbe hunters. From Ibsen's play we may distil a list of possible mistakes to be avoided. We may read *A Public Enemy* in order to understand what may go wrong, and what kind of pitfalls are to be avoided, whenever a

scientist feels the need to address a larger public, first through its intermediaries (notably journalists and politicians), but eventually face-to-face.

NOTES

¹ *A Public Enemy* by the Norwegian playwright Henrik Ibsen (1828-1906) was published and performed for the first time in 1882. All references are to the Penguin edition, easily available in English (Ibsen 1882/1964).

² In Ibsen's play *Doctor Stockmann* is presented as being in his mid-life years, around the age of forty – that is: he is approximately of the same age as Koch (1843-1910) was (who was close to 40 in 1882).

³ 'Whistle-blowing is the public disclosure, by a person working within an organisation, of acts, omissions, practices, or policies perceived as morally wrong by the person'. An illustration is a civil engineer who believes 'that a certain building practice is unsafe and reports this to his employer. The employer does not act on the report so the engineer takes it ... to the media' (Hunt 1998, p. 525).

⁴ 'Generally a very strong case has to be made for the immediate disclosure to the media of organisational information' (Hunt 1998, p. 530).

⁵ A beautiful example of science-as-theatre can be found in *The Double Helix* by James Watson where Linus Pauling, when presenting a protein structure, keeps his model behind a curtain, unveiling it only at the very end of his talk, leading Watson to comment that it was 'as if he had been in show business all his life' (Crease 1993, p. 98; Watson 1968/1980, p. 25).

⁶ Paul de Kruif was 'America's first great science writer' (Henig 2002). Born in 1890, he was trained as a bacteriologist. He published on streptococci and worked at the Rockefeller Institute, where he was fired after publishing an anonymous, critical review of contemporary medical research. He was co-author of Sinclair Lewis' novel *Arrowsmith*, published in 1925, about a research institute modelled after the Rockefeller. Critics often contend that De Kruif relied too much on his imagination, but two successful Hollywood movies and one successful Broadway play were based on *The Microbe Hunters*, his most famous book.

⁷ 'Pasteur's reports on preventing sheep anthrax were so unbelievable to some, that he was challenged by the well-known veterinarian Rossignol to conduct a carefully controlled public test of his anthrax vaccine. This was to take place at Pouilly le Fort, a farm in the town of Melun south of Paris. Twenty-five sheep were to be controls, the other twenty-five were to be vaccinated by Pasteur and then all animals would receive a lethal dose of anthrax. All of the control sheep must die and the vaccinated sheep must live... The publicity was intense. A reporter from the London *Times* sent back daily dispatches. Newspapers in France followed the events with daily bulletins. There were crowds of onlookers, farmers, engineers, veterinarians, physicians, scientists and a carnival atmosphere... Happily, the trial was a complete success – indeed, a triumph! Two days after final inoculation (May 5, 1882), every one of 25 control sheep was dead and every one of the 25 vaccinated sheep was alive and healthy. The fame of Pasteur and these experiments spread throughout France, Europe and beyond. It was ... the anthrax vaccine that spread through the public mind faith in the science of microbes' (Cohn 1996).

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⁸ Unfortunately, however, it was a temporary success. Before long, disturbing letters began to arrive. The sheep he had vaccinated were dying of anthrax after all. And then came a terribly exact scientific report, signed – by Robert Koch from Berlin.

⁹ Robert Koch was not the only man of science involved in this kind of research. Paul von Baumgarten had reported the discovery of the tuberculosis bacillus a few days earlier, but his thesis was less well-founded than Koch's. It shows, however, that this type of research was really up to date.

¹⁰ Besides Pasteur and Koch, Ignaz Semmelweis (1818-1865) and Joseph Lister (1827–1912) deserve to be mentioned as microbe fighters. Semmelweis was persecuted for saying that physicians should wash their hands before doing any procedures on patients, and when Joseph Lister actually saw microbes in a microscope he knew that Semmelweis was right. Inspired by the work of Pasteur he became the pioneer of antiseptic surgery. Also in this case, biomedical history has a literary counterpart. The Norwegian playwright Jens Bjørneboe (1920-1976) wrote a play about Semmelweis's struggle against childbed fever, with strong political overtones (Bjørneboe 1998). For obvious reasons, it is often compared to Ibsen's *A Public Enemy*.

¹¹ One could say that Stockmann is more similar to Pasteur in terms of temperament, to Koch in terms of biography.

¹² Koch's life was not always a success story, however. His claim that he had discovered a remedy for tuberculosis proved a disappointment and his decision to divorce his wife and remarry a much younger girl caused a scandal. Whereas Stockmann considered emigrating to America, Koch went off to Africa to escape public criticism – and to do research on malaria and other infectious diseases.

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