The anatomy of a scientific paper

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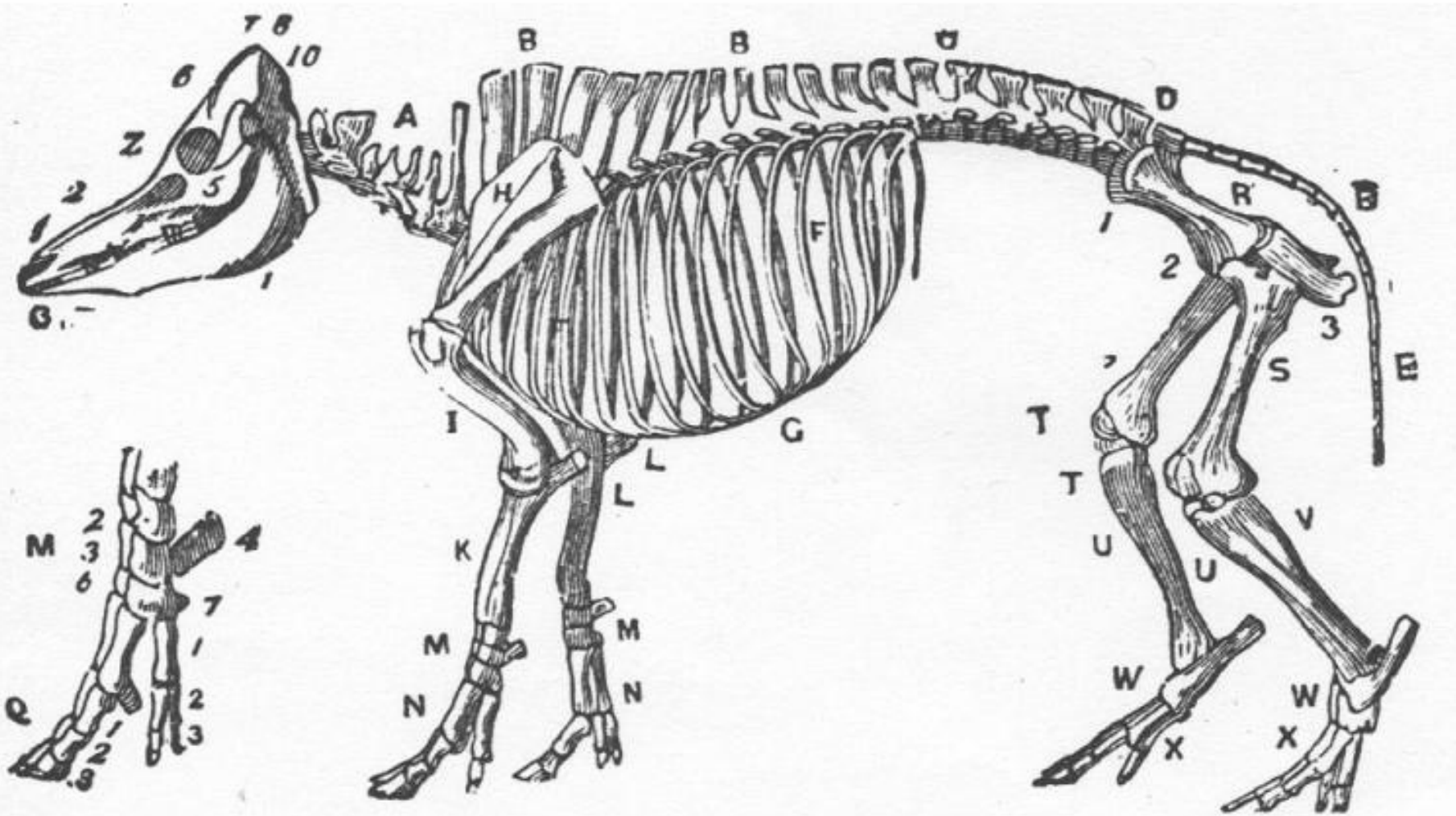
Writing a paper is like the reverse of slaughtering a pig

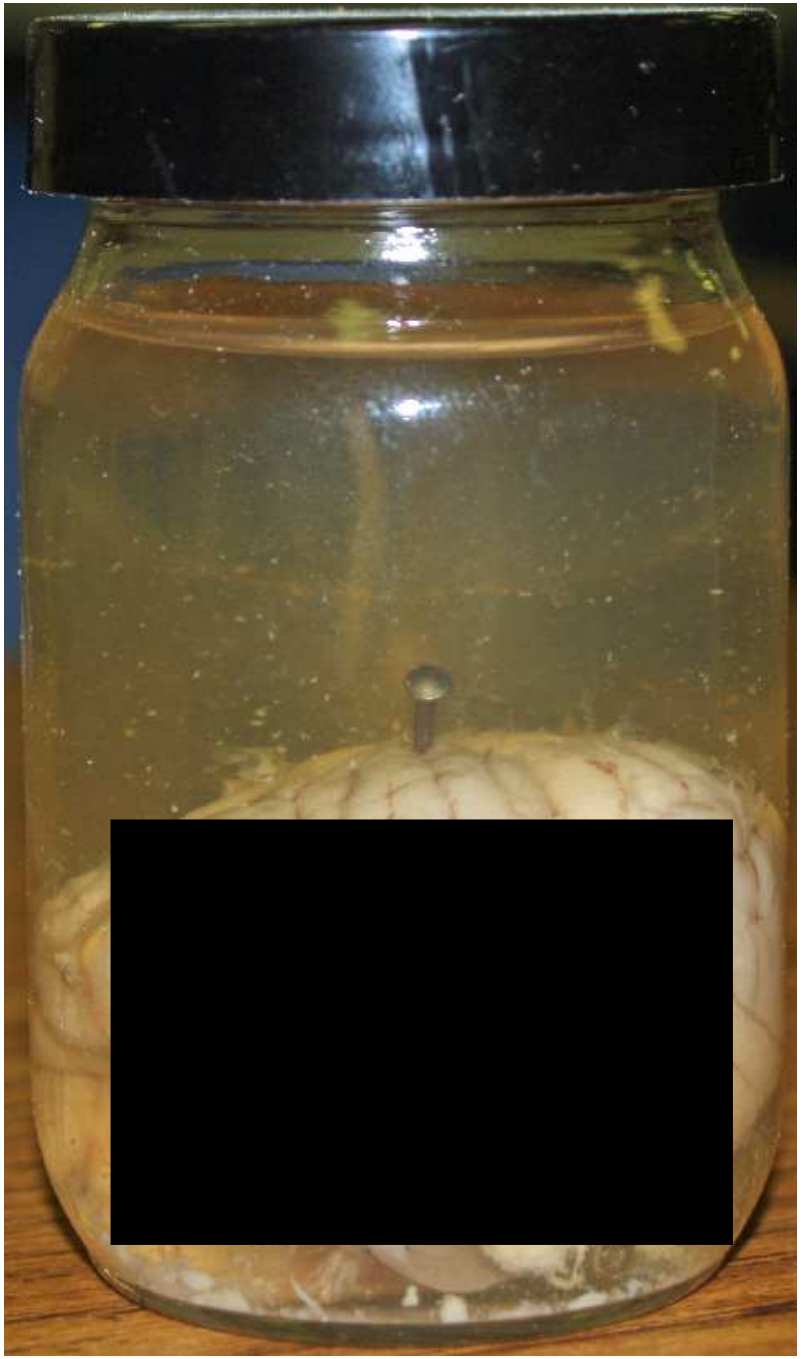
Starting with the skeleton, we sequencially add flesh, blood, and skin



SKELETON OF THE HOG.

The process of fleshing out the pig skeleton is not messy, but very systematic

The technique is to add the
various parts in sequence,
like modules or building blocks,
or Ikea furniture.



The end product is a flawless, and (in this case) intact hog

The skeleton of a paper

- Title Page
- Abstract
- Introduction
- Methods
- Results
- Discussion
- References

William Shakespeare - Sonnet #18

Shall I compare thee to a Summer's day?
Thou art more lovely and more temperate:
Rough winds do shake the darling buds of May,
And Summer's lease hath all too short a date:
Sometime too hot the eye of heaven shines,
And oft' is his gold complexion dimm'd;
And every fair from fair sometime declines,
By chance or nature's changing course untrimm'd:
But thy eternal Summer shall not fade
Nor lose possession of that fair thou owest;
Nor shall Death brag thou wanderest in his shade,
When in eternal lines to time thou growest:

So long as men can breathe, or eyes can see,
So long lives this, and this gives life to thee.

The sonnet is composed around a similar skeleton

I am quite serious; scientific writing is just another literary form

At its very best, scientific writing can be as perfect as a sonnet

The skeleton of a paper

- Title Page
- Abstract
- Introduction
- Methods
- Results
- Discussion
- References

Four out of seven of these items can be composed from the very beginning: Why wait?

- Title page
- Introduction
- Methods
- References (in part)

Rule 1: Zero tolerance: everything that can be done now, should be done now

- Writing the title page can avoid unpleasantness later on (authorships)
- It has the psychological benefit that one´s mind is settled on the topic every time the document is opened
- Why wait for later?

word count excl. references, tables
total word count
number of words in abstract:
number of tables:
number of figures:

Decreased verbal learning but not recognition performance in unmedicated alcohol-dependent patients during early abstinence

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Key words: alcoholism, withdrawal, verbal memory, cognitive function, recall, recognition

An example of a title page; the first thing you see every time you open the document

Introduction

- There has to be a point of departure for the manuscript. This can be written (recycled from protocol) before ever you do an experiment
- Why wait for later?

equipment, and to Dr. G. E. R. Deacon and the captain and officers of R.R.S. *Discovery II* for their part in making the observations.

[1] Young, F. B., Bernal, H., and Jevons, W., *Phil. Mag.*, **40**, 149 (1920).
[2] Longuet-Higgins, H. S., *Mon. Not. Roy. Astro. Soc., Geophys. Supp.*, **5**, 285 (1949).
[3] Von Arx, W. S., Woods Hole Papers in Phys. Oceanog. Meteor., **11** (2) (1950).
[4] Ekman, V. W., *Arkiv. Mat. Astron. Fysik.* (Stockholm), **2** (11) (1906).

MOLECULAR STRUCTURE OF NUCLEIC ACIDS

A Structure for Deoxyribose Nucleic Acid

We wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

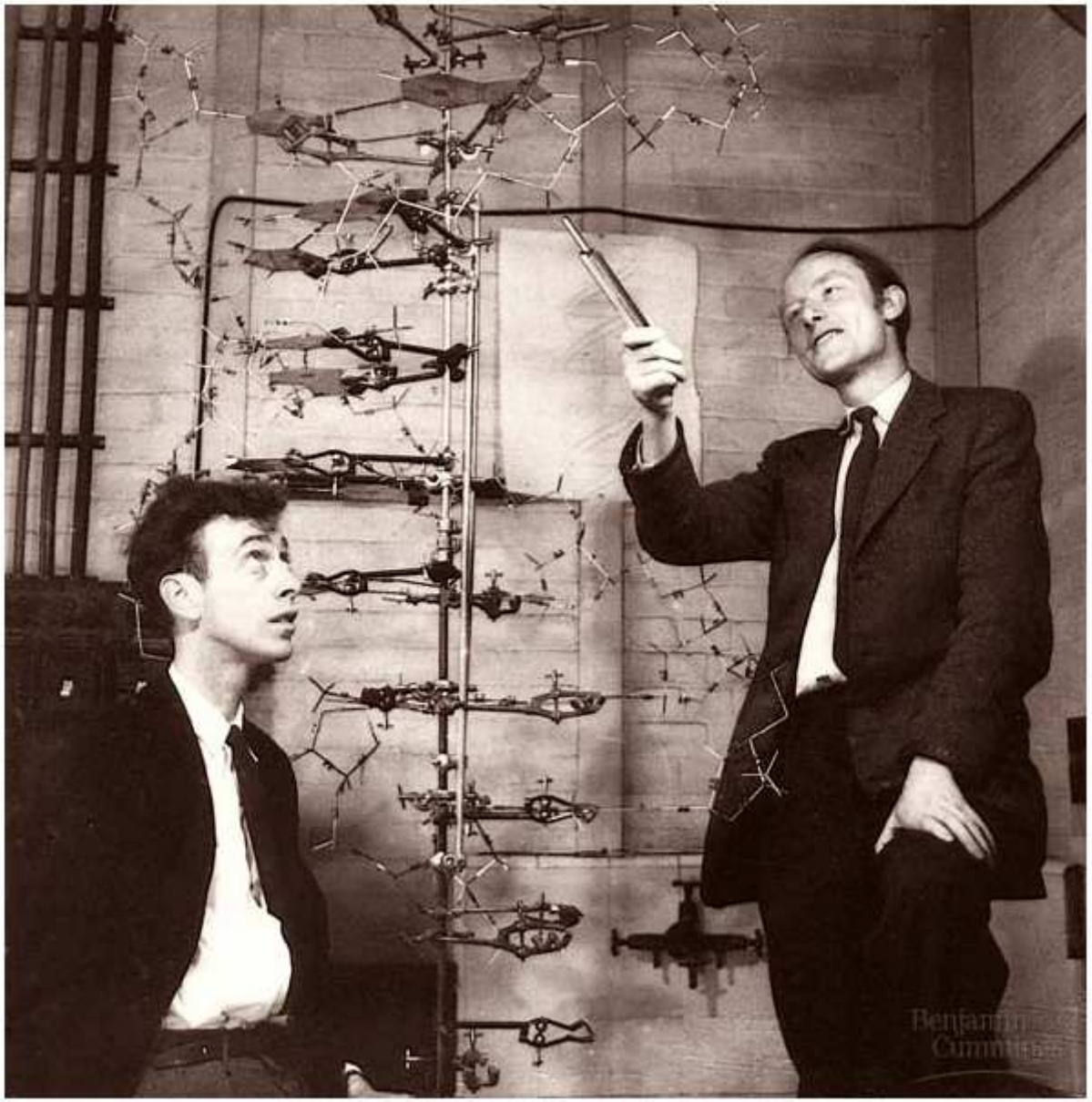
A structure for nucleic acid has already been proposed by Pauling and Corey[1]. They kindly made their manuscript available to us in advance of publication. Their model consists of three inter-twined chains, with the phosphates near the fibre axis, and the bases on the outside. In our opinion, this structure is unsatisfactory for two reasons:

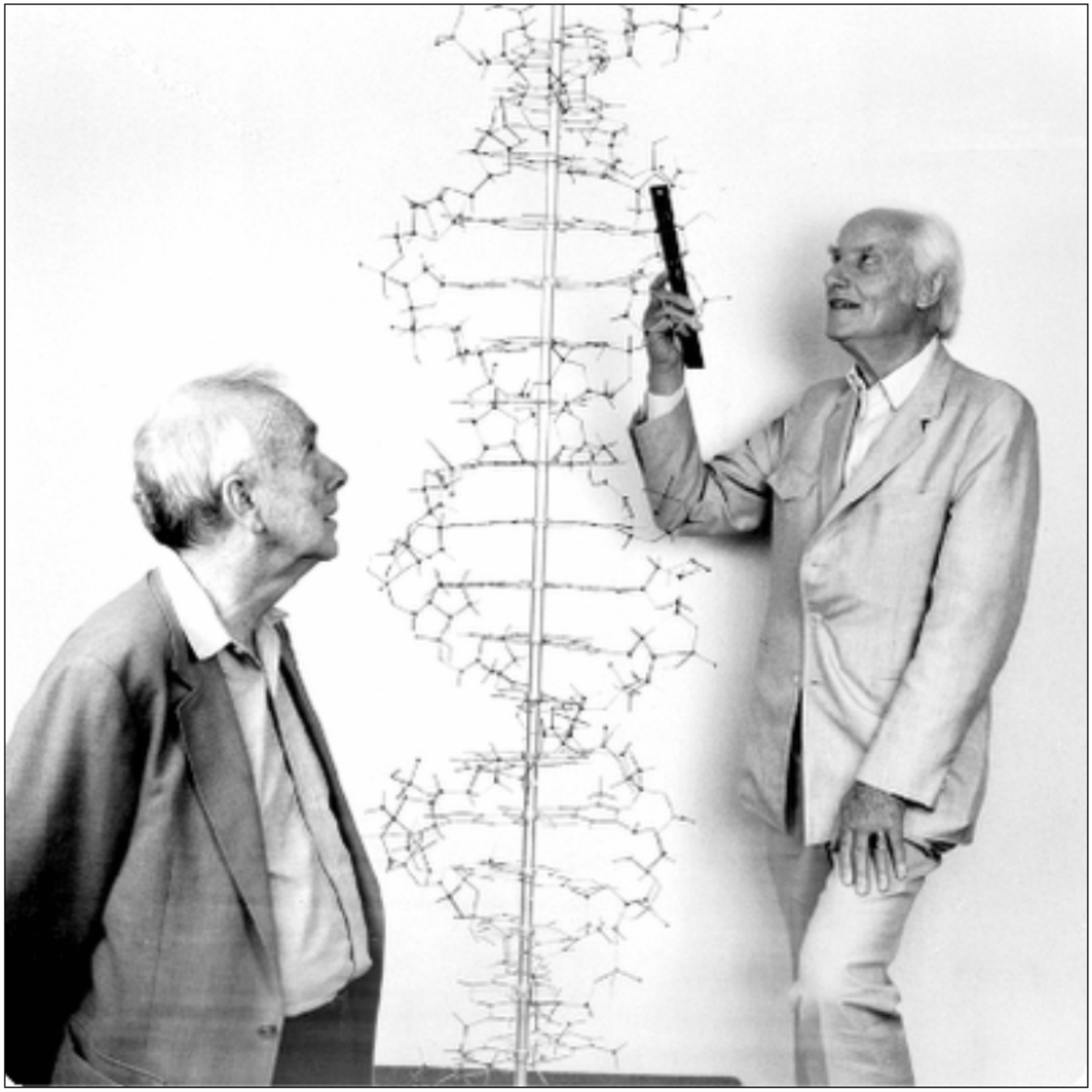
is a residue on each chain every 3·4 A. in the z-direction. We have assumed an angle of 36° between adjacent residues in the same chain, so that the structure repeats after 10 residues on each chain, that is, after 34 A. The distance of a phosphorus atom from the fibre axis is 10 A. As the phosphates are on the outside, cations have easy access to them.

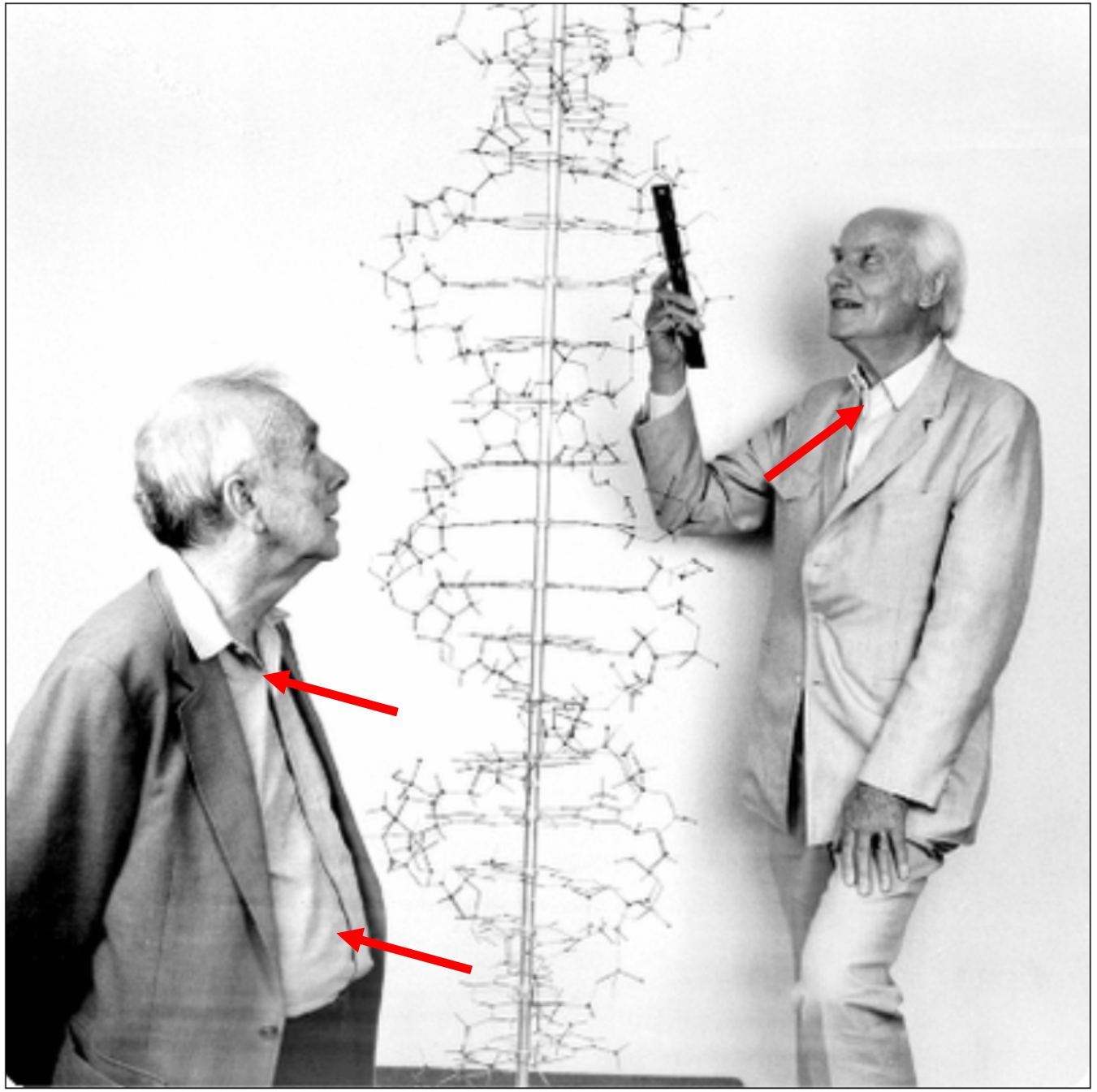
The structure is an open one, and its water content is rather high. At lower water contents we would expect the bases to tilt so that the structure could become more compact.

The novel feature of the structure is the manner in which the two chains are held together by the purine and pyrimidine bases. The planes of the bases are perpendicular to the fibre axis. They are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other chain, so that the two lie side by side with identical z-co-ordinates. One of the pair must be a purine and the other a pyrimidine for bonding to occur. The hydrogen bonds are made as follows: purine position 1 to pyrimidine position 1; purine position 6 to pyrimidine position 6.

If it is assumed that the bases only occur in the structure in the most plausible tautomeric forms (that is, with the keto rather than the enol configurations) it is found that only specific pairs of bases can bond together. These pairs are: adenine

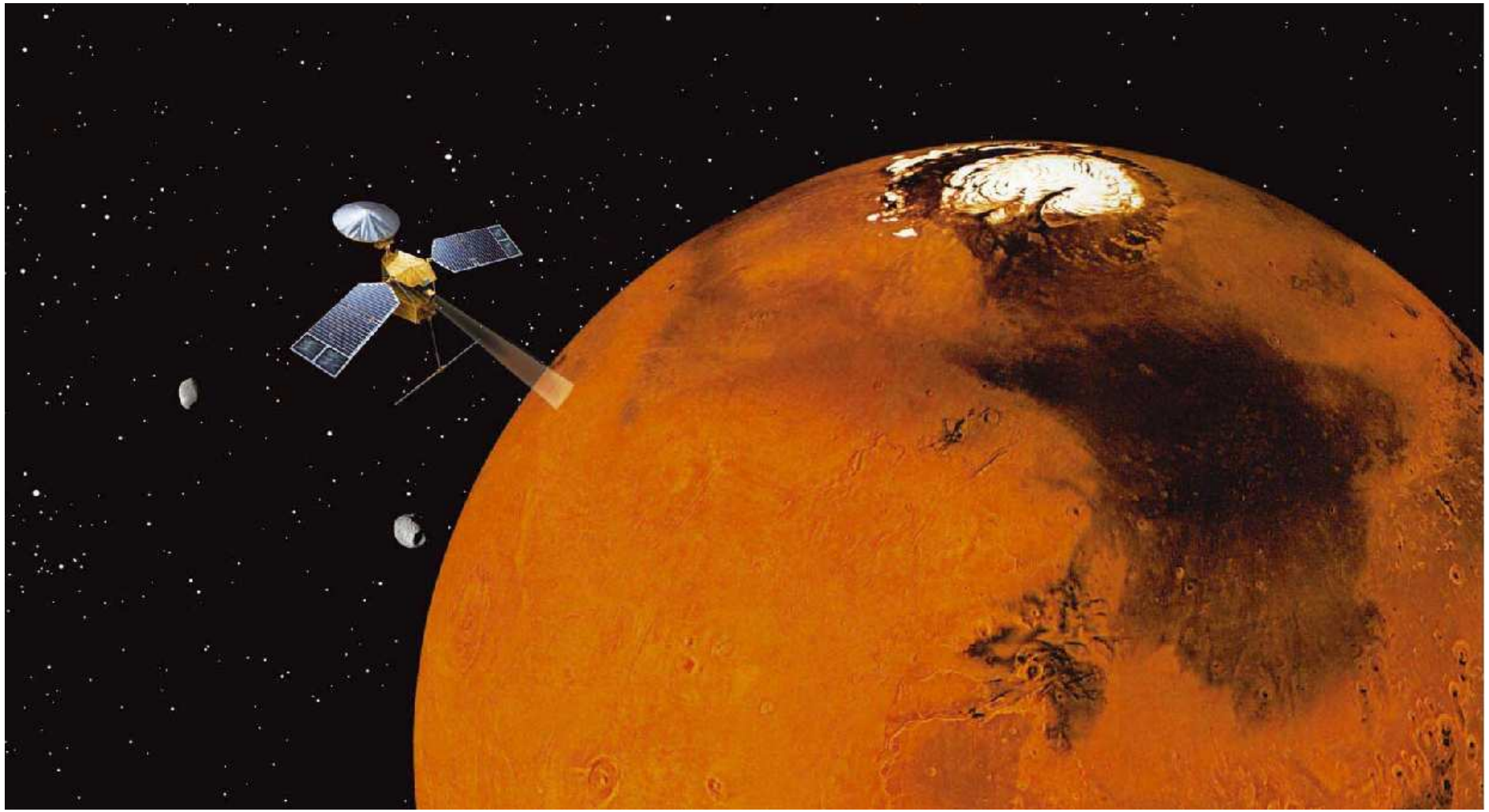






The first sentence of *Introduction* comes from Mars

We wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A).



(Evidence that our DNA really does come from Mars)

Two more examples of opening sentences, apparently coming from Mars:

Gallia est omnis divisa in partes tres

The autonomic nervous system is divided into three parts: the sympathetic nervous system, the parasympathetic nervous system and the enteric nervous system.

Let us go back even earlier than 1953, and hunt for *Introduction* in a 1917 paper by Peyton Rous, and then jump forward to 2004 to a paper by Richard Doll, comparing the styles

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THE INFLUENCE OF DIET ON TRANSPLANTED AND SPONTANEOUS MOUSE TUMORS.*

By PEYTON ROUS, M.D.

(*From the Laboratories of The Rockefeller Institute for Medical Research.*)

PLATE 21.

That cancer progresses relatively slowly in emaciated, old people has long been known; but the influence on the disease of general nutritive conditions as thus indicated has only lately attracted wide attention, following the observation that some strains of transplantable tumors grow badly, or not at all, in emaciated hosts. Moreschi[1] was the first to study the phenomenon systematically. He found that grafts of mouse sarcoma grew less frequently and more slowly in animals losing weight on a low diet. But, though he thus demonstrated that malnutrition of the host affects adversely bits of strange tissue as yet unvascularized and unattached, he did not take up the influence of the factor on large growths, on recurrences, and on the development of metastases, or, in other words, on neoplastic conditions such as require palliative treatment in human beings. Experiments in this direction which I began[2] shortly after Moreschi's paper was published demonstrated the fact that a tumor which does badly when transplanted to hosts previously underfed may be quite uninfluenced by dieting begun after the growth is vascularized and has started to develop. Nodules of the Flexner-Jobling rat carcinoma, a few millimeters in diameter, grew with equal rapidity in hosts emaciating on a restricted ration and in controls gaining weight on the same sort of food (text-figures 1 and 2). The Jensen rat sarcoma, on the contrary, even after it had

Mortality in relation to smoking: 50 years' observations on male British doctors

Richard Doll, Richard Peto, Jillian Boreham, Isabelle Sutherland

Abstract

Objective To compare the hazards of cigarette smoking in men who formed their habits at different periods, and the extent of the reduction in risk when cigarette smoking is stopped at different ages.
Design Prospective study that has continued from 1951 to 2001.
Setting United Kingdom.
Participants 34 439 male British doctors. Information about their smoking habits was obtained in 1951, and periodically thereafter; cause specific mortality was monitored for 50 years.
Main outcome measures Overall mortality by smoking habit, considering separately men born in different periods.
Results The excess mortality associated with smoking chiefly involved vascular, neoplastic, and respiratory diseases that can be caused by smoking. Men born in 1900-1930 who smoked only cigarettes and continued smoking died on average about 10 years younger than lifelong non-smokers. Cessation at age 60, 50, 40, or 30 years gained, respectively, about 3, 6, 9, or 10 years of life expectancy. The excess mortality associated with cigarette smoking was less for men born in the 19th century and was greatest for men born in the 1920s. The cigarette smoker versus non-smoker probabilities of dying in middle age (35-69) were 42% *v* 24% (a twofold death rate ratio) for those born in 1900-1909, but were 43% *v* 15% (a threefold death rate ratio) for those born in the 1920s. At older ages, the cigarette smoker versus non-smoker probabilities of surviving from age 70 to 90 were 10% *v* 12% at the death rates of the 1950s (that is, among men born around the 1870s) but were 7% *v* 33% (again a threefold death rate ratio) at the death rates of the 1990s (that is, among men born around the 1910s).
Conclusion A substantial progressive decrease in the mortality rates among non-smokers over the past half century (due to prevention and improved treatment of disease) has been wholly outweighed, among cigarette smokers, by a progressive increase in the smoker *v* non-smoker death rate ratio due to earlier and more intensive use of cigarettes. Among the men born around 1920, prolonged cigarette smoking from early adult life tripled age specific mortality rates, but cessation at age 50 halved the hazard, and cessation at age 30 avoided almost all of it.

Introduction

During the 19th century much tobacco was smoked in pipes or as cigars and little was smoked as cigarettes, but during the first few decades of the 20th century the consumption of manufactured cigarettes increased greatly.[1] This led eventually to a rapid increase in male lung cancer, particularly in the United Kingdom (where the disease became by the 1940s a major cause of death). Throughout the first half of the 20th century the hazards of smoking had remained largely unsuspected.[1] Around the middle of the century, however, several case-control studies of lung cancer were published in Western Europe[2-6] and North America,[7-10] leading to the conclusion in 1950 that smoking was "a cause, and an important cause" of the disease.[5]

1951 prospective study

This discovery stimulated much further research into the effects of smoking (not only on lung cancer but also on many other diseases), including a UK prospective study of smoking and death among British doctors that began in 1951 and has now continued for 50 years.[11-17] The decision that this study would be conducted among doctors was taken partly because it was thought that doctors might take the trouble to describe their own smoking habits accurately, but principally because their subsequent mortality would be relatively easy to follow, as they had to keep their names on the medical register if they were to continue to practise. Moreover, as most doctors would themselves have access to good medical care, the medical causes of any deaths among them should be reasonably accurately certified.

The 1951 study has now continued for much longer than originally anticipated, as the doctors did indeed prove easy to follow, and they provided further information about any changes in their smoking habits along the way (in 1957, 1966, 1971, 1978, and 1991). A final questionnaire was sent out in 2001.

By 1954 the early findings[11] had confirmed prospectively the excess of lung cancer among smokers that had been seen in the retrospective studies.[2-10] Findings on cause specific mortality in relation to smoking were published after four periods of follow up (after four years,[12] 10 years,[13] 20 years,[14 15] and 40 years[17]). The early results from this study,[12-14] together with those from several others that began soon after, showed that smoking was associated with mortality from many different diseases. Indeed, although smoking was a cause of the large majority of all UK lung cancer deaths, lung cancer accounted for less than half of the excess mortality among smokers.

As recently as the 1980s, however, the full eventual effects on overall mortality of smoking substantial numbers of cigarettes throughout adult life were still greatly underestimated, as no population that had done this had yet been followed to the end of its life span. The present report of the 50 year results chiefly emphasises the effects on overall mortality (subdivided by period of birth) of continuing to smoke cigarettes and of ceasing to do so at various ages.

Abstract writing can be a challenge: Brevity is the soul of wit

Some journals have strict limits of 200 words

Intoduction: 100 years ago, scientific style was somewhat different than today

- We don´t usually present figures in the Introduction
- Introduction tends today to be rather short, without lengthy literature review, which tends to be placed in Discussion

Introduction

- I try to give a hint about how the problem is to be solved already in the first paragraph of *Introduction*

Methods

- A receipe in a cookbook: ideally, others should be able to replicate your experiment based on reading *Methods*
- You should know your methods before you start the experiment, so you might as well write it now
- *Methods* can often be recycled (cut and paste) from a protocol

Let us look for *Methods* in Peyton Rous, and compare with Richard Doll

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Results

- You probably should wait until you have completed the experiment before writing *Results*
- Resist the temptation to trespass in *Discussion* in the *Results* section
- Go back to Peyton Rous, M.D., and identify *Results* section. Note that 100 years ago, the review of previous literature (now presented in *Introduction* and *Discussion*) seem to have less well-separated than today

Discussion

- Writing *Discussion* can be quite difficult if there are many aspects to the study
- I like to present the main finding in the first paragraph
- Impose as much order as possible, by proceeding smoothly from one topic to another (this is a creative process)
- Back to Peyton Rous and Richard Doll

Corrective surgery for the reanimation of a pig: A work in progress

Case 1: Analysis and correction of part of the thesis of a native Danish speaker

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In the revised document I have attempted to improve writing style

During the next hour, I shall attempt to justify to you the various changes, shown as red text in the corrected document.

The aim is always to obtain maximal clarity

Case 1 provides examples of:

- Factual errors
- Logical fallacy
- Vagueness about details
- Imprecision of terminology (avoid *levels*)
- Structural failures, where a concept is introduced too early, or an abbreviation is not defined, or is spelled out, having already been defined
- Incorrect paragraph breaks, and bridging
- Sentences too long or too short (avoid run-on sentences)
- Use in incorrect preposition

Corrective surgery for the reanimation of a pig: Case 2

Manuscript by a native German speaker. Compare the two documents, and see if you agree with the changes in red. Some suggested changes are very subjective

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So, having polished two draft manuscripts, let us now build one from scratch

In the final hour, I shall attempt to follow my own rules, and compose a draft manuscript:

Effect of brocolli on survival in a spontaneous mouse tumor model


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