

The logic of medicine—the contribution of general practice to the understanding of clinical method

H. J. WRIGHT, F.R.C.S., F.R.C.G.P., D.C.H.

Senior lecturer, Department of Community Medicine and General Practice,
University of Leeds

The changing aims of undergraduate medical education

Traditionally, undergraduate medical education has been (and to a variable degree, still is) heavily preoccupied with the acquisition of factual knowledge, and with skills. In a word, its traditional emphasis has been content orientated, and, at the time when many of its present teachers were themselves students, its primary aim concentrated on producing at graduation the 'safe' doctor.

However, with the rapid expansion of factual knowledge, and the equally rapid development of technical skills, two facts have become obvious. The first is that no student can hope to learn what there is to be learned by the time of graduation. The second is that, since knowledge and skills are constantly changing, any curriculum which is primarily content orientated is incapable of producing the 'safe' doctor. For even if the graduate's content of knowledge makes him 'safe' today, it will certainly be inadequate tomorrow.

It is only the doctor who has learned to think critically about what he does, about its inherent limitations, and about his attitudes to specific problems, who can (in any sense of the term) be called 'safe'.

So while the student's education needs to be concerned with mastering facts and skills, it must also be very much concerned with learning ways of thinking, and concerned with developing attitudes. The undergraduate curriculum must be process orientated as well as content orientated. The student, that is, must develop his methods of thinking and his attitudes at the same time as he is acquiring factual knowledge and learning skills.

In Britain this view of undergraduate medical education was implicit in the Report of the Royal Commission on Medical Education (1968) when it said:

"We cannot emphasise too strongly that the undergraduate course in medicine should be primarily *educational*. Its object is not to produce a fully qualified doctor, but an educated man who becomes fully qualified in the course of postgraduate training."

Undergraduate education and postgraduate training

The distinction between education and training emphasised by the Royal Commission is important; for while the hallmark of training is its particularity, the hallmark of education is its universality. Training is predominantly concerned with the preparation of an individual for specific tasks, i.e. with skills (and with knowledge insofar as it is relevant to those skills). Education, by contrast, is not confined to specific tasks, nor to skills and their related knowledge, but is also much concerned with ways of thinking and

attitudes. It aims to develop a capacity for 'transfer'—the ability to apply the insights of any one discipline to the problems of another and a capacity for intellectual integration and synthesis.

A generation ago, the medical undergraduate period was designed to train the 'safe' general practitioner—as a base from which to develop the specialist. With the growth of medicine this is no longer possible and, with the advent of vocational training, no longer desirable. The undergraduate period must now become primarily educational; vocational training makes this practicable.

If this is so, each clinical discipline must re-examine the objectives of its undergraduate training in educational terms and define the insights which it can most appropriately offer to all students, no matter what their subsequent choice of professional work proves to be.

This process is illustrated here by examining some of the insights into clinical method which general practice can provide for medical students.

The clinician's function

Clinical medicine is a very practical human activity concerned with the identification, assessment, solution, and prevention of health problems involving people. Because these problems concern people, they exist simultaneously in several dimensions—the physical, the psychological, and the social. More often than not they are multiple rather than single and complex rather than simple in origin.

Thus the student must learn to consider each of these three dimensions at each stage of his problem solving, and to do this he must be able to think critically about the logic and the limitations of the clinical method he uses.

THE ELEMENTS OF CLINICAL METHOD

The elements of clinical method consist of:

- (1) Data collection,
- (2) Communication,
- (3) Assessment of clinical problems,
- (4) Probability, diagnosis, and prognosis,
- (5) Management of clinical problems.

(1) Data collection

The student's first task is to develop skills in collecting data. Traditionally he is taught what questions to ask: 'the complete history', what signs to elicit—'the complete physical examination', and what investigations to request.

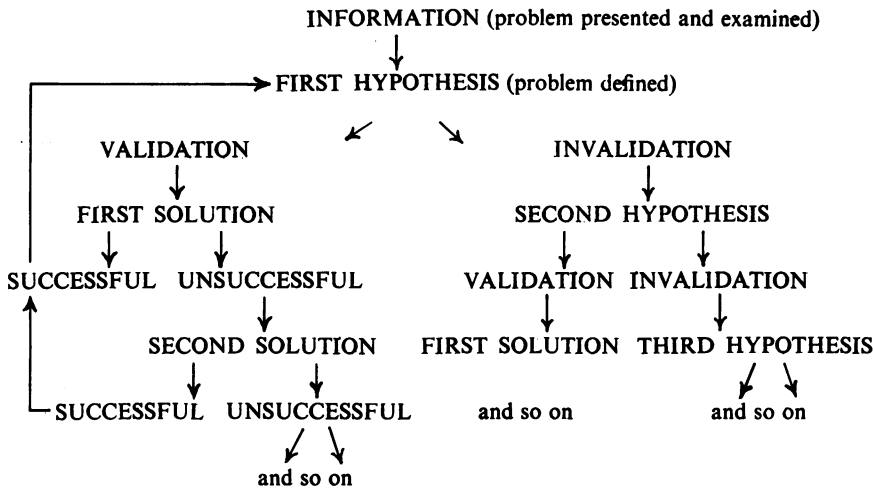
He is taught to distinguish between 'subjective' data offered by the patient and 'objective' data elicited by the physician; but he is unlikely to be taught that much of the 'objective' data elicited by the physician as is 'subjective' as that proffered by the patient; or that the 'complete history' is a complete myth—and is an activity in which no clinician, after graduation, indulges. In a word he is rarely taught the principles of selectivity.

Yet all data collection—like the writing of history—is selective; the student must consciously be aware of the basis of his selection and be able to devise a suitable search strategy for each situation that confronts him.

Perhaps the reason why we do not emphasise this basic skill of selection is that as teachers we still live under Flexner's shadow. Flexner (1925) considered that the basic

aim of all medical education should be to teach the students inductive thinking—that is to teach him to collect facts exhaustively, and then draw conclusions.

But no clinician works in this way. Instead, we work deductively—formulating a series of successive hypotheses, and then collecting *selectively* those facts which will most speedily validate or invalidate them. The process has been portrayed thus:



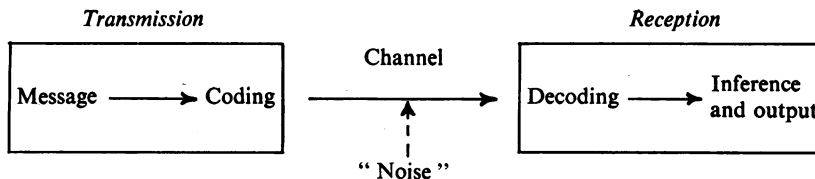
Now one of the singular contributions of general practice to the undergraduate's learning lies precisely here. The student, the consultant, and indeed the newly appointed practitioner alike, often see the process of history-taking in general practice as 'incomplete' or involving 'short-cuts'. But, in fact, history-taking in general practice illustrates a characteristic of all clinical method—comprising a series of systematic moves through a subconscious flow sheet.

Properly formulated and presented to the student, an experience in general practice thus obliges him (perhaps for the first time) to reconsider and develop his ideas of selectivity in history taking.

(2) Communication

Secondly, since all history-taking depends on communication, the student must learn to visualise clearly the processes and hazards of communication, and to recognise the limitations that operate (Parry, 1967).

In analogy with radio communication, the process may be portrayed thus:



This is a picture which every student should formulate in his mind—remembering, as he does so, that whereas the barriers to radio communication have centred around transmission and channel, those of human communication centre equally around perception and interpretation.

Common barriers to communication

Not until the processes of communication are seen in this way can the student learn to respect and manipulate the *common barriers to communication*.

He must, for example, become aware of the barriers in transmission which frequently constrain the patient. He must understand the ways in which the consultation is affected by the patient's perception of the importance of symptoms by the patient's concepts of the doctor's role, by his emotional response to his own problem, and by society's view of what is 'respectable' and what is 'shameful'.

The student must also be able to manipulate and sift the often confused presentation of such problems. Conversely, he must be able to visualise the patient's problems of reception when he himself starts to transmit information, comment, or advice.

At the other end of the communication process, the student must learn to recognise the limitations on his own 'reception.' As a matter of common experience—supported by much research into learning processes—it is clear that training enables the observer to perceive, infer, and perform more efficiently. As a result of his training, the observer's initial hypotheses are performed more rapidly. But the student must recognise that these hypotheses may themselves be barriers to perception. The observer sees what he expects or wants to see. Expectations impose patterns and the clinician who organises and guides the consultation is no exception.

Nor are these expectations created solely by the clinician's training—but by his whole background and upbringing. Here the psychologist's concepts of 'schemata'—of deep-rooted, well organised, personal 'perceptual sieves'—is of the great importance to the student. As Winston Churchill remarked, in another connection,

“When there is a flood the habits of the four-inch drain pipe do not alter. It continues to transmit its customary flow, cheerfully rejecting the rest.”

Thus, to summarise, the student must learn to recognise that his own psychological background and upbringing, his own instruction and training, his own initial hypotheses and preconceptions may all impede perception and accurate inference.

Finally, the student must learn to respect the effect of 'noise'—of 'interference', and 'loss of signal'—on his data collection, and recognise the multitudinous sources in patient, doctor, or environment from which this may arise. Two common examples will illustrate this:

The first is the effects of emotion, anxiety, fatigue, depression, drugs, or of illness itself on the patient. This perhaps is obvious and yet is often forgotten.

The second, equally common source of 'noise' is the doctor himself. The traditional teaching on history-taking often implies to the student that the consultation be guided and structured by the physician, *not* by the patient. In so doing a catastrophic amount of 'noise' may result; obliterating the real message. One is reminded of the old dictum “if you only ask questions, you will only get answers.”

Thus, the student must learn to handle communication with respect and imagination. It is perhaps easier for him to learn this in the setting of the undifferentiated problems which general practice presents than in the setting of specialised hospital care.

Methods of communication

Besides becoming familiar with the common barriers to clinical communication, the student must extend his understanding of ways of communicating data—of behavioural as well as of verbal codes.

This is a vast field in which the medical student should have a sound grounding.

But in particular there are two broad codes of behavioural communication which are of great practical importance to his clinical practice—the ‘individual’ and the ‘interactional’ codes.

‘Individual’ behavioural codes include the codes of posture, movement, gesture, eye movement, facial expression, appearance and dress, and pitch and rate of speaking. All of these may provide both the physician and—in turn the patient—with a wealth of information that neither can afford to ignore.

‘Interactional codes’ include data derived directly from the interaction of people with each other. For example, when the student becomes able to stand outside himself, he will commonly find that he focuses consultations on certain aspects of patient’s problems and blocks the emergence of others; and when he observes this, he may recognise that his selection is not based on any rationally applied scale of importance to the patient, but is due to the fact that he himself finds these aspects easiest and most gratifying to deal with.

Conversely, the student may often find the patient manipulating his objectivity in a whole variety of ways. Not only is it critical that the embryonic physician learns to observe what is happening, but in observing it he may learn much, too, about the aetiology of his patient’s illness.

Here again, because of both the artificiality of the hospital environment and the conditioning that has preceded the patient’s arrival in hospital, it is easier to teach this aspect of data collection to the student in the setting of general practice.

(3) Assessment of clinical problems

Once data have been collected, the student’s assessment of clinical problems revolves around two sets of activity—his notions of normality, and the search for causes.

(a) *Notions of normality*

As a student, I cannot recall ever being stimulated to examine concepts of normality beyond a crude, dogmatic numerical level. It may be different now—but I suspect not, and I suspect too, that most students are not taught to think critically about statistical, prognostic, and omoeostatic concepts of normality at any stage of their clinical education.

Statistical normality. For most students, statistical concepts of normality remain as bald numerate statements (e.g. the normal haemoglobin level is 14 grammes \pm or $-$ two grammes per 100 ml.). The student is rarely invited to refine such statements in terms of quartiles, percentiles, or standard deviations from the mean, let alone to translate such refinements into prognostic terms. This leads to the situation, for example, in which any adult patient with a haemoglobin level of less than, say, 12 grammes and with the appropriate indices, may automatically be seen as a candidate for iron therapy, irrespective of the latter’s unproven therapeutic effects.

Conditional normality. It is only in the realms of paediatrics and general practice that the student is stimulated to think about the variations of such numerate ‘normals’ with age, to develop, that is, the concept of ‘conditional normality’. Yet such a concept is plainly important. That this is so is due, I suggest, to the fact that it is only in these two specialties that the concept of the individual undergoing a continual process of development and change is readily recognised and taught.

Homoestatic normality. But perhaps the most important aspect of ‘normality’ to escape the student is the concept of homoestatic normality. The student in hospital practice is taught, for example, to recognise pulmonary consolidation as ‘abnormal’. Full stop. Yet, in the face of bacterial infection the patient who exhibits such consolidation is far more ‘normal’ than the patient who does not, for he is exhibiting an

important adaptive mechanism. Apply this concept of adaptation and homeostasis to the realm of psychiatric illness, for example, and its importance is both immediately apparent and intensely practical.

In clinical practice, the fact is that concepts of normality which are divorced from concepts of homeostasis are of limited value to the clinician. In practice, he must judge 'abnormality' according to whether it is favourable or unfavourable to the individual's continued ability to adapt to his total environment and this demands, of course, that the physician be *aware* of the patient's total environment.

Conditions which (at a given moment in time) may be labelled 'abnormal' by the statistician or by the pathologist may more rightly be seen by the clinician as 'normal,' indeed necessary responses which (over a period of time) ensure the individual's continued health.

Once again we must recognise the practical difficulties of demonstrating such concepts of homeostatic normality within the artificial environment of the hospital. If the student is to grasp their importance he will do so more easily and quickly in the setting of community practice.

(b) The search for causes

Secondly, in assessing problems, the student must search for causes. Rationally, the question "why has it happened?" must precede any attempt to solve or ameliorate his patient's problems.

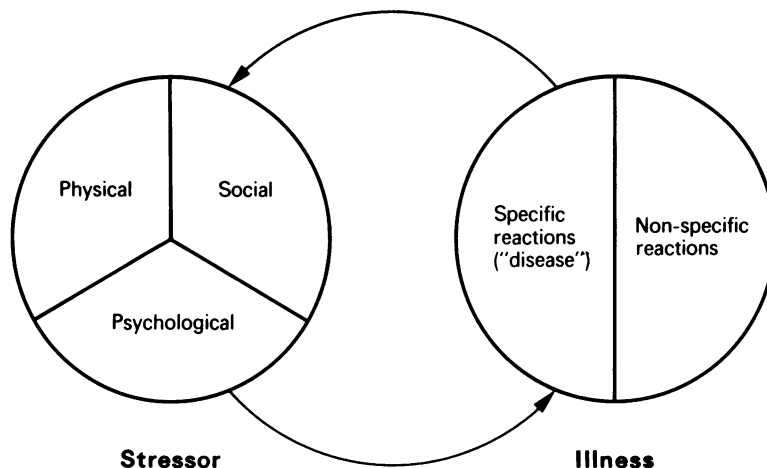
Here we need, I suggest, to widen the student's understanding of human ecology and not only his understanding of the multitudinous physical and chemical stressors (pollution of all sorts, radiation, drugs, dietary patterns) which successive waves of technology leave in their wake, but equally important his awareness of psychological and social stresses.

In this connection, the work of Wolff (1968), Dunbar (1954) and many others on human physiological response to psychological stress has had scant attention drawn to it in undergraduate education. Yet this work has produced much good evidence that such diverse physiological activities as nasobronchial secretion, pulmonary function, cardiac output and ECG patterns, gastric acidity, skin secretion, cholesterol levels, glycosuria, and ketonuria are all affected by psychological stressors.

Clinically the everyday problems which may be associated with or exacerbated by, psychological stress may be grouped as follows:—

Predisposition to disease and trauma:	e.g. childhood injury
Symptoms:	e.g. palpitation, dizziness, backache
Physiological dysfunctioning:	e.g. enuresis, asthma
Organic disease:	e.g. peptic ulcer, ulcerative colitis, acne
Retreat reactions:	e.g. Anxiety states, depressive illness, phobias, hysterical manifestations, abuse of drugs, food and persons, suicide
Psychoses	
Mal-utilisation of medical care	

The work of Selye (1936 and 1957), Wolff (1968), Dunbar (1954) and Mason (1968) and others on stress reactions indeed leads us away from a restricted concept of disease entities to a view of illness as the total adaptive response of the individual to noxious elements in his environment. Such a view might be portrayed thus:



This emphasises that disease and illness are not only produced by, but themselves produce, stressors on the individual.

If the physician is to assist, rather than hinder, the patient's homoestasis he must be able not only to assess the aetiological factors fully, but he must also be aware of the chain reactions they may set up in the individual.

(4) Probability, diagnosis, and prognosis

While the student must learn the constraints and the techniques of data collection and the hazards of communication, he must develop his concepts of normality. And he must learn to search for causal associations, if need be over a wide field. Classically his next task is then to establish a 'diagnosis' which defines the morbid processes and their causes, makes predictions about these processes, and predicts the result of intervention.

To do this he must learn to define the degrees of probability—of certainty/uncertainty—with which he can proceed. He must learn that there are many situations in medicine where a high degree of probability is unachievable, and where his task is to live with uncertainty, making decisions on inadequate data. As Lord Platt is reputed to have remarked:

“ If you cannot reach a diagnosis,
for God's sake reach a decision.”

It is here that we reach a critical point in the student's thinking. Early in his career the student needs to perceive that all information derived from observation falls into two basically different categories—sign information and content information (Wright, 1973).

(a) Sign information

This closely resembles information transmitted in artificial communication systems like morse code.

(1) In a given context each sign is specific, unambiguous, and cannot distort the coder's intention (e.g. three dots followed by a dash represents the letter ' V ').

(2) Secondly, each sign operates within a finite range of related signs (e.g. in transmitting the messages in the English language by morse code this range numbers 26—corresponding to the letters of the alphabet).

(3) Thirdly, because it is both specific and operating within a finite range, *sign information expresses a probability and reduces uncertainty*. Thus, in the example, as the

receiver picks up the message of three dots and a dash, the probability of correct interpretation is increased from $1/27$ to $1/1$.

(b) *Content information*

Content information by contrast has none of these three characteristics. It is descriptive, and may carry different meanings for the patient and for the doctor. It connotes attributes which cannot be measured and quantified and which do not operate within a finite range. It does not, therefore, necessarily reduce uncertainty, nor does it express a mathematical probability.

These differences between sign information and content information are well illustrated in two everyday clinical examples. The statement that "the left conjunctiva is red" illustrates sign information. The patient who says "I have a painful tender swelling" is transmitting content information.

Why is it important for the student to recognise the difference between these two types of information? There are two reasons.

First, because he will often hear his teachers emphasising the need to make medicine more 'scientific', and disparaging the 'non-scientific'.

Now the essence of the scientific method is that it formulates theories from the data available, uses these theories to make predictions, and then subjects the predictions to test and refutation. Any theory which can be used in this way is rightly called 'scientific', and until it is disproved (refuted) is regarded as 'true'.

By contrast, theories which do not allow prediction and testing are *not* scientific. This, however, is not to say that they are not useful and of practical and interpretative value.

As an example of a scientific theory, we may recall Metchnikow's theory that irritation of normal human tissue is always followed by an inflammatory response. This prediction has not yet been refuted, and it allows us to conclude that whenever we observe the classical signs of inflammation we should search for the irritant.

An example of a non-scientific theory is Freud's theory of the neuroses. This cannot, by its very nature, be subjected to refutation. But, though by definition it is not 'scientific', it is of great interpretative value in everyday clinical care.

Secondly, it is important for the student to be able to distinguish between these two kinds of information because one of his tasks as a clinician is to convert content information into sign information wherever this is possible.

e.g. Patient: "I have a pain in my right lower tummy, I feel sick and off my food. It hurts when I press."

Doctor: "You have acute appendicitis."

The patient's statement is almost pure content information, the doctor's sign information—defining a probability and enabling predictions to be made which are capable of refutation (in this case by the surgeon or the pathologist).

Whilst such situations (in which content information can be transformed into sign information) are comparatively common in the medical and surgical wards of a hospital they are less common in general practice and in psychiatry. The reason for this is perhaps obvious—for while many of the specific reactions of *disease* can be expressed as sign information (allowing prediction), the non-specific elements of *illness* can only be handled interpretatively and do not allow probabilistic predictions to be made.

Every clinician (in all branches of medicine) works with both sign information and with content information, with observations amenable to scientific method and with observations not so amenable. The student must learn to handle this quality in medicine

clearly and firmly, early on in his education otherwise he will constantly attempt to be 'scientific' in situations where this is inherently impossible. Furthermore, he must learn to live with the inescapable uncertainty which content information carries. He is more likely to be able to achieve this if part of his learning is set in general practice than if he learns exclusively in institutions dedicated to the 'scientific' approach.

(5) Management of clinical problems

Finally, the student must learn the principles of prevention and intervention in patient's problems. There are two aspects of management which merit special attention.

(a) *Concepts of prevention, cure, and palliation*

The student must be encouraged to escape from the traditional dividing lines drawn between prevention, palliation, and cure. A much more useful concept is that of "primary, secondary, and tertiary prevention" popularised by Morris (1962). This shifts the commitment of the clinician both to the left and to the right of traditional "treatment," seeing management as a spectrum which extends from a point before the problem arises to a point where the patient's homoeostasis is maximally restored.

Any view of clinical management which falls short of this spectrum is an inadequate picture; and it is simply not possible for the student to experience this spectrum in full unless part of his education takes place outside the hospital.

(b) *Counselling*

The second aspect of management which must be mentioned here is that of counselling.

With the shift of morbidity patterns which we have witnessed over the past generation, and with the predominance which chronic disease on the one hand, and neurotic illness on the other, have achieved, it is long past time that the student learned something of the indications for, and the skills of, counselling in management.

Classically, the clinician's approach to management has been authoritarian; and while, of course, there remain wide areas of therapeutic management in which crisp, authoritarian, factual advice is essential, there are also increasing situations in which it is unproductive or irrelevant.

In so far as hospital-based clinicians continue to see this area of counselling as the function of the family physician rather than of themselves, it is again to general practice we must turn in order to provide the student with opportunities in which he may learn something of its demands.

The contribution of general practice to undergraduate education

When we come to look, therefore, at the knowledge, skills, modes of thinking, and attitudes which the undergraduate medical student needs to acquire, it is plain that some of his needs are more readily met, indeed can *only* be met, in the setting of general practice.

I only discuss here the student's needs in learning clinical method. But there are, of course, other important objectives, too, which are also more readily achieved in the setting of general practice than in the setting of hospital care. For example, in the realms of *factual knowledge* the student is able to extend his experience of disease to many of those conditions which never reach hospital. In the realm of *skills*, he can experience the demands of early diagnosis, of continuing care, and of the care of specific groups. In the realm of *attitudes* he can experience some of the complex issues of ethics and of social responsibility in medicine with a sense of immediacy not so readily achieved in the setting of a hospital. An extended period in general practice has thus much to offer the undergraduate medical student.

But there can be no proper rivalry here. Medicine is a unity—whether it is practised inside or outside an institution. Both the student and his teachers must see it as such. What is taught and where it is taught is ultimately less important than what is learned.

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