Understanding Ulcers: Medical Knowledge, Social Constructionism, and Helicobacter Pylori

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Paper published in
Annual Review of Health Social Sciences (1996) 6:1-39.

The study of historical change in the content of medical knowledge in regard to specific illnesses or diseases provides sociologists with the opportunity to investigate both social processes and social theory. In this study of medical knowledge, propositions from the social constructionist school of sociology are utilised to highlight the way new knowledge about ulcers is generated, and to identify the cultural and social factors which inhibit the dissemination of new knowledge. The paper then explores recent challenges to this school of thought, using the case study of ulcers to suggest that there are limits to social constructionism and its capacity to explain change in medical knowledge and practice.

Social constructionism, though it has its antecedents in the works of Marx and Durkheim, is a relatively recent development in the social sciences. It has been described as a school of research within which there are many diverse, and perhaps incompatible views (White,1991:72; Bury,1986:138). Though the school is unified neither politically nor theoretically, social constructionism brings together scholars who share an opposition to the 'traditional social scientific view of medicine' (Short,1989:6).

Perhaps the most significant outcome of social constructionism for the sociology of health and illness has been to problematise medical knowledge. Its focus has been on the construction of knowledge in daily social practice and the way in which knowledge reflects social, historical, and political phenomena. The school of social constructionism offers a number of common themes or research strategies rather than specific theoretical approaches.

The first of these themes refers to medical knowledge as a product of the social context. This is an explicit rejection of the proposition that medical knowledge is ontologically different from other areas of knowledge. Rather, all knowledge is understood to be the product of social processes and is socially negotiated. The language and knowledge of medical science is not 'technical', set apart from social processes, but a set of social categories that filter and construct experience (White,1991:71-2). According to social constructionism, the 'objects' of medical knowledge are 'social' rather than 'natural' products (Bury,1986:137) because the content of medical knowledge does not come from nature. The scientist does not merely 'discover' natural laws which define reality. Social constructionism proposes that the classification of nature and the order assigned to nature are constructs imposed upon the world (Romanucci-Ross & Moerman,1991:391). It demonstrates that medical knowledge, even supposedly 'biological facts,' embody and express social values and social inequalities. Indeed the very structure of medical knowledge is an outcome of the social, political, and economic concerns of the social groups who produce it (White,1991:77). As a consequence, medical knowledge can be understood as a product of the distribution of power and authority.

A second theme of social constructionism is that social practices are mediated by medical knowledge (cf: White,1991:71). Given that medical knowledge embodies social structures of inequality such as class, ethnicity and gender, the medical profession takes a role in maintaining social order, using its powerful position in the social structure to shape and control social practices. In effect, the medical profession uses the inherently unequal basis of orthodox medical knowledge to ensure its own status. Various studies have demonstrated that the claim of expert knowledge has provided the professions with occupational success, power, prestige and reward (eg. Freidson,1970; Larson,1977).

A third theme of social constructionism is that innovation in medical knowledge occurs through a social, rather than technical or logical process of development. It is contended that change in medical knowledge is not explicable in terms of a linear process of continual 'discovery'. Instead, medical knowledge has a social history which is open to sociological analysis like all other histories (White,1991:72). This perspective challenges the view that 'truth' inevitably triumphs and that current (Western) medical knowledge is the repository and culmination of this

'truth'. Social constructionism proposes that all new medical theories, *whatever their truth value*, are subjected to social factors which shape and retard their development and dissemination.

"Resistance to innovations in medicine may be said to be the rule rather than the exception." (Stern,1941:175).

These various thematics within social constructionism can be drawn upon to explore developments in medical knowledge about ulcer disease, and explain the historical process of change in scientific research and clinical treatments. In addition, the case study of ulcer disease offers an opportunity to examine some of the problems posed by the theoretical framework of social constructionism.

Medical Knowledge and the Treatment of Ulcer Disease

Stomach or duodenal ulcers have recently come to be defined as sores or lesions that form in the lining of the stomach or duodenum. Ulcer disease is said to effect 20% of adults during their lifetime (Alper & Spalding,1985:17). For over one hundred years, Western medical knowledge proposed that ulcer disease was caused by lifestyle factors such as stress and diet (eg. the consumption of alcohol, drugs or smoking).

During the early part of the twentieth century, researchers began to explore the relationship between ulcers and the psyche, perceiving some types of illness as the expression of psychic conflict (eg. Freud,1924). 'Personality profiles' were devised, linking specific illnesses to personality 'types', psychic 'disorders' or attitudes (eg. Dunbar,1938; Williams,1961:3-8; Grace & Graham,1952). The relationship between ulcers and family environment was examined, and it was suggested that ulcers occur in young men where there is a history of maternal 'dominance', paternal 'passivity', closer than average emotional ties between mother and son, and an inability to express aggression (eg. Goldberg & Kanter,1958). Many practitioners came to consider ulcer disease as 'psychosomatic' (eg. Lachman,1972), a term often used interchangeably with 'malingering', particularly given that the number of ulcer disease sufferers fell during periods of severe economic depression and rose with economic recovery (Figlio,1982:209).

By the 1950s researchers announced the discovery of the biological mechanism linking the digestive fluids (such as hydrochloric acid and pepsin) with activities of the nervous system. This finding supported biomedical explanations for the existence and formation of ulcers. It was argued that the nervous system could trigger physiological responses in the body, such as increasing or decreasing the flow of gastric juices in the stomach and duodenum. Excessive levels of gastric acid could overwhelm the normal protective mechanisms, alter normal alkalinity, and allow the acids to dissolve the stomach lining (eg. Moss,1973:121-3).

Treatment strategies for ulcer disease slowly altered as knowledge about the underlying cause of disease also changed. There was a noticeable shift from psychotherapy and family therapy to the manipulation of diet and lifestyle. Patients were advised to eliminate 'rich' and spicy foods, and minimise the consumption of stomach 'stimulants' and 'irritants' such as tea, coffee, alcohol and cigarettes. Consumption of 'bland' and 'protective' foods such as milk and poached eggs were recommended. The new strategy was aimed at reducing acid production in order to better protect the stomach lining, and the new focus was on self-management by the patient.

This change in medical knowledge about ulcers and its treatment reflected other cultural changes. With the new knowledge about diet and lifestyle, most ulcer patients were expected to 'cure' themselves through appropriate behavioural modification and the self-medication of antacids. Where the ulcer sufferer was previously considered to be suffering a form of neurosis (a 'victim' of family and personality), they had now become vulnerable to the charge of being irresponsible or even a 'deviant' member of society, unable or unwilling to take on the moral responsibility for 'self-maintenance' and 'self-preservation' by controlling their consumption of alcohol, food and various toxic substances. The shift in medical explanations of illness and treatment strategies echoes wider cultural changes, since the explanatory categories of medicine derive from categories which are in common daily use, both within and outside medicine (cf: Edwards,1992), and all classificatory schemes are historically specific (White,1991:61). The change in focus toward individual responsibility for health is not restricted

to ulcer disease, but can be understood as part of a broader movement in Western societies toward a body-centred culture that emphasises physical fitness in order to combat processes of deterioration and decay (cf: Turner,1992:165).

While the emphasis on lifestyle has never been fully transcended, by the 1970s the push towards a drug based therapy was given impetus by claims that H_2-antagonists could counteract ulcer formation. These powerful new drugs were developed for the specific purpose of reducing the production of acid in the stomach and eliminating the need for restrictive diets for ulcer sufferers. The most common H_2-antagonists were sold in Australia under the names of Tagamet and Zantac. International drug companies, conceptualising ulcers in terms of biochemical disorders, claimed that gastric acids break down the protective lining of the stomach, causing the formation of ulcers. Furthermore, the companies claimed that the use of these H_2-antagonists drugs heal 65% of stomach ulcers and 70% of duodenal ulcers *(Economist*,1983:61).

This case demonstrates the market value of medical products and one of the common social uses of medical knowledge. The production of the H_2-antagonist drugs has earned millions of dollars per year for the pharmaceutical companies. In 1982 Tagamet was providing SmithKline with 30% of its $US3 billion sales and two thirds of its $450 million profits *(Business Week*,1982). Zantac, (the main competitor) provided Glaxo with $65 million worth of sales in Italy alone in its first nine months of sales (ibid). Using social constructionist approaches, various studies have examined the use of medical knowledge by various groups and institutions for their own benefit. For example, Doyal & Pennell (1983), Figlio (1982), and Navarro (1976) offer analyses of the instrumental use of medical knowledge as a tool of capital.

At the time when SmithKline had annual worldwide sales of $925 million for its drug Tagamet, and Glaxo was rapidly expanding its market share of Zantac, an Australian proposed a radically different cause of ulcers. A gastro-enterologist, Robert Warren, working in the Royal Perth Hospital in 1979, noticed bacteria in the biopsies of tissues taken during routine endoscopy examinations. He discussed his findings with various colleagues but his ideas were quickly dismissed. For 100 years the standard textbooks had stated that such organisms could not grow in the acid environment of the stomach. Eventually in 1982, a microbiologist, Barry Marshall, became interested in Warren's claims. Together they set up a research project and, after initial difficulties, systematically identified the presence of a micro-organism around the site of stomach ulcers and in the tissue of patients with gastritis (an inflammation of the stomach lining).

This organism, a small spiral bacterium, was found to inhabit the mucus layer in the gastric mucosa. Although the scientists thought it possible that the bacterium may be the prototype for a *new* genus, they initially included it in the genus *Pyloric Campylobacter*. Classification in this genus was thought to be the most appropriate given the organism's similarity of structure to others in that group, and given its association with similar diseases (Marshall, McGechie *et al,*1985:442). The initial study was repeated, and in January 1983 the original observations were confirmed (ibid:439). The research was first publicised in the prestigious international medical journal *The Lancet* (Marshall,1983; Warren,1983). Further research by Marshall and various colleagues continued to support the identification of this organism (Marshall & Warren,1984; Marshall, Royce *et al,*1984; Marshall, Armstrong *et al,*1985; Marshall, McGechie *et al,*1985) as did research in other countries (eg. Langenberg *et al*,1984; Jones *et al*,1984).

The announcement of the presence of the *campylobacter* bacterium in patients with stomach ulcers and gastritis represented a radical shift in knowledge about ulcers. Marshall and Warren were proposing that ulcer disease is a bacterial infection that can be treated with antibiotics. The claim is not that the bacteria produces ulcers, but that it allows the stomach wall to be attacked by acid. This occurs because the bacteria attacks the mucosal lining (a lining which protects the stomach wall from gastric acids) by burrowing beneath this lining and slowly digesting it. While this is occurring, the bacterium is protected from stomach acids, but its action consequently weakens the stomach lining allowing acid to find its way to the stomach wall. An ulcer can then form on the stomach wall where the mucosal lining has been weakened. Where the acid has reached the stomach wall, the acid also kills the bacterium, explaining why the organism is not found within the ulcer itself but only in the surrounding tissue (Alper & Spalding,1985:18). Marshall's later studies concluded that the bacteria could be found

in 90% of patients with duodenal ulcer, 67% of those with benign gastric ulcer, and 61% of patients with non-ulcer dyspepsia (Marshall, McGechie *et al,*1985:439).

The proposition that infection rather than psychosis or diet cause ulcer disease was put forward as an explanation for why, while H_2-antagonist drugs are quite efficacious, they do not prevent the recurrence of ulcers. It has been estimated that between 70 and 90% of all ulcer patients develop another ulcer within five years of the treatment (Boyd *et al,*1984). Previous explanations for the high rate of relapse were put forward by some practitioners (including Sir James Black of King's College Medical School in London and the discoverer of Tagamet in 1972) who argued that the use of acid-suppressing drugs might create conditions in the stomach which encourage ulcers to form *(Economist,*1987:80). Another suggestion is that the H_2-antagonists merely suppress the symptoms of ulcer disease and do not 'treat' the underlying cause of disease.

Business analysts were not slow to recognise the effect this discovery could have on the ulcer drug market and the cost of health care. They discussed the possibility of plunging sales for SmithKline's ulcer drug, the company which had the largest market in 1985 (eg. Schiller *et al*,1987:46; Alper & Spalding,1985:17). Others predicted that the use of antibiotic therapy rather than Tagamet would dramatically reduce health costs to the consumer and government as antibiotics could be supplied at about a quarter of the price of H_2-antagonists (eg. Alper & Spalding,1985:17).

Despite the new knowledge claims of Marshall and his colleagues, little changed in the practical management of the disease. While the claims were recognised in the change of the name of the organism - from *campylobacter pyloridis* to *helicobacter pylori* (evidence of its recognition as a new genus) - the use of H_2-antagonist drugs has continued. Zantac remains the world's top-selling drug, accounting for half of Glaxo's $5.1 billion sales *(Economist*,April,1991:70), and new H_2-antagonist drugs are being brought onto the market. These new acid suppressant drugs include omeprazole by the Swedish firm Astra *(Economist,*March,1991:80) and Losec by Merck *(Economist,*1990:69). Furthermore, the medical treatment of ulcers has hardly changed since the discovery of the organism. In 1994 many medical practitioners still do not regard antibiotic therapy as the first form of treatment for ulcers. Some practitioners estimate that 30% of doctors use this treatment (Vines,1994:12), but a study of veterans in Australia concluded that only 2.3% of patients were being given antibiotics rather than acid-suppressant drugs for ulcer disease *(Daily Telegraph Mirror*,1995).

Medical Knowledge and Scientific Practice

How can practitioner resistance to changing the treatment strategy for patients with stomach ulcers be explained? Social constructionism provides an answer through an examination of the formation and dissemination of medical knowledge. The social constructionist perspective rejects the idea that changes occur in medical knowledge as an inevitable outcome of a 'progressive unfolding' (Wright & Treacher,1982:12). In its place, changes in medical knowledge are understood to occur as an historical, cultural, social and political process. This approach requires an exploration of the relationship between medical knowledge and the social organisation of medicine, and specifically, interaction between the pharmaceutical industry, the scientific medical community, and government regulatory and funding bodies.

In the case of ulcer disease, the scientific and medical community strongly resisted the adoption of the new theory and its associated therapies. Late in 1984, one of the researchers, Barry Marshall, toured the US trying to convince others of the new theory (Alper & Spalding,1985:17). He recruited few followers. Some of his critics dismissed the claim of a causal relationship between *campylobacter pyloridis* and ulcers. They argued that the bacteria are merely opportunistic organisms attracted to abnormal mucosa (cf: Bradford Hill,1965). Others suggested that while the bacteria may have some role in ulcers or gastritis, it could not have a primary, causal role. Some criticised Marshall and Warren's methodology. It was suggested that there had been an insufficient control group in the study, and more patients without ulcers or gastritis should have been examined to ensure the link between bacterial infection and the condition (Andersen & Nielsen,1993; Alper & Spalding,1985:17).

The new theory of ulcer disease has been claimed as a paradigmatic shift in medical knowledge. The concept of paradigms comes from Kuhn's view of innovation which he derived

from Fleck's idea of 'thought styles' (White,1991:58). Paradigms are networks of ideas, containing conceptual categories, relationships, theories, examples and methods. According to Kuhn, paradigms allow knowledge to grow rapidly, providing a systematic school of thought which defines both the research problem and its solution (1972:84-5). Paradigms also offer a model of social change, because they are understood as fundamentally dynamic, containing the 'seeds of their own destruction' (ibid). However, contra Kuhn, paradigms are also viewed as moral constraints which, rather than bringing about innovation in science, prevent change (Mulkay,1972:130-1).

This alternative view is supported by the case of ulcer disease where Marshall and Warren's claim was not approached with 'detailed, unemotional investigation' as dictated by Merton's 'norms' of scientific behaviour (Merton,1972), but with resistance, intellectual rigidity, and, in many cases, a re-affirmation of established theories. The concept of paradigmatic change is also challenged by the case study because it fails to define how much alteration must occur for there to be 'paradigmatic change'. In this case the researchers argued for a new approach to ulcer disease, but their claims were not completely radical. They did not challenge the existence of the disease itself, nor the orthodox medical model of illness and disease. In fact the new knowledge further medicalises ulcer disease because it supports medical intervention rather than behaviour modification. In this sense the new knowledge reaffirms drug intervention - the 'triumph of allopathic medicine' (Romanucci-Ross & Moerman, 1991:395-6) - and remains within the positivist scientific paradigm which focuses on the creation of scientific facts.

Marshall was keen to convince the scientific and medical community of the truth of his claims. He did what a number of scientists do - he experimented on himself. Marshall swallowed a culture of *C.pyloridis* bacteria to test his reaction, and subsequently developed a mild illness identified as gastritis which lasted for about a fortnight. This was successfully treated with antibiotics. The action of Marshall was not unique. The most famous example of self-experimentation is the testing of the impact of radium on the skin by the scientist Marie Curie (cf: Reid,1978). A more recent example occurred in the 1970s during the early development phase of the pelletised, enteric coated erythromycin product "Eryc" in Australia's pharmaceutical company FH Faulding. The scientist Bernard Boggiano swallowed the product and asked his local doctor to take regular blood samples in order to test the bio-availability of the antibiotic drug (Collyer,1993:269).

Marshall's action convinced some of his colleagues of the truth of his claim, and they treated it seriously. An editorial in 1981 in the *Medical Journal of Australia* called the finding 'significant', though it was cautious in its endorsement:

"If the hypotheses of Marshall *et al* withstand the challenges forthcoming when these additional data are obtained, then their work will remain forever as a landmark in our knowledge of ulcer disease" (Piper,1985:431).

At this time a few scientists, such as Sherwood Gorbach from a medical school in Boston, were cautiously suggesting there was enough evidence of the role of *campylobacter pyloridis* to recommend clinical trials should be set up to test the efficacy of antibiotics in the clinical treatment of ulcers and gastritis (Alper & Spalding,1985:17).

A clinical trial was set up in 1986 with 100 patients in the Royal Perth Hospital to test the advantages of antibiotic therapy for ulcer ailments. Preliminary results indicated a similar healing rate between the group taking antibiotics and the group taking the H_2-antagonists, but the antibiotics had the additional effect of reducing the recurrence of ulcers. Marshall concluded that only 20% of those taking antibiotics were troubled by another bout of ulcers or gastritis, but 75% of those who received the H_2-antagonists suffered a relapse with the year *(Economist*,1986:100; Schiller *et al*,1987:46; Marshall, Warren *et al*,1987).

The clinical trial is said to be the 'gold standard' of scientific medicine (White,1991:79; McKinlay,1981:393). Clinical trials, and particularly randomised, double-blind trials, are considered the best method for determining the outcome of drug intervention, as they are understood to provide an 'objective' and 'absolute' method for establishing validity. Such tests are part of the theoretical and methodological 'norms' of scientific practice laid down in a scientific education (Mulkay,1972). In many cases the marketing of medical products is largely

dependent on the results of the clinical trial and the acceptance of these by government regulatory authorities.

Scholars working from a perspective of social constructionism have identified a number of problems with the use of the clinical trial as a method for deciding the efficacy of a given treatment. The basis of the problem is that the protocols and principles upon which the trials are based are drawn from the established paradigms, theories and procedures of science (Richards,1991:219-20, 230). This means the clinical trial is itself a product of social processes. It embodies the values and interests of those who have designed it and those who use it - including members of the scientific and medical community, government and industry. The reputation of the researchers and the public credibility of the sponsoring company have a significant impact on the number of tests completed, the selection of the subjects and trial protocols, and the results of the trials. This social shaping of the process can become apparent when the results of the trials are publicly contested (Collyer,1993:269).

In regard to the sampling process, clinical trials usually test drugs according to a notion of a 'universal' patient. This ignores individual differences as well as those of sex, age, race, body size and shape. The design of clinical trials also reflects the assumptions and expectations of the investigator, as investigators tend to look very narrowly at the causal chain. Investigators are trained to ignore and attempt to remove 'extraneous' factors from a trial, and focus on only one possible chain of cause and effect (Romanucci-Ross & Moerman,1991:395). This means investigators can neglect to notice other effects of the drug therapy, which could present an alternative explanation for the different outcome amongst the groups. Clinical trials are also based on the premise that 'good' sampling techniques ensure a valid outcome. However the test of statistical significance does not protect against the possibility that the outcome can be due to chance (ibid:395-6).

The socially constructed nature of the clinical trial is also apparent in the conventional methodological procedures of the trial itself. Where various treatment regimes are being compared under test conditions, patients are randomly assigned a treatment. They may be given an active drug substance, a placebo treatment, or "no treatment". The goal is to determine which intervention has a statistically significant impact on the condition at hand (Romanucci-Ross & Moerman,1991:393). However all therapy situations are subject to a placebo effect. (This is where improvements in health are attained irrespective of the treatment used). The placebo effect may be considered a response to the *form* of the treatment rather than its *content* (Moerman,1983:3). An example of the placebo effect is where the patient responds to a belief that a drug treatment has been given (White,1996:49) or where the physicians' skills as a therapist bring about an improvement in the patient's condition (Moerman,1983:15). In the clinical trial situation, researchers take into account the difference in outcome between the group given a placebo and the group given the drug substance, enabling them to arrive at conclusions about the effectiveness of the drug. For this reason, the use of placebos is considered essential in a reliable clinical trial.

One of the problems with the use of the placebo in the clinical trial, is that the placebo effect is generally assumed to be constant. In a review of 31 studies of ulcer drug trials however, it was found that the placebo effect could be as low as 10% and as high as 90% (Moerman,1983:13). Moerman argues that variation in the placebo effect can be related to a range of differences in the *form* of the treatment. However, in the interpretation of the results of clinical trials, the healing rates of the patients are taken to be significant, but not the placebo effectiveness. The differences between the placebo healing rates in different studies for ulcer drugs is considered random and is ignored (ibid:15).

The established scientific protocols of the clinical trial explicitly deny the significance of placebo effectiveness and its variability. This indicates that researchers are interested primarily in ascertaining the chemical effect of the drug product rather than producing 'good health' in the patient. As an alternative, researchers could attempt to isolate the causes of the placebo effect, and ascertain why some trials produce healing in 90% of patients with the use of a placebo, while others only produce 10%. Clinical trials could be used as a means of ensuring a 90-100% healing effect from the use of the placebo rather than including the placebo only in order to exclude its effects (Moerman,1991:15; Brody,1980:27).

Social constructionism proposes that the *explicit exclusion* of the placebo in the clinical trial ensures that drug intervention will inevitably appear to be more 'efficacious' than non-intervention. This practice clearly benefits the researchers who have invested resources and reputation in a specialist area of treatment, as well as the commercial sponsors of drug products. It also ensures the continued use of the clinical trial in medical and scientific practice and the high profits of the drug industry.

The outcome of the 1987 clinical trial at the Royal Perth Hospital for the treatment of ulcer disease was received by the medical and scientific community with what Mulkay would have described as displays of 'resistance' and 'intellectual rigidity' (cf: Mulkay,1972). Despite evidence supplied in the clinical trial, the scientific community continued to debate Marshall's claim. Practitioners objected to being told of the need to wear gloves and thoroughly sterilise theatre equipment to prevent infection between patients, particularly when conventional knowledge dictated that bacteria would not be found in such an acid environment. Influential scientists and practitioners wanted to know why only half of the adults with evidence of *C. pyloridis* infection were showing symptoms of gastritis or ulcers (Schiller *et al*,1987:46; Marshall, McGechie *et al*,1985:443), and why a significant number of people with ulcers did not show evidence of *C. pyloridis* infection (Marshall, McGechie *et al*,1985:441). The debate over infection versus diet in the causation of disease continues to be debated within medicine. Although there is considerable support for the bacterial theory of disease in the scientific community, disputes arise irregularly, questioning the role of bacteria and their relationship to illness.

The traditional science view of the 'knowledge making' process is that conflicts over competing knowledge claims are resolved through the provision of evidence via the 'objective' rules of experimental procedure (Martin & Richards,1995:513). In the case of the theory of ulcer formation, scientists used Koch's postulates as an 'objective and technical' method to determine causality (cf: Marshall, Armstrong *et al*,1985). These postulates were devised over a century ago, and are still used, in a modified form. Much simplified, the postulates are that the identified agent is found in each case of the disease; that it is not found as a non-pathogenic agent in other diseases; and that after being isolated and cultured it will bring about the disease in others. In the case of ulcer disease, the use of these postulates resulted in further scientific controversy and professional debate over the interpretation of the postulates (eg. Andersen & Nielsen,1993).

From a perspective of social constructionism, the use of Koch's postulates could not, in themselves, lead to the resolution of the dispute. Social constructionism considers 'scientific facts' as the outcome of exchanges between competing groups with alternative definitions of reality (White,1991:58). Thus there is a search for social factors which have enabled one knowledge claim to be presented as more plausible or authentic than another. Accordingly, it is this *social* process which explains why some beliefs become true and others false.

In the case of ulcer disease it is clear that the provision of scientific evidence has been insufficient to resolve the dispute. The social constructionist view is that Marshall and Warren's scientific claim is being resolved through a social process in which some factors have assisted their claim whilst other factors have mitigated against it.

Cultural and Social Barriers to New Medical Knowledge

An early but almost unknown proponent of social constructionism is Bernhard Stern. His 1927 and 1941 studies of medical history and medical progress appear to have become lost to the more modern school. Nevertheless his analysis of the factors which inhibit medical innovation remain highly relevant today. Stern proposes that it is primarily cultural factors and vested interests (both economic and professional) that determine the rate of social change.

Cultural Factors

Stern studied a large number of medical innovations, including Harvey's theory of the circulation of the blood, the anatomical dissection of the body, Pasteur's work on microbes, and Holmes and Semmelweis on the source of puerperal fever. He proposed that conflicts between the new theory and established cultural ideas could retard the innovation. In the study of Harvey's theory of blood circulation, the new theory conflicted with cultural ideas about the

spiritual basis of the heart. According to Galenic doctrine, the heart expanded through its own innate heat, whereas Harvey proposed that the heart mechanically contracts and propels the blood throughout the body (Stern,1927:44;1941:188). Harvey's new theory questioned the entrenched cultural idea that all knowledge must come from the ancients. He proposed that knowledge could arise from observation and experimentation. Similarly, in the case of vaccination, Stern contends that the new practice was resisted because it was understood to be an attempt to interfere with the 'plans of God' (1927:63).

In the case of knowledge about ulcers, the theory of bacteriological infection has challenged prevailing attitudes and morality about individual responsibility for body maintenance and a healthy lifestyle. It suggests that the individual is unable to manage their own health and must return to the medical profession for assistance. Furthermore, the new knowledge attacks firmly embedded cultural stereotypes based on an assumed link between immoral behaviour (eg. smoking, gluttony) and stomach disease.

Vested Interests (Professional)

Stern recognised that there were factors within the practice of medicine that retard medical innovation, and that these factors operate at the level of the individual, the group, and the institution. At the individual level, Stern argues that innovation is resisted because it may involve personal inconvenience, temporary pain, more work and the breaking of old, comfortable habits (1927:14). At the group level, innovations require a revaluation of customs and routine behaviour, disturbing the status quo. "The innovator is always placed militantly on the defensive" (Stern,1927:15). At the institutional level, there is control over the diffusion of information and funding, and via tradition and authority, institutions protect established practices (ibid:11-12).

In cases of innovation where practitioners find that current methods of treatment produce reasonable results, they are, perhaps understandably, reluctant to alter their practice. In Stern's examination of resistance to Lister's theory of antisepsis, surgeons argued:

"Happily it is no part of the clinical surgeon to bolster up theories whether they be good or bad, or to make facts rigidly conform to them. The germ theory may be perfectly well founded but nine out of ten surgeons do not much care whether it is or not, so long as they cure their cases and reduce their mortality to the lowest possible degree." (Stern,1927:83).

In the case of ulcer disease, the efficacy of conventional anti-acid drug therapy has made it very difficult for the scientists to prove their claim. These drugs are reasonably effective for a large number of people, and this fact tends to support existing theories of causation. Furthermore, the new theories are made to appear slightly irrelevant. They have no obvious role, and there appears to be no *need* for a new theory.

Marshall has countered these arguments, proposing that the theory of bacterial infection better explains the high recurrence of ulcers. He suggests that the suppression of stomach acids does not eliminate the infection, but merely gives the body time to heal the ulcer. Elimination of the infective agent on the other hand, attacks the underlying cause of ulceration (Alper & Spalding,1985:17). Marshall also offers new evidence to support his explanation of the cause of ulcers, stating that the infected patients produce higher levels of gastric acid. Nevertheless there has been a discernible apathy amongst many practitioners in the wake of the new theory.

The organisation of medical and scientific practice provided Marshall and Warren with the opportunity to make a successful claim to new knowledge, but it also presented the scientists with almost invincible barriers. Social constructionist studies of science have revealed that 'experts' have substantial autonomy to promote knowledge and claim resources for their own advantage (Cozzens & Woodhouse,1995:535). In the case of ulcer disease, the researchers had the advantage of holding positions as specialist doctors in a public hospital, access to patients, basic research funds and facilities. A number of studies have indicated that professional status and the accompanying resources are critical to the process of discovery and recognition (Whitley,1984; Richards,1991; Goldberg,1988; Bliss,1982). In the medical sciences, clinical privileges have been found to be of particular importance, as these provide the researcher with legitimate access to, and autonomy over, patients as research subjects (Collyer,1993).

However, as Stern has rightly pointed out, medical discoveries are often suppressed by the academic authority of the medical faculties of the universities (1941:222). Historically it has been philanthropic and state agencies that have saved lives and reduced illness through public health measures, while the profession as a whole has lagged behind (ibid:212). Specifically, the suppression of innovation has been the work of 'cliques' within the profession, which resist change in their 'habits of thought and practice' (Stern,1927:33). In the case of ulcer disease, recognition for the claim to new knowledge was circumscribed by contemporary dogma which held that only specialists working within the discipline of molecular biology could generate significant medical breakthroughs. The ulcer disease researchers were *clinical* practitioners, gastroenterologists, who were working without the more prestigious support of the biomedical 'research establishment'. This made it difficult for Marshall and Warren to gain research support from traditional funding bodies (Vines,1994:14) and convince others of their claim.

Vested Interests (Economic)

Stern's analysis of medical progress, though insightful, has its limitations. Given that all medical knowledge is historical, it is not surprising that Stern's knowledge is also historically situated. Since his study of medical progress in the first half of this century, there have been remarkable changes in the role of industry and the State in the process of innovation, as there have been in the analysis of these roles. Stern recognised that economic factors could play a crucial part in the progression of medical knowledge, but he focussed on the additional expense of using an innovation and how this would inhibit its dissemination (cf: Stern,1941:29). More recent analyses have unravelled the complex relationship between economic interests and innovation, demonstrating that industry plays a critical role in the development and dissemination of an innovation.

McKinlay (1981) for example, points to the important role of sponsorship in the development and marketing of a new technology. He argues that the success of an innovation is the consequence of the power of the sponsor, not of any intrinsic qualities of the innovation itself (ibid:386). The relationship between science and industry is a complex one, as private corporations are given authority by the State to own, distribute and financially profit from medical technologies. This gives the private sector an interest in basic scientific research and an incentive to become involved from the early development stage (cf: Cozzens & Woodhouse,1995:535).

In the case of the new knowledge about ulcers, it has been the lack of industry sponsorship which has represented a crucial obstruction to bringing about change in medical knowledge and practice. The lack of involvement of a commercial sponsor is partly due to the nature of the proposed treatment solution. In this case the proposed treatment solution is a generic one - a mixture of existing antibiotic drugs. It is a clinical solution which offers little possibility of new profits. Pharmaceutical companies have been, as a result, generally unwilling to support research which might threaten existing sales of H_2-antagonist drugs. Companies have also been reluctant to give credibility to the new theory through public acknowledgment. The initial reaction of SmithKline officials was to deny the causative role of *campylobacter*, asserting that it "flies in the face of everything we know about ulcers" (Alper & Spalding,1985:18). Two years later SmithKline officials had only slightly modified their position, stating that even if the bacterium is implicated, their acid-reducing drugs would continue to have an important role to play in ulcer treatment (Schiller *et al*,1987:46). Glaxo's public position was similar, stating that it was unconvinced of the claims (Ibid:46), and, in an international tele-conference, announced that it was expecting Zantac to be even more widely prescribed *(Economist*,1987:80).

Corporate sponsorship can be essential to both the construction, and the distribution of medical knowledge. Before a drug has even been fully developed, large companies such as Glaxo organise expensive international symposiums, inviting practitioners and researchers. This enables the company to build a market for the drug and gauge its market potential before its release *(Economist,*April,1991:70). In Australia, researchers and practitioners are provided with most of their post graduate education about drug treatments by the major drug companies through advertising, professional publications, conferences and seminars (White,1994:244; Hemminki,1986).

The drug industry uses a variety of media for constructing and disseminating medical knowledge about its products, including the clinical trial. Although companies are unable to sell products in Australia until they have been approved by the government, they can make it available for research and for use in clinical trials. The dissemination of information in a research and teaching environment is crucial to the later market success of the product, because doctors tend to continue to prescribe products with which they have became familiar during their training - even where there is clinical evidence of adverse effects (Collyer,1996:254). Pharmaceutical companies are also able to 'altruistically' give products to patients without a fee. This latter method has been shown to be a clever 'back door' pre-marketing strategy. In a number of cases, most notably involving people with HIV/AIDS, pharmaceutical firms have realised that supplying these groups with experimental drugs may increase the possibility of early government approval. Organised consumer groups can place pressure on government to make drugs available and accessible.

Once a product has been approved for sale, doctors are provided with literature, advertisements appear in journals, educational seminars are supported, and doctors and hospitals are visited by pharmaceutical representatives offering a range of advertising products and incentives. Advertising also occurs during the post-marketing study. Companies provide funds for doctors to conduct studies on 'normal' populations, enrolling patients in the study and attempting to track adverse effects which may not have shown up in the controlled laboratory environment of the clinical trial. Although legal, this form of advertising is thought to be unethical because doctors are paid to conduct the studies, patients are recruited who might normally use other products, and the companies know that the patients are likely to continue using the product after completion of the trial *(Economist*, April,1991:70).

There is little evidence that this industry-generated information is provided in a disinterested, unbiased form. Advertising has been shown to be sexist (Prather & Fiddell,1986) and to confirm societal stereotypes about disease. It is often untrue or exaggerated *(Economist*,April,1991:70), vital information is withheld to ensure sales *(Economist*,1993:75), and promotional material often offers unrealistic promises about the outcome of treatment (Kleinman & Cohen,1991). Furthermore, the lack of an alternative voice means there is little fully informed scientific debate about the potential side-effects of pharmaceutical products. In order to change this, the World Health Organisation has recommended that governments, rather than pharmaceutical companies, should finance the drug sales force *(Economist*,April 1991:70).

In the case of ulcer disease, the claim for a new theory of disease causation was without the powerful support of the drug industry, and, without corporate sponsorship, the new knowledge claim about ulcer disease was also without the support of the State. State support has been shown to be a crucial factor in the success of a medical innovation (McKinlay,1981). In Australia there is a centralised drug regulation system in which marketing approval is granted for pharmaceutical sales and where the cost of 'necessary' drugs is negotiated by government and subsidised for the consumer. The most successful drugs on the market are those which are on the list of subsidised drugs - the Pharmaceutical Benefits Schedule (PBS). Inclusion on this list ensures a high volume of sales to the industry because most doctors treat it as a 'normative' guide to prescribing, selecting drugs almost solely from it (Collyer,1993:351).

Without a new drug product and its accompanying industry sponsorship, the claim for new knowledge about ulcer disease has not invoked the processes of government evaluation and regulation. This has restricted practitioners and scientists to a scientific debate (conducted within specialist journals) rather than a public one about the new theory of ulcer infection. Most new disease treatments are subjected to 'expert' evaluation through a process of government evaluation and regulation. The evaluation of a drug product in Australia is administered by a unit within the federal health bureaucracy, the Therapeutics Goods Administration (TGA). These officials are 'advised' by a selected panel of medical experts, the Australian Drug Evaluation Committee (ADEC). ADEC recommends products for market approval products in Australia and suggests the conditions under which they can be sold. Responsibility for the final decision for the marketing of the product rests with the federal minister for health. Historically, recommendations by the medical 'experts' of ADEC have been adopted by the bureaucracy and there has been little political influence over the approval of new products in Australia. Similarly the bureaucracy has successfully resisted pressure from the pharmaceutical industry (Collyer,1993:288). This contrasts sharply with the situation in the USA and Britain, where both

regulatory bodies have come under severe criticism for having too 'close' a relationship with the drug industry *(Economist*, April,1991:70).

The Australian situation has changed in the last five years however. In contrast to the USA and Britain, the TGA has been severely criticised for its *lack of sympathy* with the commercial demands of the industry. An Australian government inquiry into drug evaluation urged the TGA to increase its responsiveness to industry (cf: Baume,1991). The TGA had been limiting the marketing of 'me-too' products and encouraging the evaluation of new or different drugs which offered the possibility of providing better or safer forms of treatment (Collyer,1993:281-3). The TGA had taken the position that where there were a number of similar drugs already on the market, administrative resources would be better spent examining alternatives rather than 'me-too' products. The report recommended this practice should cease immediately (Baume,1991:75-6).

The Baume report examined the regulation system from an industry perspective, clearly assuming that the 'free market' is the most appropriate mechanism for the operation of the drug industry, and argued for greater industry 'self-assessment' (cf:Baume,1991:78). The report consistently uses the term 'over-regulated' to describe the government's involvement with drug products (ibid:130) and suggests that companies are 'best placed' to provide prescribers with information about its products (ibid:133). Despite considerable evidence that the interests of consumers are not best served by this information system (eg. Braithwaite,1984; Starr,1982), the TGA was criticised for taking the view that it had a legitimate role to protect public safety (cf: Baume,1991:68) and recommendations were made to limit its evaluative role and allow market forces to operate (ibid:75-6). Many of the recommended changes have since been implemented.

Scientific Acceptance of The New Theory

Marshall found it particularly difficult to obtain research support within Australia, but eventually located a financial sponsor at the University of Virginia in Charlottesville, USA. He began working on a study of 1000 ulcer patients to determine how many of them host the bacteria, and discover the most efficacious form of treatment. The funding for the study came from Proctor and Gamble, a company which produced the over-the-counter digestive aid, Pepto-Bismol. This product contains bismuth, a substance which appears to attack the bacteria as well as suppress acid secretion. Proctor and Gamble became interested in sponsoring the new study when they realised it might support their entry into the more profitable pharmaceutical market (Schiller *et al*,1987:46).

Widespread scepticism of the connection between ulcer disease and infection continued for a decade following the announcement of the discovery of the bacterium. But an increasing number of studies began to support Marshall and Warren's theory, identifying the organism and arguing that it was indeed pathogenic (eg Bode *et al,*1987; Hirschl *et al,*1986). By 1993 scientists were taking the claims more seriously. A review of the medical literature indicates that *campylobacter pyloridis* (now known as *helicobacter pylori*) has finally become recognised within scientific circles as the major causal agent of human chronic active gastritis and duodenal ulcer disease (eg. Decross & Marshall,1993; Andersen & Nielsen,1993; Castiglione *et al,*1993; Lazzaroni & Porro,1993; Prescott,1991; Rappuoli *et al,*1993).

Other events in 1994 and 1995 also suggest an emerging consensus. In February 1994 the National Institutes of Health (NIH) in the USA formed an expert panel supporting the idea of a causal link between ulcers and infection and advising doctors to abandon the practice of prescribing conventional acid suppressing drugs in favour of antibiotics (Vines,1994:12;*Economist,*1994:91). The public, and far-reaching, pronouncement by the NIH suggests that *helicobacter pylori* has become recognised as an 'objective scientific fact.' In 1995, Marshall was awarded a scientific prize (the Lasker Award) for his part in the discovery of *helicobacter pylori* (Bishop,1995). The power of the NIH may be a factor in forging a consensus in the medical and scientific community about ulcer disease, and it may have an effect on future medical practice.

This is not to suggest all areas of disagreement have been resolved. There remain areas of debate, such as the mechanism by which the bacterium brings about ulcers, the precise route of transmission, and the best combination of antibiotics for eradicating the bacteria (Hopkins &

Morris,1994). However, the idea of an association between microbes and stomach disease has led to a flurry of research into *helicobacter pylori*. Internationally, researchers have begun investigating possible links between the bacteria and medical conditions such as functional dyspepsia, irritable bowel syndrome (eg. Talley,1995), peptic ulcer (eg. Andersen & Nielsen,1993), and gastric cancer (eg. Talley *et al*,1991; Decross & Marshall,1993). The new theory has also opened up opportunities for social constructionists to further challenge theories of stomach disease which hold individuals responsible for their own suffering through 'immoral' lifestyle choices. The new studies are identifying social trends in *helicobacter pylori* infection, showing that infection is dependent upon specific social arrangements. Children are more likely to be infected than adults, making it amenable to the use of a childhood vaccination scheme (Mendall & Pajarosgarcia,1995), as are those living in institutions (Lambert *et al*,1995). *Helicobacter pylori* infection is also dependent on factors such as education (Forman *et al*, 1993), age, gender and race (Graham *et al,* 1989), and is far more prevalent in developing countries (Oderda & Cadranel,1995). Indeed, the new studies are clearly disproving previously assumed links between stomach disease and lifestyle factors such as smoking, alcohol and overindulgence in rich foods (eg. Talley & Zinsmeister *et al,*1994).

The Challenge to Social Constructionism

Social constructionism reveals medical knowledge as a medical interpretation of reality and offers a critical analysis of disease as a sociological problematic. It contributes an understanding of the relationship between disease categories and social practices, offering a view of the social values and inequalities embedded within medical knowledge itself. Social constructionism also provides a valuable insight into the process by which medical knowledge mediates social relations, shaping and forming the sphere of medicine as well as other areas of social practice. Through the use of the case study of ulcers, social constructionism has demonstrated that the formation of new medical knowledge can be explained as a process of political, corporate, and cultural negotiation. It has also shown that 'ignorance' or a 'lack of knowledge' can equally offer financial and political rewards. Change in medical knowledge is shown to be the outcome of conflict and cooperation between various groups, organisations, and institutions, and disputes are propounded (though not resolved) in terms of 'technical' issues.

Social constructionism has, nevertheless, been subjected to strong criticism. Bury (1986:138) for example, argues that social constructionism, in defining medical knowledge as a social product, reduces all knowledge to a relativist position. One of the implications is that all knowledge is a reflection of social, historical and political factors, and cannot be neutral. This means there are no grounds for accepting one account rather than another. Social constructionism 'places a question mark' over the idea of progress or advancement in scientific knowledge (Bury,1986:146) as modern medical knowledge cannot be assumed to be 'better' than pre-modern knowledge. In this it rejects the Kuhnian proposition that the historical outcome of paradigmatic change is an increasingly 'true' knowledge base. The epistemological consequences of this for sociology are immense, particularly because it challenges the privileging of the sociological critique of the traditional view of science, and reduces the value of this critique to a mere boundary dispute between professional specialities.

For many sociologists, methodological relativism does not present a problem. For example Martin and Richards (1995) rigorously examine scientific controversies using this approach, and Nicolson and McLaughlin clearly see relativism as a strength rather than a weakness (1987:117). Other scholars however, are troubled by this. Winner for instance argues that it means disregarding the social consequences of technical choice (1993:368,372) while Bury contends that social constructionism undermines the validity of its own statements (1986:164).

A second implication of conceptualising knowledge as a social product is that it casts all new 'discoveries' as social constructs or 'inventions'. As Bury states, 'the stable realities of the human body and disease are in fact 'fabrications' or 'inventions' rather than discoveries' (1986:137). Knowledge of reality is constructed rather than disclosed, and this makes it difficult to fully explain the origin of creativity and new knowledge, except as modifications of existing social products (Collyer,1995).

A third implication of the social construction of knowledge approach arises in its treatment of biological reality. Some scholars insist that social constructionism explicitly disregards the

biological aspect of illness, and that it depends, fundamentally, on a distinction between the biological and the social. This distinction was made by Freidson, among others:

"... illness as a biophysical state exists independently of human knowledge and evaluation, illness as a social state is created and shaped by human knowledge and evaluation ..." (1970:212).

For some scholars, the reduction of health and illness to social process is problematic. Hopkins for instance argues that overlooking the biological basis of illness can allow those in power to dismiss claims of injury by the less powerful (1989:2-3). Similarly, Turner contends that it can also mean a denial of the biological and material implications of illness (1987).

An alternative perspective is that social constructionism doesn't *necessarily* fail to account for the interaction between medical knowledge and physical reality. For example, Wright & Treacher contend that social constructionism does not mean that illness is imaginary:

"When we argue that medical knowledge is a social product - not some privileged and asocial penetration of the workings of Nature - *we are not* implying that it is somehow unreal or spurious; still less that the activities of doctors are bogus or that disease is imaginary. Illnesses really do exist, but as sufferings which have no necessary, transhistorical, universal shape" (1982:14).

Nicolson and McLaughlin take a similar view, arguing that there are diverse views within social constructionism, and a range of different ways of conceptualising the interaction between ideas and the 'outside' world (1987:110). For instance, they suggest the Strong Programme of David Bloor recognises that knowledge is not a product of pure thought and imagination, but is formed in 'encounters' with reality (ibid:111). Other studies vary in the extent to which they acknowledge the possibility of 'biological' input into the formation of medical knowledge, but all are bounded within a school of research which rejects the proposition that physical reality can 'uniquely determine rather than merely lead us to modify ... our understanding of it' (ibid).

The need for a more coherent formulation of the relationship between material and social reality is acknowledged in Turner's analysis of 'the body'. He argues that 'the body' has been treated as a residual category in the development of sociological theory, and that there is a need for a "... conception of the embodied actor which will transcend the all pervasive Cartesian division of mind-body ... [and] develop a phenomenology of 'the lived body' (Turner,1992:8,91). This task is made more difficult with the advent of postmodernism, which problematises 'the body', and challenges essentialist notions of the physical body - particularly with the interpenetration of technology and the rise of the cyborg (ibid:8,95).

The need to re-examine the theoretical relationship between social and physical reality is also recognised in science and technology studies. Studies within the philosophy and history of science during the 1970s revealed the social basis of scientific knowledge. Later developments argued that scientific knowledge is constrained by the natural, as well as the social world (Bowden,1995:71).

"Constructionism ... is neither nihilism nor scepticism, nor a doctrine that reduces objects to something like imputed and subjective meanings. Constructionist studies have recognized that the material world offers resistances; that facts are not made by pronouncing them to be facts but by being intricately constructed against the resistances of the natural (and social!) order. What constructionism departed from, however, is the idea that the laws and propositions of science provided literal descriptions of material reality, *and hence can be accounted for in terms of this reality* rather than in terms of the mechanisms and processes of construction. Constructionism did not argue the absence of material reality from scientific activities; it just asked that 'reality' or 'nature,' be considered as entities continually retranscribed from within scientific and other activities. The focus of interest, for constructionism, is the process of transcription" (Knorr Cetina, 1995:148-9).

Much of the latest research within technology studies has attempted to theoretically integrate the 'social' and the 'technical' without *technical determinism* (the reduction of the 'social' to the 'technical'). For example, the relationship between technology and society are purported to form a 'seamless web' in which the 'technical' and the 'social' are defined only in relation to one

another (Hughes,1983). Similarly, the concept of 'socio-technical ensembles' are used to explain the way technology shapes social practices, but is itself shaped and constructed by social processes (Bijker,1995:252). A related theoretical development is the actor-network approach associated with the work of Callon (1986) and Latour (1987). This approach is characterised by the ontological equivalence given to all elements within the ensemble, whether these are human or non-human. All entities within the network 'endowed with the ability to act' are given the label of 'actant' (Callon,1995:53), and an 'actant' may be a political party, a machine, a chemical or even a researcher.

The conceptual contribution of technical-ensembles is significant because it takes into account elements of the process of knowledge construction which social constructionism overlooks. For example, medical knowledge derives not only from the world of ideas and their social context, but from interaction with physical objects and instruments. The knowledge derived from the laboratory has been described as 'tacit' knowledge, where social practices are 'entwined with experimental apparatus, protocols, and observational or theoretical statements' (Callon,1995:42-3). In the actor-network approach, all elements are endowed with the ability to contribute to the invention. Technologies and techniques are not merely passive elements in an otherwise dynamic process.

Both the sociology of the body and the sociology of technology provide insights into the redefinition of, and relationship between, the 'social' and the 'material' world. The case of ulcer disease exemplifies the need to re-explore and clarify this relationship from a position which avoids the positivism of the traditional science view, and avoids technological determinism as well as sociological reductionism.

Though offering a solid critique of the traditional science view, social constructionism is also unable to satisfactorily explain the placebo effect. Though it can identify social factors which shape the methodology of the clinical trial and disclose the groups and institutions that control and benefit from it, social constructionism is unable to fully account for the factors which shape and create an interplay between 'society' and the 'body'. As mentioned in previous discussion about clinical trials, placebos are used in the evaluation of various forms of treatment for ulcer disease, as a means to distinguish between one treatment option and another. In the clinical trial, placebos are assumed to offer a different form of treatment to pharmaceutical preparations. From a traditional science view, the former is taken to be psychological in origin and the later physiological. Furthermore it is assumed that the effects are separable, that only one kind of effect will occur in each patient. On the contrary however, these two forms of healing interact and are concurrent (Moerman,1983:13). The placebo effect cannot be adequately explained by the traditional science view, which explicitly ignores the placebo effect, denies the validity of interactive effects of body and mind, and assumes that the bio-chemical reaction of the drug is the only valid factor in the causal chain under study. But nor can it be explained by social constructionism, where the input from biology is disregarded.

A more satisfactory account might be derived from the concepts of technology studies, which analyses the multitude of factors which form the 'seamless web' but also includes factors usually regarded as 'technical' or 'biological'. The socio-technical-ensemble approach overcomes the problem of technical and social reductionism because it emphasises the co-production process, in which all elements, whether 'natural', 'technical' or 'social', become modified and transformed in the translation process (Latour,1991:116; Callon,1995; Hughes,1983). This means neither biology nor social practices are perceived as having a 'fixed nature', but are dynamic aspects of a process in which knowledge and technological products are co-produced.

Conclusion

This paper has examined the process of the historical construction and dissemination of claims about the formation and treatment of ulcer disease. Bernhard Stern's social constructionist typology was utilised to analyse the historically contingent process of medical innovation. Various factors were considered to inhibit the dissemination of new medical knowledge, including cultural ideas and values, as well as economic interests and professional rivalries. In addition, the State and industry were shown to have important roles in the innovation process.

The case study demonstrated that historical change is brought about through a variety of factors, and that each change is unique. Early knowledge of ulcer disease and its treatment was transformed by cultural factors which emphasised the morality of self-maintenance and individual responsibility for one's health. These cultural changes have made it more difficult for scientists to institute new knowledge, given that the new claim undermines individual responsibility for health and reinstates the role of the physician in ulcer disease. In addition, recent innovations in the knowledge and treatment of ulcer disease have been inhibited by specific social practices and institutions which developed in order to protect financial and professional interests. Primary among these inhibiting factors has been the power of the pharmaceutical industry, the capacity of the profession to protect its own hierarchical and specialist structure, and the pro-industry policies of the government.

The last part of the paper analysed some of the limitations of social constructionism, particularly its capacity to address the relationship between 'the social' and 'material' reality. The paper identified emerging areas of social theory which offer new conceptions of this relationship. Of particular importance are postmodernist theories which problematise the 'fixed corporeal nature' of the body, and the technology studies approach which conceptualises a 'seamless web' of translation and co-production between all elements (biological, social and technical) in the socio-technical ensemble. These theories and concepts might be used to offer new insights into the construction of medical knowledge and medical practice.

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