

6. In B. J. Murstein (Ed.) (1971)
Theories of Attraction and Love
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Passionate Love

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DEFINITIONS

Liking has been defined by a number of researchers (e.g., Newcomb, 1961; Homans, 1950) as "a positive attitude toward another, evidenced by a tendency to approach and interact with him." Theorists generally agree on the genesis of liking: individuals like those who reward them.*

Researchers have spent little time defining or investigating *passionate love*. Many theorists simply assume that passionate love is nothing more than very intense liking. We would argue, however, that passionate love is a distinct emotional state. We would argue that a person will experience love only if 1) he is physiologically aroused, and 2) he concludes that love is the appropriate label for his aroused feelings.

PASSIONATE LOVE: A TABOO TOPIC

Most of us would agree that passion is more fascinating than friendship. However, a multitude of researchers have conducted experiments on liking, while very few have explored passionate love.

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* We use the term *companionate love* to indicate unusually intense *liking* between two persons.

What accounts for this imbalance?

1) First, scientists who wanted to investigate romantic attraction found it very difficult to secure research funds. Granting agencies, sensitive to the feelings of legislators and the public, were nervous about even considering proposals whose titles contained the offensive words "Love" or "Sex." Even today, whenever a researcher is ill-mannered enough to affix such a title to his proposal, alert bureaucrats quickly expurgate the offensive term and substitute the euphemism, "social affiliation."

2) Psychologists did not themselves acknowledge the legitimacy of investigating passionate love. They often ridiculed colleagues who began conducting experiments on this taboo topic. To study love was to be "soft-headed," "unscientific," or to possess a flair for the trivial. It is interesting to note that early in their careers some of our most eminent social psychologists conducted one—and only one—study on romantic attraction. Professional reaction to their research uniformly led them to decide to investigate other topics.

3) Psychologists tend to assume that in the laboratory one can only study mild and quickly developing phenomena. Although poets argue that love may occur "at first sight," psychologists have had less confidence that one can generate passionate love in a two-hour laboratory experiment. Thus, many researchers erroneously assumed that passionate love could only be studied in the field.

Suddenly, the situation changed. The humanists invaded psychology, and the study of tender emotions became respectable. Masters and Johnson's (1966) impressive research demonstrated that even sex could be examined in the laboratory. (Ironically, these pioneers were attacked by the public for failing to investigate love as well as sex.) In the last five years more psychologists have begun to study romantic love than investigated the phenomenon in the history of psychology.

The problem now is not finding respectability but finding out some facts. Presently, when faced with requests for information about love and sex, chagrined psychologists must admit that "they really don't know love at all." Hopefully, in this conference we can gain a better understanding about this vital—and entertaining—topic. In this lecture, I will propose a theoretical framework which may give us a better understanding of passionate love.

"WHAT IS THIS THING CALLED LOVE?"

Interpersonal attraction and companionate love seem like sensible phenomena. One can predict quite well how much a person will like

another, if he knows to what extent the other rewards or punishes the person. Reward has so predictable an impact on liking that Byrne et al (1968) could with confidence propose an exact correspondence between reinforcement and liking: ("Attraction towards X is a positive linear function of the proportion of positive reinforcements received from X or expected from X.") Data support their formulation.

Sometimes passionate love seems to operate in a sensible fashion. Some practical people have been known to fall in love with those beautiful, wise, entertaining, and kind people who offer affection or material rewards to them. Generally, however, passionate love does not seem to fit so neatly into the reinforcement paradigm. Individuals do *not* always feel passionate about the person who provides the most rewards with the greatest consistency. Passion sometimes develops under conditions that would seem more likely to provoke aggression and hatred than love. For example, reinforcement theorists argue that "we like those who like us and reject those who dislike us." Yet individuals experience intense love for those who have rejected them.

A woman discovers her husband is seeing another. The pain and suffering the jealous wife experiences at this discovery cause her to realize how much she loves her husband.

Lovers pine away for the girls who spurn their affection. For example, a recent Associated Press release reports the desperate excuse of an Italian lover who kidnapped his former sweetheart: "The fact that she rejected me only made me want and love her more," he tearfully explained."

Reinforcement theorists tell us that "frustration always breeds aggression." Yet, inhibited sexuality is assumed to be the foundation of romantic feelings. Freud (1912) even argued that:

Some obstacle is necessary to swell the tide of libido to its height; and at all periods of history whenever natural barriers in the way of satisfaction have not sufficed, mankind has erected conventional ones in order to enjoy love.

The observation that passionate love flourishes in settings which would seem to thwart its development has always been puzzling to social scientists. Poets attribute such inexplicable phenomena to the essential illogic of love. Scientists, who refuse to acknowledge that anything is inexplicable, do not have such an easy way out.

Happily, we believe that a theoretical framework exists which makes the "illogical" phenomena of passionate love explicable and predictable.

SCHACHTER'S TWO-COMPONENT THEORY

On the basis of an ingenious series of experiments, Schachter (1964) proposed a paradigm for understanding human emotional response. He argues that in order for a person to experience true emotion, two factors must coexist: 1) The individual must be physiologically aroused, and 2) It must be reasonable to interpret his stirred-up state in emotional terms. Schachter argued that neither physiological arousal nor appropriate cognitions *alone* is sufficient to produce an emotional experience.

It is possible to manipulate an individual's physiological arousal artificially. A drug, adrenalin, exists whose effects mimic the discharge of the sympathetic nervous system. Shortly after one receives an injection of adrenalin, systolic blood pressure increases markedly, heart rate increases somewhat, cutaneous blood flow decreases, muscle and cerebral blood flow increase, blood sugar and lactic acid concentration increase, and respiration rate increases slightly. The individual who has been injected with adrenalin experiences palpitation, tremor, and sometimes flushing and accelerated breathing. These reactions are identical to the physiological reactions which accompany a variety of natural emotional states.

An injection of adrenalin will not, by itself, however, engender an emotional response in a person. When an individual is injected with adrenalin and asked to introspect, he will report either no emotional response or, at best, report feeling "as if" he might be experiencing some emotion (Marañón, 1924). Individuals make statements such as "I feel *as if* I were afraid." The person who has been injected with adrenalin perceives that something is not quite authentic about his reactions. Something is missing.

Schachter argues that what is missing is an appropriate label for the physiological reactions one is experiencing. If one could lead the drugged individual to attribute his stirred-up state to some emotion-arousing event (rather than attributing it to the injection of adrenalin which he received), Schachter argues that he would experience a "true" emotion.

The researcher who wishes to test the notion that physiological arousal and appropriate cognitions are separate and indispensable components of a true emotional experience, is faced with the challenging task of separately manipulating these two components. In a classic

In the *Anger* setting, the confederate had been trained to make the subject angry. The confederate first complained about the experimental procedures. He became especially indignant on encountering the questionnaire they had been asked to fill out (and which admittedly asked stupid and offensive questions). Finally, the confederate slammed his questionnaire to the floor and stomped out.

The authors assessed subject's emotional reactions to the confederate's behavior in two ways. Observers stationed behind a one-way mirror assessed to what extent the subject caught the stooge's euphoric or angry mood; secondly, subjects were asked to describe their moods and to estimate how euphoric and angry they felt.

Schachter and Singer predicted that those subjects who had received an adrenalin injection would have stronger emotional reactions than would subjects who had received a placebo or had received an adrenalin injection but had been warned of exactly what physiological changes they should expect. The data supported these hypotheses. The experiment thus supported the contention that both physiological arousal and appropriate cognitions are indispensable components of a true emotional experience. Schachter and Wheeler (1962) and Hohmann (1962) provide additional support for this contention.

THE TWO-COMPONENT THEORY AND PASSIONATE LOVE

The discovery that almost any sort of intense physiological arousal—if properly interpreted—will precipitate an emotional experience has intriguing implications. We were particularly intrigued by the possibility that Schachter's "two-component" theory might help explain a heretofore inexplicable phenomena—passionate love.

As long as researchers were busily absorbed in figuring out how passionate love could be integrated into the reinforcement paradigm, we made little progress. The observation that negative experiences often lead to increased evaluation remained inexplicable.

A sudden insight solved our dilemma. Two components are necessary for a passionate experience: arousal and appropriate cognitions. Perhaps negative experiences do not increase love by somehow improving one's evaluation of the other (beneficially altering his cognitions). Perhaps negative experiences are effective in inducing love because they intensify the second component—arousal.

We would suggest that perhaps it does not really matter how one pro-

duces an agitated state in an individual. Stimuli that usually produce sexual arousal, gratitude, anxiety, guilt, loneliness, hatred, jealousy, or confusion may all increase one's physiological arousal, and thus increase the intensity of his emotional experience. As long as one attributes his agitated state to passion, he should experience true passionate love. As soon as he ceases to attribute his tumultuous feelings to passion, love should die.

Does any evidence exist to support our contention? Some early observers noticed that any form of strong emotional arousal breeds love (although not, of course, interpreting this relationship in Schachterian terms). Finck (1891), an early psychologist, concluded:

Love can only be excited by strong and vivid emotion, and it is almost immaterial whether these emotions are agreeable or disagreeable. The Cid wooed the proud heart of Diana Ximene, whose father he had slain, by shooting one after another of her pet pigeons. Such persons as arouse in us only weak emotions or none at all, are obviously least likely to incline us toward them. . . . Our aversion is most likely to be bestowed on individuals who, as the phrase goes, are neither 'warm' nor 'cold'; whereas impulsive, choleric people, though they may readily offend us, are just as capable of making us warmly attached to them (p. 240).

Unfortunately, experimental evidence does not yet exist to support the contention that almost any form of high arousal, if properly labeled, will deepen passion. There are, however, a few studies designed to test other hypotheses, which provide some minimal support for our contention.*

Since it was the juxtaposition of misery and ecstasy in romantic love that we initially found so perplexing, let us first examine the relation between negative experiences and love.

Unpleasant Emotional States: Facilitators of Passion?

That negative reinforcements produce strong emotional reactions in all animals is not in doubt (see Skinner, 1938). There is some evidence that under the right conditions such unpleasant, but arousing, states as fear, rejection, and frustration do enhance romantic passion.

* These studies are only "minimally supportive" because the authors investigate only liking, not passionate loving—a phenomenon we have argued is unique. Whether or not the same results would occur in a romantic context must yet be determined.

Fear: A Facilitator of Passion

Frightening a person is a very good way of producing intense psychological arousal for a substantial period of time (see Ax, 1953; Wolf and Wolff, 1947; and Schachter, 1957).

An intriguing study by Brehm et al (1970) demonstrates that a frightened man is a romantic man. Brehm et al tested the hypothesis that "a person's attraction to another would be multiplied by prior arousal from an irrelevant event." In this experiment, some men were led to believe that they would soon receive three "pretty stiff" electrical shocks. Half of the men, "Threat" subjects, were allowed to retain this erroneous expectation throughout the experiment. Half of the men, "Threat-Relief," were frightened and then, sometime later, were told that the experimenter had made an error; they had been assigned to the control group and would receive no shock. The remainder of the men were assigned to a control group, in which the possibility of their receiving shock was not even mentioned.

Men were then introduced to a young co-ed, and asked how much they liked her.

The Threat subjects who expected to be shocked in the future should be quite frightened at the time they meet the girl. The Threat-Relief subjects who had just learned they would not be shocked should be experiencing vast relief when they meet the girl. Both the frightened and the frightened-relieved men should be more aroused than are men in the control group. Brehm predicted, as we would, that Threat and Threat-Relief subjects would like the girl more than would control subjects. Brehm's expectations were confirmed; threatened men experienced more liking for the girl (and did not differ in their liking) than did control group men, who had never been frightened. An irrelevant frightening event, then, does seem to facilitate attraction.

Rejection: An Antecedent of Passion

Rejection is always disturbing. And generally when a person is rejected he has a strong emotional reaction. Usually he experiences embarrassment, pain, or anger. Although it is probably most reasonable for a rejected person to label his agitation in this way, if our hypothesis is correct, it should be possible, under the right conditions, to induce a rejected individual to label his emotional response as "love" as well as "hate."

Some slight evidence that passionate love or hate may emerge from

rejection comes from several laboratory experiments designed to test other hypotheses (Dittes, 1959; Walster, 1965; and Jacobs et al, 1971).

Let us consider one of these experiments and the way a Schachterian might reinterpret these data.

The experiment of Jacobs et al was designed to determine how changes in the self-esteem of college students affected their receptivity to love and affection. First, students took a number of personality tests (the *MMPI*, Rorschach, etc.) A few weeks later, a psychologist returned an analysis of his personality to each student. Half of the students were given a flattering personality report. The reports stressed their sensitivity, honesty, originality, and freedom of outlook. (Undoubtedly this flattering personality report confirmed many of the wonderful things the students already thought about themselves.) Half of the students received an insulting personality report. The report stressed their immaturity, weak personality, conventionality, and lack of leadership ability. This critical report was naturally most upsetting for students.

Soon after receiving their analyses, the males got acquainted individually with a young female college student (actually, this girl was an experimental confederate). Half of the time the girl treated the boy in a warm, affectionate, and accepting way. Under such conditions, the men who had received the critical personality evaluation were far more attracted to her than were their more confident counterparts. (Presumably, the previous irrelevant arousal engendered by rejection facilitated the subsequent development of affection.)

Half of the time the girl was cold and rejecting. Under these conditions, a dramatic reversal occurred; the previously rejected men disliked the girl more than did their more confident counterparts. (Presumably, under these conditions, the low self-esteem individual's agitation was transformed to hatred.)

An irrelevant, painful event, then, can incite various strong emotional reactions toward others. Depending on how he labels his feelings, the individual may experience either intensive attraction or intense hostility.

Frustration and Challenge: Facilitators of Passion

Socrates, Ovid, Terence, the Kama Sutra and "Dear Abby" are all in agreement about one thing: the person whose affection is easily won will inspire less passion than the person whose affection is hard to win.

Vassilikos (1964) poetically elucidated the principle that frustration fuels passion while continual gratification dims it:

Once upon a time there was a little fish who was a bird from the waist up and who was madly in love with a little bird who was a fish from the waist up. So the Fish-Bird kept saying to the Bird-Fish: "Oh, why were we created so that we can never live together? You in the wind and I in the wave. What a pity for both of us." And the Bird-Fish would answer: "No, what luck for both of us. This way we'll always be in love because we'll always be separated" (p. 131).

Some provisional evidence that the hard-to-get person may engender unusual passion in the eventually successful suitor comes from Aronson and Linder (1965). These authors tested the hypothesis that: "A gain in esteem is a more potent reward than invariant esteem." They predicted that a person would be better liked if his positive regard was difficult to acquire than if it was easily had.

This hypothesis was tested in the following way: Subjects were required to converse with a confederate (who appeared to be another naive subject) over a series of seven meetings. After each meeting, the subject discovered (secretly) how her conversation partner felt about her. How the confederate "felt" was systematically varied. In one condition the girl expressed a negative impression of the subject after their first meetings. (She described the subject as being a dull conversationalist, a rather ordinary person, not very intelligent, as probably not having many friends, etc.). Only after the partners had become well acquainted did she begin expressing favorable opinions of the subject. In the remaining conditions, from the first, the confederate expressed only positive opinions about the subject.

As Aronson and Linder predicted, subjects liked the confederate whose affection was hard to win better than they liked the confederate whose high opinion was readily obtained.

The preceding evidence is consistent with our suggestion that under the right conditions, a hard-to-get girl should generate more passion than the constantly rewarding girl. The aloof girl's challenge may excite the suitor; her momentary rejection may shake his self-esteem. In both cases, such arousal may intensify the suitor's feelings toward her.

The preceding analysis lends some credence to the argument that the juxtaposition of agony and ecstasy in passionate love is not entirely accidental. (The original meaning of "passion" was, in fact, "agony"—for example, as in Christ's passion.) Loneliness, deprivation, frustration, hatred, and insecurity may in fact supplement a person's romantic experiences. Passion requires physiological arousal, and all of the preceding states are certainly arousing.

Pleasant Emotional States: Facilitators of Passion?

We would like to make it clear that, theoretically, passion need not include a negative component. The positive reinforcements of discovery, excitement, companionship, and playful-joy can generate as intense an arousal as that stirred by fear, frustration, or rejection. For example, in many autobiographical accounts, entirely joyful (albeit brief) passionate encounters are described (e.g., Duncan, 1968).

Sexual Gratification: A Facilitator of Passion

Sexual experiences can be enormously rewarding and enormously arousing. Masters and Johnson (1966) point out that sexual intercourse induces hyperventilation, tachycardia, and marked increases in blood pressure. And, religious advisors, school counselors, and psychoanalysts to the contrary—sexual gratification has undoubtedly generated as much passionate love as has sexual continence.

Valins (1966) demonstrated that even the erroneous belief that another has excited one (sexually or aesthetically) will facilitate attraction. Valins recruited male college students for a study of males' physiological reactions to sexual stimuli. The sexual stimuli he utilized were ten semi-nude *Playboy* photographs. The subjects were told that while they scrutinized these photographs, their heart rate would be amplified and recorded. They were led to believe that their heart rates altered markedly to some of the slides but that they had no reaction at all to others. (Valins assumed that the subjects would interpret an alteration in heart rate as sexual enthusiasm.)

The subjects' liking for the "arousing" and "nonarousing" slides was then assessed in three ways. Regardless of the measure used, the men markedly preferred the pin-ups they thought had aroused them to those that had not affected their heart rate. 1) They were asked to rate how "attractive or appealing" each pin-up was. They preferred the pin-ups they believed were arousing to all others. 2) They were offered a pin-up in remuneration for participating in the experiment. They chose the arousing pin-ups more often than the nonarousing ones. 3) Finally, they were interviewed a month later (in a totally different context) and they still markedly preferred the arousing pin-ups to the others.

Need Satisfaction: A Facilitator of Passion

Although psychologists tend to focus almost exclusively on the contribution of sex to love, other rewards can have an equally important

emotional impact. People have a wide variety of needs, and at any stage of life many of one's needs must remain unsatisfied. When any important unsatisfied need is recognized or met, the emotional response which accompanies such reinforcement could provide fuel for passion. To the adolescent boy who has been humored, coddled, and babied at home, the girl who finally recognizes his masculinity may be an over-powering joy. The good, steady, reliable, hard-working father may be captivated when an alert lady recognizes that he has the potential to be a playful and reckless lover.

To the person who has been deprived of such rewards, an intelligent, artistic, witty, beautiful, athletic, or playful companion may prove a passionate and absorbing joy.

LABELING

We are proposing a two-factor theory of passionate love. Yet the preceding discussion has focused almost exclusively on one factor. We have concentrated on demonstrating that physiological arousal is a crucial component of passionate love, and that fear, pain, and frustration as well as discovery and delight may contribute to the passionate experience.

We should now at least remind the reader that according to our theory an individual will be incapable of experiencing "love" unless he's prepared to define his feelings in that way.

Cultural Encouragement of Love

In our culture, it is expected that everyone will eventually fall in love. Individuals are strongly encouraged to interpret a wide range of confused feelings as love. Linton makes this point in a somewhat harsh observation:

All societies recognize that there are occasional violent emotional attachments between persons of the opposite sex, but our present American culture is practically the only one which has attempted to capitalize on these and make them the basis for marriage. The hero of the modern American movie is always a romantic lover, just as the hero of an old Arab epic is always an epileptic. A cynic may suspect that in any ordinary population the percentage of individuals with capacity for romantic love of the Hollywood type was about as large as that of persons able to throw genuine epileptic fits (p.175).

* From: *The study of man: An introduction*, by Ralph Linton. Copyright 1936. Copyright © 1961 by Meredith Corporation. Reprinted by permission of Appleton-Century-Crofts, Educational Division, Meredith Corporation.

Individuals are often encouraged to interpret certain confused or mixed feelings as love, because our culture insists that certain reactions are acceptable if one is madly in love. For example, the delightful experience of sexual intercourse can be frankly labeled as "sexual fun" by a man. Such an interpretation of what she is experiencing is probably less acceptable to his partner. She (and her parents) are undoubtedly happier if she attributes her abandoned behavior to love.

Margaret Mead interprets jealousy in one way:

Jealousy is not a barometer by which the depth of love may be read. It merely records the degree of the lover's insecurity. It is a negative, miserable state of feeling, having its origin in a sense of insecurity and inferiority.

Jealous people, however, usually interpret their jealous reactions in quite another way; jealous feelings are taken as evidence of passionate love rather than inferiority. Thus, in this culture, a jealous man is a loving man rather than an embarrassed man.

Thus, whether or not an individual is susceptible to "falling in love," should depend on the expectations of his culture and his reference groups.

Individual Expectations

An individual's own expectations should also determine how likely he is to experience love.

The individual who thinks of himself as a nonromantic person should fall in love less often than should an individual who assumes that love is inevitable. The nonromantic may experience the same feelings that the romantic does, but he will code them differently.

Similarly, individuals who feel they are unlovable should have a difficult time finding love. Individuals convey their expectations in very subtle ways to others, and these expectations influence the way one's partner labels *his* reactions. The insecure girl who complains to her boyfriend: "You don't love me, you just think you do. If you loved me you wouldn't treat me this way," and then itemizes evidence of his neglect, may, by automatically interpreting her boyfriend's actions in a damaging way, effect an alteration in his feelings for her. Alternately, a girl with a great deal of self-confidence, may (by her unconscious guidance) induce a normally unreceptive gentleman to label his feelings for her as love.

REFERENCES

- Aronson, E., & Linder, D. Gain and loss of esteem as determinants of interpersonal attractiveness. *Journal of Experimental Social Psychology*, 1965, *1*, 156-171.
- Ax, A. F. Fear and anger in humans. *Psychosomatic Medicine*, 1953, *15*, 433-442.
- Brehm, J. W., Gatz, M., Geothals, G., McCrimmon, J., & Ward, L. Psychological arousal and interpersonal attraction. Mimco, 1970, Available from authors.
- Byrne, D., London, O., & Reeves, K. The effect of physical attractiveness, sex, and attitude similarity on interpersonal attraction. *Journal of Personality*, 1968, *36*, 269-271.
- Dittes, J. E. Attractiveness of group as function of self-esteem and acceptance by group. *Journal of Abnormal and Social Psychology*, 1959, *59*, 77-82.
- Duncan, I. *Isadora*. New York: Award Books, 1968.
- Finck, H. T. *Romantic love and personal beauty: Their development, causal relations, historic and national peculiarities*. London: Macmillan, 1891.
- Freud, S. The most prevalent form of degradation in erotic life. In E. Jones (ed.), *Collected papers, 4*. London: Hogarth, 1925, pp. 203-216.
- Hohmann, G. W. The effect of dysfunctions of the autonomic nervous system on experienced feelings and emotions. Paper read at Conference on Emotions and Feelings at New School for Social Research, New York, 1962.
- Homans, G. C. *The human group*. New York: Harcourt, Brace, and World, 1950.
- Jacobs, L., Walster, E., & Berscheid, E. Self-esteem and attraction. *Journal of Personality and Social Psychology*, 1971, *17*, 84-91.
- Linton, R. *The study of man (1936)*. New York: Appleton-Century, 1964.
- Maranon, G. Contribution a l'etude de l'action emotive de l'adrenaline. *Revue Francaise Endocrinologia*, 1921, *2*, 301-325.
- Masters, W. H., & Johnson, V. E. *Human sexual response*. Boston: Little, Brown and Company, 1966.
- Mead, M. In A. M. Krich, *The anatomy of love*. New York: Dell, 1960.
- Newcomb, T. N. *The acquaintance process*. New York: Holt, Rinehart, and Winston, 1961.
- Schachter, J. Pain, fear and anger in hypertensives and normotensives: A psychophysiological study. *Psychosomatic Medicine*, 1957, *19*, 17-24.
- Schachter, S. The interaction of cognitive and physiological determinants of emotional state. In Berkowitz (ed.), *Advances in experimental social psychology, 1*. New York: Academic Press, 1964, pp. 49-80.
- Schachter, S., & Singer, J. Cognitive, social and physiological determinants of emotional state. *Psychological Review*, 1962, *69*, 379-399.
- Schachter, S., & Wheeler, L. Epinephrine, chlorpromazine, and amusement. *Journal of Abnormal Social Psychology*, 1962, *65*, 121-128.
- Valins, S. Cognitive effects of false heart-rate feedback. *Journal of Personality and Social Psychology*, 1966, *4*, 400-408.
- Vassilikos, V. *The plant; the well; the angel: A trilogy*. Translated from Greek

- by Edmund and Mary Keeley (1st American ed.). New York: Knopf, 1964.
- Walster, E. The effect of self-esteem on romantic liking. *Journal of Experimental Social Psychology*, 1965, *1*, 184-197.
- Wolf, S., & Wolff, H. G. *Human gastric function* (2nd edition). London: Oxford University Press, 1947.

