Seasonal Affective Disorder and light therapy in a historical perspective

Kathelijne M. Kooreengevel\textsuperscript{1} and Ybe Meesters\textsuperscript{2}

Department of Psychiatry
\textsuperscript{1}University of Groningen
\textsuperscript{2}Groningen Academic Hospital, The Netherlands
INTRODUCTION

Seasonal Affective Disorder, winter-type, (SAD) is a depressive syndrome distinguishable from other depressive syndromes by clinical course and symptom profile (Rosenthal et al 1984). SAD annually occurs in autumn and winter and is often marked by prominent ‘atypical’ symptoms. These symptoms are less frequently observed in non-seasonal types of depression and include fatigue, hypersomnia, an increase of appetite (especially for carbohydrates) and weight gain. In spring and summer there is a complete absence of symptoms. Another prominent feature of SAD is that the majority of patients can be effectively treated with bright light (Terman et al 1989).

As it is first described in the early 1980s, this syndrome as well as its treatment might appear novelties of modern psychiatry. However, a review of history reveals a different picture. Ancient medical scriptures already underscored both the impact of the seasons on the pathogenesis of several diseases and the beneficial effects of light in the restoration of health. The present paper is inspired by the previous work of Wehr (1989). It is devoted to the history of medical views on the seasonality of affective disorders. Furthermore, the history of the use of both sun- and artificial light in the treatment of various illnesses, and of depressive disorders in particular, will be described. This overview, which is not intended to be exhaustive, will highlight the fact that ancient knowledge, although often dismissed and only regarded as a curiosity, might still contain opinions valid in ‘modern’ medical science.

SEASONALITY AND SEASONAL CYCLING MOOD DISORDERS

In early times, illness was believed to emerge from the presence of an evil force, such as a devil, within the patient’s body or mind (Davison and Neale 1982). About 4000 years ago, the ancient Babylonians for instance attributed each disease to the influence of a different demon (Spiegel and Springer 1997). Medicine and religion were tightly intertwined and treatment often consisted of religious procedures. Although demonology existed up to medieval times, the ancient Greeks rejected it. Instead, the
prevailing ancient Greek theory of medicine postulated that diseases originate from natural causes and that nature, in turn, provides proper treatment modalities. These ideas were condensed into the humoral theory (Jackson 1986).

The Humoral Theory

The humoral theory explicitly linked health and disease with seasonal and other environmental influences and was first delineated in the works of Hippocrates (460-377 BC). After its outline in the Hippocratic writings of the fifth and fourth century BC, humoralism remained the central theoretical framework for the understanding of health and disease for about two thousand years (Jackson 1986). The Nature of Man (Hippocrates 1967) describes that four ‘bodily fluids’ or humors govern human physiology: blood, yellow bile, black bile and phlegm. Depending on the time of year, one of these humors predominated. The amount of blood was assumed to increase in spring, whereas a preponderance of yellow bile, black bile and phlegm occurred in summer, fall, and winter respectively. Perfect health was considered a condition in which the body contained a proper mix of the humors with respect to season, whereas sickness resulted from an inappropriate humoral mixture. Not only the onset but also the course of an illness was believed to be seasonal. Thus, if a disease manifested itself in autumn, its remission was expected in spring, etcetera. The book Humours (Hippocrates 1967) stated that especially the change of seasons was responsible for the occurrence of illness. Moreover, it was assumed that human physiology could be well or ill adjusted to a particular season.

The Seasonality of Mood Disorders through the Ages

The Antiquity

In ancient Greece, the state of prolonged fear and depression was known as melancholia. Melancholia is derived from the Greek words μελανα χολε (melaina chole) meaning ‘black bile’ (Jackson 1986). In general, mental disturbances were considered as psychological manifestations of a physiological disturbance. Melancholia was assumed to result from the effects of black bile on the brain. According to the humoral theory, a preponderance of black bile was present in autumn. Therefore, the risk of melancholia was highest in this particular season (Jackson 1986). In the Hippocratic writings black bile was associated with the qualities of coldness and dryness. Aristotle (384-322 BC) instead hypothesized that black bile was a mixture of both heat and cold (Jackson 1986). Aristotle’s ideas on the pathogenesis of mental disease were centered on the concept of ‘natural heat’ (i.e., an entity located in the heart), the energy of which supported the aims and movements of the soul (Roccatagliata 1986). Any factor modifying the ‘natural heat’ and thus resulting in a rise or lowering of temperature could cause psychiatric symptomatology. Both seasons and age were regarded as modifiers of the natural heat. During youth and spring natural heat could
be qualified as hot and moist, whereas old age and winter resulted in dryness and coldness of that heat (Roccatagliata 1986). Both melancholia and mania were assumed to be caused by an excessive quantity of the melancholic humor which was either extremely cold or overheated (Aristotle 1965).

Aretaeus of Cappadocia (ca. 150 BC), probably a contemporary of Galen (Jackson 1986), was maybe the first to suggest a close relationship between melancholia and mania. According to Aretaeus, melancholia arose from a cooling and drying of the ‘vital tone’ (vis vitalis) which was seated in the heart, the center of emotions. As a consequence, a cold pneuma increased the amount of black bile in the blood, resulting in the coldness and dryness of the brain in which the psychic functions were located. Furthermore, Aretaeus taught that the black bile was especially affected in autumn and that melancholia was more frequent in women than in men (Roccatagliata 1986). Galen (131-201) explicitly related each humor and associated season with a fixed combination of two of the four qualities, i.e., hot, cold, dry and moist. Blood (spring) was regarded as warm and moist, yellow bile (summer) was warm and dry, black bile (autumn) was cold and dry and phlegm (winter) cold and moist. Furthermore, Galen introduced the theory of temperaments. According to this theory, nine types of temperaments could be distinguished. The ideal temperament, or constitution, consisted of a balanced mix of the four qualities. The other temperaments, among which the sanguine, phlegmatic, choleric and melancholic type, predisposed to certain illnesses, behaviors and emotions. Like others, Galen noted that an excess of black bile occurred more frequently in autumn and that this excess was responsible for the occurrence of melancholic disease through its effects on the brain (Jackson 1986).

In Caelius Aurelianus’ (250-320) translation of Soranus’ treatises, which were written during the reign of Trajan (98-117) and Hadrian (117-138), it can be read that some physicians avoided humoralism (Aurelianus 1950). However, from other ancient scriptures it can be concluded that the majority of ancient ideas about health and disease were somehow premised on the humoral theory and that furthermore many physicians adhered to the notion of melancholia (and mania) being a seasonal disorder.

**The Middle Ages until the Seventeenth Century**

Not much is known about the prevalence of ideas on seasonality of diseases in medieval times. Although probably not as frequently as assumed (Davison and Neale 1982), from the Middle Ages up to the seventeenth century, mental disturbances were often regarded as resulting from demonic possession (Dewhurst 1962). Around 1628 Burton wrote *The Anatomy of Melancholy* under the pseudonym of Democritus junior. In the introduction of the edition of 1977, it is stated that in this work a bridge is formed between medieval and modern thought. Also Democritus
junior taught that autumn was the most melancholic season of the year (Burton 1977). Furthermore, he elaborated on the effects of climate on wellbeing and described the cold climes as more subject to natural melancholy. The notion of seasons influencing the course of manic-depressive psychosis has also been found in the medical reports concerning Anne Grenville, a patient observed by several prominent physicians of the seventeenth century (Dewhurst 1962). Although not much is mentioned about her depressive episodes, her manic episodes were described as annually recurring in the summer season.

The Eighteenth until the Twentieth Century
At the end of the eighteenth century, Philippe Pinel (1745-1826) had become famous for releasing his patients from their chains at the asylum of La Bicêtre in Paris (Shorter 1998). This founder of ‘modern’ psychiatry published *A Treatise on Insanity* in which he stressed the importance of the changes of the seasons and the weather on the condition of psychiatric patients and stated that periodical insanity was the most common form of psychiatric disease (Pinel 1962). Although he had observed that manic episodes were often precipitated by the summer solstice and terminated by the end of autumn, he also recognized that some manifestations of periodical insanity were not to be ascribed to the change of seasons. Likewise, Pinel’s student Esquirol (1772-1840) acknowledged the climates and seasons as causes of insanity. He observed several cases in which mania exacerbated at the summer solstice or the approach of stormy weather. His *Mental Maladies: a Treatise on Insanity* contains a remarkable description of a 42-year-old Belgian winter-type Seasonal Affective Disorder patient (Esquirol 1965). Following Esquirol’s advice, this patient escaped his next depressive episode – he had suffered from depressive complaints for three consecutive winters - by travelling to the South of France and Italy during the winter season. On the other hand, Pinel also described ‘reverse SAD’, i.e., a patient with manic episodes occurring each winter and remitting each following spring. Finally, he noted that the seasonality of some less severe cases of manic-depressive illness might only be recognized by careful observations during their normal daily routines (Esquirol 1965).

In 1854, Baillarger postulated that in many patients melancholia and mania were both parts of the same disease which he called the ‘folie à double forme’ (Baillarger 1854). He outlined several manifestations of this manic-depressive illness, which differed with respect to cycle length. One of these descriptions consisted of a reverse SAD case. Griesinger (1855-1882) endorsed the idea of mania and melancholia often being alternate manifestations of the same disease. He mentioned that he had observed patients suffering from a severe melancholic state during the winter season which was followed by a manic state during summer, starting at the beginning of
The Middle Ages until the Seventeenth Century
Not much is known about the use of light therapy in medieval times. Christians regarded sunbathing as a pagan practice and might have avoided being regarded as sun worshippers (Kime 1980; Daniel and Hill 1991). Although genuine (sun)light therapy continued to exist (Daniel and Hill 1991), most patients were probably treated with symbolic light of God (Fris 1959).

In 1628, Democritus junior stated in his *Anatomy of Melancholy* that both night and darkness make sad and that clear air exerts the opposite effect (Burton 1977). He furthermore noted that both sun- and candlelight were beneficial to those suffering from melancholy.

The Eighteenth until the Twentieth Century
In the eighteenth century, the positive effects of sunlight on wellbeing were gradually re-appreciated (Kime 1980). In 1815, the physician Cauvin wrote that sunlight had to be prescribed to the sad and the weak. He also stated that light was a curative agent for scrofula, rickets, scurvy, rheumatism, paralysis, dropsy, swellings and muscle weakness (Kime 1980; Daniel and Hill 1991). Both Esquirol (1772-1840) and Cauvin reported on the journeys of some members of the nobility to the South of France and Italy in order to cure their melancholy and spleen, which was a disease of temper (Esquirol 1965, Kime 1980).

In the nineteenth century, some physicians in large cities observed that people working and living under dark and damp conditions lacked energy and were often affected by rheumatic diseases. Furthermore, physicians observed the positive effects of sunlight on several tuberculous diseases (Kime 1980). In 1877, Downes and Blunt found that sunlight is able to kill bacteria and it was Marshall Ward who demonstrated in 1892 that this effect is mainly produced by the ultraviolet component of the spectrum (Kime 1980).

In 1903 Niels Finsen won the Noble Prize for his work on Lupus vulgaris for which he had developed a successful treatment with artificial ultraviolet light (Fris 1959; Kime 1980; Daniel and Hill 1991). Furthermore, at the beginning of the twentieth century, both local and general heliotherapy were applied for the treatment of surgical tuberculosis in specially built sanatoriums (Fris 1959; Kime 1980).

The American ship doctor Frederick Cook was maybe the first to observe a direct link between the deprivation of sun light and a subsequent deterioration of mood (Jefferson 1986). In 1898, the ship *The Belgica* was on an expedition to Antarctica and got stuck in the ice pack for 347 days of which 68 had to be spent in continuous darkness. During his previous travels, Cook had already observed that the Arctic conditions caused Eskimos to live highly periodic lives with ‘diminished secretions and suppressed passions’ during the period of constant darkness (Cook 1894). While the
Historical overview

Spring (Griesinger 1876). Additionally, Pilcz (1901) distinguished a rare form of recurrent melancholy that was not alternated by mania and illustrated this with a case history of a winter-type SAD patient who was previously described by Krafft-Ebing. He mentioned that others, such as Kraepelin, believed that this type of melancholia was actually a form of manic-depressive illness (Pilcz 1901). Kraepelin, in turn, described that in 4-5% of the patients the episodes of mania and depression exhibit a lifetime regular alternation. In the majority of these patients depressive episodes start in autumn and mania in spring, when ‘the sap shoots in the trees’ (Kraepelin 1913). He compared this type of manic depressive cycling with often relatively mild symptomatology, with the seasonal mood variations reported by healthy subjects. At about the same time, the first edition of Hellpach’s book on the effects of weather, climate, soil and landscape on wellbeing was published. Hellpach stated that the various ways in which people reacted to weather influences ranged from complete insensitivity to hypersensitivity. He furthermore questioned the seasonality of manic-depressive psychosis and cyclothymia, but accepted the seasonality of subclinical mood variations (Hellpach 1949).

Also in the second half of the twentieth century seasonality was described in the psychiatric literature. Frumkes (1946) reports the successful psychoanalytic treatment of a 31-year-old clerk who for ten years suffered every winter from depressions from which he recovered every following spring and summer. Kinkelin (1954) describes the course and prognosis of manic-depressive illness and concluded like Kraepelin that the seasonal form of manic-depression is most often found in the less severely affected patients. Not only time of year has been considered responsible for the onset of manic-depressive episodes in several patients. Kraines (1957) postulates that environmental temperature, humidity and barometric pressure affect the severity of psychiatric symptoms in general.

The (Re-) Discovery of Seasonal Affective Disorder

In general, twentieth century’s medical science has abandoned the ancient notion of the importance of seasonal influence on health and disease. Yet, several recent epidemiological studies performed in the Northern Hemisphere have shown associations between the seasons and for instance suicide rates, time of onset and hospital admissions in affective disorder patients. Most of these studies revealed a peak in the occurrence of these phenomena in spring and autumn (reviewed by Rosenthal et al 1983a; Wehr and Rosenthal 1989).

More than two decades ago, a group of scientists became interested in the possibility of endogenous circadian rhythm disturbances underlying cyclical mood disorders (Rosenthal 1998). Their actual reappraisal of seasonally cycling mood disorders, and subsequent definition of Seasonal Affective Disorder originated from the exten-
sive observations of two patients whose depressive complaints appeared to be linked with the seasonal changes in day length (Rosenthal et al 1984). Both patients suffered from depressive episodes recurring annually in the fall and/or winter season. In one of them, a 29-year-old female, these episodes were strongly related with the relative latitude of residence: the further north her domicile, the earlier in autumn the depressive episode occurred and the more severe her symptoms. (Rosenthal et al 1984; Mueller and Allen 1984). Moreover, winter vacations at an extreme southern location relieved her depressive symptoms. Exposure to artificial full-spectrum light in the early morning had dramatic therapeutic effects in this patient.

The other patient, a research scientist who had kept detailed records of his annually recurring affective complaints, noticed that his mood cycles showed a remarkable relationship with day length (Rosenthal et al 1983b; Kern and Lewy 1990). From January till June, when day length is gradually expanding, he was generally hypomanic, whereas in the second half of the year, when day length shortens, he suffered from depressive complaints. In search for a biochemical marker that might correlate with the course of his mood changes, he contacted one of the scientists previously mentioned who had just discovered that the human melatonin secretion rhythm resembles that of other mammals (Lewy and Markey 1978; Lewy et al 1980). The circadian pacemaker governs the secretion of melatonin by the pineal gland. Melatonin secretion predominantly occurs during the night and can be suppressed by light exposure in both diurnal and nocturnal animals. The circadian pacemaker, localized in the suprachiasmatic nuclei of the brain, is very sensitive to ocular light exposure. In animals, the circadian pacemaker is involved in the regulation of seasonal behavior. Melatonin, in turn, is engaged in the communication between the circadian pacemaker and the other organs. Also in this patient an experimental treatment with artificial full spectrum light, in this case timed in the early morning and late afternoon in order to extend day length, was beneficial (Lewy et al 1982).

These findings elicited an increasing amount of research. The study of similar patients resulted in the description of Seasonal Affective Disorder (SAD) and the first results of a novel antidepressant treatment: the manipulation of environmental light (Rosenthal et al 1984). The seasonal occurrence and the beneficial effects of light once again suggested the importance of environmental influences in affective disorders.

**HISTORY OF LIGHT THERAPY**

Life on earth is subjected to geophysical cycles that result in the alternation of light and darkness and the change of seasons. Although largely reduced by means of modern technology, up to date the importance of the geophysical environment,
especially of the alternation of day and night, is still overt in a multitude of aspects of human functioning. In many cultures for instance, darkness is associated with death, fear and mourning and light with the feeling of life, safety and happiness (Fris 1959; Dietzel 1990). In ancient times, many religions were based on the worship of the sun or considered the god that represented the sun of great eminence (Fris 1959; Daniell and Hill 1991). This is most probably indicative for the vital importance of favorable geophysical conditions at that time. The reign of Pharaoh Amenhotep IV from 1353 until 1336 BC is a remarkable example of sun worshipping. This Pharaoh introduced a monotheistic religion around Aten, the sun god, and subsequently changed his name into Achnaton, meaning ‘He who makes himself useful for Aten’ (Freed et al 2000). With respect to ancient medicine, it was already described in former paragraphs that the change of seasons represented the core factor in theories on the preservation of health and the development of illness (Jackson 1986). In line with this, it is not surprising that light has been used as a therapeutic agent throughout all ages.

**Light Therapy through the Ages**

**The Antiquity**

Approximately 4000 years ago, the Babylonian king Hammurabi ordered his priests to use sunlight in the treatment of illnesses (Fris 1959). Furthermore, it is known that the ancient Egyptians, Chinese and Indians were also familiar with the healing properties of sunlight which was applied in the cure of for instance several skin diseases, rickets and psychosis (Daniel and Hill 1991). Herodotus, a physician of the second century BC, emphasized the beneficial effects of sunlight in the restoration of health and is therefore often regarded as the ‘father of heliotherapy’ (Kime 1980; Daniel and Hill 1991). In both ancient Greece and Rome, sunbathing was a popular activity. Ancient Greek took their sunbath in *arenariae*, that were often located near the seaside, whereas Roman houses often comprised *solaria* for the same purpose (Kime 1980; Daniel and Hill 1991). Sunbathing was advised for a variety of afflictions among which anemia, epilepsy, paralysis, asthma, jaundice, malnutrition, and obesity (Fris 1959; Kime 1980). In the second century AD, Aretaeus recommended that ‘lethargics’ had to be exposed to sunlight (Rosenthal 1998). Additionally, in his translation of Soranus’ treatises, Caelius Aurelianus (250-320) described that light as well as darkness could be used as treatment modalities, depending on the type of illness. Darkness was considered as an astringent agent whereas light exerted a relaxing effect. Light therapy with either lamplight or daylight had to be skillfully organized. Aurelianus stated that ‘Light is a relaxing agent by reason of the color by which it is seen, but of necessity because of its fineness it completely envelops the rest of the body even through the unseen’ (Aurelianus 1950).
The Middle Ages until the Seventeenth Century
Not much is known about the use of light therapy in medieval times. Christians regarded sunbathing as a pagan practice and might have avoided being regarded as sun worshippers (Kime 1980; Daniel and Hill 1991). Although genuine (sun)light therapy continued to exist (Daniel and Hill 1991), most patients were probably treated with symbolic light of God (Fris 1959).

In 1628, Democritus junior stated in his Anatomy of Melancholy that both night and darkness make sad and that clear air exerts the opposite effect (Burton 1977). He furthermore noted that both sun- and candlelight were beneficial to those suffering from melancholy.

The Eighteenth until the Twentieth Century
In the eighteenth century, the positive effects of sunlight on wellbeing were gradually re-appreciated (Kime 1980). In 1815, the physician Cauvin wrote that sunlight had to be prescribed to the sad and the weak. He also stated that light was a curative agent for scrofula, rickets, scurvy, rheumatism, paralysis, dropsy, swellings and muscle weakness (Kime 1980; Daniel and Hill 1991). Both Esquirol (1772-1840) and Cauvin reported on the journeys of some members of the nobility to the South of France and Italy in order to cure their melancholy and spleen, which was a disease of temper (Esquirol 1965, Kime 1980).

In the nineteenth century, some physicians in large cities observed that people working and living under dark and damp conditions lacked energy and were often affected by rheumatic diseases. Furthermore, physicians observed the positive effects of sunlight on several tuberculous diseases (Kime 1980). In 1877, Downes and Blunt found that sunlight is able to kill bacteria and it was Marshall Ward who demonstrated in 1892 that this effect is mainly produced by the ultraviolet component of the spectrum (Kime 1980).

In 1903 Niels Finsen won the Noble Prize for his work on Lupus vulgaris for which he had developed a successful treatment with artificial ultraviolet light (Fris 1959; Kime 1980; Daniel and Hill 1991). Furthermore, at the beginning of the twentieth century, both local and general heliotherapy were applied for the treatment of surgical tuberculosis in specially built sanatoriums (Fris 1959; Kime 1980).

The American ship doctor Frederick Cook was maybe the first to observe a direct link between the deprivation of sun light and a subsequent deterioration of mood (Jefferson 1986). In 1898, the ship The Belgica was on an expedition to Antarctica and got stuck in the ice pack for 347 days of which 68 had to be spent in continuous darkness. During his previous travels, Cook had already observed that the Arctic conditions caused Eskimos to live highly periodic lives with ‘diminished secretions and suppressed passions’ during the period of constant darkness (Cook 1894). While the
ship was stuck, Cook noted the adverse effects of the absence of sunlight on the well-being of the crew. Bright light, preferably light from an open fire, offered some relief (Jefferson 1986).

In 1910, Kellogg published a book on phototherapy. Amongst the several disorders for which light treatment was indicated, neurasthenia, melancholia and mania were mentioned. For the treatment of melancholia, Kellogg recommended a combination of a laxative diet and an electric-light bath two to three times a week. Application of the arc light to the spinal region was considered as extremely useful, whereas tanning of the entire body surface resulted in the improvement of the patient’s general condition (Kellogg 1910).

Marx (1946), was the first to report on the successful treatment of Seasonal Affective Disorder-like symptoms with sunray lamps and open-air light baths in three German soldiers encamped in the North of Finland and Lapland during the winter season. He hypothesized that these symptoms were either due to a pituitary insufficiency or simply related to the influence of the altered 24-hour light-dark cycle on the hypothalamus (Marx 1946).

The description of Seasonal Affective Disorder (SAD) and the first results of bright light treatment have been the trigger for the study of the therapeutic potency of light in the early 1980s (Rosenthal et al 1984). At present, light has become the treatment of first choice for this disorder (Terman et al 1989, 1998; Lewy et al 1998, Eastman et al 1998).

**DISCUSSION**

Since ancient times, the change of seasons has been considered an important factor in the etiology of several disorders. Moreover, light, whether originating from the sun or an artificial source, has often been used for the restoration of health. Nevertheless, the description of Seasonal Affective Disorder and the systematic study of the antidepressant effects of light have only started some twenty years ago (Rosenthal et al 1984). Before that time, the etiological and therapeutic properties of light had lost much of the interest.

Several mechanisms have been suggested to underlie this development. First of all, modern medical science has rejected the humoral theory in which the importance of the seasons in the occurrence of illness was central and is nowadays mainly occupied with the search for biochemical, physiological and/or psychological processes (Wehr and Rosenthal 1989). A major reason why light therapy had sunk into oblivion probably lies in the development of pharmacological treatments. The discovery of antibiotics caused light to become obsolete in the treatment of infectious diseases (Kime 1980). Likewise, the invention of psychotropic drugs has led to the domination of
pharmacological treatment of mental illness. In the past, psychotropics were mainly prescribed for the more severely disturbed psychiatric patients, whereas those who did not need hospitalization were offered psychotherapy (Rosenthal 1998). Additionally, it has been suggested that by altering the natural course, pharmacotherapy may have obscured the association between the seasons and the affective disorders (Wehr and Rosenthal 1989).

In the past two decades, many investigations have been devoted to the pathogenesis of SAD and the mechanisms of action of light therapy. Bright light therapy has become the preferred treatment for this disorder (Terman et al 1989, 1998; Lewy et al 1998; Eastman et al 1998). Since 1987, diagnostic criteria for seasonal pattern have been introduced in the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association 1987). Because of its sensitivity to light and its involvement in the regulation of seasonal behavior, the functioning of the circadian pacemaker has received a prominent place in the theoretical framework for studying and explaining the origin of SAD. However, despite extensive research, the involvement of the circadian pacemaker in SAD is still controversial (see for example Boivin 2000). Therefore, as far as the pathogenesis is concerned, a review of the history of Seasonal Affective Disorder and light therapy may end with the words of the Ecclesiastes: ‘there is nothing new under the sun’.

**ACKNOWLEDGMENTS**

The authors are grateful to Iteke te Riet for her contribution in collecting the historical publications.