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# The Pineal Gland and the Ancient Art of *Iatromathematica*

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**Abstract**—The medical astrologers of Ancient Greece: the iatromathematici, and the later European physician-astrologers, assumed a correlation between events in the heavens and those on earth that was relevant to both health and disease.

Some of the early practitioners of modern scientific medicine did the same under the aegis of what we might term, proto-cosmobiology, though none could provide an adequate mechanism to explain the nature of the link they believed existed between the skies and ourselves.

With the discovery and elucidation of the pineal gland's functions in the mid twentieth century, which are discussed in detail, we were in a position to provide such a link, and we can now to a great extent explain in conventional scientific terms how those influences of the sun, moon, planets and other celestial phenomena studied by the early iatromathematici and early cosmobiologists could, can, and do, affect us.

*Keywords:* Pineal gland — melatonin — astrology — geomagnetism — planetary influences

## Introduction

In Ancient Greece there was a distinction made between those who studied the stars in fairly general terms—the *mathematici* or *magi*—and those who did so for medical purposes—the *iatromathematici.* However the two areas of study overlapped considerably, sometimes with little distinction being made between physical and metaphysical speculations. Accordingly, it seems that what we now term separately astronomy and astrology remained virtually indistinguishable for centuries (Tester, 1987: 19, 125).

In addition to cosmological influences, Greek physicians stressed the importance of environmental factors in the welfare of their patients, and considerations of local geography and climate were deemed important in the diagnosis and prognosis of disease (Luce, 1973: 31).

In the thirteenth century, Thomas Aquinas, while sympathetic to astrology, stressed the importance of the eccentricity of the earth's orbit with respect to the links that existed between the earth and ourselves, and the fourteenth century Bishop of Liseux, Nicolas Orseme, stressed the importance of the sun and the moon in contemporary medicine, again making no clear distinction between astronomy and astrology (Tester, 1987: 198).

In the fifteenth century, Sir Francis Bacon suggested that, while it was unlikely that the stars influenced us individually, collectively, populations might be affected by them (Tester, 1987: 221), and in the sixteenth, Galileo's colleague Sanctorius suggested the existence of a lunar cycle in men that paralleled the menstrual cycle in women (McGillion, in press).

So it's clear the early mixture of astronomy and astrology known as, *astrologia* or *astronomia*, gave rise to consideration of physical forces and their effects by informed physician-astrologers, in addition to those "forces" or "influences" we would now think on as purely esoteric or "astrological."

Traditional astrology had long been a part of medical curricula in Western Europe, and, as far back as the eleventh century, it was taught at Bologna University where under the aegis of medical astrologers such as the eminent Professor Giovani Garonzi, physicians sought answers to clinical questions in horoscopes including specialist problems such as those presented by kidney disease (Bonomini et al., 1994; Kibre, 1967). Indeed, it seems an interest in an association between astrology and urology persists, and a contemporary clinical study has repeated this search for such a correlation, concluding that: "…no significant link was found…disproving the traditional astrologer's claims" (Hughes, 1990).

With the onset of the Restoration and the Enlightenment in England, a combination of political and other factors contributed to astrology being removed from formal medical curricula in the West and the subject itself becoming identified with superstition (Curry, 1989; Tarnas, 1998: 486). However, the belief celestial factors were significant in both medical conditions and physiological processes, was still held within the scientific and medical communities in modified form.

Thus, in 1898, the Nobel Laureate, Svante Arrhenius, published *Cosmic Influences on Physiological Phenomena*, while, almost simultaneously, Sigmund Freud and his colleague, Wilhelm Fliess, were developing their own ideas on the nature of the extraterrestrial forces they believed influenced everything on earth, including health, and Freud was assuming he'd become what he termed: "an honorary astrologer" (Fliess, 1923; McGillion, 1998).

In the mid twentieth century, Carl Jung was studying astrology and relating it from a variety of perspectives to his general ideas on depth psychology and the nature of chance events (De Vries & McGillion, 1997). However more practical researchers, such as Dr. Franz Halberg, were studying putative interactions between living organisms and the skies and developing the sorts of concepts that helped define modern cosmobiology (Halberg, 1967, 1969).

What was lacking in all of these investigations, however, and what, in part, tarnished them with the by now unpopular taint of astrology, was the lack of a credible mechanism to explain how celestial events could interact with us biologically.

From Fliess' work in particular which, like Aquinas', stressed the importance of the eccentricity of the orbit of the earth, it was evident that, in order to

substantiate his ideas in this respect, any celestial or "planetary" force would—like the horoscope used by the *iatromathematicus*—have to be capable of description in terms of the position of the sun, the moon and the planets at the time and place of birth. Further, such a force would also have to be evident at frequent intervals throughout life through ongoing celestial influences of a sort the *iatromathematici*, along with other astrologers, believed influenced us on a day-to-day basis.

In the mid twentieth century, after centuries of searching by greater and lesser lights of science, such a mechanism duly arrived when the true physiological role of an anatomical structure itself long associated with arcane matters, became known.

## The Pineal Gland

At various times in the history of medicine the function of the small discrete pea-like structure we have in the centre of our brains, called the pineal gland, was considered to be: a memory valve, a valve controlling circulating vital fluids, the seat of the soul, and the site of a presumed pathology causing certain types of mental illness—"a stony hardness of the pineal gland" (McGillion, 1980: 6).

In the mid nineteen fifties this confusion began to clear when the pineal gland's true function was discovered and the nature of the link between ourselves and certain events in the skies above us was finally revealed.

The modern systematic study of the pineal gland began in 1954 when, after a review of the existing literature of almost fifteen hundred items, Mark Altschule and Julian Kitay suggested it could be a productive area for research (Kitay & Altschule, 1954). Their comprehensive review suggested that the gland—until then generally held to be unimportant by modern scientific medicine—appeared to have a number of possible, if minor, physiological roles, many of which had been reported in the literature on the light sensitivity of certain mammals (Fiske, 1941).

## Melatonin

It was soon established that the pineal gland produced a number of neuropeptides including one: 5-methoxy, N-acetyltryptamine, considered to be the most important of the pineal hormones and commonly called melatonin (Figure 1).

The biosynthesis of melatonin was discovered to be dependent on a number of substrates and co-factors, and on the activity of a number of enzymes including the light-sensitive: hydroxy-indole-O-methyl transferase (HIOMT) (Lerner et al., 1958, 1959).

As Brownstein and Heller (1968) demonstrated, this enzyme—which catalyses the conversion of serotonin to melatonin—is modulated by nerves that impinge directly onto the pineal gland, the activity of which, in turn, depends

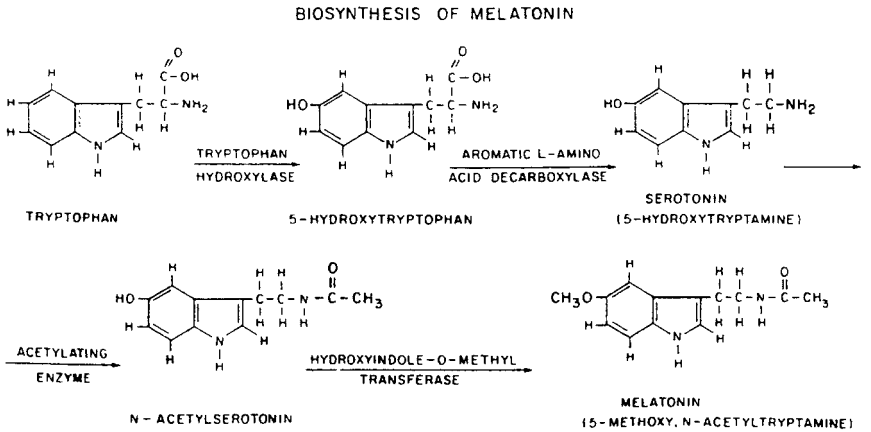


Fig. 1. The biosynthesis of melatonin involves sophisticated interactions between various substrates and cofactors, neural activity via offshoots of the optic nerves, and enzymes such as HIOMT that are sensitive to light and other radiations. Initially discovered to be sensitive to light of certain wavelengths and intensities in the visible spectrum, we now know such enzymes are sensitive to earth strength magnetic fields also.

upon input from the optic nerves. Thus a small proportion of the impulses set up in the optic nerves bypasses the main visual pathway and, instead, takes a circuitous route to the pineal. Stimulation of these nerves modifies the activity of HIOMT and, hence, controls the synthesis of melatonin.

Bright light inhibits melatonin production by inhibiting nerve tone to the pineal, whereas darkness has the opposite effect and, by increasing neural activity to the gland, stimulates the production of melatonin. This effect of light is dependent both upon its wavelength and its intensity.

In 1973, Cardinali et al. showed that red light produced minimal inhibition of melatonin synthesis, whereas green light caused maximal stimulation. In addition, illumination with a light intensity of 0.5 microwatt/cm$^2$ for forty-eight hours produced a fifty per cent decrease in melatonin synthesis in the rat pineal gland.

By way of comparison, sunlight, which strongly inhibits melatonin production, has an intensity of around 50,000 microwatt/cm$^2$, whereas full moonlight has an intensity of around 0.3 microwatt/cm$^2$ (Altschule, 1975: 25).

Because of its low light intensity, the moon was originally thought to have no effect on the production of melatonin by the pineal gland. However, as we discuss below, more recent studies have produced results that suggest there may be some link between lunar phase and the secretion of melatonin (Law, 1986).

In addition to light, other electromagnetic (EM) radiations influence melatonin production, and EM fields of varying strengths and types—including earth strength magnetic fields—have been shown to influence melatonin production to the same degree as the exposure to light does: both *in vivo*, and *in*

*vitro* and in a number of species including humans (Reiter, 1993a,b; Reiter & Richardson, 1992; Schneider et al., 1994; Yaga et al., 1993). Further, magnetic fields of this general type have been found to be effective in directly influencing pineal tissue (Richardson et al., 1992).

## Human Studies

The change of the intensity of ambient lighting with season has long been considered to be a possible source of antigonadal activity in humans as well as animals and, in the late nineteenth century, a description was given in the medical literature of how Eskimo women ceased menstruation in the long winter nights of the Arctic (Cook, cited in Altschule, 1975: 74).

Additional evidence was produced for a seasonal factor linked to reproduction and photoperiod, when a positive bias towards summer conceptions in Finland was demonstrated that showed an increase at more northerly latitudes. The fact the incidence of multiple pregnancies was also increased at these latitudes strongly suggested this was not an effect due to seasonal social influences, but a true physiological effect due to an increased fertility associated with the longer periods of daylight occurring in the summer (Timonen & Carpen, 1968).

Other studies in humans suggested a possibly related phenomenon at work linking light to human reproductive processes. Thus Dewan (1967), and Dewan et al (1978), normalised irregular menstrual flow by using light midway through the menstrual cycle. Similarly, Elden (1971) demonstrated that, of one hundred and twenty predicted births in a sample of congenitally blind women, there was only one actual birth. In an even larger sample, only six births occurred out of a predicted one thousand.

More recent studies have also shown that certain phenomena associated with hyperovulation—such as the incidence of twin births—are linked to both season and photoperiod (Dionne et al., 1993; Fellman & Eriksson, 1999).

Thus with the discovery of the antigonadal activity of melatonin, and with the emergence of the fact it was inhibited by light, we were starting to elucidate a more sophisticated mechanism to explain the effects of light-radiation on reproductive phenomena, one, moreover, that seemed closely related to the actual and putative effect(s) of melatonin on sexual development and hence to the effect of external EM radiation on the pineal gland.

However, one action of extraneously administered melatonin on sexual development identified early on by researchers in this area, appeared not only to be related to its antigonadal action, but to be dependent upon the age of the recipient when it was administered, also.

## "Pre-Programming" from Birth

In a number of sophisticated studies of melatonin in animals, it appeared that, as with certain other hormones, the response of a neonatal animal to

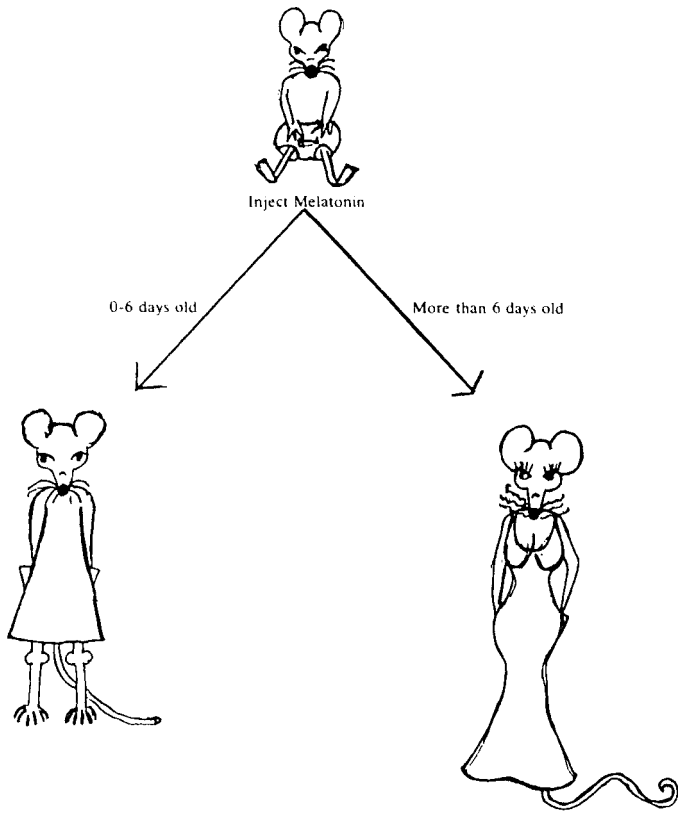


Fig. 2. The "Pre-programming" Action of Melatonin. Administration of melatonin to a neonate around the time of birth can cause developmental changes such as an inhibition or delay in the onset of secondary sexual characteristics. After a certain critical period *post partum*, however—in rats six days—melatonin administration has no such effect.

melatonin administration depended on precisely *when* the melatonin was administered in terms of chronological age. Thus it seemed when melatonin was administered *around the time of birth*, it somehow produced changes in development that were delayed in onset until later in life and were therefore, in a biological sense, "pre-programmed" (Figure 2).

Further, these effects, which have been replicated in contemporary studies, appeared to influence both normal and pathological development (Arai, 1968; Esquifino et al., 1987; Vaughan & Vaughan, 1974).

It was also discovered such changes in development did not take place if melatonin administration was delayed until a certain time *after* birth. Thus these delayed developmental effects of the hormone only occurred when it was administered at a set, critical time during the perinatal period.

As one researcher unambiguously stated in this context: "...alterations of the hormonal status of a neonate during a defined critical period [after birth]

lead to profound sequelae in…subsequent biological function," (Reiter et al., 1975: 82).

From consideration of this phenomenon it was clear there were mechanisms involved that could potentially be of major significance to our long-term development in that: "neonatal administration of melatonin may cause…an abnormal secretion of biogenic amines in adulthood…" (Reiter et al., 1975: 90).

Such delayed-onset, or "pre-programming" effects of perinatally administered melatonin, while short lasting without reinforcement, were evident in a number of behavioural and physiological indices studied in animals. They included, not only those associated with sexual development, but other developmental features also, including exploratory and maternal behaviour. Further, they could be produced either by the direct administration of melatonin, or by pinealectomy at birth, strongly suggesting a primary causal role for melatonin in these processes (Sampson, "Maternal Behaviour in the Pinealectomised Rat", cited in Altschule, 1975; Sampson & Bigelow, 1971).

In addition, observations in humans where congenital blindness, or exposure to extremes of light-dark periods had been evident at the time of, and immediately after, birth, paralleled these findings, and studies in both congenitally blind women and other groups continue to provide pertinent observations and findings in this respect (Boldsen, 1992; Commentz et al., 1997; Jaldo-Alba et al., 1993a,b; Kennaway et al., 1992; Sans, 1977; Schmidt et al., 1995).

## Effects of Ambient Electromagnetic Radiation

Given the production of melatonin is, amongst other things, controlled by the intensity and nature of ambient electromagnetic fields (EMF's) of geomagnetic strength, then the intensity and orientation of the EM field(s) a neonate is exposed to perinatally could obviously alter the level of pineal melatonin in that neonate and hence, influence its later development.

We know the exposure of neonatal animals to light significantly changes later melatonin secretion patterns, and we know similar effects occur in human newborns (Fielke et al., 1994; Pelisek et al., 1994). We also know EM radiations significantly alter circulation melatonin in humans (Graham et al., 1997; Juutilainen et al., 2000; Reiter, 1995). And there also appears to be a link between the geomagnetic field and developmental factors in humans. Thus, the only significant factor that correlates with the development of epilepsy in young adults is the level of geomagnetic activity for two days after birth, and geomagnetic variables have also been considered to be a *trigger* for birth. There is also a significant correlation between the level of geomagnetism on, and for up to three days before, the birth of male children (Persinger & Hodge, 1999).

Hence an association between the precise time of birth and later general developmental traits might be expected, and, in one of the most recent social studies of this general type, Wallace and Fisher (2001) have reported that our preference for day or night activity—i.e. whether we are a "day person" or a

"night person"—appears to be determined quite simply by whether we were born during the day or born at night.

The mechanism they suggest for this predisposition is one relating to a setting of our body clock, and, if true, the neonatal effects of melatonin and the light-dark sensitivity of the pineal gland discussed above could be important in this respect.

Hence, despite the many potential variables inherent in all these studies, what clearly emerges is that the precise time of exposure to altered levels of melatonin, *relative to the time of birth*, is probably a critical factor in determining whether or not some change in development or behaviour is observed in adulthood.

In other words, exposure of a neonate to melatonin, or to factors that significantly alter circulating melatonin levels at the time of birth—such as local geomagnetic and other EM fields—can potentially lead to highly significant changes in later development and behaviour.

Put simply: the place, time, and date of a child's birth can—at least in part—determine its future development: an observation that would have been assumed by the *iatromathematicus* and his fellow astrologers.

## Magnetite

Despite our increased understanding of the functions and mechanisms of action of the pineal gland in the past few decades, the precise mechanism at a cellular level whereby electromagnetic radiation can produce biological effects was, until recently, unknown. However in the past decade or so, studies of the ferrous mineral known as magnetite, have shown it can act as a transducer linking ambient electromagnetic activity to cellular function. In addition—in both animals and humans—magnetite has been identified in most tissues examined, including the pineal gland (Lohmann & Johnsen, 2000; Schultheiss-Grassi & Dobson, 1999).

## Newborns

In part as a consequence of the potential development-modifying actions of pineal activity and melatonin on neonates, Reiter (1995) has suggested that any perturbations in electric and magnetic fields causing a reduction in normal melatonin levels in humans could have significant physiological and pathophysiological consequences.

Such considerations have led some health professionals to reassess the practice of exposing neonates in intensive care units and neonatal nurseries to strong light and other EM fields, given the known, or postulated, associations of such exposure with breast cancer, reproductive irregularities, and depression (Glotzbach et al., 1993).

Given all of this, we should expect something else that our *iatromathematicus* would presumably have assumed: the existence of a quantifiable link between certain, long term developmental factor(s) in humans, and the purely

physical factors that dictate the degree and type of radiation a neonate is exposed to *post partum.* Such physical factors include: photoperiod, local geomagnetic and other ambient EMFs, and what in great part determines these, and what we shall consider here in some detail for the purposes of illustration: seasonality and the season-of-birth.

## Seasonality

The second century Greek physician, Aretaeus of Cappadocia, in his *On Airs, Waters and Places* stated quite clearly: "…human diseases change along with the seasons." This was a view shared by later scientists and physicians such as the eighteenth century English physician, Richard Meade, who stressed the importance of such seasonal factors in his seminal work, *The Action of Sun and Moon in Animal Bodies* (Roos, 2000).

A number of our forebears believed season of *conception* was of some importance to our later lives, and in contemporary epidemiological studies, there are some aspects of development that have been looked at in this respect (Liederman & Flannery, 1994). However, most studies of the relationship of seasonality to the subsequent development of normal or pathological traits refer to the season-of-birth.

## Season-Of-Birth Effects

There are a great many month-of-birth and season-of-birth studies reported in the medical literature, and they include attempts to associate this with conditions such as: diabetes (Laron et al., 1999); morning-evening preference (Natale & Adan, 1999); left or right handedness (Martin & Jones, 1999); cleft lip (Fraser & Gwyn, 1998); panic attack (Castrogiovanni et al., 1999); bulimia (Morgan & Lacey, 1999); alcoholism (Levine & Wojcik, 1999); ectopic pregnancy (Cagnacci et al., 1999); weight and length at birth (Wohlfahrt et al., 1998); psychiatric problems (Torrey, 1975) and many others.

Such studies are not always easy to analyse or interpret and they often show a diversity of results within the conditions or parameters being studied. In addition, it has been suggested such effects could be merely statistical artefacts due to a type of age incidence phenomenon, whereby an event occurring predominantly at a particular age appears to correlate significantly with season-of-birth (Lewis, 1989 a,b).

While such considerations may well account for some reported season-of-birth effects to a greater or lesser degree, it is unlikely to account for all of them. For despite these considerations, many accomplished research workers continue to look for and report such effects in the literature, and—perhaps more importantly—very definite changes *do* occur in mammalian biology due to seasonal effects, especially in the case of the pineal gland. The awakening of reproductive function in many species in springtime is a seasonally determined biological phenomenon—not a statistical artefact.

Anyway, in the context of this paper, what really matters is how physicians and others, prior to the age of modern scientific medicine, observed and interpreted phenomena such as seasonal changes in behaviour or health, and related them to cosmological factors. Whether or not they were statistical artefacts, didn't appear to be of major import to such as Paracelsus—or indeed Freud.

For all of these reasons, we will address at least one season-of-birth effect as if it *were* biologically determined for the purposes of elucidating the biological model and/or thesis underpinning this paper: that in both contemporary and historical society, astrology gained credibility due to seasonal related changes in pineal physiology.

## The Seasonality of Schizophrenia

One parameter that has been both strongly and consistently associated with the season-of-birth for many years now—and the one we shall look at in detail to examine more fully the various seasonal factors that influence the pineal gland—is the population incidence of schizophrenia.

Although the disorder termed, *deficit schizophrenia*, appears to show an excess in summer births at northern latitudes, (Kirkpatrick et al., 2000), there's little doubt that there appears to be a tendency for people who go on to develop the psychotic disorder we generally call, schizophrenia, to be born at an increased incidence around the time of the spring (vernal) equinox in both the northern and southern hemispheres (Torrey, 1975; McGrath & Welham, 1999).

This pattern of birth demonstrates a parallel with the idealised annual pattern of mammalian pineal gland activity, which, given its sensitivity to light and other EM radiations, is associated with photoperiod in a similar, seasonally related, manner (Figure 3).

To our physician-astrologer predecessors, this sort of pattern—possibly on a month-to-month basis—would have borne a direct relationship to the Signs of the Zodiac (i.e. of the western, or *tropical*, zodiac, as opposed to the *sidereal* zodiac which is based on the background of fixed stars), which are effectively monthly divisions of the solar orbit. Further, the Sign of the Zodiac that astrological tradition associates with psychotic illness is the Sign of Pisces, which the sun "occupies" until precisely the day of the vernal equinox.

Both length of day *and* geomagnetic field, fluctuate by season and both are associated with varying melatonin excretion, which peaks in June and November when low values of the geomagnetic field are recorded (Bergiannaki Joff et al., 1996).

In addition, naturally occurring EMFs, which vary seasonally, have been associated with affective disorder (Sandyk et al., 1991), and at the equator, where there is no seasonal photoperiod change, the seasonal effect on schizophrenic births reportedly disappears (Parker et al., 2000).

All of this appears to be compelling evidence for a possible role of the pineal gland and melatonin in the apparent seasonal related aetiology of this disorder: a disorder, moreover, in which pineal extracts and melatonin had previously been thought to be beneficial (Altschule, 1957; Eldred et al., 1961).

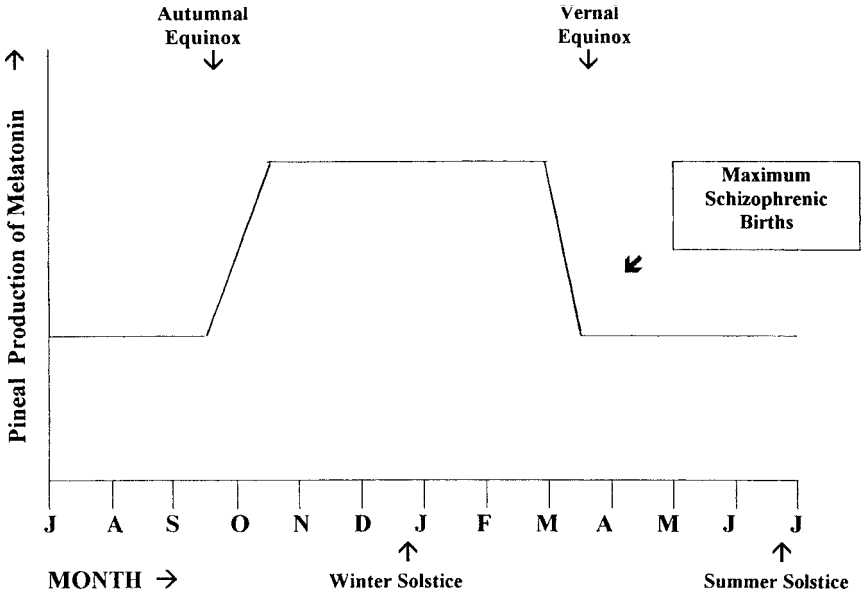


Fig. 3. Idealised correlation between seasonal pineal activity and schizophrenic births in the Northern Hemisphere.

It is interesting from a variety of perspectives to observe that the presence of this particular seasonal pattern has led to a resurrection of *iatromathematical* thinking, and prompted contemporary psychiatrists to look for a correlation between schizophrenia and *astrology*. Indeed, a positive correlation between aspects of schizo-affective disorder and astrological factors has recently been reported in the medical literature (Ohaeri, 1997).

However, a number of culprits other than astrological influences can be, and have been, suggested to account for this putative relationship between season-of-birth and schizophrenia. They include statistical artefact as discussed, as well as: infectious diseases—including poliomyelitis and influenza (Battle et al., 1999; Suzisaari et al., 1999), various prenatal and perinatal factors (Geddes, 1999; Hultman et al., 1999); extremes in temperature (Watson et al., 1984); exposure to EMFs, and light, (Sandyk et al., 1991); and other factors, including possible novel biochemical abnormalities (McGillion et al., 1974).

## Seasonal Disorders

In other areas of psychopathology, however, there is little doubt that, at least in some cases, an overt pathological mood state *is* directly associated with a specific season of the year and with pineal gland function, though not specifically with the season-of-birth. In such cases, season and mood or other disorders are linked in a way that strongly suggests at least one prime cause could

well be an influence—direct or indirect—of ambient EM radiation, including solar radiation, on the pineal gland and melatonin production (Summers & Shur, 1992; Clarke at al., 1999).

Thus, although changes in artificial lighting can have acute beneficial effects on such conditions (Hawkins, 1992), the occurrence of the depressive condition known as seasonal affective disorder (SAD), and of certain eating disorders such as anorexia nervosa and bulimia nervosa, appears to bear a direct relation to the seasonally induced change in daily, ambient, lighting (Rezaul et al., 1996).

Illumination of a type and magnitude that improves such disorders clinically is capable of changing the rhythm of melatonin excretion, and symptomatic improvement of affective disorder can be produced by light of the wavelength(s) the pineal gland is particularly sensitive to (Laakso et al., 1993; Oren et al., 1991).

Further, a reversal of seasonally induced changes in light intensity and duration, through, for example, the use of a light-box or simulation of dawn, can alter melatonin metabolism and reverse both the progression and outcome of the seasonal condition in question (Danilenko et al., 2000; Terman et al., 1989, 1998).

Once again, there is probably no simple causal connection between melatonin secretion and clinical effect, as cognitive studies involving the use of what research workers have termed, "symbolic" light, can also improve these disorders, suggesting both cognitive and physical factors are at work (Bouhuys et al., 1994).

However, the evidence for *some* sort of involvement of melatonin in seasonal mood, and, other disorders is compelling, and—given the role of ambient radiation in pineal melatonin metabolism—it seems reasonable to suggest the existence of a psychophysical link between pineal activity and mood state; one that could, just conceivably, bear some connection to the seasonal birth effect in schizophrenia and other conditions.

Seasonal changes in melatonin levels that are directly associated with EMF intensity have been reported in the literature as indicated (Bergiannaki Joff et al., 1996), and this is suggestive of a possible linkage between: season, geomagnetic field fluctuation, melatonin production and immediate, or delayed, acute, or chronic, normal and pathophysiological states.

It is likely therefore, that, to a greater or lesser degree, the effect of such EM radiations on the human pineal gland during the perinatal period may, in some way, predispose certain children, born in a specific month and/or season, to developmental changes that, later in life, could lead to the development of physical, and/or psychological, traits related to specific pathologies, including schizophrenia.

## Personality

There is also evidence to support the possibility of a, greater or lesser, biological basis for certain personality traits (Balada et al., 1993; Uvnas-Moberg

et al., 1993) including those partly determined by season, and by pre-natal hormonal effects (Frogon & Prokop, 1992).

If such reports are demonstrative of a causal link between early biological development and personality of the sort we referred to above in the studies on neonates, we could reasonably suggest the season-of-birth, and/or the prevailing EM conditions at the time of birth, might equate with subsequent personality type through some such mechanism. This is another relationship that would have been assumed by our *iatromathematicus*.

## The Moon

The *iatromathematici* gave due consideration to the moon as well as the sun in terms of human physiology: the former often being associated with physical characteristics and the latter, psychical ones—a reversal of roles in terms of what later astrologers were to attribute to these "planets" (Tester, 1987: 28). Similarly, many astrologer-physicians thought chronic diseases were associated with the sun, and acute ones with the moon (Camden, 1930) and, as we have seen, Sanctorius posited a male menstrual cycle—something as it happens also posited by Wilhelm Fliess (McGillion, in press).

In more contemporary literature, there is evidence that suggests the existence of some sort of lunar effect on animals (Brown, 1967), and claims of a putative lunar effect on humans, though still highly controversial, continue to be reported and refuted with almost equal incidence. (Cutler, 1980; Drysdale, 1999; Law, 1986; Mikulecky & Valachova, 1996; Parry, 1999; Raison et al., 1999; Rotton & Kelly, 1985).

Despite this ongoing controversy, it would appear *some* sort of biological effect of the moon—whether direct or indirect and of a greater or lesser significance to us—could possibly occur in humans in a number of conceivable ways of which some at least would appear to be scientifically credible.

Thus a putative effect of the moon on pineal activity seems credible (Law, 1986), as does another—that could be related—through the highly speculative mechanism of *magnetospheric resonance*, which is described below.

## Other Astronomical Phenomena

In the medical and scientific literature, in addition to those reports concerning photoperiod, season, the sun and the moon, there are others of a number of more general astronomical phenomena that appear to be able to influence biological systems. Thus, sunspots (Takata, cited in Dean, 1977: 505), the solar wind (Randal, 1990), the regular movement of the earth through space (Piccardi, 1962: 146), and even supernovae (Terry & Tucker, 1968), have been implicated in this respect.

Perhaps importantly, a possible causal relationship between the solar wind, human birth rates, magnetism, and melatonin has also been proposed, which demonstrates troughs at the solstices and peaks at the equinoxes: the latter

times being those when, as we have seen, schizophrenic births have a greater incidence (Randal, 1990).

Additionally, one of the more general astronomical phenomena that reportedly influence biological systems has a peak in March and a lesser peak in September: again, a parallel with the findings on the incidence of schizophrenic births (Piccardi, 1962: 146).

## The Planets

For many years there have also been a variety of suggestions as to how the planets might influence us here on earth, though some of these findings and their suggested mechanisms of action have since been disputed and others put in a more appropriate context than they were perhaps formerly assigned to (Dean, 1977: 215).

However, some astronomers have suggested certain planets may influence the solar wind and solar and geophysical EM fields—collectively termed the magnetosphere—in a predictable manner through a resonance type effect (Seymour, 1988: 98).

Such an effect is observed with the moon and the tides, an example being the tidal range in the Bay of Fundy, which varies between a few feet and sixty feet as a consequence of resonance phenomena apparently linked to lunar movements relative to that location (Seymour 2000).

Unlikely as some researchers find such a possibility, if there *is* a significant effect of certain planets on EM fields of a type and intensity known to influence the pineal gland, it's just possible the positions of certain planets at the time of birth could—to a greater or lesser degree through the perinatal actions of melatonin—influence our development and behaviour from the time of our birth as physician-astrologers have claimed for millennia.

## Size of Effects

Any influence of the planets on the magnetosphere based in a simple manner on the laws of gravitation would be infinitesimally small. However, the possibility of resonance effects suggests that through "tidal effects"—whereby the gravitational forces of the planets interact with the sun, the moon and the solar wind and so affect the magnetosphere—changes in local geomagnetism could influence biological systems, including those in the newborn. Indeed there are reported correlations between the sun and moon, other celestial bodies, and geomagnetism (Mikulecky et al., 1996).

In this general context it is relevant to mention that, in addition to purely solar or lunar phenomena, certain types of extraterrestrial influence involving *both* sun and moon appear to affect us to a degree, as some people appear to be more susceptible to death due to heart attack (Sitar, 1989).

Despite these more specific considerations concerning the origins of the various astronomical influences on us, one researcher suggests it isn't necessarily productive to isolate and separate those that originate from the various

terrestrial and extraterrestrial sources. Instead, it's suggested we should attempt to integrate these through a series of experimental models; though caution in so doing is urged because: "…this may lead to popularisation of astrology which has nothing in common with serious research" (Sitar, 1994).

## Day-to-Day Effects of EMFs

There is now also a large body of work suggesting changes in geomagnetic, and other, radiations in an individual's immediate environment could—mainly it seems through actions on the temporal lobe of the brain—produce subjective experiences in humans which, certainly in some cases, could approach hallucinatory status (Persinger, 1995).

It has even been credibly suggested there could be an association between wars, increased solar-geomagnetic activity and aggression (Persinger, 1999)—in very general terms, the sort of qualitative relationship between celestial forces and political or military action, that the *mathematici* or *magi*, were traditionally consulted about.

Research in this general area—of applied EMFs to human volunteers—has also suggested the possible involvement of melatonin in both the objective and subjective phenomena produced by such fields (O'Connor & Persinger, 1996, 1997; Persinger, 1993), an association consistent with melatonin's known sensitivity to these.

Hence, if astronomical factors *do* regularly alter such fields in a physiologically significant manner, we might well expect them, not only to be capable of influencing development in the long-term in neonates, but also to be capable of producing day-to-day changes in objective and subjective parameters in people of any age: precisely the sorts of conditions for "celestial" or "planetary" influences required by those such as Fliess and the *iatromathematici*.

The existence of such acute changes is reminiscent of the possible role of sunlight and other EM radiations in SAD and other seasonal disorders. However, in the case of those that influence the temporal lobe and melatonin, their effect on us could well be a great deal subtler than the gross mood changes seen, for example, in SAD.

Accordingly, when it comes to considering the possible effect on us of "celestial" and "planetary" influences, to quote Sir Francis Bacon: the stars may "…rather incline than compel" (Tester, 1987: 221).

## Conclusion

It is evident that consideration of the diverse factors that influence the activity of the pineal gland, including those that occur in the skies above us at and around the time of birth, might help us discover hitherto unknown relationships between these and our later development.

The sun, and possibly the moon—considered to be earth's planets by our forebears—influence the pineal gland and its major hormone, melatonin, which can in turn influence development. It is unlikely, but possible some of

the planets could do the same by way of a planetary resonance effect on the magnetosphere.

Further, the place, time and date of our birth—the essential parameters of the horoscope—determine our environment in terms of the intensity and type of light and other electromagnetic radiations we're exposed to: thus also partly determining neonatal melatonin levels at birth.

Many of the above factors are also potentially related to certain types of subjective experience we may have due to ambient electromagnetic field effects on our temporal lobes—again perhaps facilitated by alterations in melatonin metabolism. These could also predispose to, and/or cause influences on our mood, and other, states of consciousness on a day-to-day basis.

Such considerations may provide a rational basis for the traditional belief system of astrology in general and for the practitioners of medical astrology: the *iatromathematici*. They probably also give us a firm biophysical basis for the proto-cosmobiological theories of scientists and physicians like Svante Arrhenius and Wilhelm Fliess, as they undoubtedly do for many of the findings of the more modern, established science of cosmobiology.

In other words, many of the medical and physiological associations that have, for millennia, been thought to exist between celestial phenomena and ourselves, are probably not those of arcane astrological influence, or of some other esoteric quality of celestial phenomena. They are almost certainly the result of the effect of known physical forces on the pineal gland and melatonin, both at, and around, the time of our birth, and, quite possibly, throughout the course of our life.

Thus, although the rationale may be different, and the context in cosmological terms considerably altered, it's all very much like the practitioners of the ancient art of *iatromathematica* said it was.

## Note

[1] The author is a member of the Research Colloquium on Astrology coordinated from the University of Southampton, U.K.

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## COMMENTARY

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The ancients claimed that our health is indicated in the heavens at our moment of birth. Modern astrologers claim the same. Could it be true? Dr. McGillion reviews more than 120 references relevant to the pineal gland and concludes that, yes, it could be true: "it's all very much like the practitioners of the ancient art of *iatromathematica* said it was." The planets do affect us.

If such claims are seen as a broad *unspecific* yes-the-heavens-affect-us, it is hard to disagree, as those who depend on daylight will testify. But *specific* claims are something else. Some examples: "Mercury well placed and aspected at birth gives a good and well-balanced mind … Venus rules the veins of the legs … high blood pressure is denoted by Jupiter and Mars … rheumatism is caused by Saturn", and only the birth moment is significant (Cornell, 1972). It is clearly a leap of faith to link such claims with pineal effects during the perinatal period. It is like noting how the timing of my barbecue is influenced by a full moon and concluding that, yes, astrology could be true.

Of course it might be different if iatro/astro claims had some basis in observation. But they are based on magical analogies (X has properties A and B, Y has A, therefore Y also has B) in which the role of observation is effectively denied—there are far too many variables, their conflicting indications guarantee nonfalsifiability (so nothing could be genuinely observed), and inferential errors are the norm (Dean et al., 1999).[1]