Some Energy Field Observations of Man and Nature

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Since the early 1960s, considerable effort has been focused on the overall study of psychoenergetics by investigators in the Soviet Union (Ostrander and Schroeder, 1970). An organization chart of their activities in this area is given in *Figure 37*. In this paper attention will be focused on only two of these topics, (1) high-voltage photography (Kirlian photography) and (2) acupuncture.

In the following section, a description of some of the Soviet devices and their experimental results will be reviewed. In addition, some English work using D.C. pulses is presented and some American results are discussed to indicate the complexity of the process being dealt with here. In the next section, attention is

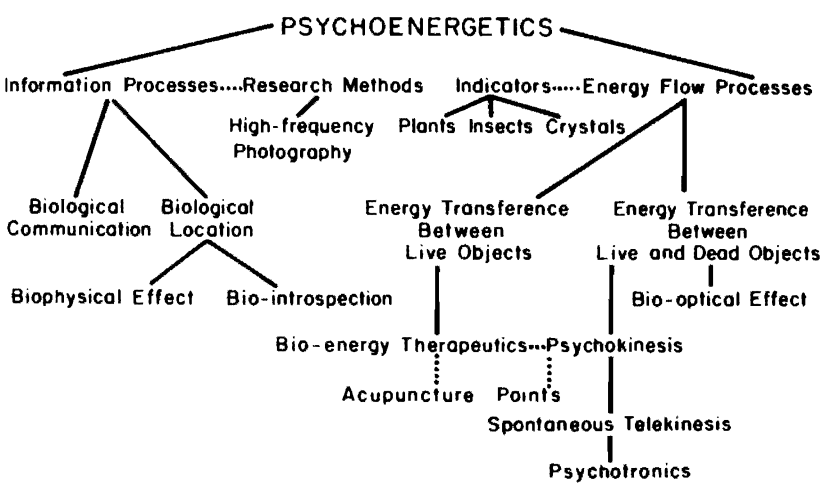


Figure 37. Organization chart, psychoenergetics in the U.S.S.R. (courtesy, E. Naumov)

focused on instruments and experiments for the measurement of electrical resistance, voltage, current and energy emission characteristics of acupuncture points during conditions of well-being, ill health, emotional and mental stimulation, etc. A review of some of the experiments of Kim Bong Han (1963, 1965), which purport to have (a) delineated the morphology and the environmental structure of the acupuncture meridians and the active elements of the acupuncture points, (b) measured the circulation of a fluid within the meridians independent of the other major body circulatory systems, and (c) outlined the biochemical and histochemical study of the overall system, are presented.

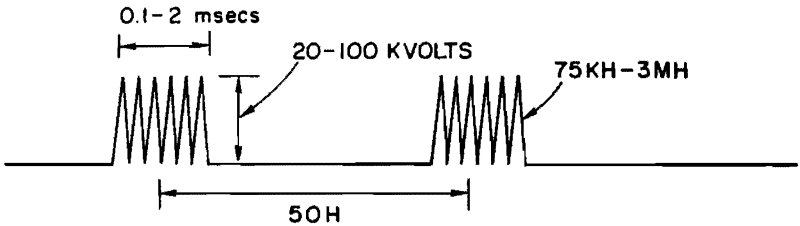
Finally, utilizing a colloid stability model, a rationalization of the efficacy of acupuncture point stimulation on the vitality level of particular body glands and systems is presented.

KIRLIAN PHOTOGRAPHY

A. Review of Some Soviet Work

In this section, the important features fall into three categories: (a) the operating characteristics of the electrical power source and the postulated mechanism of device functioning, (b) the configuration and components of the information display and recording devices, and (c) the general experimental results obtained.

(a) V. G. Adamenko (1971) has indicated that the power source for Kirlian photography should be a pulsed high-frequency field, somewhat similar to a radar power source. The pulse characteristics are given in *Figure 38*, and are (i) pulse height=20K–100 K volt, (ii) pulse width=10^{-4} to 2×10^{-3} sec, generally (as small as 10^{-6} sec in some cases), (iii) pulse repetition rate=60 per sec, and (iv) A.C. frequency=75 to 3000 K hertz. This electric field is applied to a device, such as illustrated in *Figure 39*, producing a discharge phenomenon that appears to be cold electron emission from living systems (because the current/electric field relationship follows the Fowler-Nordheim plot). It is felt that the electron work function varies over the surface being photographed and, in air, the picture of the discharge channel occurs as a result of the positive ions clustering around the channel providing a focusing effect to the electrons.



KIRLIAN POWER SUPPLY CHARACTERISTICS

Figure 38. Electrical output properties of the energy source (courtesy, W. A. Tiller)

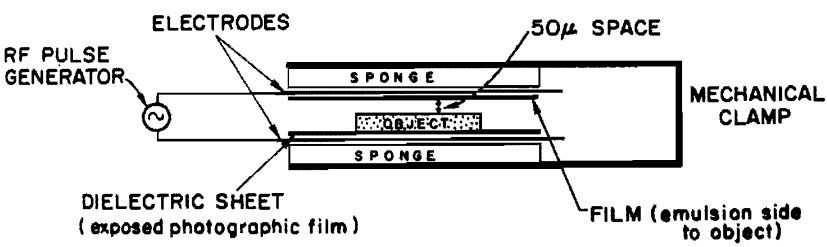


Figure 39. Simple electrode device for taking Kirlian photographs (courtesy, W. A. Tiller)

The Soviet experience was that a single D.C. pulse would not be effective in producing the desired effect and that it would be rather dangerous to use D.C. rather than high-frequency A.C. inside the pulse envelope. Although a static electric field of the same value as used in the A.C. system ($\sim 10^7$ volts/cm) would also yield cold electron emission, the situation is not straightforward as strong polarization of the electrodes would occur (electrolysis). The Soviets feel that it is necessary to have a discharge spacing between the specimen and the film in order for proper channel formation to occur (as a result of positive ion clustering around the electron stream). The electrons exit from the surface

with different velocities and this includes information about the object. If one uses a D.C. power source, equilibration of electrons seems to occur and the image is absent. With D.C., in the first few moments an image appears but then disappears later as equilibration occurs. The H.F. signal is also used in the pulse so that one can decrease the size of the equipment. The use of different frequencies allows one to obtain quite different pictures, presumably associated with different resonances from different cells, etc.; i.e., the electrons can come from different parts of the skin.

Actually, one need use only one pulse to obtain a photograph. The slow pulse repetition rate is to provide low average power. It seems that a pulse duration of about 2×10^{-3} sec is maximum and, if τ is much larger, the image is poor. On the other hand, if τ is too small, the channel discharge process does not have time to develop. (For contact photography, one can use $\tau\sim2\times10^{-6}$ sec.) The total current drawn from the entire surface is less than 1 μ amp so that the actual current in a discharge channel is much less. They suggest that this is the reason for the stability of the cold electron emission.

The average power of a generator is about 1 watt (pulse power is much larger, of course). Thus, quite small generators using batteries, transformers, transistors, etc., can be built and taken out into the field. However, such small generators generally do not have as much stability as one would like.

It has been stated (Adamenko, 1971) that any discharge includes photons but that only discharges in a strong field produce an image. This seems to relate to electron acceleration which leads to photon emission. Of course, even the radiation damage effect of the electrons hitting the photographic grains can be expected to produce massive exposure of such grains.

(b) In the simplest Kirlian device, shaped like a sandwich or parallel plate condenser, the object is placed between the two plates to which voltage is applied. If the condenser plates are too close to the object, there will be no effect on the film. In order to get good pictures, there must be a dielectric gap between the object and the film. The exposure time depends on the film speed and on the power density of the electric field.

To improve the effect and augment it, a fine screen (like a silk screen) may be placed between the object and capacitor plate

(and film). The film is between the condenser plate and the screen. This screen enhances the effect, probably by its serving as a dielectric. One type of effective screen material is film itself that has been completely exposed and developed.

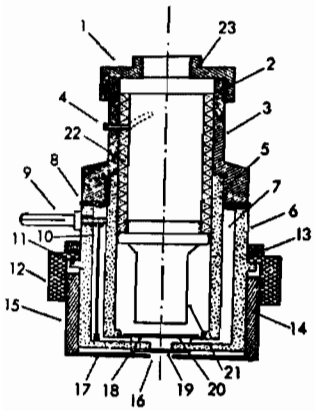
The device can be placed in a clamp arrangement as illustrated in *Figure 39,* the clamp being used to apply a slight but even pressure via the paralon (or sponge) pads. The electrodes are developed X-ray film (AgBr→Ag) and the leads are fastened to them as indicated. The dull matt finish of these electrodes provides poor reflectivity of light and thus is an aid to producing a good image. The spacing between object and film is about 50 microns (can be 10 μ to 100 μ).

To improve the resolution, a layer of saline water or other conductive liquid is sometimes placed between the object and the film. In this case, the film is placed with the emulsion facing away from the object so that the emulsion will not be disturbed. The capacitor plate is then placed outside the film. A further improvement can be made by using the conductive liquid as one of the capacitor plates, thereby permitting better resolution and faster work with the film.

For taking pictures of a section of human skin or other part of the body, only one electrode is needed. In this case, the body acts as ground; i.e., only one half of the device, presented in *Figure 39,* is needed. This same electrode procedure is used for the Kirlian microscope, illustrated in *Figure 40,* when it is applied to the body.

A simple rolling device, which has the advantage of operating at less than 1 watt average power, was also described. It is illustrated in *Figure 41.* In this device, no discharge occurs at points A or C but does occur at point B where the spacing is about 10 microns. The cylinder is rolled at about 10 cm/min and gives a moving line discharge to expose the film in sequence. A device for taking moving pictures is illustrated in *Figure 42.* It utilizes the arrangement of *Figure 39.* Controlled weights are applied to the device and the film is pulled through at some particular speed while the discharge process is going on. The film is rolled in the usual way and all is contained within a casette.

Figure 43 is an illustration of an extremely useful device idea. The previous methods utilized rigid capacitor plates which do not



1. Transitional nut (to microscope tube)
2. Thread
3. Upper half of housing
4. Pin for focusing
5. Thread
6. Lower half of housing
7. Two orifices (⌀ 4mm) disposed one in front of the other
8. Rubber washer
9. Contact to power source
10. Metallic wire (for protection against circuit disruption because of water evaporation)
11. Thickening in form of a ring
12. Pressing nut, freely revolving
13. Collars
14. Thread
15. Traverse
16. Orifice ⌀ 5mm
17. Bottom of the traverse
18. Glass with thickness 0.6-1.0mm
19. Glass with thickness 0.13-0.14mm
20. Chamber (cell), flooded by water through orifice 7
21. 8-12 times objective
22. Bushing which carries objective
23. Thread (in accordance with microscope tube thread)

Figure 40. Microscope objective lens housing for direct observation of energy patterns (courtesy, W. A. Tiller)

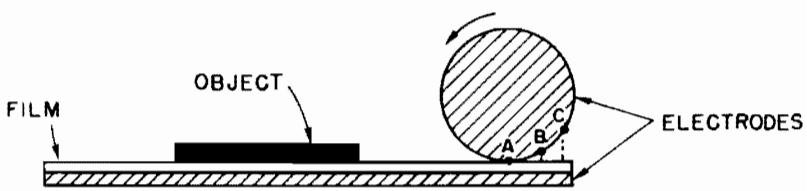


Figure 41. Rolling cylinder discharge device (courtesy, W. A. Tiller)

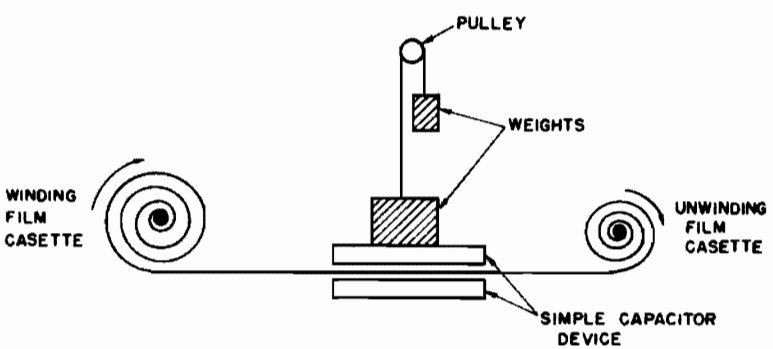


Figure 42. Cinematographic discharge device (courtesy, W. A. Tiller)

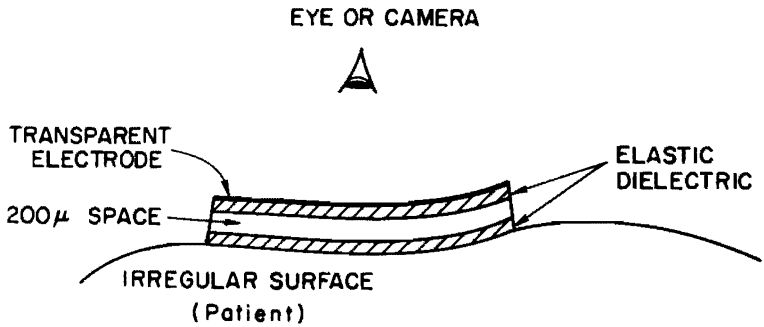


Figure 43. Transparent electrode device for continuous monitoring of energy patterns (courtesy, W. A. Tiller)

allow one to take pictures of objects having irregular profiles. In the new method (Adamenko and Kirlian, 1966), the device takes the shape of the body. The transparent electrode is a silicon organic film; however, many other possibilities exist. With this device, any portion of the body can be photographed directly. In fact, one could make a snug-fitting vest or garment of the material which could then be monitored photographically from a distance or displayed continuously via closed-circuit T.V.

This new method grew out of an earlier idea of Kirlian's (1963) which utilized a conductive transparent material as part of the capacitor, to which a hinged mirror was attached, and a flexible conductive material which is laid upon the object to be photographed. The mirror is concave and acts as a lens, enlarging the object to be studied. The mirror is apparently used for visual examination when not taking photographs. Between the object and the flexible, transparent condenser plate is placed a dielectric net. A photographic plate is placed over the front or top of the conductor so that the prints were merely contact prints without focusing.

The foregoing devices all operate in air at 1 atmosphere pressure. If the pressure is reduced to 10^{-5} mm of mercury, the image is still retained provided the electrode separation is increased to 20–30 cm. At a pressure of 10^{-6} mm of mercury, the image disappears. A visual display system using something like a television

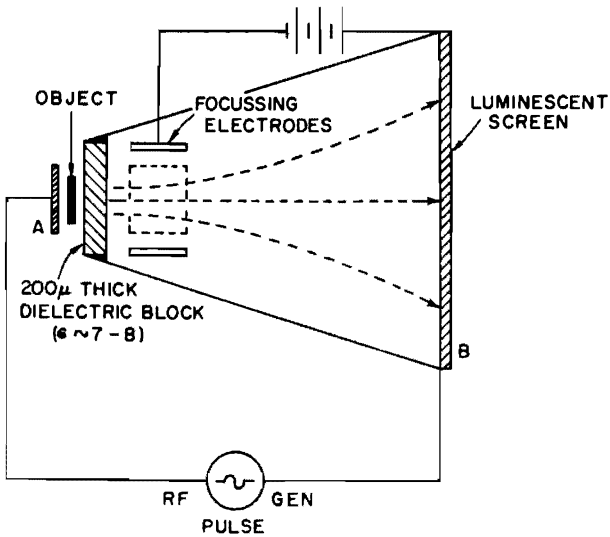


Figure 44. Cathode ray tube device for taking Kirlian photographs (courtesy, W. A. Tiller)

tube is illustrated in *Figure 44*. In this CRT device, electrons from the object impinge on a 200-μ thick dielectric film and their charge pattern induces charge polarization on the other side of the film which, in turn, affects the preferential geometry of electron emission from the film. Thus, the eventual image on the screen is indeed that of the object. This is a very important phenomenon which allows many interesting modifications of device design.

The methods have been developed for image amplification (magnification). In the first case, they use cold emission obtained in the small spacing device (50 μ) of *Figure 39* with a high electric field at the edges, $E_e \sim 10^6$ V/cm. However, E is caused to decrease in the middle to $E_M \sim 10^4$ V/cm (see *Figure 45*). Thus, the magnification, μ, is given by

$$\mu = \frac{E_e}{E_M}$$

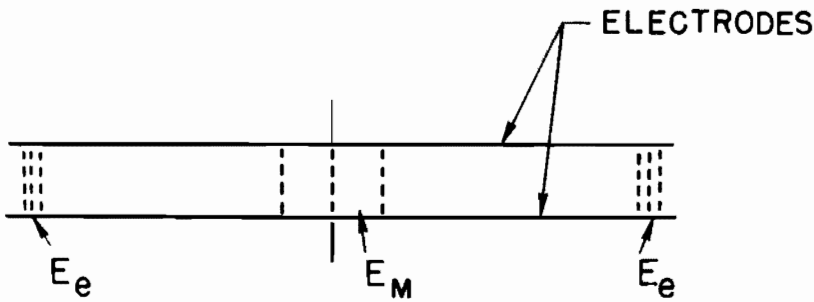


Figure 45. Magnification technique by using different electric fields at the edges, E_e, and at the middle, E_M, in the device of *Figure 39* (courtesy, W. A. Tiller)

They have obtained values of $\mu \sim 340$. The second method is carried out in a CRT type device as illustrated in *Figure 46*. The short electrode (cathode) has a field E_1 and the larger electrode (anode) has a field E_2 ($E_1 \sim 10^6$ V/cm, E_2 is smaller). In this case, the magnification, μ, is given by

$$\mu = \frac{E_1}{E_2} = \frac{S_2}{S_1}$$

where S_1 and S_2 are the tensions of the two electrodes ($S_1E_1 = S_2E_2$ from Gauss's law and charge conservation).

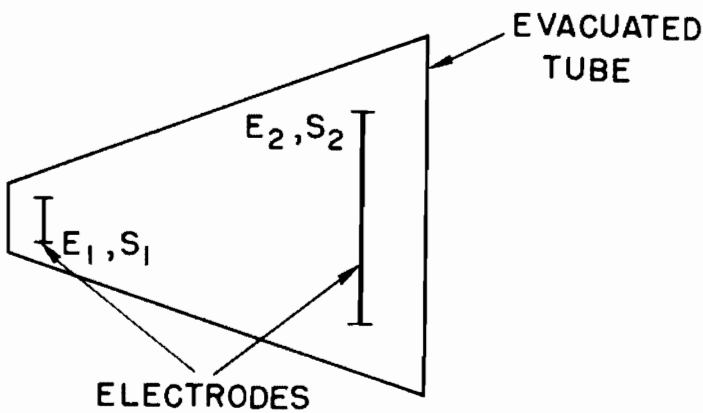


Figure 46. Magnification technique using electrodes of different area in a CRT tube device (courtesy, W. A. Tiller)

Using the T.V. tube type of device, one might expect that the use of electron lenses would allow one to build an electron microscope with very high magnification ($\sim 10^4\times$). However, because of the high vacuum needed in such a device, a severe limitation exists. At 10^{-7} to 10^{-8} mm of mercury pressure, one gets no image because of the loss of channeling ions, but at 10^{-4} to 10^{-8} mm Hg, one does not even need a lens.

It is generally quite inconvenient to be performing these experiments in a darkroom. This procedure can be avoided by utilizing an aspect of the technique illustrated in *Figure 44;* i.e., since an image of the object's energy pattern can be transferred through a thin dielectric film, it should be possible to use either a nontransparent envelope enclosing the sample or a nontransparent envelope enclosing the film. This is illustrated in *Figure 47.* This technique is in common use in the Soviet Union and greatly increases the practicality of the device for use in air under normal illumination.

(c) On the Kirlian photographs one sees an image of the structure of the surface plus a surrounding halo due to a high-fre-

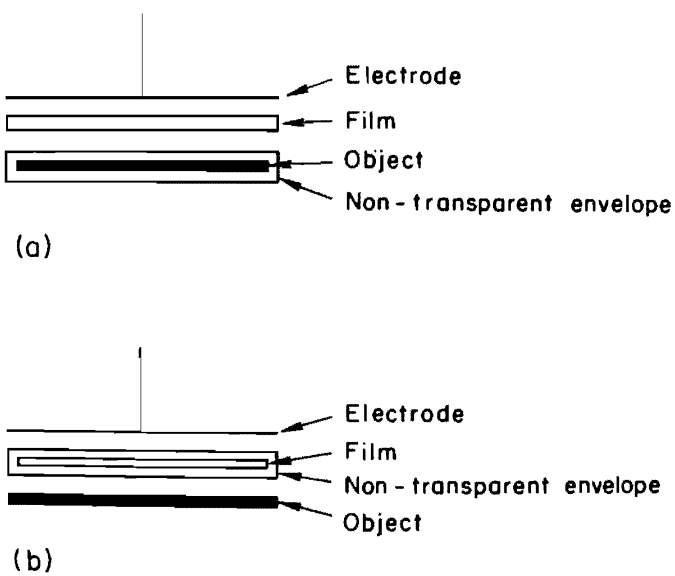


Figure 47. Schematic illustration of the envelope technique for taking photographs in a lighted room (courtesy, W. A. Tiller)

quency discharge. Both the dimensions of the halo and the overall brightness of glow change in accordance with changes in the physiological state of the organism. Different sections of skin surface are found to emit radiation in characteristically different colors: the heart area shows as dense blue, the hip shows as an olive, the forearm shows as greenish light blue (Kirlian and Kirlian, 1961). As a result of sudden emotional excitement (fear, pain, etc.) the color of the related section changes.

Using a high-magnification system, one sees discharge channels arranged on the background configuration of the skin and they exhibit a variety of energy emission characteristics (Adamenko, 1971). They may be point-like, crown-like, flare-like, or clot-like. They may have different coloring such as sky blue, various shades of lilac or yellow, and they may be bright or faded. Some of the channels glow constantly, some are twinkling, some flare up periodically, some are stationary, and some are moving, changing always from place to place. In certain sections of the skin, one sees immobile flare-up points which exhibit a definite rhythm and are light blue or golden in color. Besides these points, there are faded clots of indefinite form which are constantly changing, taking from time to time a sphere-like form. Some clots are continually spilled out from one point of the skin onto another where they are absorbed. The spilling out of one clot does not take place until the previous clot has been absorbed. In certain cases the luminous clots are not oriented in their movement. They slowly move between the flares and finally are extinguished with a little burst and seem to dissolve into space. The colors of the clots are generally milk-light blue, pale lilac, or gray-orange. In many respects these flares and clots resemble the plasma behavior often observed in observations of the sun.

They have found that a withered leaf showed almost no flares and that the clots barely move. As the leaf gradually dies, its self-emissions also decrease correspondingly until there is no emission from the dead leaf. Likewise, the finger of a human body, dead for several days, exhibits no distinctive self-emissions. The self-emission of living things seems to be a direct measure of the life processes occurring within their system.

The structure and emission characteristics of these discharge channels can be utilized for an objective evaluation of the physio-

logical state of the living organism, for diagnosis of body health or pathology, for registration of the emotional state and also for the control of the system's response to various radiations. For example, during the radiation of living objects with a laser (λ=6328 Å), one observes a sharp increase in the intensity of discharge flaring. However, daylight radiation (incoherent radiation) of the same intensity does not cause any changes in the discharge process.

A spectral investigation of the high-frequency discharge glow from the leaves of plants revealed the existence of a series of peaks (4200 Å, 4250 Å, 4550 Å, 4750 Å) and several small peaks in the red part of the spectrum. If the plants were irradiated by a laser with λ=6328 Å, then the glow spectrum from the leaves was altered in the blue and green regions so that characteristic peaks appeared at 5100 Å and 4800 Å and the spectrum shifts in the range 4400 Å to 4500 Å. However, the number of peaks in the blue part of the spectrum remains unchanged. With the skin of animals (rabbit, mainly), the peaks are found in the range 4950 Å to 5000 Å, and the short-wave portion exhibits a peak structure coinciding with that from leaves.

If one photographs, on the same film at the same time, fingers from two different people, then a crown discharge is seen around each finger. As the two fingers are brought closer together, the crowns of discharge deform and leave a small gap between them rather than interpenetrate. Using the fingers of three people, one again sees crown deformation and no penetration.

When observing the palm of a healer as he begins a healing session, one initially sees many points flaring, then fewer points are flaring but the area of discharge around the remaining points is larger (with a greater flare intensity) and eventually an area the size of a dime in the center of the palm becomes luminously brilliant. At this point, the healer is optimally attuned and the patient feels what is usually described as "heat" in that area of his body to which the healer is directing energy. By careful study of the location of the major flare points on the body, the Soviets have shown them to correspond to the active points marked on the Chinese maps of acupuncture points.

In concluding this section we should mention perhaps the most interesting and exciting experimental observation. In *Figure 48,* a photograph of a whole leaf is given, showing the edge halo and

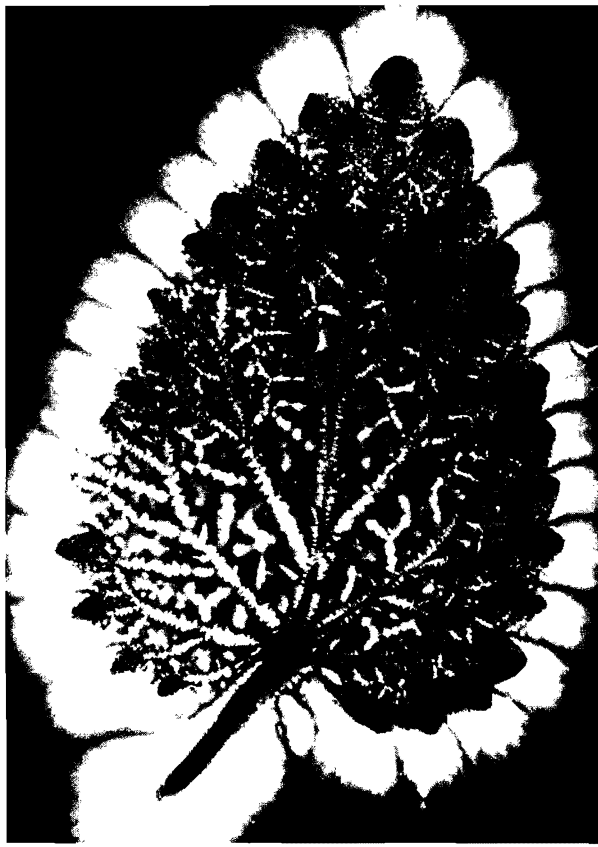


Figure 48. Electrophotograph of a whole leaf (courtesy, V. G. Adamenko)

inner light structure. It has been claimed that if 2 to 10 per cent of a leaf has been cut away from one edge, the photograph shows not only the portion of the leaf remaining but also an energy pattern from the portion of the leaf that has been physically removed. In *Figure 49* we see such a cut-leaf photograph with the right-hand edge of the leaf removed and we note the remaining radiation pattern (albeit altered in contrast). It has been suggested (Adamenko, 1971) that the number of radiation sources in the leaf may be so numerous as to produce sufficient redundancy of information that, when a portion of the leaf is re-

Figure 49. Electrophotograph of a cut leaf (courtesy, V. G. Adamenko)

moved, the lost sources do not significantly disrupt the multiple array pattern. It is also claimed that when one erases a person's fingerprint (by sanding it off), the Kirlian photograph clearly reveals the fingerprint (probably because the energy flare points are located only along the dactyloscopic design of the skin).

The Soviet investigator V. M. Inyushin (1970) has suggested that in living systems there is a single system of elementary charged particles which is dominant in all biodynamic relationships of the living organism. He has called this hypothesized system of elementary particles "biological plasma." This biologi-

cal plasma, as distinguished from nonorganic plasma, is a structurally organized system and the chaotic thermal randomization force is reduced to a minimum; i.e., the entropy is minimal. This biological plasma is found to be strongly influenced by changes in temperature and other environmental factors.

B. Review of Some English and American Work

Milner and Smart (1972) have, for some years, been experimenting with high-voltage photography using a sandwich type device similar to *Figure 39*. However, their work differs significantly from the Soviet work in that they use a D.C. pulse technique and control the process by controlling the slope of the leading and trailing edges of the pulse as illustrated in *Figure 50*. They are unable to detect any energy in the visible range; however, there is abundant new information to be found in the far ultraviolet. The pulse voltage used with their technique is in the range 5000 to 20,000 volts, and great care must be exercised during the course of experimentation, because of the significant electrical power involved.

Using the arrangement of *Figure 50,* during application of the voltage across the empty cell, nothing visible occurs in the air gap during the voltage pulse, but one finds that the photographic emulsion has been exposed on both the +ve plates and the —ve plates, as illustrated in *Figures 51* and *52*. The energy patterns on these complementary plates are quite different even though they are located only 75 μ apart. Steepening the rate of field decrease on the trailing edge of the pulse leads to *Figures 53* and *54* for the +ve plates where *Figure 54* had a much more rapid rate of decrease than *Figure 53*.

Inserting a leaf or spray of leaves into the sandwich leads to *Figure 55* for the +ve plates. Here, using a rapid pulse, the leaves are hardly registered and are separated by a type of void space from the surrounding "empty sandwich" pattern. With a more prolonged pulse, areas of the leaves become luminous and bright balls of plasma gather at the tips of the leaf serrations and begin to become detached and freed into the surrounding atmosphere (*Figure 56*). Maintaining the voltage for increasingly longer periods of time leads to the formation and detachment of more of these bright balls until the flow becomes exhausted and the leaf reverts to

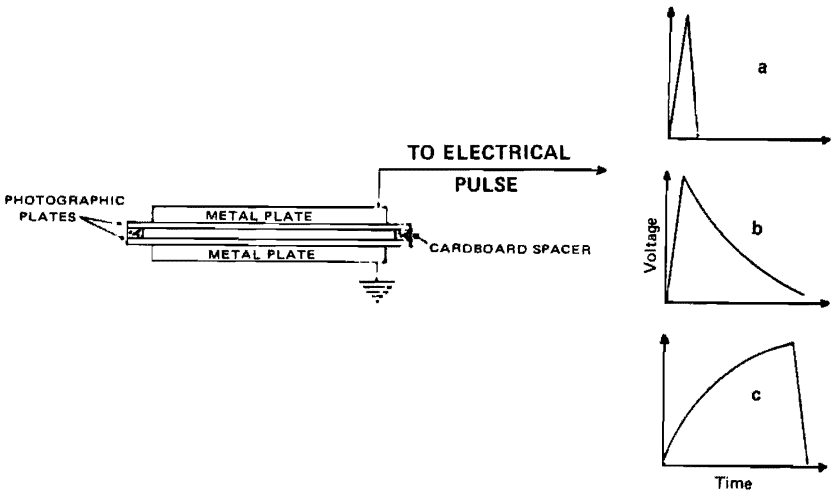


Figure 50. The method of exposing the photographic plates to a pulse of electricity with three of the types of pulse employed: (a) a rapid rate of pulse increase and decrease, (b) a rapid increase and slow decrease, and (c) a slow increase and rapid decrease (courtesy, W. A. Tiller)

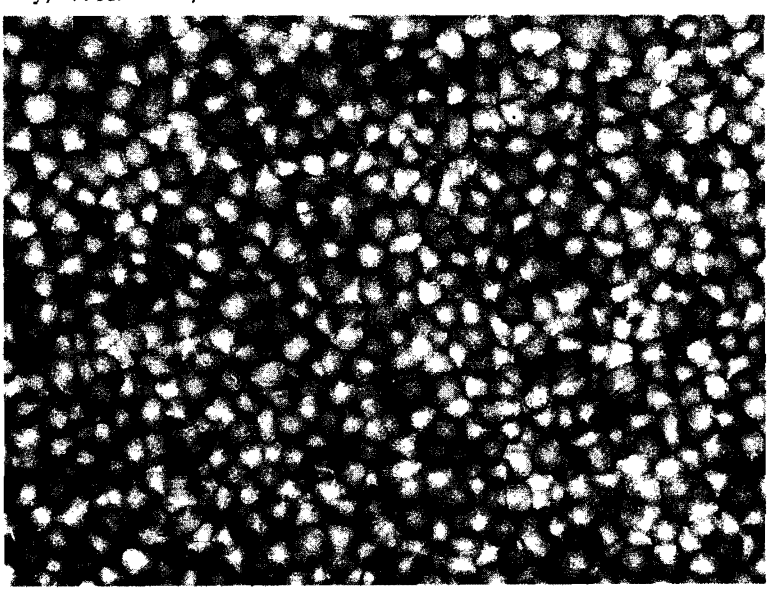


Figure 51. Photographic result on positive side of "sandwich" with intermediate rates of pulse increase and decrease (courtesy, W. A. Tiller)

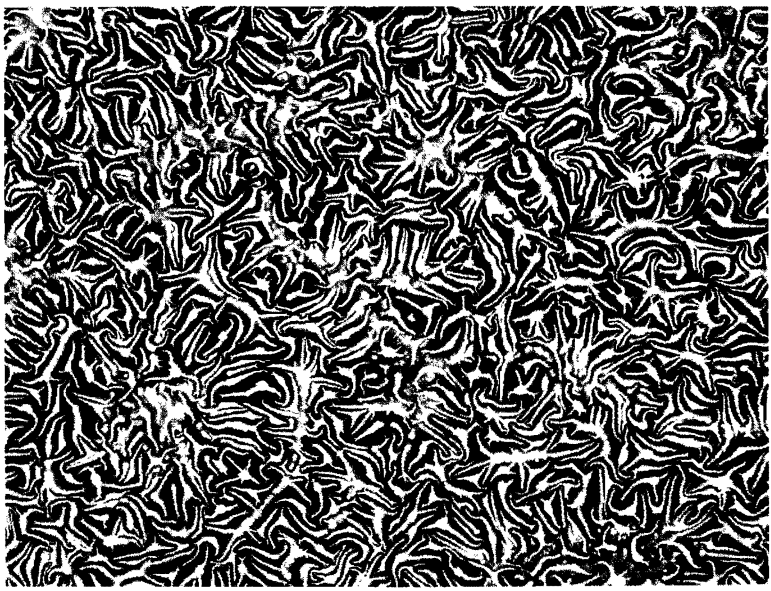


Figure 52. Photographic result on negative side of "sandwich" (courtesy, D. F. Milner and E. F. Smart)

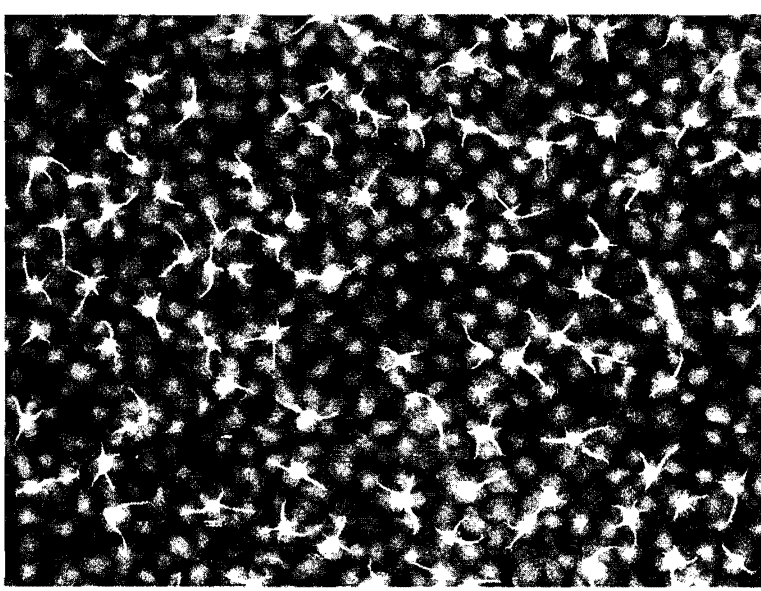


Figure 53. Photographic result on positive side with steeper rate of pulse decrease than in *Figure 51* (courtesy, D. R. Milner and E. F. Smart)

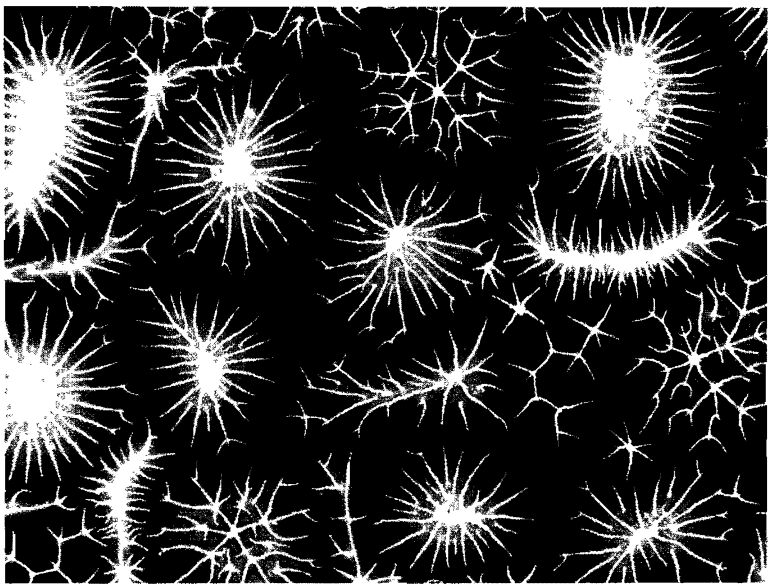


Figure 54. Photographic result on positive side with still steeper rate of pulse decrease than in *Figures 51* or *53* (courtesy, D. F. Milner and E. F. Smart)

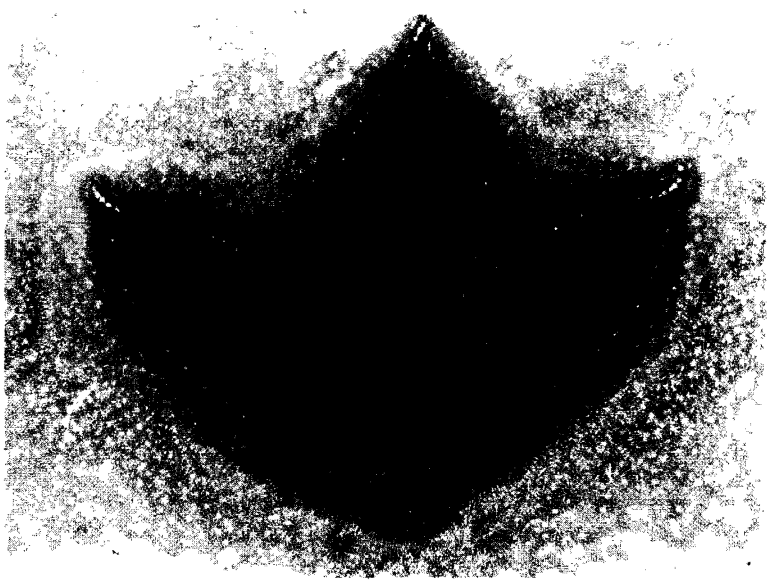


Figure 55. Result on positive side with a rapid pulse for a spray of leaves in sandwich (courtesy, D. F. Milner and E. F. Smart)

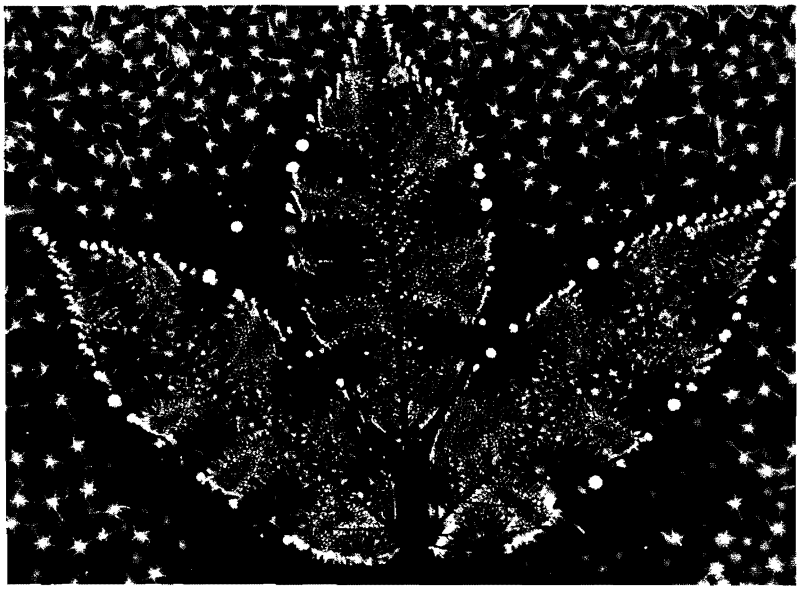


Figure 56. Result with more prolonged pulse (courtesy, D. F. Milner and E. F. Smart)

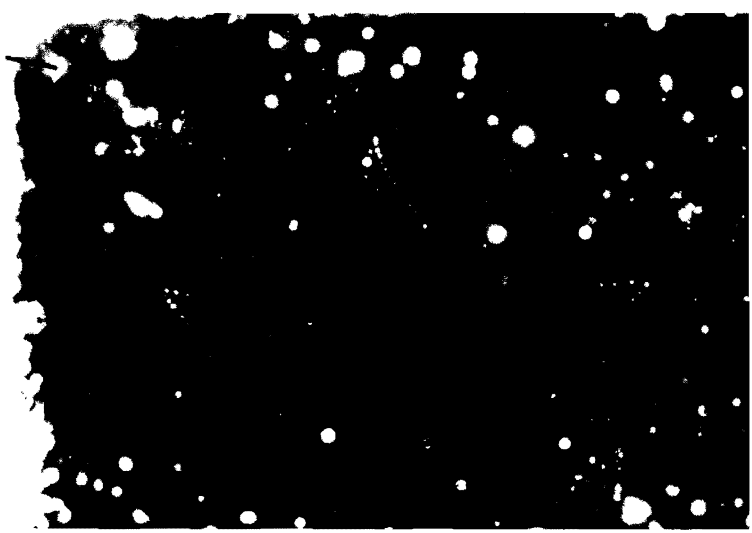


Figure 57. Result with still more prolonged pulse (courtesy, D. F. Milner and E. F. Smart)

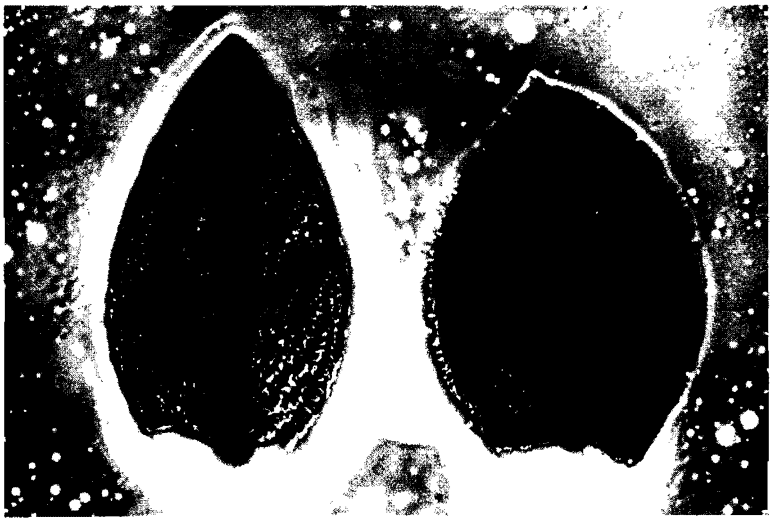


Figure 58. Example of transfer-interaction between a freshly picked privet leaf (on right) and a dying leaf picked twenty-four hours earlier (courtesy, D. F. Milner and E. F. Smart)

its original "dark" state (*Figure 57*). In *Figure 58,* we see an example of an energy transfer-interaction between a freshly picked privet leaf (right) and a dying leaf picked twenty-four hours earlier.

Obviously, we are dealing here with a very complex phenomenon. Some of these results are at considerable variance with those of section A; however, they will eventually help us to understand the phenomena involved in this process more completely.

From this work, we begin to suspect that dielectric breakdown between heterogeneities in the plates may be playing an important role. In addition, bombardment of the two plates by different types of ions (+ve and—ve) may be playing a role in the different photographic effects produced on opposite plates. This would be accentuated by surface irregularities (Soviet studies have shown that a surface roughness of 3.2 microns can be observed on exposed film with the unaided eye).

H. C. Monteith (1972) has built what is perhaps the simplest and cheapest high-voltage device for illustrating the photographic

effect.[1] Its components include:

1. Any six-volt source that can deliver at least four amperes,
2. A capacitor used in conjunction with the auto-ignition coil,
3. An auto-ignition coil,
4. A six-volt vibrator used to power auto-radios (only one set of contacts need be used),
5. The object being photographed,
6. Photographic film (Land type 58 is one of the best to use with this simple circuit—this is color film but it is slow and seems to be relatively insensitive to voltage breakdown across the capacitor but very sensitive to emission from the object),
7. A capacitor plate at the high side of the emission coil (about 34,000 volts placed on the plate),
8. A grounded capacitor plate, and
9. A variable resistor to give some control of the output voltage.

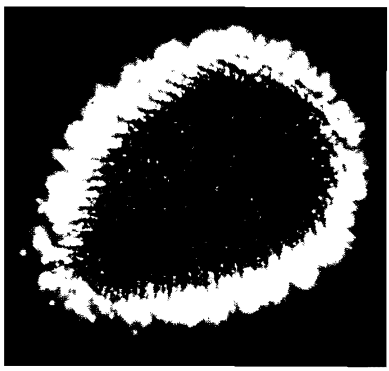
From such a simple device one cannot anticipate much stability or controllability of device operation.

Monteith (1972) found that a live leaf gave beautiful and varied emissions but a dead leaf gave, at most, only a uniform glow (generally, it did not expose the film at all). Even when a dead leaf was thoroughly wet with water, in no way was the self-emission increased.

In the high-voltage device designed by Johnson (1972) and used in association with Moss, the A.C. field was of low frequency ($\sim 10^2$ to 10^4 hertz) in contrast to the Soviet work ($\sim 10^5$ to 10^7 hertz), and yet good photographs have been obtained. They find that, with the same object, a change in the frequency leads to alternate zones where pictures appear and do not appear depending on the frequency range. This suggests that some type of harmonic or wave diffraction effect is operative here.

The Stanford device, assembled by the author and his student, Mr. D. Boyer, was designed to approximate the Soviet technique. It consists of six main components: (1) a square-wave pulse generator and (2) a variable frequency oscillator feeding into

[1] The schematic for another U.S. device, designed by Robert Martin, appears in Figure 28, p. 72.



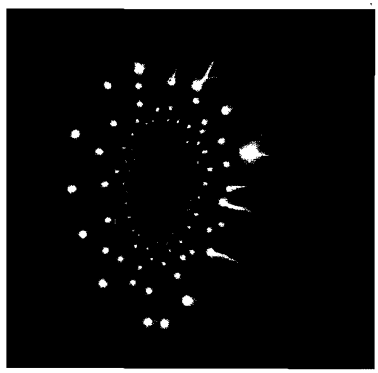


Figure 59. Left: Electrophotograph from Stanford equipment, finger pad (contact print); 100 μ sec pulse width, 20 hz rep rate, 2 sec. exposure (courtesy, W. A. Tiller)
Figure 60. Right: Electrophotograph from Stanford equipment, finger pad (contact print); 100 μ sec pulse width, 1 hz rep rate, single pulse exposure (courtesy, W. A. Tiller)

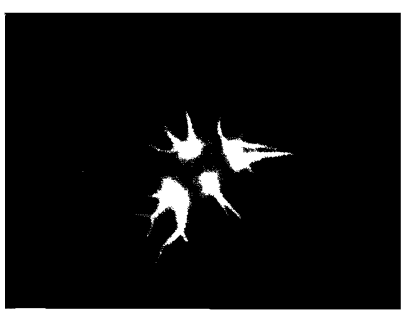


Figure 61. Electrophotograph from Stanford equipment, finger pad (long separation distance); 100 μ sec pulse width, 20 hz rep rate, very short exposure (courtesy, W. A. Tiller)

(3) a special mixing oscillator and outputting into (4) a tank circuit for stepping up the voltage. The system is monitored via (5) an oscilloscope and utilized via (6) the electrode and photographic unit. In *Figures 59* and *60* are given examples of fingerprints under various conditions using 1 megahertz as the R.F. signal. In *Figure 60* the exposure was short enough to see the point emission on the finger. In *Figure 61*, the finger was held

at a greater spacing from the film so that discharge only occurred at one point (note the similarity to some of Milner and Smart's photos). From our initial experiments it is clear that much careful standardization of techniques and control of variables will be needed before cogent statements can be made concerning the interpretation of photographs.

C. Some Theoretical Background

Most work on field emission has been carried out with metals and it seems beneficial to use this material for illustrative purposes (since we know so much more about metals than we do about living systems). At zero field, the electrons are bound inside the metal by a potential barrier equal in magnitude to the work function (*Figure 62*). As the external electric field is increased, the thickness of the potential barrier decreases. Due to the stimulation by the applied field, E, the electron emission is restricted to electron energy levels below the Fermi level ($\epsilon=0$), and the maximum of the distribution curve of the emitted electrons occurs at an energy about one volt below the Fermi level. This observation supports the hypothesis of wave-mechanical tunneling of the electrons through the potential barrier rather than over it as in thermionic or photoelectric emissions. Here, no energy needs to be added to the cathode to cause field emission.

The usual theoretical development for metals assumes the following: (1) a simple one-band electron distribution using Fermi-Dirac statistics, (2) a smooth plane metal surface where irregularities of atomic dimensions are neglected, (3) a classical image force, and (4) a uniform distribution of work function. Under such assumptions, one has a situation like that illustrated in *Figure 63*. Within the metal (at left of *Figure 63*), the significant quantity is the electron supply function $N(T,\epsilon)$ where, at a given temperature, T, it measures the relative number of electrons whose kinetic energy normal to the surface is ϵ. At higher temperatures ($T>0$), $N(T,\epsilon)$ requires a thermal tail which lifts an increasing number of electrons to higher energy levels where emission is more readily achieved. We find that

$$N(T,\epsilon)=\ln\,(1+e^{-\epsilon/kT}. \qquad (1)$$

Electrons impinging on this barrier from inside the metal have

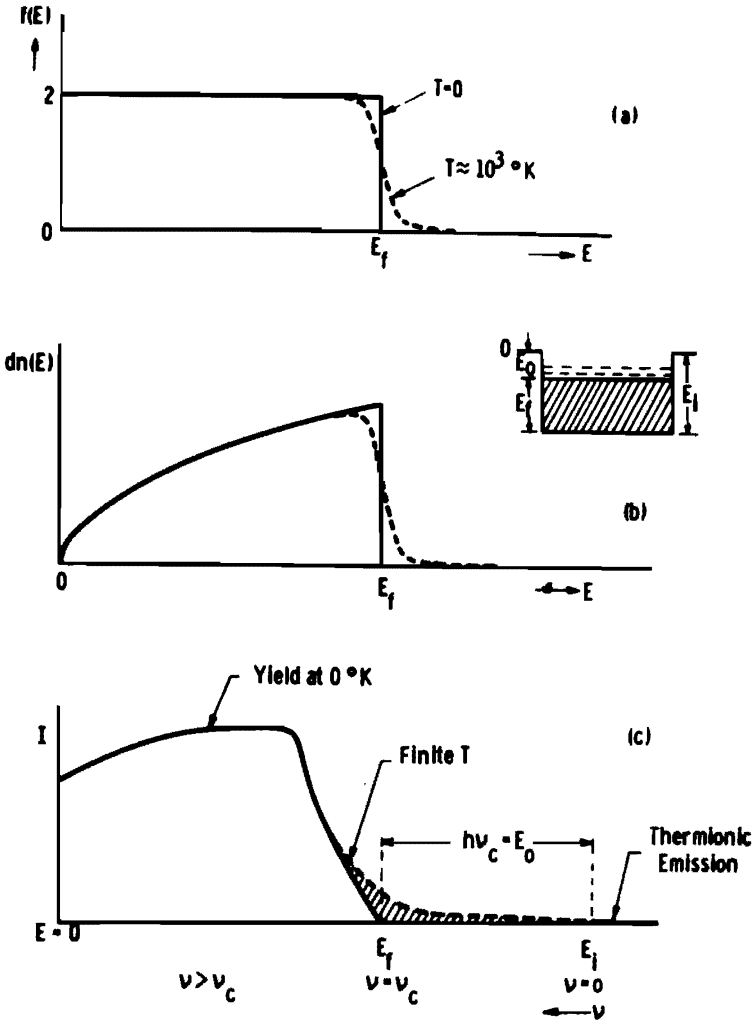


Figure 62. Fermi-Dirac distribution of electron energies in metals and its consequences for the photoelectric effect. (a) Probability function of occupancy for cells in phase space with various energy E (including a factor of two for electrons of opposite spin). (b) Number of electrons in various energy intervals beween E and E+dE. Insert shows energy level diagram with respect to vacuum. (c) Photoemissive yield for absolute zero and finite temperatures versus frequency (from right to left). Scale of "forward" energies of metal electrons is superimposed (from left to right) (courtesy, W. A. Tiller)

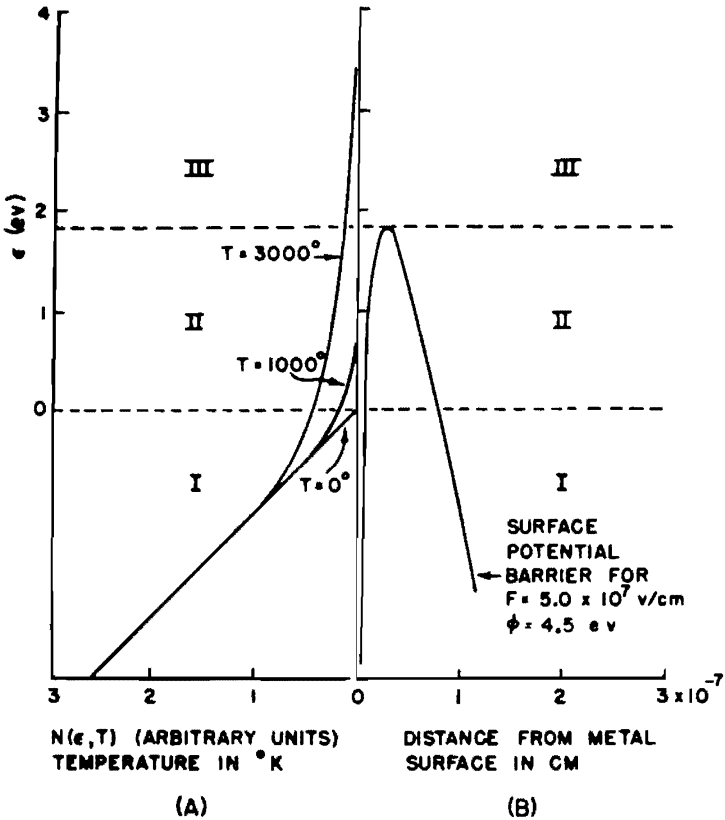


Figure 63. Schematic drawing showing, on the left, the electron supply function $N(\epsilon,T)$ in a metal for several values of the temperature, T, and, on the right, the potential barrier for a typical value of the electric field, the vertical line at 0 representing the metal surface. Region I, below the Fermi level at $\epsilon=0$, corresponds purely to field emission; Region III, above the barrier, corresponds purely to thermal emissions; Region II, between the Fermi level and the top of the barrier, corresponds to mixed emission (courtesy, W. A. Tiller)

a certain probability of penetrating the barrier and appearing outside the metal. This probability is given by the transmission coefficient D where

$$D(F,\epsilon,\phi) = \exp\left[\frac{-6.83\times10^{7}\ (\phi-\epsilon)^{3/2}f(y)}{E}\right] \qquad (2)$$

where ϕ is the electron work function in eV, E is the electric field in volts/cm, ϵ is in eV, and f(y) is a dimensionless function of the variable $y=3.79\times10^{-4}\ E^{1/2}/(\phi-\epsilon)$, which takes care of the image force.

Multiplying the number of available electrons at a given energy level by the transmission coefficient and integrated over all energies must yield the emission current, J, given by

$$J\ (\text{electrons/cm}^2\text{-sec}) = \int_{-\infty}^{\infty} C\ N(T,\epsilon)\ D(E,\epsilon,\phi)\ d\epsilon \qquad (3)$$

where $C=4\pi\ m\ kT/h^3$ (k=Boltzmann's constant, h=Planck's constant, and m is the mass of the electron). When T=0, one obtains pure field emission with no electrons surmounting the barrier and the above equation can be integrated to yield

$$J=\frac{1.5\times10^{-6}E^2}{\phi}\ \exp\left[\frac{-6.83\times10^{7}\phi^{3/2}f(y)}{E}\right] \qquad (4)$$

In *Figure 64* the change in spectral distribution of emitted electrons with both field E and temperature T has been given, in correspondence with *Figure 63,* to illustrate the types of variations to be expected from these parameter changes. As is well known, it is the local field E that is important in eq. (4) rather than the macroscopic field so that, for rounded or sharply pointed electrodes, the local field may be much larger than the macroscopic field (the point effect of emission). Obviously, with living systems as cathode material, we should be able to dispense with the image force effect and, if emission occurs only from the acupuncture points, J should be reduced by a factor β to account for the fraction of the surface that is emitting electrons. In addition, if a point effect is involved in the emissions, we should use a local field ϕE rather than the macroscopic field E. Incorporating these effects leads to an alteration of eq. (4) to the form

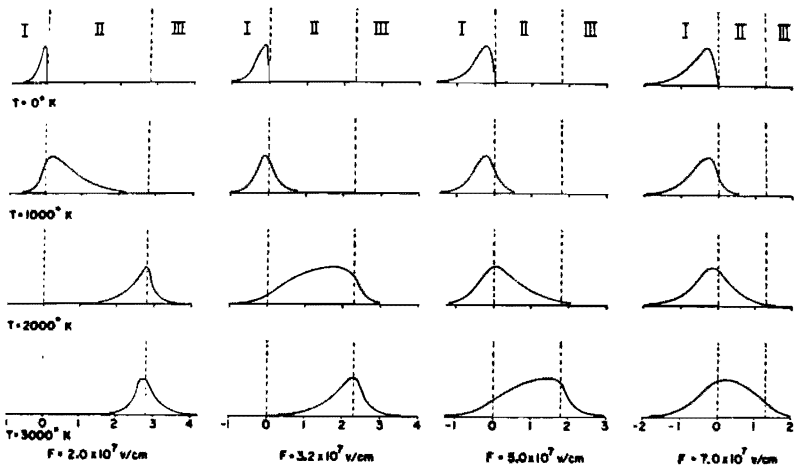


Figure 64. Theoretical energy distributions for emitted electrons at indicated fields and temperatures, for $\phi = 4.5$ eV, with amplitudes arbitrarily normalized to a common maximum (courtesy, W. A. Tiller)

$$J = \left(\frac{1.5 \times 10^{-6} \beta \phi^2 E^2}{\phi}\right) \exp\left[\frac{-6.8 \times 10^7 \phi^{3/2}}{\phi E}\right] \qquad (5)$$

Many of the features observed in field emission of electrons can be studied in a more subtle way by the investigation of photoelectric emission. In fact, combining photoelectric and field emission may provide a very powerful tool for investigating electron energy states inside living systems. Thus, it seems of value to briefly review the basic ideas concerning photoelectric emission (Garbuny, 1965).

The electrons, free inside a metal, find themselves bound by a potential energy, E_i, with respect to a vacuum (see *Figure 62*). The total energy of the electron is the sum of the potential energy E_i and the kinetic energy E which is distributed according to the Fermi-Dirac law. At T=0, the highest total energy equals $-E_i + E_f$ (represented by $\epsilon = 0$) and it is this amount at least which must be supplied by a photon to eject an electron.

In other words, the threshold energy or work function at absolute zero is given by

$$E_0 = e\phi = E_l - E_t \tag{6}$$

where ϕ represents the work function in volts.

At long wavelengths above the threshold, $\lambda_c = ch/E_0$, there is no photocurrent at T=0. When the energy is increased to and above the value of the work function $E_0 = h\nu_c$, photocurrent begins to appear, and it will grow as at larger energies a greater population of electrons becomes eligible for ejection. Ultimately, a type of volume effect will interfere since shorter wavelengths may penetrate deeper into the metal, producing photoelectrons which cannot reach the surface.

The existence of a forbidden gap E_g between an almost empty conduction band (such as found in insulators) produces conditions for the photoelectric effect which differ considerably from the behavior of metals. Perhaps the most significant feature of the bound electron structure is the virtual absence of inelastic scattering between electrons for certain ranges of energy (very long photoelectron range$\sim$500 Å for insulators and encounter losses only by lattice scattering-photon production). Thus, the photoemissive yield can be high (requires a sufficiently small electron affinity E_a, which is the energy difference between the vacuum level and the bottom of the conduction band).

The probability of finding electrons in the conduction band of semiconductors and insulators because of thermal excitation is negligible for $kT << E_g$ and thus, photoelectrons from these materials normally originate in the valence band region unless there exist F-centers and other intermediate levels. Whereas, at T=0, the most energetic photoelectrons come from the Fermi level, in semiconductors and insulators, they originate at the top of the valence band which lies deeper by an amount $e\delta$. Thus, the retarding potential $-E_t$ at which the onset of photoemission is noticeable is different for the two cases (*Figure 65*).

$$-E_t = h\nu - e\phi \qquad \text{(metals)}$$

$$-E_t = h\nu - e(\phi - \delta) \quad \text{(semiconductors)}.$$

Since the function for the density of states differs for metals

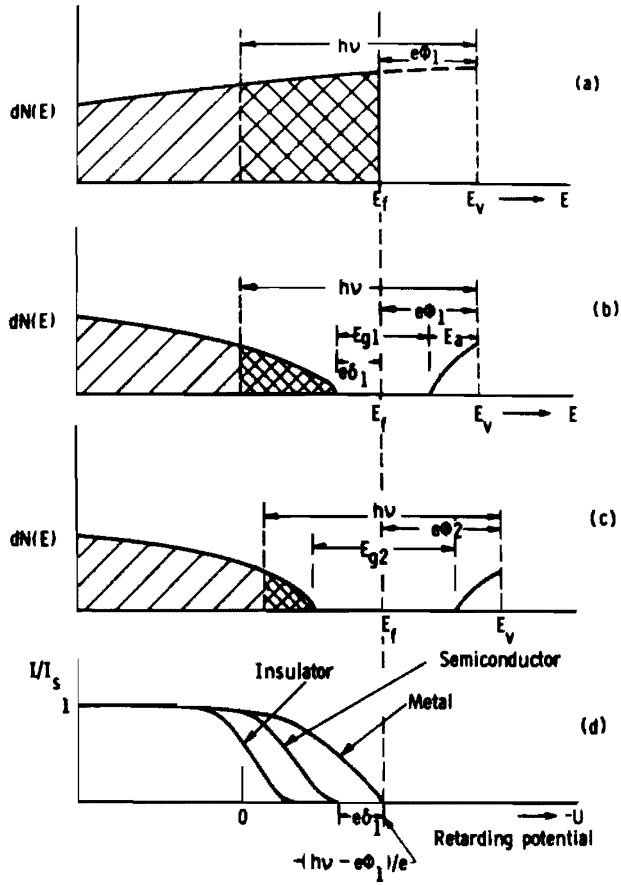


Figure 65. Density of energy states and electron distribution in (a) metals, (b) semiconductors and (c) insulators, and (d) the respective normalized photoemissive yields at retarding potential. A coincidence of the Fermi level and the same $h\nu$ has been assumed for the three cases (courtesy, W. A. Tiller)

and semiconductors, the corresponding voltage-current characteristics vary distinctly in the slope with which the yield curve rises from zero. The first derivative of the yield curve (I versus ν) is a measure of the energy distribution with which electrons leave the surface.

As the energy $h\nu$ of the incident photon is increased, the energy distribution of the photoelectrons also increases at first but changes rather abruptly to low values for certain "second" thresholds of frequency (due to an inelastic collision process between a photoelectron and an electron in the valence band). For insulators, one finds photoemission enhancement in the presence of F-centers and secondary processes like excitons. An understanding of the important electron scattering processes in living systems should lead to an understanding of the bioplasma postulated by Inyushin if electrons are the key energy conversion particle involved here.

D. Some Questions

(1) One basic Soviet idea seems to be that electrons are liberated from the material by field emission and accelerated across the air gap to give off bursts of light on collision with air molecules. This light is found to be in the visible range ($\nu \sim 10^{14}$ sec^{-1}). However, calculating the amount of electron energy gained between collisions which can be converted on collision into a single photon, it is found to have a frequency in the γ-ray range ($\nu \sim 10^{17}$ sec^{-1}). We can see this from the energy balance equation

$$h\nu \approx eE\lambda_e \tag{7}$$

where h is Planck's constant, e is the electron charge, E is the electric field, and λ_e is the electron mean free path. Using $\lambda_e =$ 0.25 microns and $E \sim 10^7$ volts/cm yields $\nu \sim 10^{17}$ sec^{-1}. Thus, we must ask ourselves the question of how the visible E.M. radiation is generated. At the very least, the process must be considerably more complex than we presently envision. In addition, this computation suggests that shielding should be added around the device to protect the experimenters from the γ-ray dosage.

(2) If we look at the period of the R.F. field ($\tau/4 = 10^{-6}$ sec for 250 KH), we can ask how far an electron travels in a quarter period, and gain some insight into the dominance of the initial energy states of the emitted electrons in the overall photon yield of the process. If, for simplicity, we assume electron

emission with zero velocity, the maximum velocity of the electron just before a collision is given by

$$\tfrac{1}{2}mV^2 \approx eE\lambda_e \qquad (8)$$

where m is the mass of the electron and V its maximum velocity. Using the same value of E as above, we obtain $V \approx 8 \times 10^8$ cm/sec, so that in 10^{-6} sec (one quarter period), the electron would travel about 800 cm or about 3×10^6 mean free paths, if it did not reach the anode first. Thus, at a minimum, it would seem that the electron suffers about 10^2 to 10^3 collisions and emits 10^2 to 10^3 photons during its flight path from cathode to anode ($\lambda_e = 0.25 \times 10^{-4}$ cm and the electrode spacing $\sim 50 \times 10^{-4}$ to 100×10^{-4} cm). How, then, can the light generated in the process be so sensitively related to the living organism's condition when 1000 photons are generated by collision events compared to only a few that can probably be directly correlated with the emitted electron condition from the living system? Perhaps this result is again telling us that more than electrons are involved here, or that they are involved in a far more complex manner than we presently imagine.

(3) The Soviet work has produced the "lost leaf" effect, whereas the American work has not. Is this due primarily to differences in the type of equipment involved or are there procedural differences of which we are not yet aware? This single observation is of such vast importance to both physics and medical science that no stone should be left unturned in seeking the answer!

(4) The shapes and forms observed in the English work are fascinating and suggestive of other characteristics to nature than we are presently considering. What is the comparison to the Soviet work; are the operating mechanisms the same?

ACUPUNCTURE

Acupuncture is the ancient Chinese art of preventive medicine —the initial idea being that people would go to the doctor about once every quarter year and have their circuits balanced using acupuncture stimulation, and then they were not supposed to become ill. One would pay the doctor for this. If one ever became ill, then the doctor paid him by spending time free of charge to

cure him. The principal theory, at a fairly simple level, indicates there are twelve main meridians in the body which are energy circuits, something like electric wiring—an analogy often used by Westerners. There is thought to exist a deep inner circuitry connected to the acupuncture points. The connections appear to occur via an energy field condition rather than obvious "wiring." For health and well-being of the body, it was felt essential that there be sufficient energy in these circuits and that they be balanced with respect to each other; i.e., that there be an equalization of energies. These were thought to be the key aspects, and the function of the acupuncture stimulation was primarily to take energy out of one limb of the circuit and put it into another—to shift these energies around so that one obtained a balanced system. Disease arose as a result of any major imbalance via what might be thought of as an irrigation principle; i.e., if there was not enough energy flowing in one meridian then the glands associated with that circuit had an altered energy terrain and the environmental energy fields were such that the soil became more favorable as a nutrient for bacteria to grow and thrive. This altered energy condition led inevitably to manifestations of disease at the physical level.

It appears at this point that there may be a fourth circulatory system in the body on an equivalent level with the blood, the lymph, and the nerves, and it is one that we know practically nothing about. I had the fortunate experience to be acupunctured while living in England for a year. I visited a doctor in London, and the acupuncture treatment led to a very quick cure (three visits) of an indigestion problem which I had had for eight months. The doctor had a device wherein one electrode was held in one hand and the other electrode moved over the body. The electrodes were connected to each other through a special amplifier. Then, when she touched certain points on the skin, the needle would swing up-scale abruptly. This would detect the acupuncture points, and the degree of reading on the meter indicated whether there was sufficient energy in that circuit or not. Later, in the U.S.S.R., I saw the tobiscope, which is a smaller device based upon the same principle.

It was interesting to note that, when there was an imbalance in the circuitry and a needle was inserted in the appropriate

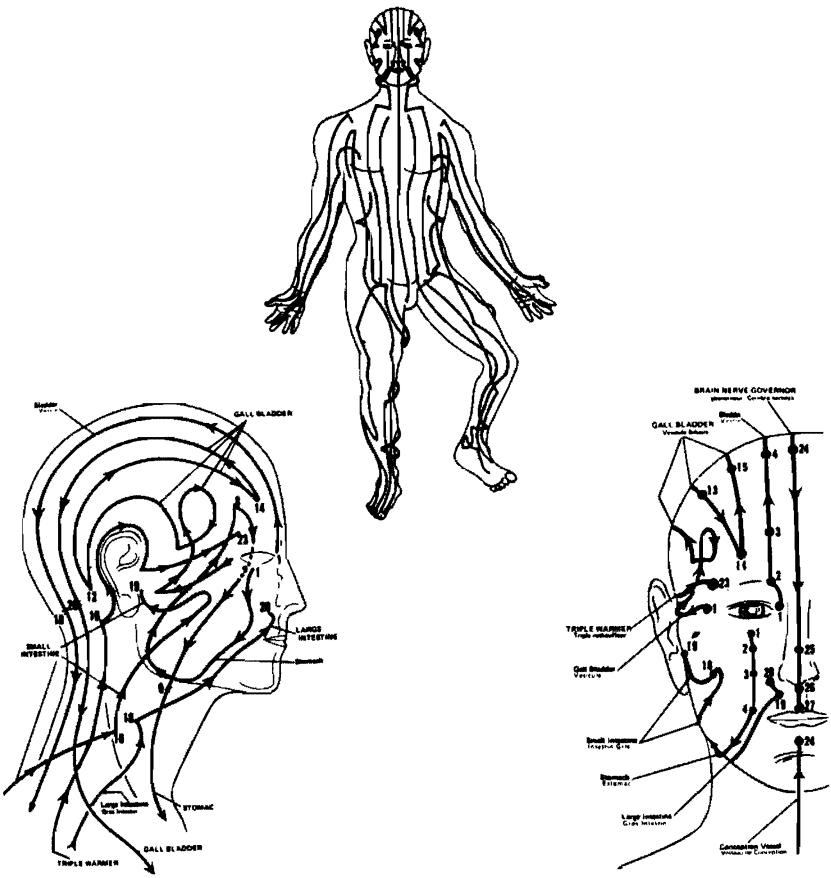


Figure 66. Some meridian circuitry and some acupuncture points in the body (courtesy, W. A. Tiller)

point, there is almost a suction force holding the needle in the point until the necessary stimulation and energy transfer has occurred. If one tries to pull the needle out too soon, it does not pull out easily and the skin pulls up around the needle. One must exert a considerable force to remove a needle under this condition. However, when balance has occurred, the needles withdraw with no difficulty; in fact, they fairly leap out. Of course, this balance is often temporary and energy changes occur in many circuits for up to weeks after a treatment.

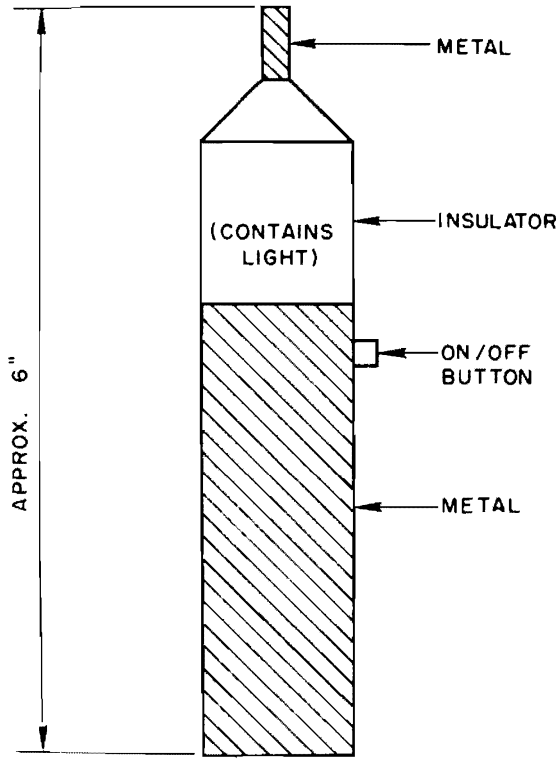


Figure 67. Schematic drawing of the Adamenko tobiscope (courtesy, W. A. Tiller)

In *Figure 66,* some of the meridian circuitry is illustrated both in the body generally and in the head; certain acupuncture points are also given. In *Figure 67,* a drawing of the Soviet tobiscope is given. With this instrument, one holds the metal portion at the back, pushes the "on" button, makes contact with the individual with the other electrode, and also makes contact with the individual's skin with the other hand. Thus, there is a complete circuit here that, for the normal skin resistance, is about one million ohms resistance, and nothing special happens to the device. However, if an acupuncture point is contacted, the resistance drops to 50,000 to 100,000 ohms, and

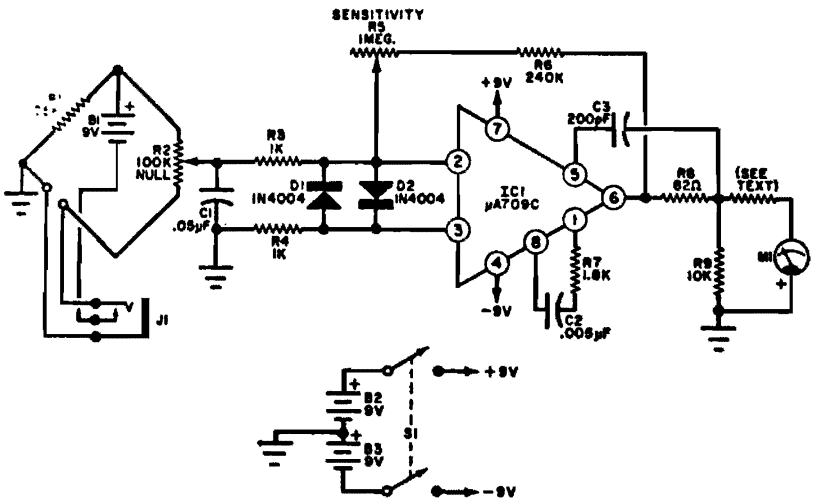


Fig.68. The low-level d.c. error signal generated in the bridge is amplified by the high-gain IC amplifier and displayed on the meter.

PARTS LIST

B1-B3—9-volt battery
C1—0.05-μF capacitor
C2—0.005-μF capacitor
C3—200-pF capacitor
D1,D2—1N4004 (or any silicon diode)
IC1—Integrated circuit (Fairchild μA709C). See text.
J1—Modified closed-circuit jack. See text.
M1—0-1-mA meter with series resistor (2500 to 3000 ohms) to measure 3 volts.
R1—75,000-ohm, ½-watt resistor
R2—100,000-ohm potentiometer
R3,R4—1000-ohm, ½-watt resistor
R5—1-megohm potentiometer (miniature preferred)
R6—240,000-ohm, ½-watt resistor
R7—1800-ohm, ½-watt resistor
R8—82-ohm, ½-watt resistor
R9—10,000-ohm, ½-watt resistor
S1—D.p.s.t. switch
Misc.—Eight-pin TO-5 socket (for IC1), two 1"-square pieces of heavy copper or two large foreign coins, pair of bicycle clips, length of insulated wire, battery clips (3), case as desired, mounting hardware, etc.

Figure 68. Circuit diagram (courtesy, R. E. Devine)

this resistance is so arranged in the circuit that it upsets a bridge balance. A signal enters an amplifier where it amplifies the voltage and lights the bulb contained in the insulator section of the device (Adamenko, 1971). This makes the section glow. A simple but effective circuit for this purpose was presented by Devine (1970:117) and is illustrated in *Figure 68*. The author has used such a device for the successful location of acupuncture points. Devine calls this a "Psych-Analyzer" device. To actually measure the resistance, an electrometer is beneficial. To eliminate pressure effects, merely place blobs of EKG sol

on the acupuncture points and merely insert the electrodes into the sol without actually touching the skin.

The Soviet work showed that there are shunt paths in the body—low-resistance paths connected to each of the acupuncture points. They found that by connecting electrodes of different materials to two acupuncture points (e.g., silver and nickel electrodes), one can develop a voltage of 50 millivolts between acupuncture points, and can draw a current of up to 10 microamperes from these electrodes. By connecting many such electrodes in series, one can obtain the order of a volt from one's body, which can be used to run little electrical devices, if you like. Thus, our body constitutes a significant battery which is an indication that a fairly good electrolyte exists inside our system.

The North Korean, Professor Kim Bong Han, performed an experiment in which he injected radioactive phosphorus into an acupuncture point and looked to see where it went in the body. He found it went primarily along that particular meridian rather than laterally. He also monitored the other acupuncture points along that meridian and found a high concentration of radioactivity there. The Kim Bong Han experiments will be discussed briefly later; for a more complete treatment of the subject, the reader is directed to another work by this author (Tiller, 1972).

The Soviet researchers performed an experiment on what they call the "semiconductor" effect using a manual healer (Adamenko, 1971). Suppose one takes an acupuncture point on the left side of the body and the symmetrical one on the right side, and measures the resistance from left to right. A value R will be obtained. Then, switching the electrodes around and measuring from right to left, R, or a different value, R′, may be obtained. If the person (or gland) in that meridian is healthy, then the reading will be the same ($R=R'$). However, if the gland is unhealthy and the point is associated with that gland, there will be a difference in the resistance ($R' \neq R$). The difference ($\Delta R = R' - R$) is what is called the semiconductor effect. To perform the healer and patient experiment, they measured the patient before treatment and obtained the data given in *Figure 69;* they also measured the healer before treatment. The healer was going to project energy via his hands to the individual. They found

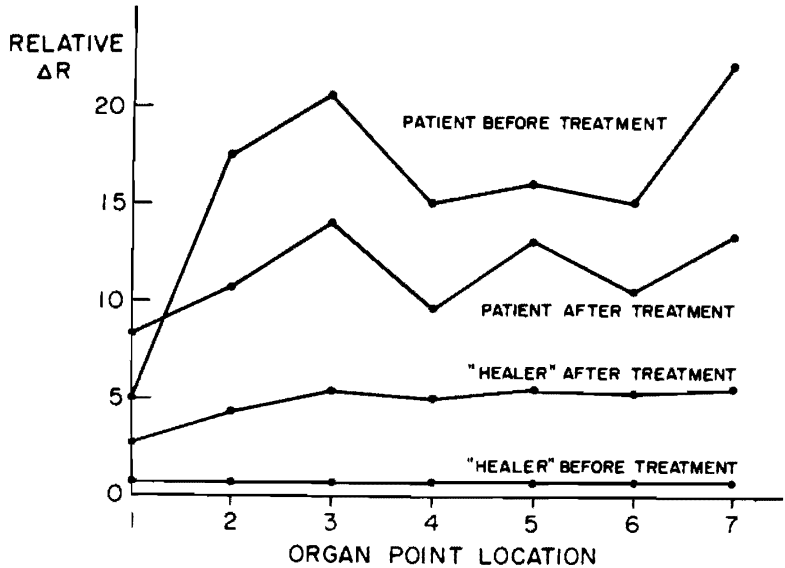


Figure 69. The semiconductor effect observed in "paranormal" healing (courtesy, W. A. Tiller)

that, after the treatment, the patient's energy circuit came more into balance, but the healer's became slightly imbalanced. Thus, it seems that the healer gave up a particular kind of energy in a particular location of his body in order to balance the circuitry of the ill individual. This is indeed a new type of energy that could not be detected before.

Soviet investigators also did some monitoring of acupuncture points in order to indicate the various hypnotic states of an individual (Adamenko, 1971). The acupuncture point resistance changes with the state of consciousness as indicated in *Figure 70.* They find that the best hypnotic subjects, of course, manifest the strongest stimuli, i.e., produce the strongest effect that they monitor at the acupuncture points. A person who is not hypnotizable at all produces no change in resistance between the various states. Thus, one is able to obtain a cause-effect relationship which connects certain mental characteristics and these physiological readings. *Figure 70* presents data from the ordinary waking

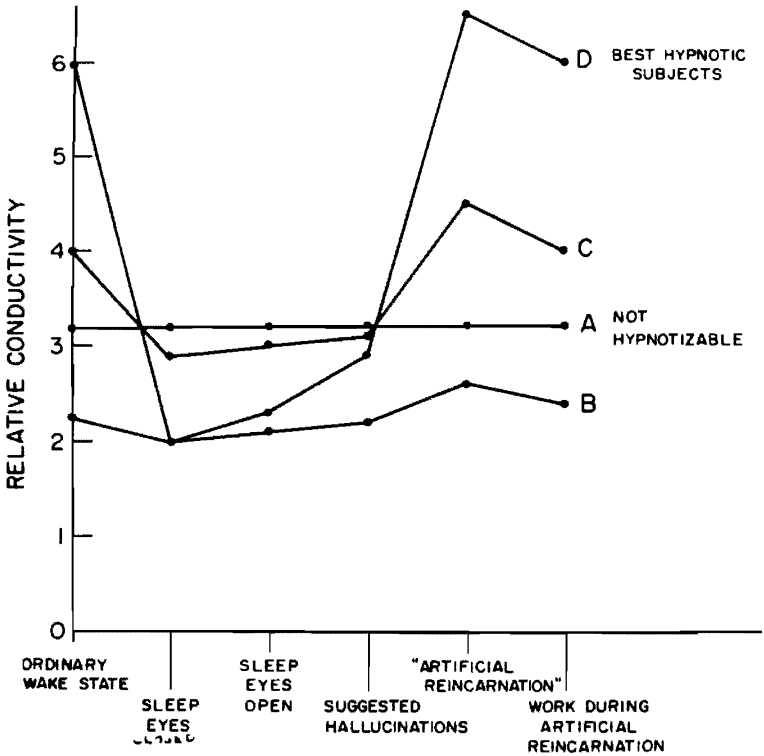


Figure 70. Relative conductivity indications versus hypnotic state of the subject (courtesy, W. A. Tiller)

state, sleep (eyes closed), sleep (eyes open), hypnotically suggested hallucinations, hypno-production ("artificial reincarnation"), and work during hypno-production. Hypno-production involves telling a hypnotized subject he is a prominent person (e.g., Rembrandt, Einstein) to stimulate his creative work.

Professor Kim Bong Han (1963, 1965), who has been working with a team of research workers, has shown that there are four main types of meridian subsystems in the organism. The original works by Kim seem to be almost impossible to obtain. However, Rose-Neil (1967) has presented an excellent review (from which the following material is extracted). The original work deals with the "Kyungrak" system, which may be equated with the "merid-

ian" system. The first of the meridian system is called the Internal Duct System. These ducts are found free-floating in the vascular and lymphatic vessels. The ductules ramify so that the path of the containing vessels are completely followed. Flowing in all ductules is a fluid or liquor. In the Internal Duct System the liquor generally follows the blood or lymph flow, but in some cases it runs in the opposite direction. Also, these Internal Ducts penetrate out of the vessels. These facts lead to the conclusion that the formation of the Internal Ducts is different in the origin from that of the blood and lymph vessels. The second series of meridians is the Intra-External Duct System. These are found on the surface of the internal organs and they form a network which is entirely independent of the vascular, the lymphatic, and the nervous systems. The third series is the External Duct System. These run alongside the outer surface of the walls of the vascular and lymphatic vessels. These ducts are also found in the corium and are here known as the Superficial Duct System. It is this latter system with which we are most familiar in acupuncture. The fourth series of ducts is known as the Neural Duct System. These are distributed in the central and peripheral nervous systems.

All of the various duct systems are interlinked together via the connection of the terminal ductules of the different systems, very much as in the case of the arterioles which link with the venules bringing together the arteries and the veins. Spaced at intervals along these meridians or ducts are small corpuscles. Each duct or meridian may contain scores of ductules which measure on the average 0.5–1.5 microns across although some are as small as 0.1 μ and some as large as 5 μ.

Kim Bong Han has shown that myeloid and lymphatic elements exist in the ducts. When erythrocytes in the bone marrow and the peripheral blood systems are killed with phenylhydrazine, activity in the corpuscles increases and they enlarge. On the contrary, anemia develops when the Internal Duct System is injured. This suggests that hematopoiesis is one of the functions of the internal meridians. To show the control of the meridians over a particular organ, Kim severed the portal duct of a frog and found that histological changes soon took place in the liver. The cells enlarged and the cytoplasm very soon became turbid. Within three

days serious vascular degeneration took place throughout the whole liver. Many other experiments confirmed these results.

Kim conducted a series of tests to establish the constituents of the duct liquor. He isolated nearly as much hyaluronic acid as is found in sperm; twenty different kinds of free amino acids, including all of the essential ones; sixteen different free mononucleotides, corticosteroids, ketosteroid, estrogen, and adrenalin. Over twice as much adrenalin was isolated as is found in the blood and in an acupoint over ten times as much was found. Kim further isolated deoxyribonucleic acid and ribonucleic acid from the liquor. Paper chromatograms of the bases of deoxyribonucleic acid showed: 1. guanine, 2. adenine, 3. cytosine, 4. thymine. Paper electrophoregram of ribonucleic acid mononucleotides showed: 1. cytidylic acid, 2. adenylic acid, 3. guanylic acid, 4. uridylic acid.

The existence of hyaluronic acid, cortical and medullary hormones, and estrogen suggest that the meridian system is closely associated with the endocrine system.

To investigate the liquor flow, Kim injected radioisotope P^{32} into an acupoint. Microautoradiography was possible in two hours in the external corpuscles. No P^{32} was detected in the blood vessels. P^{32} injected into an internal corpuscle was quickly labeled in the internal ducts but only slowly found its way to the superficial system. P^{32} injected into the ear vein could hardly be detected anywhere in the meridian network. These experiments show that the meridian system is independent of the vascular system and that the meridian liquor flows from the acupuncture points inward to the deeper ducts and corpuscles and finally outward again. Kim has shown that the terminal ductules reach the tissue cell nuclei. He further experimented with the cutting of the perineural duct of the nervous system to establish any alteration of the bending reflex of a frog. A solution of 0.5 per cent of sulphuric was used. The results were as follows:

Changes of Spinal Reflex Time After Cutting Duct

No.	*Time after cutting*	*Average reflex time (sec) based on six experiments*	*Control group*
1	Normal	2.5	—
2	30 minutes	11.5	2.5
3	12 hours	6.3	2.3
4	24 hours	8.7	3.0
5	36 hours	10.3	3.0
6	48 hours	11.3	3.1

Kim concluded that not only is the meridian system interlinked but that all cell nuclei are interwoven into the same system. Working on the embryonic chick, Kim found that basically the meridian ducts were formed within fifteen hours of conception by which time the primordia of organs are not yet formed. This suggests that the function of the meridian system exerts an influence upon the differentiation of cells. Further, the positioning of the meridian system in the embryo is completed earlier than any of the other organistic parts.

Having conducted experiments on mammals, birds, reptiles, amphibia, fish, invertebrates, and hydra, Kim suggests that the meridian system exists in all multicellular structures, both animal and vegetable.

Unique granules circulate in the duct liquor. These granules have been named Kim Bong Han Sanal. The Sanal develops into cells and after an elapse of time converts back into Sanal. There is a continuous renovation of cell tissue which is controlled by the meridian system. Sanal contains D.N.A., R.N.A., and protein. Kim has been able to grow *in vitro* cells from Sanal. The process is that Sanal flows in the meridian liquor. It forms by fusion into a cell and after a limited life bursts through the cell membrane to recirculate in the ducts as Sanal.

In the course of the formation of a cell from Sanal the content of D.N.A. is increased sixteen times, R.N.A., nine times, and protein nitrogen thirty-two times. Besides his discovery of cell formation from Sanal, Kim made important observations concerning cell division. When the cell is a stable unit, the Sanal is in a fused state. During cell division it breaks down in such a way as is suggestive of the behavior of chromosomes. If the cell

is fixed after the nuclear membrane has broken down, the Sanal gives every appearance of chromosomes and they are the same in number, as is usually found in the cell of the animal under investigation. Kim claims that chromosomes appearing at cell division are Sanal, and cell division is a specific form of movement of Sanal. The inheritance of life attributed to chromosomes is an aspect of Sanal and part of the organization of the meridians.

The cell theory holds that the cell is the uniting morphological and functional unit of the organism and that cells are formed only from cells through cell division. The Kim experiments are inconsistent with this theory. Kim used P^{32} to identify Sanal extracted from an acupoint. The extracted Sanal was injected into different parts of the circulating ducts. Within forty-eight hours, tagged Sanal could be detected among cell tissue. This experiment suggests that Sanal from the corpuscles eventually becomes part of the cell tissue. These observations were confirmed with many experiments, including those on the ovary, the suprarenal body, the liver, the kidney, and the lungs.

Kim considered that as the various acupuncture points have specific connections with relevant bodily organs and functions, then Sanal taken from different parts should produce different types of cells. He conducted a series of 344 experiments, taking Sanal from 79 different acupoints. As was expected, different cells were formed in accordance with the foci of those points. Kim's final series of experiments of which I have knowledge concerns the photochemical influence of light in the epidermis. Sanal cultivated under normal light grew 104 cells in 96 hours, whereas in a dark chamber only 32 were formed. He attributed the few cells which did grow in the dark as having already been under photochemical influence of light in the superficial corpuscles before being extracted from the ducts.

From all the available information, there appear to be several ways in which one can produce acupuncture stimulation. It appears all one needs to do is stimulate, sufficiently, the acupuncture points. This can be done by chemical stimulation. That is the weakest method. It can be done by manual massage, which is the next most satisfactory method. It can be done via the acupuncture needles, which is better still. It can be done by the injection of electrical energy; this is the next best method, but this requires

sophisticated understanding of the process. The next most successful method is to use a laser beam which, again, requires sophisticated equipment and understanding. Finally, there is the psychic energy (or "bioenergy") injection, which seems to be the best procedure for bringing about this bodily balance in many cases, if the services of an appropriate "psychic healer" can be obtained.

In conclusion, let us consider a very simple model of what might be happening during acupuncture and maybe how it relates to the anesthesia situation. The energy "Ch'i" is thought to flow in the meridian circuitry. Think of it, if you like, simply as a fluid flowing along a river bed. The fluids in the body all contain colloids (Sanal granules) and these are important energy components in the body. Let us propose that if you upset the energy fields of the body, then you produce what is called colloid instability. You generate an agglomeration phenomenon rather than a stable dispersion; thus, the colloids build a type of "raft" and the rafts become hung up in the fluid stream at various obstruction points. This, then, requires an enhanced pressure to move the fluid. Such a condition produces an imbalance between two limbs of the fluid circuit. The function of the stimulation at the acupuncture points is most likely to break up the rafts. Probably what happens is that these stimuli produce a type of capacitive energy effect in the vicinity of a point, which generates a force to move or break up the rafts. This probably alters the local energy field which breaks up the rafts via a shock discharge allowing the fluid to get moving again and develop momentum. When moving, the fluid has less inertia, and that is what starts to bring about the balance of the circuitry.

If we look at the situation of anesthesia via needle insertion in a particular point, we expect that this may divert the flow of energy into other subsidiary channels. In turn, this produces a field effect which can act in at least two ways. It may act on the various important nerve centers so that the local energy fields are reduced to such a point that the nerve firing does not occur. That is one possibility! The other relates to transmission line blockage; the nerve signals that normally go to the brain and tell you that you are being hurt or cut open or what-have-you are blocked so that, although the nerves are firing, the information does not get through. In addition, one must go deeper into this

because one has to understand why we have a type of sterilization effect here. We hear of people eating oranges during surgery. It seems quite remarkable that this absence of what we think of as the need for sterilization in the operating room does not lead to any problems. This may be because we are dealing with another level of energy, which produces effects that do not require the normal sterilization procedures.

CONCLUDING PHILOSOPHY

The flux of world-wide investigation and activity in the area of psychoenergetic fields and phenomena has been such that mankind has now exceeded the "critical mass" condition for a self-sustaining reaction. We can now anticipate a continued growth of awareness and perception relative to this domain of nature. Such an activity does not deny the validity of our present knowledge of the universe, nor does it pose a threat to what I shall call conventional physics. Rather, it calls for an extension, or expansion, of present laws to reliably model behavior in the expanded domain of variable space that circumscribes psychoenergetic fields (since we presently have some small ability to monitor this aspect of nature). Here, one should reflect on the example of Newton and Einstein. Newton's work on gravitation was not shown to be wrong by Einstein, but merely limited to a domain of variable space in nature far removed from speeds approaching the velocity of light. The laws of Einstein reproduce the laws of Newton in the appropriate limit of small velocities.

In the decades and centuries ahead, we would hope to follow and extend Einstein's example and develop quantitative laws that reliably model nature in the psychoenergetic domain and which simplify, in the appropriate limit, to our present physical laws of nature.

We may liken conventional scientific understanding of the universe to the visible tip of an iceberg. We have come to know that exposed tip fairly well. However, most of nature is still hidden from us and we know it not. History contains references and speculation to many aspects of the hidden iceberg and very recent research, especially that fine work being carried out in the

Soviet Union, suggests some fascinating characteristics. Let me touch briefly on some of these:

1. From experiments on telepathy, psychokinesis (PK), manual healers, etc., we seem to be dealing with energy fields completely different from those known to us via conventional science.

2. From experiments on PK, radionics, etc., the cause/effect relationships seem to follow a different path or "field-line" than we are used to dealing with in the conventional space-time frame of reference.

3. From a large variety of experiments, we find indications for a level of substance in nature that exhibit (a) characteristics that are predominantly magnetic, as distinct from electric, in nature; (b) an organizing rather than a disorganizing tendency as the temperature increases (in seeming violation of the second law of thermodynamics for the physical universe); (c) a radiation pattern or hologram of energy that acts as a force envelope for the organization of substance at the physical level.

4. From experiments on plants, animals, and humans, evidence is mounting that there is an interconnection at some level of substance between all things in the universe.

5. Some indications point to the existence of energy manifestations at uniquely different levels of substance which are stable in different space-time frames than we are familiar with. This leads to the suggestion that space and time might be constructs of waves at these deep levels of substance (e.g., "mind" and "spirit" levels).

In this paper we have seen that both topics discussed here, high-voltage photography and acupuncture, open a door for us into vast new realms of man and nature. Let us go forward with care, courage, and enthusiasm, performing our work thoughtfully and rigorously. It is far too important to deserve any less than the very best of our abilities to provide a firm and reliable foundation of understanding in this area. The techniques of analysis and experimentation and the standards of quality synonymous with conventional science serves as a meaningful guide to us. Let us be open-minded and flexible in our seeking but let us also require extensive proof before we rest to enjoy the satisfaction of a completed task.