The Eighty Year Enigma -

Rife and Hoyland's Frequencies Explained

A Report by the British Rife Research Group

November 2016

In memory of Aubrey Scoon and Stuart Andrews

This is the best of me, for the rest, I ate, and drank, and slept,
loved, and hated, like another; my life was as the vapour and is not;
but this I saw and knew: this, if anything of mine, is worth your memory.

John Ruskin

1 : INTRODUCTION

Today there are many so-called Rife machines which, when properly used, will produce beneficial results in the treatment of diseases including cancer. However, the recovery rate when treating late stage cancer is disappointing compared with that achieved in the 1934 clinical trial, or that reported by doctors who subsequently used the early Hoyland machines. Also, there are very few accounts of modern machines being able to consistently devitalise bacteria in vitro, whereas in the 1920s and 1930s Rife often demonstrated his machine's ability to do this under the scrutiny of knowledgeable and experienced scientists and many prominent doctors who visited his laboratory.

In view of the great advances in electronics since those times it is perplexing that today we apparently have no machines which can equal, let alone surpass, the performance of the 1930s machines. What is wrong, what has been missed, what is different about modern machines? The most obvious difference lies in the frequencies which were used with great success in Rife's 1934 clinical trial and subsequently by Drs Milbank Johnson, Couche, Hamer, Yale and Tully. All these doctors had machines which used disease-specific radio frequencies to excite the plasma tube, whereas in most modern machines it is disease-specific square-wave audio frequencies which amplitude-modulate a fixed radio-frequency carrier to drive the tube.

Modern machines employing audio frequency modulation can be very effective, but still a vitally important question remains unanswered: can we replicate the outstanding clinical results of 1934 today using modern technology and if so, how? Clearly, a machine must be built in which the correct type of plasma tube is driven in the original manner using the successful radio frequencies of those times, but what are they? This report reveals important new information about those frequencies.

Hoyland claimed that he arrived at the frequencies used in his No. 4 machine by carrying out measurements on Rife's earlier No. 3 machine (1). However, a comparison of the surviving No. 4 machine calibration documents and the earlier Rife Research Laboratory notes relating to the No. 3 machine provides little evidence in support of this claim, even though both appear to show the frequencies used to destroy particular pathogens. In fact, it is not apparent that any of the recorded frequencies are what Rife called the mortal oscillatory rates (MORs) of the pathogens.

Much hitherto overlooked information about Rife's early work can be found by careful study of material in the public domain, such as websites of individual researchers, early newspaper articles, the 1939 trial transcript and tape recordings of Rife and those who knew him. In recent years the willingness of many Rife researchers to devote their time and resources to historical research and experimentation and to freely share their findings has made further progress possible. This report could not have been written without the wealth of information they have gathered and made public.

By close examination of the descriptions and comments published at the time about Rife's and Hoyland's early machines, and having an understanding of radio engineering in that era (2), it has been possible to identify with certainty some radio frequency MORs employed in the 1930s. Others have been found which are highly probable and some which are considered to be prime candidates for verification or otherwise by experimentation and clinical trial. Ranking above all else in this report in terms of its potential benefit to humanity is the rediscovery of the specific radio frequency used by Rife and various medical doctors to successfully treat people with cancer in the 1930s.

2 : RIFE'S NO. 3 FREQUENCY INSTRUMENT

(i) Rife Research Laboratory Notes

The Rife Research Laboratory Notes are the primary source of information about Rife's No. 3 machine. Each of the twenty-four completed pages, copied by hand on Rife Research Laboratory headed notepaper, lists the characteristics of a particular pathogen together with the settings of the machine which he recorded following his successful attempts at bacteria devitalisation prior to 1934.

For each pathogen the frequencies of two oscillators were noted, that of the first oscillator (which may have been an oscillating Kennedy receiver) was recorded in cycles per second and that of the second, a super-regenerative circuit using an audion, was recorded as a wavelength in metres. From a later description (3) and photographs of the equipment taken at that time it appears that the outputs of one or both oscillators may have been amplified by a multi-stage amplifier which provided the necessary voltage to drive the plasma tube.

(ii) First Oscillator

On nine of the pages the first oscillator's frequency was shown as a round number e.g. 400 kc/s or 900 kc/s. This suggests that to find a setting of the second (super-regenerative) oscillator which would devitalise the bacteria, the first oscillator's frequency was periodically changed in steps or multiples of 100 kc/s. Between these changes the frequency of the super-regenerative audion oscillator was slowly swept while the bacteria culture was watched and renewed from time to time until a frequency setting was found which devitalised the bacteria.

The primary purpose of the first oscillator was to generate a signal which maintained an appropriate level of ionisation in the plasma tube during each cycle of super-regeneration of the second oscillator, the super-regenerative audion, and also when tuning changes were being made to the latter. This ensured that the load impedance presented by the plasma tube remained within a range in which stable circuit operation was possible throughout each part of the super-regenerative cycle, i.e. from beginning to end of the quenching period, through the most sensitive receiving period at the cessation of quenching, during the exponential build-up of oscillation and during the period of maximum amplitude of radio frequency oscillation.

For the destruction of some pathogens the first oscillator's frequency had an additional purpose, the creation of the MOR by mixing or "beating" with the second oscillator's frequency. Either by subsequent amplification or in the plasma tube itself, the first oscillator's frequency mixed with the second's and, because of the non-linearity of the amplifier and/or the plasma, intermodulation products were produced. Usually the difference frequency (a third order IP) had the greatest amplitude, but other IPs of significant amplitude were also generated. In general the low order IPs and those of lower frequency had the greatest amplitude. As the order of the other IPs increased their amplitude diminished, becoming increasingly unpredictable and eventually too small to be significant, depending on circuit factors and the characteristics of the non-linearity.

Where the recorded frequency of the first oscillator is not a round number it invites speculation as to the reason. Possible explanations are that Rife may have chosen it because it was the already-discovered MOR of another form of the same pleomorphic pathogen, or it may have been the frequency of a local radio station known to be maintained with high precision and therefore used as a convenient frequency standard at that time.

(iii) Second Oscillator - Frequency Measurement

The second oscillator, the audion, operated in the super-regenerative mode. Its radio frequency oscillation may have been self-quenched if the circuit was so designed, or quenched by an externally generated signal, most likely a sine wave within the audible range, which was applied to the grid. The quenching rate had to be slow enough to allow the full amplitude of oscillation to be reached before quenching so as to provide a high level radio-frequency pulse to drive the plasma tube, either directly or via a power amplifier. During the quenching period the gain of the audion was greatly reduced, well below the level needed to sustain oscillation, causing the resonant circuit's oscillation to decay rapidly.

If the duration of the quenching period was sufficient to completely eliminate the oscillation, the next burst of oscillation would build up from thermal and shot noise. This would produce random variations in plate current, sufficient to drive headphones and audible as noise. When a nearby Kennedy receiver was set to oscillate and tuned to the audion circuit's frequency, it would cause oscillation to build up from the small amount of coupled signal instead of from random noise. As a result the audion's plate current would become more uniform and, after a small initial increase, the audible noise would be reduced. The audion circuit's wavelength could then be found from the Kennedy dial setting.

If, however, there was still a small residual oscillation present when the quenching period ended, in the next super-regenerative cycle the audion's oscillation would build up from a combination of the residual oscillation and random circuit noise, resulting in a degree of coherence between successive radio frequency pulses. Audibly, the effect of any ongoing coherence between successive super-regenerative cycles would have been similar to the action of a beat frequency oscillator in a radio receiver, producing a beat frequency tone whose frequency dropped to zero when the receiver was perfectly tuned to a signal source. This would have allowed the oscillating Kennedy receiver's frequency to be tuned to the audion's frequency with greater precision.

An essential factor enabling Rife to measure those frequencies recorded in his Laboratory Notes which were above the Kennedy receiver's tuning range (a little below 2 Mc/s) was the very high receiving sensitivity of the super-regenerative audion. This enabled it to receive not only the fundamental output of an oscillating Kennedy receiver, but also to respond to a weak harmonic of that frequency, if the oscillating Kennedy receiver's tuning was adjusted until one of its harmonics coincided with the audion circuit's frequency. The higher harmonics could be created by amplifying the Kennedy output and driving the amplifier into non-linearity. By this means harmonics of over 20 Mc/s could be generated and received to measure the audion circuit's oscillation frequency with the same percentage accuracy as the Kennedy receiver's calibration.

Thus the super-regenerative audion circuit generated a full-power radio frequency pulse to drive the plasma tube and it also fulfilled an essential function in its more widely known role as a sensitive radio receiver. It enabled Rife to measure accurately the frequency of the audion oscillations beyond 20 Mc/s, provided he could also ascertain **which** Kennedy harmonic was being received by the super-regenerative audion circuit.

To determine which harmonic was being received, Rife attempted to find its wavelength by the Lecher line method. He measured the distance between the voltage maxima and minima of the

standing wave on the open two-wire line which conveyed RF power around his laboratory to the plasma tube (4). He may also have used quarter-wave resonant lines as frequency selection or rejection filters. His method of measurement would have been sufficiently accurate for the purpose of merely identifying the harmonic number, if the measured signal had been an undistorted sine wave and therefore free of harmonics.

The Lecher line delivered power from the machine's output stage to the plasma tube. However, the non-linear impedance of the plasma tube generated a range of harmonics which were coupled from the plasma tube to the Lecher line and were partially reflected at the far end, producing a complex set of standing waves along the length of the line. These were present in addition to the expected standing wave produced by a passive end-of-line mismatch which would otherwise have reflected only the fundamental audion signal which Rife was attempting to measure. The consequences were that it was almost impossible for him to make accurate measurements by using the Lecher line.

In some instances the error, resulting from his understandable assumption that the voltage maxima and minima on the Lecher line arose only from interference between forward and reflected waves of fundamental frequency, caused him to mistake the wavelength of the Kennedy harmonic which was being received by the super-regenerative audion. For at least three pathogens this led to incorrect values of wavelength being calculated and recorded in the laboratory notes as the wavelength of the super-regenerative audion.

The No.3 machine was subsequently used in the clinical trial of 1934. Rife knew the precise switch and dial settings that would destroy a particular pathogen, but for some pathogens he did not know the exact frequency of the MOR that was responsible for producing the results. Apart from the errors in measurement described above, at every machine setting the non-linearity of the plasma tube inevitably caused the generation of harmonics and intermodulation products. Rife could not have been certain which of the many frequencies emitted by the plasma tube was the true MOR that was producing the devitalising effect. He may not even have been aware of the existence of intermodulation products other than the simple beat or difference frequency, a third order IP.

It is possible that some frequencies of the machine's first oscillator which were above the Kennedy receiver's frequency range were also measured in a similar manner to the audion frequency, using the super-regenerative audion as a receiver, tuning it to receive the first oscillator's frequency by listening on the headphones. If Rife used the Lecher line method to identify the number of the harmonic being received, then possibly some of the recorded frequencies for the first oscillator may also be incorrect, but no instances of this have been found.

3 : HOYLAND'S RIFE RAY No. 4

(i) Background

Philip Hoyland was a competent designer and builder of radio equipment who was engaged by Rife to develop an improved machine incorporating the latest electronic techniques. It was intended to be more compact, effective and easier to use in a clinic than Rife's No. 3 machine which was large and unwieldy, having been assembled by Rife largely from commercially available electronic instruments.

Hoyland faced a monumental task. Before he could design a clinical instrument he needed to know the exact frequencies which were required to destroy a range of different bacteria. So for each one, Rife would set the switches and dials on the No. 3 machine (5), then Hoyland would find and measure the most prominent frequencies emitted by the plasma tube and the two oscillators, either confirming or correcting Rife's recorded figures. However, he still had to establish which of the frequencies he had measured was the true MOR. To do this he needed to carry out exhaustive tests with bacteria, ideally using a machine in which the plasma tube was driven by a single frequency only, to avoid confusion arising from the multiplicity of intermodulation products which had been produced by Rife's No. 3 machine. If the bacteria responded, then that frequency, or one of its harmonics produced by the plasma tube, had to be the MOR.

The machine Hoyland built for this purpose was designated the Rife Ray Machine No. 4 and it was completed late in 1935. It was designed to be a very versatile experimental instrument which would not only enable Hoyland to find the MORs but would also allow the circuitry to be optimised and simplified prior to the design of a purely clinical machine for quantity production. For example, it allowed him to determine whether higher-frequency MORs required the plasma tube to be driven at the actual MOR, or whether consistent results could be achieved by relying on the non-linearity of the plasma to generate the MOR as a harmonic of a lower excitation frequency. There were two oscillators, which allowed two frequencies to be generated simultaneously. The cabinet had sufficient internal space to accommodate any circuitry changes which might be found to be desirable in the course of testing (6).

(ii) Design considerations

Three pages of calibration information exist, from which some tentative conclusions can be drawn as to the machine's design. When studied and analysed in conjunction with the frequencies in the Rife Laboratory Notes for the corresponding bacteria, these calibration pages constitute the "Rosetta Stone" which has made it possible to discover the MORs of many of the bacteria which are listed in the original sets of documents of both No. 3 and No. 4 machines.

The Rife Ray No. 4 machine was designed to produce most of the MORs indirectly as harmonics of an oscillator frequency (7, 8). An advantage of this feature was that by tuning a Kennedy receiver to the machine's oscillator frequency, the machine's calibration could easily be checked, provided the oscillator frequency being used was within the tuning range of the Kennedy receiver, as are the oscillator frequencies on page 1, which use switch ranges 3, 4 and 5 (presumably positions 1 and 2 allowed higher oscillator frequency ranges to be selected). Another advantage was that any stray RF radiation from the plasma tube or its wiring which happened to couple to the oscillator circuit would be at the frequency of the harmonic, not the oscillator, and would therefore be less likely to cause deviation of the oscillator frequency (known as "pulling").

The first of the machine's three calibration pages lists 14 pathogens (all of which are also in the Rife Laboratory Notes), with the corresponding frequency, switch and dial settings of one of its two oscillators. Alongside these are listed the switch and dial settings for two other circuits, described as "Gp. 1" and "Gp. 2", which appear to be two independently tuned amplifier or output stages. These recorded settings seem to be preliminary test results, simply the settings required to tune Gp. 1 and Gp. 2 to the recorded fundamental oscillator frequencies. They may not necessarily be the best oscillator or Gp. 1 and Gp. 2 settings for devitalising the particular pathogen. No calibration settings

are given for the second oscillator. The second page lists the lowest and highest frequencies to which the Gp. 1 and Gp. 2 circuits can be tuned for each setting of their individual range switches.

The third page is handwritten with some corrections and lists again nine of the fourteen pathogens on page 1, together with the same oscillator switch and dial settings as on page 1. Alongside five of these are switch and dial settings for either Gp. 1 or Gp. 2 but these settings are not the same as on page 1. Four are higher frequency settings, and it appears that the purpose of the Gp. 1 and Gp. 2 circuits was to select a particular harmonic of each oscillator's frequency, or to optimise the individual tuning of each circuit to maximise the production of a desired harmonic by the plasma tube. The loaded Q of the Gp. 1 and Gp. 2 circuits and hence the selectivity of tuning is unknown, so it is possible that more than one harmonic of significant amplitude may have been present in the output, particularly when the circuit was tuned to a high harmonic.

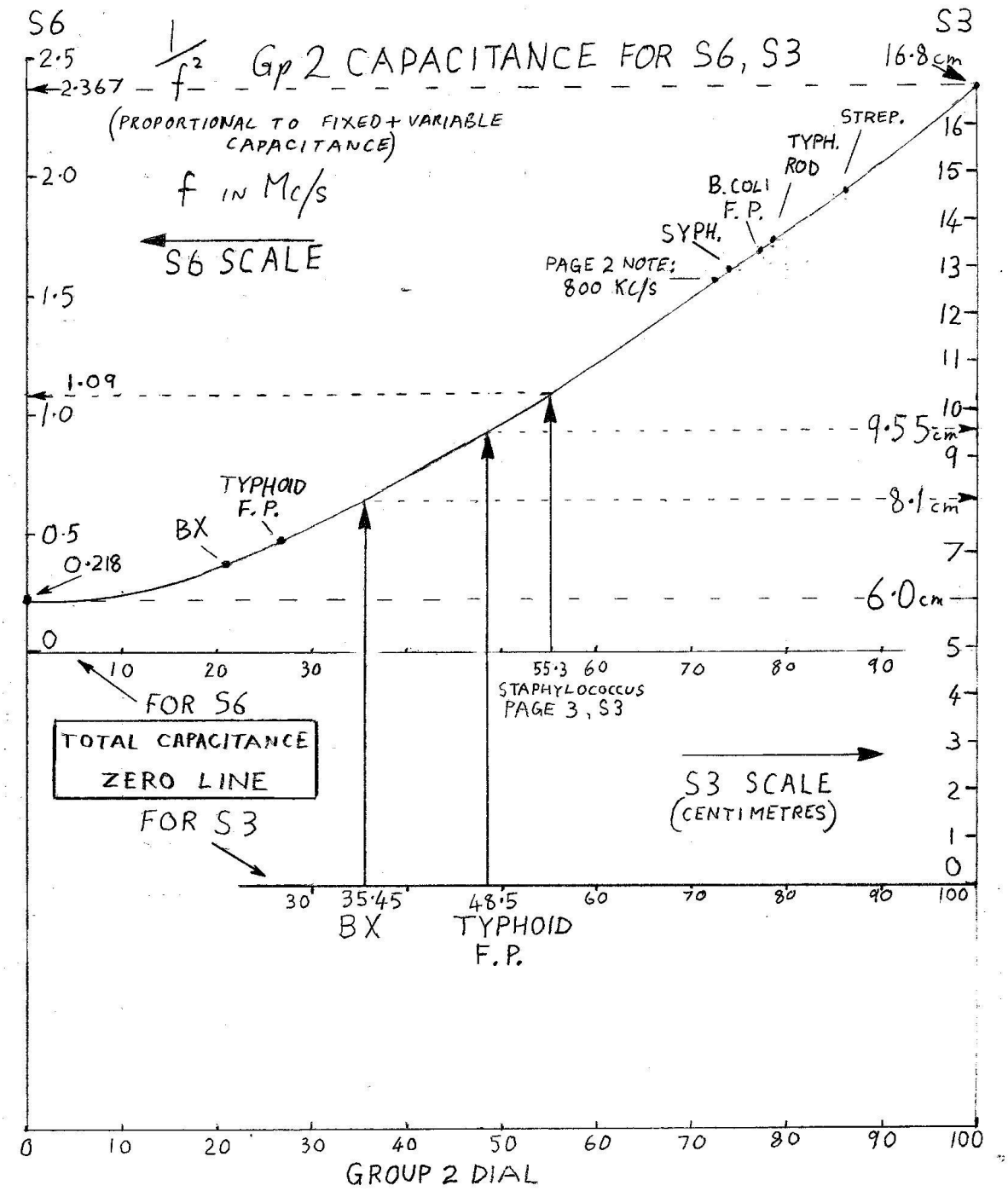
The precise manner in which the plasma tube was driven is not known. It is possible that there were separate output stages for the Gp. 1 and the Gp. 2 signals, one electrode of the plasma tube being connected to each. This would double the voltage driving the plasma tube if the Gp.1 and Gp.2 circuits, when tuned to the same harmonic, delivered the output signals in antiphase. Also, by tuning the Gp.1 and Gp.2 circuits to different harmonics, the plasma tube could produce a desired MOR at the difference frequency between the chosen harmonics. Speculation regarding the output circuitry raises the possibility that a tuned-grid long-tailed pair configuration may have been employed, tuning of each grid being achieved by the Gp. 1 and Gp. 2 circuits. This would have allowed two oscillator signals of different frequency to be combined if required and would also have provided the antiphase outputs needed to drive the plasma tube with the highest voltage.

(iii) Gp. 1 and Gp. 2 frequency calculations

The actual frequency selected by a particular dial and switch setting can be determined to a useful degree of accuracy because each tuned circuit can be modelled as a variable condenser connected in parallel with one of a number of fixed value parallel coil-condenser pairs, a particular L-C pair being selected by the frequency range switch. For simplicity the fixed capacitance of the L-C pair is taken to include the residual minimum capacitance of the variable condenser, the distributed capacitance of the coil, the stray capacitance of interconnections and the Miller capacitance of the following stage. The key to finding the circuit's frequency is a graph relating the capacitance of the variable condenser to its dial setting. (N.B. In contrast to the oscillator dial, the highest dial reading of 100 for both Gp. 1 and Gp. 2 corresponds to the lowest frequency available for a given switch position).

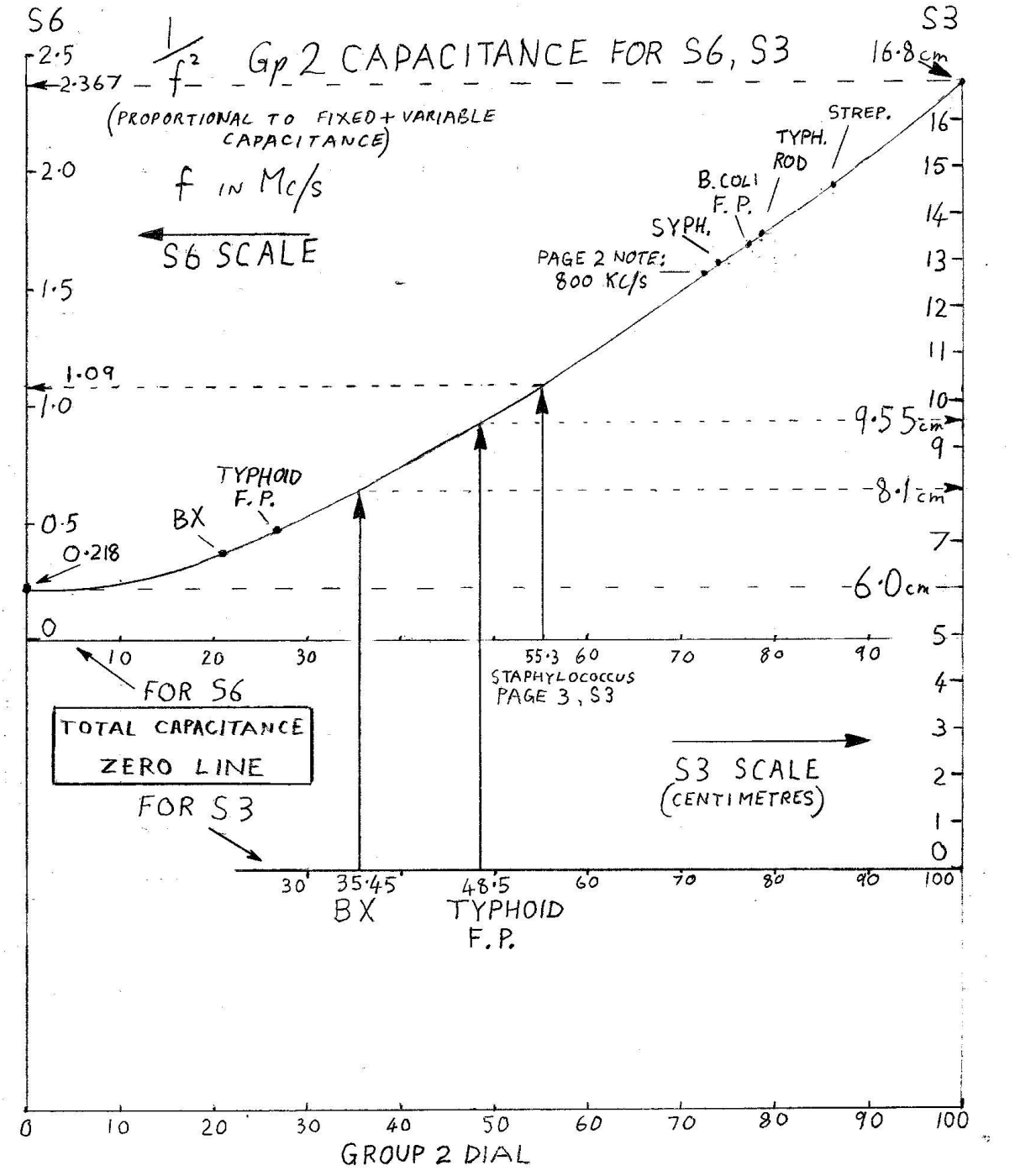
A graph of relative capacitance versus dial setting for the Gp. 2 circuit was plotted, using points taken from the S6 frequency and dial settings for pathogens given on the first page, and the S6 zero, full scale and 800 kc/s frequencies from the second page. The S6 switch setting was chosen because page 1 lists six pathogens and related oscillator frequencies for this switch setting, more than for any other switch setting. Together with the end-of-dial settings, 0 and 100, and the handwritten dial setting for 800 kc/s at the foot of page 2, there were nine points with which to plot a graph which relates total circuit capacitance to dial setting.

The total capacitance of a tuned circuit is inversely proportional to the square of its frequency, so by plotting the reciprocal of the square of frequency against the dial setting, the Y-axis scale is linear in terms of total relative capacitance.



RELATIVE TOTAL CAPACITANCE VERSUS DIAL SETTING FOR GROUP 2 S6 AND S3

Fig. 1



RELATIVE TOTAL CAPACITANCE VERSUS DIAL SETTING FOR GROUP 2 S6 AND S3

Fig.1

The linear scale makes it possible to use the same curve to find the total relative capacitance at each dial setting for the five pathogens on page 3 for which dial settings are listed, thus enabling the Gp. 1 and Gp. 2 frequencies to be calculated. However, although the shape of the graph remains the same, it is necessary to create a new zero-capacitance base line for a different switch setting because the value of capacitance at the zero dial setting is different for each switch setting. A different linear scale starting from a new base line is also needed.

The following example illustrates the procedure employed. To plot the curve for Gp. 2, S6, the value of the highest frequency (at dial setting 0) is given on page 2 as 2.14 Mc/s and the lowest (at dial setting 100) as 0.65 Mc/s. The reciprocals of the squares of these frequencies are 0.218 and 2.367 respectively, so these values were plotted on the Y-axis with X-axis dial settings of 0 and 100 respectively. Likewise the reciprocals of the squares of the six pathogen frequencies on page 1, and from page 2 the 800 kc/s frequency, were plotted at the dial settings listed alongside those frequencies. The best-fitting curve was then drawn through these nine points.

Next, the position of a new zero-capacitance base line was calculated for the Gp. 2, S3 frequency range: this was chosen because the listed dial settings for BX and filter-passing typhoid fall within this range. Whereas the S6 switch setting provided a frequency range from 2.14 to 0.65 Mc/s, a ratio of 3.292 : 1, the S3 frequencies run from 15.6 Mc/s to 9.35 Mc/s, a ratio of only 1.668 : 1. The smaller percentage tuning range relative to S6 is a result of there being a larger value of fixed capacitance in the L-C circuit selected by S3. Thus zero on the S3 capacitance scale (right hand side of the curve) is situated below the original capacitance zero line for S6 on account of the greater fixed capacitance.

The maximum to minimum frequency ratio for S3 is 1.668 : 1, therefore the capacitance ratio, being the reciprocal of the square of the frequency ratio, is the reciprocal of 1.668^2 , i.e. 0.3594 : 1. On the S6 curve of frequency versus dial setting, the capacitance scale measurement is 10.8 cms between minimum and maximum capacitance settings. In order to be consistent with these figures the position of the new zero line, found empirically by successive approximations, is 6.06 cms below the minimum capacitance value on the right hand vertical scale. This was verified by checking the validity of 6.06 cms by its compliance with the relationship below and the zero line was then drawn.

$$\text{capacitance ratio} \times C_{max} = C_{min}$$

$$0.3594 \times (6.06 + 10.8) \approx 6.06$$

The dial settings for BX and filter-passing typhoid are listed on page 3 as 35.45 and 48.5 respectively, the corresponding values of relative capacitance read from the right hand capacitance scale are 8.1 and 9.55 cms respectively. By scaling-up the minimum frequency (9.35Mc/s) by the square root of the ratio of 16.86 cms (the scale reading at maximum capacitance) to each of the above values, the Gp.2 S3 frequencies can be calculated:

$$f_{BX} = 9.35 \times \sqrt{\frac{16.86}{8.2}} = 13.41 \text{ Mc/s} \qquad f_{TYPH.FIL} = 9.35\sqrt{\frac{16.86}{9.55}} = 12.42 \text{ Mc/s}$$

4 : IDENTIFYING THE MORS

(i) Method employed

The graphical method described above has been used as a guide to the particular harmonic of the No. 4 machine's oscillator frequency which was selected to drive the plasma tube for five of the fourteen listed pathogens. With these five the actual MORs may have been the selected harmonic, or a higher harmonic created from it by the non-linearity of the output stage and/or plasma tube. No information regarding Gp. 1 or Gp.2 settings is available for any of the other pathogens listed for the No. 4 machine, so their MORs could be either the fundamental oscillator frequency or a harmonic. In the case of Rife's No. 3 machine, the two oscillator frequencies in the Rife Laboratory Notes would have produced not only a larger number of harmonics but also a range of intermodulation products.

To find the MOR of a pathogen, for each machine a list was made of the frequency of every signal of significant amplitude which could have been produced by the recorded oscillator settings for that pathogen. The lists were then compared to identify similar frequencies which could have been produced by both machines. The main criteria taken into account were the closeness of the match between the frequencies produced by the two machines, and the likelihood that a signal of sufficient amplitude at that frequency would be present in the spectrum produced by Rife's No. 3 machine. Unlike the No. 3 machine, the No. 4 had the Gp. 1 and Gp. 2 tuned circuits which, to a degree, enabled a particular harmonic to be selected and amplified. As a result, most of the output power capability of the No. 4 machine would have been available to produce the required harmonic, instead of being spent in amplifying a spectrum of unwanted frequencies as in the No. 3 machine.

(ii) Criteria for selection

The MOR frequencies finally listed for each pathogen (see comparison chart) are those which appear to be either certain or most probable, having compared and assessed all the information which can be found from the calibration data and other sources for the two machines. Inevitably this was a subjective decision, influenced by personal electronic experience, informed expectations of the measurement accuracy possible using the equipment of that era and the need for a low probability of a close but false match occurring by chance. The question arose, how close a frequency match should be expected? Some of the No.3 machine's frequencies were discovered by Rife in the 1920s. Although Rife no doubt made every effort to obtain accurate frequency measurements at all times, it is by no means certain that the same strains of bacteria were used in every test which took place over several years. An unknown factor is by how much a different strain of the same bacteria might differ in its MOR.

Broadly speaking, the qualifying criteria adopted are that for each pathogen, the frequencies produced by each machine should be in agreement to better than 2% and in the case of the No. 3 machine, the MOR should be one of the higher amplitude frequencies likely to be present in the spectrum of the plasma tube's output and no lower than 15 dB below the peak amplitude of the super-regenerative audion frequency. Where no fully compliant frequency could be found, the criteria were relaxed somewhat and it would be prudent to regard the resulting MORs as provisional, pending verification by experiment. In some cases several possible MORs were found and all have been listed: here also, experimental verification is needed to decide which of the MORs is valid.

(iii) Other considerations

When converting the wavelength of the super-regenerative audion to a frequency, the velocity of a radio wave has for convenience been taken to be 300 metres per microsecond. The possible error incurred by so doing is certain to be less than 1 part in 1,500. The values of propagation velocity used by Rife and Hoyland are unknown.

In the list comparing MORs from the two machines, the frequency of the harmonic produced by the No. 4 machine, being a more recent measurement, is considered likely to be the more accurate and is taken to be the true MOR for evaluating the percentage difference.

In the 1950s Rife spoke to some doctors about MORs which he had discovered more than twenty years earlier. His comments (9) show that he had become aware that in some cases the devitalising effects of his machine were due to harmonics of the frequencies which he had initially thought were MORs. His comments are significant as they may also apply to some frequencies described as MORs in this report which, in most instances and to be more precise, are those frequencies used to drive the plasma tube which caused it to produce the desired results, sometimes because the non-linearity of the output stage or plasma had caused a harmonic to be produced which was responsible for the effect on the bacteria.

In this report the term MOR is used in the sense that it is a specific frequency generated by a machine which appears to destroy the pathogen, but with the proviso that a harmonic might be responsible. Even if a pure sine wave is applied to a person's skin there is the possibility that the skin or underlying tissue may respond non-linearly, thus generating harmonics. Rife, however, used the term "MOR" to mean an intrinsic property of a microbe, a frequency to which it responds with high selectivity, making it susceptible to detection or destruction by a wave or field of that frequency.

5 : PATHOGENS AND MORS

(i) Those with Gp. 1 or Gp. 2 settings

(a) Non-filterable

Streptococcus Pyogenes

This is the first of the five pathogens for which either Gp 1 or Gp 2 settings are listed for the No. 4 machine, with an oscillator frequency given on page 1 of 720 kc/s. The table on page 2 gives a Gp 1 frequency range for switch position 5 from 4850 kc/s down to 2150 kc/s. Since a dial setting of 100 corresponds to the lowest frequency setting, the listed dial setting of 98.2 denotes a frequency very close to 2150 kc/s, the lowest possible frequency. The third harmonic of the oscillator frequency is 2160 kc/s, so the Gp 1 setting of 98.2 is fully consistent with the Gp 1 circuit being tuned to the third harmonic of the oscillator frequency.

The wavelength of the super-regenerative audion given in the Rife Laboratory Note for Streptococcus Pyogenes is 142 metres, which equates to a frequency of 2113kc/s which is 2.2% lower. This is not deemed sufficiently close to qualify as a highly probable match, but it remains a possibility that the MOR of Streptococcus Pyogenes is 2160 kc/s. If so, the recorded first oscillator frequency of 1241kc/s played no part in determining the MOR in Rife's No, 3 machine.

There is another possibility. The seventh harmonic of 720 kc/s (the No.4 oscillator frequency) is 5040 kc/s. For the No. 3 machine the third harmonic of the super-regenerative audion's frequency, (2113 kc/s) is 6339 kc/s and the difference (beat) frequency between that and the No. 3 machine's first oscillator frequency (1241 kc/) is 5098 kc/s. The discrepancy between 5040 kc/s and 5098 kc/s is 58 kc/s or 1.15%.

Although in frequency terms an MOR of 5040 kc/s is a better match than an MOR of 2160 kc/s, another factor to consider is that the selection of the third harmonic by the No.4 machines Gp.1 setting of about 2160 kc/s would have required the Gp.1 circuit to have had a very wide passband if the 7th harmonic were also to be produced with sufficient amplitude. On balance an MOR of 2160 kc/s seems more likely, unless the Gp 1 switch and dial settings had been retuned to favour the seventh harmonic of the No. 4 machine's 720 kc/s oscillator, 5040 kc/s.

Bacillus Typhosus

This is the second pathogen with Gp 1 settings and four settings are listed, of which three have been deleted including the 760 kc/s Gp 1 settings given on the first page. The one remaining entry records a Gp 1 switch setting of 7 and because the highest frequency for this switch setting is listed as only 615 kc/s on page 3, lower than the oscillator frequency, no conclusions regarding which harmonic is the MOR can be drawn from this entry which appears to be incorrect.

Turning to the Rife Laboratory Note, this gives the wavelength of the super-regenerative audion as 345 metres, which converts to a frequency of 869.6 kc/s based on a radio wave velocity of 300 km/s. The 8th harmonic of the No. 4 machine's 760kc/s oscillator is 6,080 kc/s and the 7th harmonic of the super-regenerative audion frequency is 6087 kc/s, a difference of only 0.12%. This suggests that the MOR of Bacillus Typhosus may be 6080 kc/s. Once again the first oscillator frequency (900 kc/s) plays no part in determining the MOR in the No.3 machine.

Staphylococcus

This is listed with a No.4 machine oscillator frequency of 478 kc/s and Gp 2 switch and dial settings of 6 and 55.3 respectively. The tuning range given for a switch setting of 6 is 2140 kc/s to 650 kc/s and by using the initial scale of the graph drawn earlier it was found that the dial setting of 55.3 corresponds directly to a frequency of 958 kc/s. Since the second harmonic of the oscillator frequency is 956 kc/s it is evident that it is the second harmonic that is being selected, thus the MOR for staphylococcus must be either 956 kc/s or a harmonic of 956 kc/s. The particular strain of staphylococcus is not specified.

Turning to the Rife Laboratory Note entitled Staphylococcus Pyogenes Aureus, two values for the first frequency, 998 kc/s and 740 kc/s are listed. The wavelength of the super-regenerative audion was originally written as 546 metres, this value being amended to 540 metres. It is stated in correspondence (10) that the MOR of Staphylococcus Albus is 546 metres. Thus it is possible that the amended value of the wavelength of the super-regenerative audion, 540 metres, (555.6 kc/s) for Staphylococcus Aureus is correct whereas the deleted value of 546 metres (549.5 kc/s) relates to Staphylococcus Albus.

There are several possible matches between harmonics of the No. 4 machine's selected output frequency of 956 kc/s and various frequencies which can be produced by four possible combinations

of the recorded settings of the No. 3 machine's oscillators. These are listed below, followed in brackets by the No. 4 machine's relevant frequency, i.e. the number of the harmonic of 956 kc/s, (not the oscillator frequency) and the percentage discrepancy.

The seventh harmonic of 549.5 kc/s, the super-regenerative audion frequency for Staphylococcus Albus, is 3846.5 kc/s. (3824 kc/s, 4th harmonic, 0.6%)

The seventh harmonic of 549.5 kc/s (which is the super-regenerative audion frequency for Staphylococcus Albus) is 3846.5 kc/s and this mixes with the fixed oscillator signal of 998 kc/s creating a third order intermodulation product (beat frequency) of 2848.5 kc/s.
(2868 kc/s, 3rd harmonic, 0.7%)

The seventh harmonic of 555.6 kc/s (which is the super-regenerative audion frequency for Staphylococcus Aureus) is 3889.2 kc/s and this mixes with the fixed oscillator frequency of 998 kc/s creating a third order intermodulation product (beat frequency) of 2891.2 kc/s.
(2868 kc/s, 3rd harmonic, 0.8%)

The tenth harmonic of 549.5 kc/s (which is the super-regenerative audion frequency for Staphylococcus Albus) is 5495 kc/s and this mixes with the fixed oscillator frequency of 740 kc/s creating a third order intermodulation product (beat frequency) of 4755 kc/s.
(4780 kc/s, 5th harmonic, 0.5%)

The tenth harmonic of 555.6 kc/s (which is the super-regenerative audion frequency for Staphylococcus Aureus) is 5556 kc/s and this mixes with the fixed oscillator frequency of 740 kc/s creating a third order intermodulation product (beat frequency) of 4816 kc/s.
(4780 kc/s, 5th harmonic, 0.75%)

To summarise, the MORs of both Staphylococcus Albus and Staphylococcus Aureus most probably lie within 1% of either the fourth, sixth or tenth harmonic of 478 kc/s, i.e. 2868 kc/s, 3824 or 4780 kc/s and the MOR of the Aureus strain is probably about 1% higher than that of the Albus strain.

(b) Filterable forms

Bacillus X and the filterable form of Bacillus Typhosus are the two remaining pathogens for which either Gp. 1 or Gp. 2 settings of the Rife Ray No. 4 machine were recorded. Although the filterable form of Bacillus Coli lacks Gp. 1 or 2 settings, it is appropriate that it too should be included in this section: in the years 1932-3 much of Rife's time was devoted to studying all three. He carried out research with Dr. Kendall on the filterable form of the Bacillus Typhosus which they discovered in 1932, resulting in papers being published. After many years of fruitless searching, in the same year Rife discovered the causative agent of Carcinoma, a filterable pathogen which he named BX. Also in 1932 the filterable form of Bacillus Coli was discovered. A very significant conclusion resulting from this work was that by appropriate changes to the culture medium, over a period of time BX could be transformed into either Bacillus Typhosus or Bacillus Coli.

Bacillus X – Carcinoma

The Rife Ray Machine No. 4 data lists an oscillator frequency of 1.604 kc/s for this pathogen, with Gp 2 settings of S3 and dial 35.45. Using the graphical method described earlier, these settings were found to correspond to a frequency of 13.4 Mc/s. The closest harmonic of the oscillator frequency to 13.4 Mc/s is the eighth harmonic, 12.832 Mc/s, so this harmonic is most probably the MOR.

For Rife's No 3 machine the first oscillator's frequency is listed as 11.78 Mc/s and the wavelength of super-regeneration of the audion tube is wrongly recorded as 17.6 metres (17.045 Mc/s). The reason for this error is as follows.

After Rife discovered the settings of the No.3 machine which destroyed BX, he set about measuring the wavelength of the super-regenerative audion. First he used the Lecher line method to obtain an approximate value. By sliding a moveable voltage probe on the long open-wire transmission line which delivered the machine's output power to the plasma tube, he measured the distance between maxima and/or minima of the standing wave voltage, which would have been located at regular half-wavelength intervals were the line terminated in a passive load. However, the plasma tube was not a passive load: its non-linear impedance generated multiple harmonics which coupled to the line, disrupting the standing wave pattern. Rife's measurements were greatly affected, leading him to believe, wrongly, that the wavelength was in the region of 17.6 metres.

Next, Rife obtained a precise reading, more accurate than that obtainable from Lecher lines. He used a Kennedy receiver which he adjusted to oscillate and radiate harmonics of the Kennedy's accurately-known frequency at a level high enough to be received by the super-regenerative audion acting as a receiver. When no signal was being received the random variations in the super-regenerative audion's plate current were audible on headphones as loud background noise. Rife first set the Kennedy receiver to oscillate at its maximum tuneable frequency (a little below 2 Mc/s) and slowly rotated the dial, reducing the Kennedy's frequency until he heard the characteristic quieting caused by a received carrier, a harmonic of the Kennedy frequency. He carefully read the Kennedy's dial and noted the wavelength, which in this case can be shown to be 158.4 metres.

Rife knew he had received a harmonic of the Kennedy frequency, but he still had to find out the number of the harmonic. He divided the Kennedy wavelength by his (incorrect) Lecher line measurement. The resulting number was evidently in the region of 9. Understandably, Rife thought that the super-regenerative audion had received the ninth harmonic of the precisely measured 158.4 metre (1.894 Mc/s) Kennedy oscillation. He therefore divided the Kennedy wavelength by nine and recorded the result, 17.6 metres, as the wavelength of the super-regenerative audion circuit.

There is no harmonic of the 158.4 metre (1.894 Mc/s) Kennedy oscillation which is close to the frequency of the most probable MOR (12.832 Mc/s), found by examination of the No.4 machine data as described earlier, therefore the MOR was not being produced as a direct harmonic of the super-regenerative audion frequency. The next step therefore was to search for the matching MOR among the many intermodulation products generated by the mixing of the No.3 machine's recorded first oscillator frequency, 11.78 Mc/s, and harmonics (other than the ninth) of the Kennedy's 158.4 metre (1.894 Mc/s) frequency. The 13^{th} harmonic exhibits remarkably close agreement: the beat frequency between 11.78 Mc/s and the 13^{th} harmonic (24.62 Mc/s) is 12.84 Mc/s, a discrepancy of only 0.06% when compared with the No.4 machine's most probable MOR of 12.832 Mc/s, thus confirming 12.832 Mc/s as the MOR of the filterable form of BX.

Filterable form of Bacillus Typhosus

The Rife Ray Machine No.4 data lists an oscillator frequency of 1445 kc/s, with Gp. 2 settings of S3 and dial 48.5. Using the graphical method described earlier, these settings can be shown to correspond to a frequency of 12.4 Mc/s. The closest harmonic of the oscillator frequency to 12.4 Mc/s is the ninth harmonic, 13.005 Mc/s, so this harmonic is most likely to be the MOR.

For Rife's No. 3 machine the first oscillator's frequency is listed as 9.68 Mc/s and the wavelength of super-regeneration of the audion is wrongly recorded as 21.5 metres (13.953 Mc/s). The explanation for this error is similar to that described above for BX. It appears that Rife's Lecher line measurements led him to wrongly believe that the wavelength of the super-regenerative audion was in the region of 21.5 metres, because that was the value he subsequently recorded in the Laboratory Notes.

To make the most accurate measurement Rife used an oscillating Kennedy receiver to provide harmonics of its oscillating frequency, as before. He slowly turned the Kennedy dial, reducing its frequency from the highest possible value until he heard a quieting signal on the headphones. He noted the Kennedy's wavelength, which in this case will be shown to be 172 metres. To obtain the harmonic number he divided this wavelength by the incorrect wavelength derived from the Lecher line measurement and the resulting figure in the region of eight caused him to believe he had received the eighth harmonic. He divided his precisely measured Kennedy wavelength of 172 metres by eight and recorded a value of 21.5 metres as the wavelength of the super-regenerative audion.

There is no harmonic of the Kennedy's 172 metre oscillation which is close to the most probable MOR (13.005 Mc/s), found from examination of the No. 4 machine data as previously described. Accordingly, the next step was to look for a matching MOR among the third order intermodulation products generated by the mixing of the No. 3 machine's recorded first oscillator frequency, 9.68 Mc/s and harmonics of the Kennedy's 172 metre (1.744 Mc/s) frequency. Coincidentally it was again the 13^{th} harmonic which exhibited remarkably close agreement. The beat frequency between 9.68 Mc/s and the 13^{th} harmonic (22.674 Mc/s) is 12.994 Mc/s, a discrepancy of only 0.08% when compared with the No. 4 machine's probable MOR of 13.005 Mc/s, thus confirming that 13.005 Mc/s is the MOR of the filterable form of Bacillus Typhosus.

Filterable form of Bacillus Coli

On the first page of the Rife Ray Machine No. 4 calibration data this pathogen is listed as having an oscillator frequency of 770 kc/s but unfortunately no Gp.1 or Gp.2 settings are recorded. In the Rife Research Laboratory note the first frequency is 8.581 Mc/s and 27 metres (11.11 Mc/s) is recorded as the wavelength of the super-regenerative audion. Neither of these frequencies nor their third order intermodulation products are a close match to any harmonic of 770 kc/s.

When Rife was attempting to precisely measure the wavelength of the super-regenerative audion by using it to receive a harmonic generated by the oscillating Kennedy receiver, he started by setting the latter to its shortest wavelength (just above 150 metres) then slowly rotated the Kennedy dial until the super-regenerative audion received a harmonic of the Kennedy frequency. Since he recorded 27 metres as the wavelength, it appears that his (erroneous) Lecher line test results had led him to believe that the audion wavelength was in the region of 27 metres (11.11 Mc/s).

As he slowly tuned the oscillating Kennedy receiver from its shortest possible wavelength to progressively longer wavelengths, he therefore expected that the first harmonic to be received by

the super-regenerative audion would be the sixth harmonic of the Kennedy frequency. The first audible harmonic was received when the Kennedy dial reached 162 metres, so he divided this wavelength by six and recorded the result, 27 metres, as the super-regenerative audion's wavelength.

In fact the Kennedy harmonic which Rife heard was the fifth, and the true wavelength of the superregenerative audion was a fifth of 162 metres, i.e. 32.4 metres (9.259 Mc/s).

The 12th harmonic of 770 kc/s, the No. 4 machine's oscillator frequency, is 9.240 Mc/s and the discrepancy between this and 9.259 kc/s is only 0.2%, so it is highly probable that 9.240Mc/s is the MOR of the filterable form of Bacillus Coli.

(iii) Remaining pathogens listed with No. 4 machine settings

Eight remaining bacteria are listed in both the Rife Laboratory Notes and the calibration information for the Rife Ray Machine No. 4. Unfortunately the latter provides only the oscillator frequencies for these eight. The plasma tube of the No. 4 machine is driven by one (or possibly more than one) harmonic of the oscillator but in the absence of any Gp.1 or Gp. 2 settings to indicate the harmonic selected, the only information available from the No. 4 machine is that the pathogen's MOR is either the oscillator frequency or one of its harmonics.

The possible MORs which have been found are listed below with comments. When more than one has been found, that with the lowest frequency or which is the intermodulation product of the lowest order is suggested as the most probable and the first candidate for experimental verification.

Actinomycosis (Streptothrix)

The super-regenerative audion wavelength of 1607 metres (186.7 kc/s) differs from the No. 4 machine's oscillator frequency of 192 kc/s by 2.8%.

A possible MOR is 192kc/s.

Bacillus Anthracis (Anthrax)

The super-regenerative audion wavelength of 1100 metres (272.7 kc/s) differs from the second harmonic (278.4 kc/s) of the No.4 machine's 139.2 kc/s oscillator frequency by 1.5%.

The most probable MOR is 278.4 kc/s.

Bacillus Coli

The super-regenerative audion wavelength of 943 metres (318 kc/s) has a fourth harmonic of 1272 kc/s and the third harmonic of the No.4 machine's 417 kc/s oscillator frequency is 1251 kc/s, a difference of 1.7%.

The wavelength of the super-regenerative audion was originally recorded as 1050 metres (285.7 kc/s) and subsequently replaced by 943 metres (318.1 kc/s). Interestingly, the tenth harmonic (2857 kc/s) of the original frequency differs from the ninth harmonic (2863 kc/s) of the new frequency by only 0.2%, suggesting the possibility that both frequencies produced an effective MOR.

The seventh harmonic of 417 kc/s is 2919 kc/s, which differs from 2863 kc/s by 1.9%.

Thus there are two possible MORs, 1251 kc/s and 2919 kc/s, the former being the more probable.

Diplococcus Pneumoniae

The wavelength of the super-regenerative audion is 785 metres (382.2 kc/s) and its second harmonic is 764.4 kc/s. The beat frequency between the latter and the first oscillator frequency of 1200kc/s is 435.6 kc/s. The No.4 machine's oscillator frequency is 427 kc/s, a difference of 2%.

The tenth harmonic of the super-regenerative audion's frequency is 3822kc/s and the ninth harmonic of the No.4 machine's oscillator frequency is 3843 kc/s, a difference of 0.5%.

There are two possible MORs, 427kc/s and 3843 kc/s.

Bacillus Tetani

The wavelength of the super-regenerative audion is 19,000 metres (15.8kc/s) and the first oscillator frequency is 700 kc/s. These frequencies give rise to third order intermodulation products of 684.2 kc/s and 715.8 kc/s due to non-linearity in the plasma tube. The third harmonic of the No.4 machine's (234 kc/s) oscillator frequency is 702 kc/s and this differs from the 715.8 kc/s intermodulation product by 2%.

A possible MOR is 702 kc/s, if not, then it is probable that the MOR is close to 702 Kc/s.

Treponema Pallidum (Syphillis)

The wavelength of the super-regenerative audion is 108 metres (2778 kc/s) and the second harmonic is 5556 kc/s. The No. 4 machine's oscillator is 789 kc/s, and the seventh harmonic is 5523 kc/s, which differs from 5556 kc/s by 0.6%.

A possible MOR is 5523 kc/s.

Gonorrhoea

The wavelength of the super-regenerative audion is 1990 metres (150.8 kc/s) and the third harmonic is 452.4 kc/s. The second harmonic of the No. 4 machine's oscillator (233 kc/s) is 466 kc/s, a difference of 2.9%.

The beat frequency between the super-regenerative audion's frequency (150.8 kc/s) and the first oscillator's frequency of 600 kc/s is 449.2 kc/s. This differs from the second harmonic of the No. 4 machine's oscillator, 466 kc/s, by 3.6%.

Both alternatives indicate a possible MOR of 466 kc/s.

Tuberculosis Bacillus

The wavelength of the super-regenerative audion is 554 metres (541.5 kc/s) and its second harmonic is 1083 kc/s. The third harmonic of the No. 4 machine's oscillator frequency (369 kc/s) is 1107 kc/s and this differs from 1083 kc/s by 2.2%.

Also, the sum of the super-regenerative audion's frequency (541.5 kc/s) and the first oscillator frequency (583 kc/s) is 1124.5 kc/s. The third harmonic of the No.4 machine's oscillator frequency (369 kc/s) is (1107 kc/s), a difference of 1.6% .

There is a third possibility: the sum of the third harmonic (1624.5 kc/s) of the super-regenerative audion frequency and the fixed frequency (583 kc/s) is 2207.5 kc/s. The sixth harmonic of the No.4 machine's oscillator is 2214 kc/s, which differs by 0.3%.

Possible MORs are 1107 kc/s and 2214 kc/s.

6 : COMPARISON TABLE

The comparison table which follows summarises the above results in a convenient form.

For Rife's No. 3 machine, the fourth column headed "source" lists the capital letter or letters denoting either the super-regenerative audion's harmonic, or the relationship of the two oscillator frequencies which results in an intermodulation product, whichever produces the MOR shown in the third column. The three highest super-regenerative audion frequencies, shown in bold print, are corrected values. They are the oscillating Kennedy receiver's frequency measured by Rife, multiplied by the **true** number of the harmonic which he heard on the headphones of the super-regenerative audion circuit in each case.

For Hoyland's No. 4 machine, either the oscillator frequency itself (fundamental) or the particular harmonic of it identified as the MOR is listed in the second column. The final column lists the difference between the MORs produced by the two machines, a positive figure indicating that the No. 4 machine produced the higher MOR.

The information given should not be regarded as final and complete; there may be some errors or omissions. It is offered both as a starting point to assist those who seek to carry out lethality tests on some of the bacteria studied by Rife, and as an aid to assessing the effectiveness of machines in the course of development.

Comparison of possible MORs generated by No. 3 and No. 4 machine

Microorganism	Rife's No.3 machine Audion(A)	1st osc(B)	MOR, source		Hoyland's No.4 machine Osc.	Harmonic	MOR	Difference
Streptococcus Pyogenes	2113	1241	2113	A	720	3rd	2160	+ 2.2%
"	2113	1241	5098	3A - B	720	7th	5040	- 1.15%
Typhoid (Rod form)	869.6	900	6087	7A	760	8th	6080	- 0.12%
Staphylococcus	549.5	Either	3846	7A	478	8th	3824	- 0.6%
"	549.5	998	2848	7A - B	478	6th	2868	+ 0.7%
"	555.6	998	2891	7A - B	478	6th	2868	- 0.8%
"	549.5	740	4755	10A – B	478	10th	4780	+ 0.5%
"	555.6	740	4816	10A – B	478	10th	4780	- 0.75%
Typhoid (Filterable)	**22675**	9680	12995	A – B	1445	9th	13005	+ 0.08%
Carcinoma (BX)	**24620**	11780	12840	A – B	1604	8th	12832	- 0.06%
B. Coli (Filterable)	**9259**	8581	9259	A	770	12th	9240	- 0.2%
Actinomycosis	186.7	678	186.7	A	192	Fund.	192	+ 2.8%
Bacillus Anthracis	272.7	900	272.7	A	139.2	2nd	278.4	+ 1.5%
B. Coli (Rod)	318	683	1272	4A	417	3rd	1251	- 1.7%
"	318	683	2863	9A	417	7th	2919	+ 1.9%
Diplococcus Pneumoniae	382.2	1200	435.6	B - 2A	427	Fund.	427	- 2.0%
"	382.2	1200	3822	10A	427	9th	3843	+ 0.5%
Tetanus	15.8	700	715.8	A + B	234	3rd	702	- 2.0%
Treponema Pallidum	2778	900	5556	2A	789	7th	5523	- 0.6%
Gonorrhea	150.8	600	452.4	3A	233	2nd	466	+ 2.9%
"	150.8	600	449.2	B - A	233	2nd	466	+ 3.6%
Tuberculosis (Rod)	541.5	583	1083	2A	369	3rd	1107	+ 2.0%
"	541.5	583	1124.5	A + B	369	3rd	1107	- 1.6%
"	541.5	583	2207.5	3A + B	369	6th	2214	+ 0.3%

Frequencies arein kc/s. Metres to kc/s conversion velocity 300,000 km/s. Corrected values in bold type.

7 : CONCLUSIONS

Rife's extensive use of the No.3 machine in his collaborative and experimental work on BX and the filterable forms of Bacillus Typhosus and Bacillus Coli gave him much experience in measuring their MORs and the procedure for setting them repeatably with high accuracy. As might be expected with these three MORs, the values derived from study of the No. 4 machine and the values calculated using the true super-regenerative audion wavelengths found for the No. 3 machine are in extremely close agreement. These three results provide strong validation for the descriptions given of how Rife measured the super-regenerative audion wavelength and how the limitations of the Lecher line technique and the presence of harmonics caused incorrect wavelengths of the super-regenerative audion to be recorded. They also confirm that the Gp1 and Gp 2 settings of the No. 4 machine were the means by which a particular oscillator harmonic was selected to produce the same MOR output as the No.3 machine.

It is a tribute to Rife's skill and precision in setting and reading the analogue dials on the early machines, that the accuracy of his measurements has made it possible to recover many of the true MORs more than 80 years later. The results support his tape-recorded description of the meticulous way he made the measurements, repeating them again and again, always zeroing the instruments before each measurement (11).

From a historical perspective the results show that Hoyland was fully aware that three important values of the super-regenerative audion's wavelength recorded in the Rife Laboratory Notes were incorrect. He had found Rife's true MORs by early 1936 at the latest. It is not clear whether he ever explained his findings to Rife or intended to amend the three Laboratory Notes, but using the settings in his calibration data, the No.4 machine reproduced Rife's original MORs. Confusion regarding the MORs has existed ever since, when in fact both machines produced the same MORs.

Experimental work with bacteria is needed to determine which of the possible MORs listed in the comparison table is valid where more than one possible value is shown. Although a particular type of plasma tube may give good results with audio frequency MORs, there is reason to believe that specific ways of driving the tube must be used if it is also to function effectively at Rife's original radio frequencies. Evidence for this and indications of areas needing further research are given next.

In reference (4) Rife spoke candidly when interviewed about what he considered to be the most difficult challenges he had overcome and his greatest achievements. The unknown reporter wrote: "Before he could work out the details of his super-regenerative ray it was necessary for him to work out a method of changing the polarisation of vacuum tubes at will. He can switch them from negative to positive and then switch them back, something which has not been done in New York, Munich, Vienna or anywhere else." In reference (12) Ben Cullen describes how Rife worked with tubes supplied by Steinmetz, how he developed finally a way of testing the polarity of the material in the tubes and how, by matching the polarity of the filaments to the polarity of the "poles", he was able to develop very much more high frequency power than ever before.

Significant progress has been made with the discovery of many of Rife's orginal radio frequencies. However, a greater understanding is now needed of how a plasma tube should be made, biased and driven so that it functions efficiently at radio frequencies (4), (12). Then, maybe it will be possible to realise the full therapeutic potential of Rife's radio frequencies transmitted from a plasma tube.

References

(1) Beam Ray trial transcript, Comparet examines Hoyland

(2) Super-regenerative Receivers, J.R. Whitehead, Cambridge University Press, 1950

(3) Letter, Jack Free to Milbank Johnson, 17 December, 1935

(4) San Diego Union, 11 March 1929. “Local man bares wonders of germ life”

(5) Beam Ray trial transcript, Comparet examines Hoyland P. 36

(6) Letter Milbank Johnson to Rife, 18 July 1935

(7) Beam Ray trial transcript, Comparet examines Hoyland P. 51

(8) Letter, Rife to Gonin, May 14, 1939

(9) Rife CD No. 13, track 8, starting at 13 minutes, Rife

(10) Letter, Jack Free to Milbank Johnson, October 26, 1935

(11) Rife CD No. 13, track 8, starting at 13 minutes, Rife

(12) Rife CD No. 6, track 1, starting at 6 minutes, Ben Cullen

The website www.rife.org provides online access to the calibration information for the No. 3 and No. 4 machines and all of the above references except J.R. Whitehead’s book and the Rife CDs.

It also provides details of where the CDs can be purchased and it is certainly one of the most important sources of information available to the serious researcher.

Appendix

Three pages of calibration notes for Hoyland’s No. 4 machine and three pages of relevant Rife Laboratory Notes for the filterable forms of Typhoid Bacillus, Bacillus Coli and BX are provided for ease of reference. All are in the public domain.

RIFE RAY MACHINE NO. 4

NAME	OSCILLATOR			GROUP 1		GROUP 2	
	S	DIAL	FREQUENCY KC	S	DIAL	S	DIAL
BX Filterpassing	5	85.50	1604	6	18.8	6	21.0
TYPHOID Filterpassing	5	76.66	1445	6	25.2	6	26.6
TYPHOID Rod	5	55.00	760	6	76.2	6	79.0
ACTINOMYCOSIS (Streptothrix)	4	20.75	192			8	77.1
STAPHYLOCOCCUS	4	85.25	478	7	27.2	7	44.5
B. COLI Rod	4	73.50	417	7	42.6	7	62.5
DIPLOCOCCUS PNEUMONIAE	4	75.55	427	7	40.0	7	59.1
BACILLUS TETANI (Tetanus)	4	36.5	234			8	49.25
STREPTOCOCCUS PYOGENOUS	5	51.00	720	6	82.2	6	86.2
BACILLUS TUBERCULOSIS Rod	4	64.50	369	7	57.7	7	80.6
B Coli - f.1	3	36	770.	6	74.5	6	77.25
B Anthrax	5	81.26	139.2			9	29.1
Treponema Paludium	3	37.25	789	6	71.25	6	74
Streptococcus	4	36	233			8	49.5

RIFE RAY MACHINE NO. 4

GROUP 1			GROUP 2		
Switch	From KC	To KC	Switch	From KC	To KC
1			1		
2	22,500.	15,400.	2		
3	16,300.	9,270.	3	15,600.	9,350.
4	9,500.	4,800.	4	9,370.	4,640.
5	4,850.	2,150.	5	4,750.	2,150.
6	2,175.	615.	6	2,140.	650.
7	615.	282.	7	670.	325.
8			8	352.	168.
9			9	172.	87.
10			10		

No setting Between 650 KC AND 2130 KC that works [illegible]
800 KC [illegible] YGISLD 70 $.256 D 72.5

RIFE RAY MACHINE NO. 4

Name	ase setting		Run machine				Remark
			GROUP No 1		GROUP No 2		
	Sinks	Dial	Sinks	Dial	Sinks	Dial	
Actenomycosis Staphylitis (Bovis)	4	20 3/4 20.75					
Streptococcus Pyogenous	3	31	5	98.2			
Bacillus Typhosus (Rod Type Filter passing)	3	35	~~4 25.1~~ ~~5 73.1~~ ~~6 76~~ 7	74.5			
Much Granule							
Bacillus Tuberculosis (Rod)	4	64.50					
B. Coli	4	73.5					
Diplococcus PNEUMONIA	4	75.33					
Bacillus Typhosus (Filter passing)	3	76.2/3 76.66 3			3	48.5	
Staphylococcus	4	85.25			6	55.3	
B.	3	85.5			3	35.45	

RIFE RESEARCH LABORATORY

Bacillus X (Cancer) Carcinoma

(Rife) 11-20-32

Filterable Virus: Passes W: K Medium

motile-small ovoid granule
highly plastic
visable only with mono chromatic light
angle of refraction 123/10
color by chemical refraction Purple-red
length - 1/15 u : breadth 1/20 u

Polarity
+ anode
- cathode X

Death rate in milliamperes	175 D.C.
Influence of X ray	none
" " Ultra Violet ray	slows motility
" - Infra Red -	none
Thermal death point	42C. 24 hrs.
Filiment voltage	10
" amperage	86
Plate voltage	928
Cycles per second	14,780,000

Wave length of super regeneration of audion tube 17 b/10 Me

RIFE RESEARCH LABORATORY

Bacillus Typhosus Filterable virus:
Rose & (Kendall) 1932 passes W. K medium

natile small ovoid granule
ighly plastic
isable only with monochromatic light
ngle of refraction 4.8—
olar by chemical refraction turquoise blue
ength: broadside

olarity
+anode X
−cathode
eath rate in milliamperes 128. D.C.
nfluence of X ray none
" " Ultra Violet ray slows motility
" " Infra Red " none
hermal death point 41C 24 hrs.
ilament voltage 11
late voltage 1,700
ycles per second 9,600,000
ave length of super regeneration of audion tube 21½ m
ilament amperage 49

RIFE RESEARCH LABORATORY

Bacillus Coli — Filterable virus

R.S.C. (Kendall) 1932 — passes W. K medium

motile avoid granule
highly plastic
visable only with monochromatic light
angle of refraction 7° +
color by chemical refraction dark brown
length: breadth

Polarity
+ anode X
- cathode X

Death rate in milliamperes 86. DC.
Influence of X ray none
" " Ultra Violet ray none
" " Infra Red stimulates growth
Thermal death point 43 C 24 hrs.
Filiment voltage 12
" amperage 30
Plate voltage 980
Cycles per second 8,581,000
Wave length of super regeneration of audion tube. 27 Meters