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Hello Reader

Thank you for deciding to consider LUNACEPTION. You are in for a great adventure. Although the book was published a long time ago, and the bibliography is out of date, LUNACEPTION is timeless, and you will find it works just as well as when I wrote it. Fine tune the information with the following:

* The chapter on contraception is painfully out of date. Unless you want to know what it was like when I started out, I'd skip it if I were you;

* The chapter on the biochemistry of the theory has largely been proved to be true;

* There is new information available now:

For example, I have learned that red light -- as with a darkroom bulb -- does not disturb cycles the way that white light does. So, for example, you can use a red light to go to the bathroom, or change a baby's diaper. You can get a red light at most any hardware store.

Making your bedroom dark at night can be problematic. Even rare, intermittent light coming in can affect your body's hormones. Street and car lights can shine in, especially in the Summer when you may have the window(s) open and the curtain billows. You will have to find window covers that are really thick. Experiment by turning off all the lights and holding up your hands. Can you still see them? If so, work at it some more. I use stick pins on my curtains liberally.

I have given thought to bringing the book up to date, but at my age it would be a great investment of time, and I haven't been able to do that yet. I do have a lot of notes, and if you have questions, ask them at the email or snail mail address above.

Please let me hear from you again after you have read and mastered the methods. Tell me what you have learned and what you have accomplished. I care.

Warmly,



Louise Lacey

Lunaception

A Feminine Odyssey
into Fertility and Contraception

by Louise Lacey

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Thirty-five years later, my list would make a small town's phone directory. During that period a great number of women read and used Lunaception and once again told me of their results. This time, because of the years involved, many other pieces of information were determined. Truly, the so called rhythm method, with these Lunaception twists, has been shown to be accurate. When women are empowered by the information given here, they can decide how many children to have, and space them to their own decisions. If you want to know more, write to me at: Lacey@Lunaception.net

Foreword

You are about to read the story of the rediscovery of what appears to be nature's own form of female human contraception. It is a capacity built right into women's bodies, operating in response to predictable influences from the environment. No devices, pills, unguents, or potions are required. Lunaception can't accurately be called a "system" or method of "control." There is more to it than that. It is:

A revolutionary frame of reference for looking at your own body;

a biologically gratifying way to come into a personal balance with the universe;

a tool for health; and last but not least,

a possible means to discretionary conception.

I have written in a personal way because health and sex and life are very personal subjects, and because the story of Lunaception is a chronicle of my own search for an effective way to avoid conception without violating my body. I found what I wanted, and a great deal more.

So far as I know, no large scientific test has yet been done on the contraception aspects of Lunaception. It is still my hope that this book will induce one. I intend no miracles. I do believe wholeheartedly that any normal woman can come to know her body so well, can be so tuned into her part in the cosmos, that she will be able to make pregnancy an option instead of an inevitability.

This book will show her why and how.

PART I
Out of Context

1 / A Personal Problem

Every time I begin to congratulate myself, thinking I have acquired some Answers to Life's Important Questions, something happens to illuminate yet another aspect of my fundamental ignorance. Mocking finger in my humble pie.

So, predictably, just when I thought I had made all the necessary adjustments to my womanly self-image, I went for my annual examination at Family Planning. "You have a lump in this breast," the young doctor told me. "You'd better see a surgeon."

I guess no woman is ever prepared for the prospect of breast cancer. Certainly I wasn't. It seemed to me that I had withstood the psychic batterings of the media (DOCTOR SAYS WOMEN'S LIB MAKES MEN IMPOTENT), friends ("You drive a car just like a man"), and even the occasional passer-by ("Are you liberated, lady, or do you want some help with that flat tire?"), only to be betrayed by my own body.

Contemplating what I knew about the prognosis for a woman of my age and medical history with breast cancer, I wasn't reassured. I had no medical insurance, nor even enough money to pay for a visit to a

second-rate surgeon. Whenever I thought about it—which was as infrequently as possible—I broke out into a sweat. (I know, ladies don't sweat. They perspire.)

After nerve-wracking weeks of bureaucratic delay I managed to secure an appointment at the university medical center. In the surgery clinic I was examined down to my toenails, and my breasts were squeezed and palpated by a succession of silently grave medical students. Lips pursed. Slight frown. No comment.

Then, after two muffled conferences in the hall with his students, the chief surgeon finally delivered his verdict: What I had was not a tumor, but what he called a fibroid mass. He said it was not malignant, that he didn't even want to do a biopsy.

When my heartbeat rate had returned to normal, I began to understand the other things he was saying. While the phenomenon was not new, a lot more lumpy-breasted women were turning up after taking the pill for many years. I was just one of many. He couldn't know for sure, of course, because the pill is something new in the history of medicine, but he thought that the masses (for I had several by this time) wouldn't become cancerous at a later date, either. At any rate, he advised me, I would be likely to keep getting more so long as I kept taking the pill, and I would have to keep coming back to the medical center for squeezing and palpations every few months in order to insure that no real cancer lurked behind the innocuous masses.

I asked him why such pertinent information as the possibility of breast masses resulting from the pill wasn't more generally known. He replied blandly that what with all the fear and hysteria recently surrounding the pill, which was, after all, the most efficient method of birth control known, doctors didn't want to add more fuel to the "emotional fire."

Thanks, I thought to myself as he disappeared through the door, trailing his silent students, I'll take my hysteria and my lumps and go home.

That was the last day I took the pill.

On one level stopping was a vast relief. Not only had I found my fears of cancer unsubstantiated, but I wasn't dosing myself with synthetic hormones anymore. I had always had reservations about the wisdom of manipulating my hormonal balance with birth-control pills. Yet I knew from repeated experience that I was extremely fertile; I had used nearly all the other methods, sometimes several together at one time, with a demonstrable lack of success. So I had taken the pill—for ten years. Now it felt good to be practicing what I had believed for a long time: that it is best not to artificially regulate or pervert the natural balances of the body.

But on another level I did not feel good at all about being totally vulnerable again. I did not want to get pregnant. The alternatives to exposing myself to the risk weren't very appealing. I couldn't enjoy masturbation or lesbianism, yet I didn't appreciate the idea of involuntary abstinence either. I had run out of possibilities and was left with only abortion.

I know some women pay little attention to the matter of their fertility. They take risks thoughtlessly and absolve themselves of the consequences with routine abortions. Why couldn't I do that? Modern medicine provides me with not only one but two cop-outs from pregnancy: I can either violate my body before (with the pill) or after (with an abortion). Was it science's fault I wasn't comfortable with either alternative? My slip of prejudicial feeling sometimes hangs down below my hem of rationality. When that happens, I occasionally feel a momentary bitterness at the kind of technology our culture practices. Why must I do violence to myself to prevent conception?

Back before the pill I had an abortion, a classic tabletop affair. At the time I thought it was the only thing to do and had few moral qualms about it. I was more involved with the pain and the expense and the fear. The experience was so stark and so immediate that I had to deal with the reality of it. No sterile white walls

or impersonal professional participants helped me to disassociate. The grease floating on the top of the pan of hot water; the hollow crunching sound ("There's bones to break, girl"); the chilly damp smell of mold in an unheated house all made sure I paid attention to what was happening. I decided on the spot I would never do that again.

Now, a dispassionate ten years later, I reopened the proposition with myself. Wouldn't I be justified today, when cheap and safe abortions are so easily obtained? But the more I thought about the subject, the more sure I was I didn't want any more abortions. I believe wholeheartedly that people should be able to do with their bodies as they please. In my own value structure abortion is killing, no matter how undeveloped the embryo. While I would not call myself a pacifist, I can see killing only as a very serious matter, certainly not something I would decide to do except under extraordinary circumstances. So abortion was still not for me.

There seemed no way around it: I must be responsible for what I conceive. I don't want to close the issue permanently with sterilization; I want to have my own family, but I'm not ready for that yet. I want to continue to be able to choose not to have a baby until the time I decide to have one. If I don't make that choice, it will be made for me. Therefore, I cannot help but conclude, my responsibility is not to get pregnant until I am ready.

But how? That was my dilemma. So began my search for another alternative. I don't know what I would have done if I hadn't been going through a hiatus in my love life at the time, because abstinence was my only recourse for quite a while.

I gained a great deal of respect for the wholeness of my body during the long time it took to readjust from the pill to a state of normalcy. It was nearly a year before the last masses disappeared from my breasts, and even now they occasionally reappear briefly. I consider myself lucky; the doctor told me I might always have them. Medical science is divided over the role of the pill in

breast masses. Some doctors think it causes them, others that it retards their development.

Until I stopped the pill I had no idea what it was doing to me. It was only when I had a standard for comparison that I could see how profoundly my system had been affected. The first and most obvious change occurred in my menstrual cycle, which became very irregular. Figuring it would be a while before it settled down, I didn't give it much thought at first. But then other strange symptoms of imbalance began to force themselves on my awareness.

About six months after I stopped taking the pill dozens of new wrinkles suddenly appeared on my face, my buttocks fell, my waist thickened without any increase in weight, and my whole torso changed shape. These are all aging changes that normally are gradual and culminate in menopause. I can only conclude that the hormonal balance of my body had been hyped up for so long, relying on the artificial crutch of the pill to supply its essential ingredients (which otherwise would have been manufactured at home, so to speak) that when I stopped taking it, my system collapsed, literally.

Another, more subtle, sign of the problem was reflected in my disposition. I was more restless and aggressive than I had been. And I had flashes of moods that would leave me crying from despair or laughing when there was little cause for either.

And then, finally, a symptom so literally vivid I couldn't ignore it: My eyesight, myopic since early adolescence, improved radically. For the first time since childhood I could see, without glasses, individual leaves on trees.

A doctor prescribed a solution for all my symptoms: estrogen pills.

Thanks again. But no thanks, again.

I asked around and found other women who'd stopped taking the pill. In fact, I heard dozens of horror stories about the pill's consequences. I didn't solicit these stories. Simple mention of the topic of birth control

brought forth spontaneous outpourings from woman after woman; some of the stories made my lumpy breasts seem not so bad after all. The two most common problems women had when coming off the pill—although I hadn't experienced them myself—were weight gain and acne.

All other things, such as diet, being equal, the weight problem, when unrelated to water retention, suggested that some change in the metabolism occurred, so that the same number of calories taken in were utilized differently when combined with the pill. The acne a woman gets when she goes off the pill is probably a consequence of hormone imbalance.

While not considering his answer conclusive, I asked a dermatologist how common the acne problem was among women quitting the pill. He said he couldn't tell how prevalent it was, but that ninety-five percent of his women acne patients over twenty-five had been taking the pill and had had no acne until they stopped taking it.

The "in-house" glandular system has been short-circuited during all the years of pill-taking. Medical science has no real evidence as to any permanent consequences resulting from use of the pill. As soon as you stop, goes the official story, any consequences you might have had to face are over. So I asked the dermatologist about that. Is the metabolism permanently altered by the use of the pill? Yes, he said, he was afraid so.

If he is right (I did not ask any metabolism specialists), are we to assume that a permanently altered metabolism is of no consequence?

And did that mean I was going to have to experience menopause unless I relented and went back onto hormone treatment? I wasn't ready for that. Not at thirty-two.

A nutritionist friend suggested that I might get my own glandular system working again by priming it with extra doses of vitamins B and E. She recommended that

I take vitamin pills, until I could work out diet supplements, in the following quantities:

Vitamin B-1 (Thiamine Hydrochloride)	10 mg.
Vitamin B-2 (Riboflavin)	10 mg.
Vitamin B-6 (Pyridoxine Hydrochloride)	10 mg.
Para Aminobenzoid Acid	10 mg.
Niacinamide	20 mg.
Biotin	10 mcg.
Folic Acid	0.05 mg.
Pantothenic Acid (Calcium Pantothenate)	100 mg.
Vitamin B-12 (Cobalamin Concentrate)	5 mcg.
Vitamin E (d-Alpha Tocopherol)	600 I.U.

I was appalled at her list. I didn't want to be a pill-popper, I protested. She reassured me that first, all the B vitamins could be found in one daily pill, and the E vitamins in as few as two; and second, I could do it for a couple of months, and judge the result for myself. If the regime turned out to be of value, I could learn something about nutrition myself and eat my vitamins in my food instead of taking pills. Otherwise I could just quit doing it. In any case I had only the price of the pills to lose, as these vitamins, particularly in such moderate doses, could have no harmful effect.

So I did as she suggested. Inside a month the new wrinkles had disappeared, and my shape reverted to normal. Even my fanny, to my astonishment, climbed back up. The mood flashes disappeared and my normal personality pattern of contained boisterousness reasserted itself. It had been an awesome preview of middle age. I wasn't sorry to put it back on the shelf for a while, even if it did mean I had to keep my glasses, for my perception of detail receded to an accustomed fuzziness.

My delight at my success in getting my hormonal processes working again was marred only by the fact that when I stopped taking the vitamins, thinking everything was fine again, some of the symptoms returned. So I did have to work out diet supplements for myself, and I am resigned now to the necessity of boosting my glands indefinitely. I can't help but think that my metabolism certainly was permanently altered by the pill, no matter what the medical profession declares.

I had thought I knew what I was doing when I took the pill, and I hadn't. Now I had to pay the price, including abstinence. That was a price I wasn't willing to pay indefinitely. It wasn't rewarding at all. So I turned my attention to the subject of the female body in order to understand my own—and possibly find an answer to my problem.

2 / *Her Wholeness*

Hail the belly dancer. You can understand life when you see her move.

—COUNTRY JOE McDONALD

I still remember vividly, after twenty years, those movies in high school biology class. As we giggled nervously behind our hands in the darkness, the authoritative voice of the announcer described the mechanism of the strange, colorful shapes on the screen. It was all so clinical I thought I could smell ether.

While I believed in the accuracy of the material presented, I didn't make any visceral connection between what I saw on the screen and what I was doing every weekend in the back seat of my boyfriend's car. That was another subject, so to speak. It didn't smell anything like ether.

My mother, a registered nurse, reinforced the dichotomy whenever she talked to me about sex. She would answer any questions, accurately and thoroughly, but she always emphasized that sex was something that "happened" to two people who had loved one another so

much that they had gotten married. I didn't argue with her about that.

Although I didn't understand then, years later I could see in retrospect that everything I learned was divided into separate categories, each a separate and distinct body of information. These distinctions were accentuated by the fact that, whether by an authority in school, church, or home, I was graded and assessed, rewarded or punished, separately for each category, according to my ability to demonstrate that I remembered what I'd been told. In fact, until my second year of college I had never heard a hint that the individual subjects somehow related to one another. No connections were ever expected, let alone assumed. A connection was something between electrical wires or somebody who could do you a favor.

Aside from the fact that this kind of education did not teach me how to think but only to memorize, I also suffered from another, more subtle, consequence: I didn't take much of anything I learned officially on a personal level; it was all academic; I was just the observer of knowledge; none of it touched my heart or clutched my gut.

Even after I made the discovery that I did have a mental habit of compartmentalizing knowledge and figured out what that meant, still the discovery was not enough by itself. I had to begin the enormous task of integrating past knowledge with momentary experience, had to create a new mental habit of relating current reality with stored data. Until I did that for each category—a lifetime task!—I literally didn't have any *feeling* for what I *knew*.

Thinking about all this and talking with my contemporaries, I came to the conclusion that I was very typical of my time. In fact, I would venture to guess that while I may have been more dense than a lot of other people, this habit of compartmentalizing and fragmenting knowledge—and the resulting emotional numbness—was, until very recently, something deliber-

ately inculcated into just about everyone. We had the answers, but we weren't involved with them. If poets, inventors, and other dreamers avoided indoctrination, it was only because they weren't paying attention. Unfortunately for me, I was.

Not surprisingly, then, when I turned my attention to the solution of my own personal contraceptive problem, I found out just how alienated from my own body I really was—and incidentally, just how ignorant I was about the details of reproduction. I knew the generalities by heart, but was numb to the particulars.

For example, while I knew about the trip of the egg down the fallopian tube, I had no idea how long that took, or how long the egg was susceptible to fertilization. Even more important, I didn't know when ovulation happened because I couldn't feel it. Wasn't there some way I could know? It seemed to me there ought to be. And what about the spermatozoa? How long do they live? Why were my periods so irregular now that I wasn't taking the pill anymore? What caused cramps, and what could I do about them? When would my body return to normal, or would it ever?

The fact that I didn't know the answers to those questions inspired me to do a lot of research. And a lot of listening to my body. I found out that there is a great deal more to reproduction than the hygiene books ever get around to mentioning.

Formal knowledge of sexual physiology does not guarantee sexual gratification. Conversely, a satisfying sex relationship does not necessarily indicate any knowledge of physiology. Perhaps it takes some magic combination of accurate information and thoughtful body experience for us to be really aware of and at home in our bodies. That's what it took for me. I started with books.

Of course the books always deal with fragments; in this case the parts are given anatomical labels.

I confined my detailed survey of sexual reproduction

mostly to the feminine aspects, limiting my study of the male to areas of comparison and actual reproductive function, because there was so much information to be assimilated, and my primary concern, after all, was to gain a greater intimacy with my own, female, body. I tried as much as possible to approach the subject as if I knew nothing about it at all, so that I could gain a broader perspective through fresh impressions. I thought that would be hard to do, the way it is hard to see one's own behavior objectively, but it turned out to be easier than that. I think now it was easier precisely because I was so alienated from my body and had always viewed it impersonally, like an academic subject rather than a personal one.

The first thing to strike me as I browsed through the medical books was the extraordinary beauty of the design in relation to its function. All the female parts that need protection—the ovaries, fallopian tubes, uterus (where the egg is created and fertilized and where it develops)—are housed within the large bony structure of the pelvis, while the external genitals are conveniently designed for receiving sexual stimuli.

The male genitals, on the other hand, are nearly all prominently visible, and vulnerable. Nature made his delivery system handy. What to do with the penis when not in use has been as much a matter of style and fad throughout history as the corresponding female problem of what to do with the breasts. Since the scrotum (which houses the testicles) lies outside the body proper, so to speak, its temperature is lower than that of the body. Whereas spermatogenesis is inhibited at body temperature, the lower temperature of the scrotum is an adaptation that permits sufficient numbers of sperm cells to be produced in the testicles. During hot weather the testes are lowered even farther from the body proper, to prevent overheating.

Out of the same tissues grow either ovaries or testes. From other tissues develop either a penis or a clitoris. It becomes apparent that despite striking differences

between their appearances, the sex organs of men and women have the same architect. Only the details have been changed to suit the needs of the particular owner. Woman, as producer of the egg, needs a lot of room to nurture its growth. Man, as producer of the mobile sperm, needs an instrument to deliver it. They share the need for mechanisms for the creation and storage of sex cells as well as spaces and planes suitable for the evocation of pleasure and desirable places for encounter.

The difference between the protected female body and the vulnerable male is an example of a common biological design. The female is designed conservatively throughout the animal kingdom. Nature seems to have designated males as the experimental models, while females are the old, reliable, standard model. The human male, for example, has a throwing mechanism in his shoulder and a pelvic structure adapted for running, which are unique. The human female makes do with the shoulder and pelvis she shares as an inheritance with the other primates. The typical woman throws like an ape because she shares its equipment. Only the human male, among all the primates, can run erect and throw efficiently.

The human female, on the other hand, has a couple of strange traits herself. The hymen is certainly one of the strangest physical characteristics of any living thing. Roughly doughnut-shaped, it narrows the vaginal opening without actually closing it off. The startling thing about the hymen is that it is a part of the body that usually must be destroyed before a vital function can be performed, though a woman can be impregnated and her hymen remain intact.

The existence of the hymen has been known for thousands of years, in cultures all over the world. Not surprisingly, they all attribute some importance to its existence and many of them devised elaborate rituals to deal with it. Most of the cultures mistakenly assumed that the hymen was a reliable indicator of chastity. Innumerable girls were punished for acts they never

enjoyed. The majority, hymens still intact, might have been ritually "deflowered" by medicine men or women, priests, lords, or fathers. This ritual, along with first menstruation, was marked as the end of childhood and the commencement of adulthood for females. A hymen ceremony of some kind frequently immediately preceded an engagement or marriage because prospective husbands wanted to know the status of their betrothed.

The clitoris (pronounced with the accent on the first syllable) has another claim to uniqueness, which some women's liberationists have lately been trumpeting joyously: It serves no reproductive function; its only function is to receive pleasurable stimulation.

All the external genitals of the woman, collectively called the vulva (meaning "covering"), are sensitive to touch and pressure, as are the male genitals. They include the mons pubis, the major and minor labia (lips), the clitoris, and the vaginal orifice (opening).

The mons pubis is the soft, elevated fatty tissue over the pubic bone in the front, which becomes covered with hair during puberty. The major lips (labia majora) are the two outermost folds of skin that run down and back from the mons pubis to the front of the rectum. Some women have flat lips, hardly visible behind the thick hair; others bulge prominently. Ordinarily the major lips are close together and the inner parts appear hidden.

The minor lips are two pinkish hairless folds of skin located between the major lips. They enclose the space into which the urethra (urinary outlet), the vagina, and some small secretory glands open. In front the minor lips form a fold of skin over the clitoris.

The clitoris, like the penis, is a highly sensitive structure that becomes hard and erect when engorged with blood during sexual excitement. It concentrates more nerve endings than the penis carries, in a much smaller space.

The vaginal opening, or orifice, is only visible when the inner lips are parted. It is larger and farther back

than the urethra, and its appearance depends to a large extent upon the shape and condition of the hymen.

A thick wall of muscle called the perineum divides the vagina from the rectum, and it is this muscle that is routinely cut in an operation called an episiotomy, during childbirth to allow a larger opening for the infant to pass through.

Inside the vaginal opening and past the hymen lies a collapsed muscular tube, the vagina. The vagina is a potential space rather than a permanent structure, expanding to fit whatever comes through, whether menstrual fluid, penis, or baby. It is not very sensitive to touch or pressure and contributes little to pleasure or pain.

However, a sling of muscles at the mouth of the vagina, at and just inside the hymen, is extremely sensitive. These muscles are subject to conscious manipulation and with practice can be flexed at will. The physiological function of these muscles is to hold the vagina and related structures in place during the stress of intercourse and childbirth.

The appearance of the inner lining of the vagina is affected by hormone levels. Ordinarily the walls are corrugated, but fleshy and soft. With sexual excitement, a watery lubricant is secreted, making the surface slippery, and many other things happen too.

At the upper end of the vagina lies the entrance to the uterus, the cervix. The cervix is a bulb-shaped hemisphere with a very small hole in the middle. In a woman who has never been pregnant, a mucous plug usually protrudes down from the hole. In women who have delivered through it, the mucous plug is concave.

The uterus itself is shaped like an upside down pear, about three inches long except in pregnancy, when it expands to hold as much as eighteen pounds of baby, amniotic fluid, and placenta. The lining of the uterus is called the endometrium, which contains numerous glands and a rich network of blood vessels. The uterus has a muscular wall ruled by the autonomic nervous

system, which means that muscular contractions of the uterus are, like those of the heart, not dependent on conscious effort. It works by itself, contracting forcefully during orgasm and childbirth, and minimally during menstruation.

Branching out from the upper portion of the uterus—and reaching out toward the ovaries—lie the two fallopian tubes, or oviducts, each just a few inches long. At the bottom ends they open into the uterus, but at the outer ends they do not actually attach to the ovaries. Instead the upper ends of the tubes open up into a shape like a fringed funnel spread around the ovaries. The ovaries themselves have two important functions. Not only do they produce the eggs, but they also manufacture the female hormones, estrogen and progesterone, which cyclically maintain the reproductive functions and those external characteristics typically woman's.

Each ovary is about the size and shape of a prune. Within the walls are follicles, each containing an egg in one or another stage of development. Although each egg when mature is only about 1/200 of an inch in diameter, it is the largest cell in the human body, and the only one visible to the naked eye.

Every woman is born with about 400,000 eggs, all immature; they do not begin to develop until just before menarche, or first menstruation. In any event at one a month she will only need about 400 during her fertile years.

So much for the parts.

The precision of the process, whereby the parts work together in a rhythmic, sequential course, is remarkable. A woman's monthly cycle is a complex orchestration of a series of interdependent events, repeating itself over and over like the song of the humpback whale. At the start of menstruation, one cycle fades out as another begins, and so that point is usually designated as the beginning of any discussion of the whole cycle.

My initial interest concerned the irregularity of my own menstrual cycle. For ten years it had been

artificially regulated by the pill. Once I had quit, the cycle seemed abnormally erratic. I was concerned because the matter had become for me a measure of just how permanently the pill had affected my metabolism. Thus I began my search with a dual misconception: that regularity was normal and that irregularity could be considered a consequence of having taken the pill.

The fact is that menstrual regularity, as it is commonly understood, does not exist.

Study after study has shown that 1) most women consider themselves to be "pretty regular," and 2) the overwhelming majority of them aren't regular at all.

It occurred to me to wonder at the level of lack of awareness that many women had of their bodies. The pill encouraged that lack of awareness in me. On the pill we were on autopilot, so to speak. It all worked by itself and required no attention except to the daily pill-popping habit.

The myth of regularity persists on the face of evidence to the contrary first documented almost one hundred and fifty years ago. In a paper published in 1832 in a Scottish medical journal, J. Robertson said, in his "An Inquiry Into the Natural History of the Menstrual Function," that among the urban Scottish women he studied, deviation from a twenty-eight-day average length was so common as to be considered entirely normal. A survey by F. P. Foster of fifty-six cases of normal New York women reported on in 1889 found only one woman with a consistently regular cycle—and it was twenty-six days in length. In 1933 a larger study by E. Allen, of 131 normal women, determined that none was quite regular.

In 1935 D. L. Gunn *et al.* decided to do a definitive investigation, since the evidence continued to contradict popular wisdom. When they published their report two years later, they not only concurred that "the term 'regular' has no precise meaning in connection with menstruation," but they unveiled a number of other surprises.

They took records with precise times for one year from 209 women judged extremely reliable and from 561 others whose data were only slightly questionable. They found that the results of the second group differed little from those of the first.

In the more reliable group the cumulative average length of menstrual cycle was 29.0 days, but as they found out when they broke down the figures in both groups into individual histories, this figure was misleading. Not only was there a considerable variability in the interval between onsets of successive menstruations in each woman, but each woman's pattern was different from all the other women. The "average" hid the erratic nature of the phenomenon. No woman had a cycle that was regular to the day. Most women showed a variation in cycle-length of between eight and nine days, and eighty-four percent had a range of at least six days between the lengths of the shortest and longest intervals.

They found also that married women did not have a noticeably different pattern from unmarried. (The implication was that having sexual relations on a regular basis did not change one's menstrual cycle.) No proof emerged indicating that menstrual intervals were any longer during cold weather.

When they plotted individual cycles according to the day of the week they started, they found a predictably average number began on Sunday, fewer menstrual periods began on Monday, Tuesday, and Wednesday than chance would suggest, while Thursday, Friday, and Saturday incidence was much higher.

One of the researchers in the Gunn group was interested to learn whether or not menstruation had any correlation with moon cycles; the study found no connection. This observation contradicted a study by Arrhenius (1898) done in Stockholm of 12,000 cycles, which was not as rigorously conducted as Gunn's.

The biggest surprise was that some entirely new trends could be observed among the statistics. There appeared to be a correlation between age and average

interval, or cycle length. The general tendency seemed to be toward a progressive decrease in the average length of cycle with increasing age, amounting to one day in each five or six years between the ages of twenty-one and thirty-nine. At about age forty, the trend reversed itself and the cycles began to lengthen, reaching a maximum just before menopause. This was a computed "average," of course, and didn't reflect every case.

Although the researchers were sure that irregularity was normal, the question remained concerning the significance of the pattern of cycle lengths. The women were not tested over their fertile lifetimes but for only one year. Thus, all Gunn and the others could really say was that women born in different five-year periods generally had decreasing lengths of cycle, leaving open the matter of why that was the case. Rather than being an evolved norm, the decreasing intervals may have been an effect on the entire population of one particular factor. Social habits, wars, environmental changes, etc., might have had a permanent effect on the periodicities of the younger women. There was no way to know.

Thirty years later, in 1967, a very comprehensive study was published by Treloar *et al.* in the *International Journal of Fertility*. They studied 2,700 women over more than a quarter of a million cycles which covered nearly 26,000 person-years. This survey confirmed the general validity of the previous studies, refined some points, and added new information.

Only one woman, out of 2,700, was very nearly regular—at twenty-eight-day intervals—for eleven years. Except for this case (which they thoroughly investigated as suspicious precisely because it was so regular), "the nearest approach in regularity in any other history available to us contains eight consecutive intervals of the same length." Not only was each menstrual interval independent of the length of its predecessor, but the experiences of the women differed much more between themselves than could be attributed to chance.

This report confirmed the interval decrease with age

that the previous study had found; this time women were studied over time intervals up to decades, and so some broader generalizations could be attempted. Their "average" woman had her first menstruation at age thirteen, with a mean of thirty-three-day cycles, which in the next few years dropped to a thirty-day interval. By age twenty, the average cycle-length had stabilized around twenty-nine days, where it stayed about the same until age twenty-six. Between ages twenty-six and forty the intervals decreased slowly to 26.3 days. The minimal interval tended to be reached about eight years before menopause, after which the cycles began to lengthen rather quickly again until they reached maximum length just before menopause.

Along with this trend toward decrease in interval during the early and middle years of fertility, the early erratic variability decreased, too, so that by age thirty-six the variability between longest and shortest cycles was down to about two and a half days. Short-term exceptions to this rule included the typical post-childbirth pattern which was more erratic.

An incidental finding was that true skipped periods are very rare. Women, they concluded, mistake missed periods for exceptionally long ones and lapses ended by early spontaneous abortion.

Treloar and his group concluded that "all menstrual histories show individualities that make the norms provided by statistical procedures useful only for comparisons of groups of persons." Regularity in individual women was almost unknown.

Women could not be classified so precisely, after all. And the question of the causes for the interval and variability patterns remained unknown. The old dichotomy again: heredity or environment? This time it seemed to be a reasonable question.

By the time I had finished reading these and other substantiating studies, I was satisfied, for the time being, that my own body was not unusual. I found that information immensely reassuring and important to me personally.

I continued my study, reviewing the familiar facts about what goes on at each stage of the cycle and trying to internalize the information, finding comfort in the already known and again confirmed data. In my mind's eye I watched the endometrium shed its accumulated riches through the menstrual process and the release by the pituitary gland of FSH (follicle stimulating hormone) to begin the stimulation of growth of several follicles on the surface of the ovaries, which then themselves begin to secrete a new monthly supply of estrogen. One month one ovary matures the egg, the next—perhaps—the other. Usually they alternate, but it is not uncommon for one to develop eggs several months running.

Nothing new there. On to the next stage: The menstrual flow ends and immediately the estrogen released by the follicle stimulates the endometrium to begin its building-up process again. Before ovulation an enormous number of changes occur in a very short time. The pituitary gland releases large amounts of FSH and LH, triggering the final development of one egg, and estrogen production levels off. Then, during the periods immediately preceding, during, and just following ovulation, these are just some of the events that occur: Within the twenty-four hours preceding ovulation, body temperature usually drops sharply, as does calcium and sodium chloride (the chemical in table salt) excretion in urine and cervical mucus. A few days before ovulation, the cervical mucus begins to undergo visible physical as well as chemical changes; the normally thick and cloudy plug finally becomes clear and runny at the time of ovulation.

At ovulation some ten percent of all women feel *Mittelschmerz* (literally "middle pain"), an abdominal twinge that is thought to coincide with the moment when the follicle releases the egg. The follicle remaining after the ovum is released then changes into the corpus luteum and begins to secrete a hormone of its own, progesterone, which makes the body temperature rise, and maintains the endometrium (or lining of the

uterus) for potential implantation, among other things. Urinary excretion of vitamin C increases tenfold. The body temperature rises from one-half to as much as one full degree. At this point a relatively large amount of sodium chloride and glucose (the body's form of blood sugar) is excreted in the cervical mucus, which reaches its greatest wetness and elasticity. Nasal congestion frequently occurs at the same time, even though odor acuity is increased tremendously. Perhaps the sensitivity of the nose to odor at this point is a survival factor. Even though her nose may be running, she can smell out her man. There is some evidence that her sweat glands are more active and pungent at this time, too, so odor can play a mutual role. Though not functionally equivalent, the male and female responses are effectively paired at the right time.

Ovulation concerns all these interdependent processes, but the central act is the release of the selected egg from the ovarian follicle. The mechanism of the trip it takes is fascinating. Immediately upon its release from the ovary, the egg is faced with a problem: how to get into the fallopian tube. Although the fringed rim of the funnel-shaped opening into the tube is near the ovary, it does not surround it or connect with it in any way. The egg, unlike the spermatozoon, is not self-propelled. Gravity, plus perhaps some as yet unknown process, almost always works to get the egg into the funnel. It is known that during most of the menstrual cycle the fringelike projections from the end of the tube are inert and drooping, but become active at the time of ovulation, perhaps allowing better contact with the surface of the ovum. The tube itself is a hollow bore about the size of a broom straw, the inner surface of which is covered with moving furlike hairs called cilia.

The released egg traverses the distance from the ovary to the uterus in something like three days, moving more swiftly in the beginning than in the end. The egg must be fertilized while it passes through the tubes if it is to successfully create a new life. Actually it must be

fertilized in a period of about twelve hours while it is within a small section of the tube. That means that a woman is fertile only for the equivalent of less than seven days out of the year, in widely spaced twelve-hour stretches.

If fertilization does not take place during those twelve hours, the egg begins to disintegrate, usually to be washed out immediately with mucus. If it is fertilized, and after a lapse of about a day, it begins dividing into multiple cells as it continues down the oviduct, becoming a unit of two cells, three, four, etc. The round mass of cells that results arrives in the uterus about three days after conception, floats around within it for a couple of days, and then on about the sixth day, attaches itself to the uterine lining and begins to burrow in toward the source of nutrients that will sustain it. About seventeen days after ovulation and conception, the ball of cells is snugly implanted and the old cycle is broken, to be replaced with another: pregnancy.

Thus the matter of timing is crucial, and the qualities of the sperm add a whole new dimension to the picture because sometimes they can live a lot longer than the twelve-hour span of the egg. A three-year study at Philadelphia's Albert Einstein Medical Center, reported in 1964, found that some sperm from some men live as long as one full week. Assuming that any sperm that are mobile are capable of fertilization (and that isn't necessarily the case; no one knows how long sperm are effective agents of life creation), then sexual activity as much as a week before ovulation might cause pregnancy. But that is unlikely. Other studies have demonstrated that sperm normally live two days inside the female body, but the determination of the viability and fecundity of the sperm of one man within the fallopian tubes of one particular woman is close to impossible.

Clearly the preconditions for fertility are not so precisely definable as I had hoped to find them. But at least I felt I understood a little better how the whole process worked and could put myself into the picture in

some more realistic way. Sometimes I thought I could actually *feel* what was going on in my reproductive system. Whether I was right or not, it *felt* good to believe that, and the *feeling* was what I'd been after; I'd had the *knowledge*, in its broad outlines, since puberty.

Perhaps that broad knowledge was never enough to make me understand on a visceral level what reproduction was all about. Perhaps I had to learn the minutiae in all their raunchiness before my emotions were involved. It's hard to grasp the reality of such things as cycle-lengths and variations, FSH, and proliferating cells. But contemplating the sweat and odor glands of the genitals as organs of attraction was a very personal and immediate matter, the kind of thing I could check for myself. Its value is not so much intellectual as emotional, teaching about life in the same way that giving birth and raising a child do.

Some time after my reading and my experience had been integrated in me into something approaching real understanding, I reflected on the beauty of the arrangement whereby our most ecstatic and totally involving behavior insures our perpetuation as a species. And I began to glimpse the implications of the whole idea of conception avoidance, which we call birth control.

PART II

The Social Context

3 / Birth "Control"

Soon we should understand the mysteries of the flesh so much more perfectly that all women will be able to avoid pregnancy at will without resorting to unnatural means.

—MONSIGNOR EDOUARD GAGNON

No society has ever blithely produced babies without some social mechanism that limited in some way membership in that society. Menstrual taboos, postpartum taboos, incest taboos, infanticide, initiation rites—they all served the purpose of regulating membership. But such regulation is not the same thing as birth control.

Birth control as we know it today amounts to a direct action to limit the number of children born. Until relatively recently in human history, limitation on quantity was seldom a deliberate goal. Regulation of membership meant that people who did not meet specific standards were excluded. Deformed babies were killed at birth, cowardly young men who performed

poorly in initiation rites were banished, and so on. The usual practice was for each case to be judged individually.

Cultures create institutions to deal with what they consider to be social problems—that is, issues that affect the society as a whole—and a measure of a society can be taken by examination of what institutions exist. Since the concept of limitation of numbers has seldom been an issue until relatively recently, there is little history of social institutions dealing with birth control, *per se*. Those institutions that did exist to deal with reproduction were religious and promoted fertility, not its avoidance. Overpopulation could always be handled; the tragedy was sterility.

This doesn't mean that no limitation on numbers existed, but only that birth control was seldom the specific aim of a culture, because too many children was not a *social* problem. However, individual women in many cultures for millennia have practiced contraception, birth control and population control in one form or another

Plato in his *Republic* recommended infanticide for inferior or deformed newborns, advocating that they be "put away in some mysterious, unknown place, as they should be." Aristotle agreed in his *Politics*, adding other fertility-limitation measures such as separation of the sexes and homosexuality. He also had some ideas about specific contraceptive processes. In his *History of Animals* he put forth the opinion that if women's "parts" were made smoother, the "matter" (sperm) would be induced to slip off, and thus never get inside the woman to impregnate her. Toward that end he recommended ointment of lead or frankincense and olive oil, very dangerous remedies but ones apparently used in his time.

Abortion, particularly for unmarried women, has a long history, and some agents of plant origin that affect fertility have been known in various places around the world. Sexual continence is the oldest and most

widespread method of conception avoidance—conscious or otherwise.

Today Western society views overpopulation as a social problem, and we have a multibillion dollar industry devoted to "birth control." The term accurately reflects our characteristic attitude, which is to *attack* problems, try to *control* things.

Control: 1. To exercise authority or dominating influence over; direct; regulate. 2. To hold in restraint; to check.

That seems clear enough on the face of it, and not particularly threatening. But if you think about it a while, as I did, the hidden meanings scream out for interpretation from between the words. This is birth control we are talking about here; women's bodies, not street traffic. How is it possible to regulate or direct or check a living body? Life isn't like water through a faucet, doesn't like to be held in restraint. In fact, putting physical restraint upon a living thing sometimes means death and always raises the possibility of damage—as anyone who has ever tried to break up a cat fight, or collect butterflies, or jail someone, knows.

Our culture takes the attitude that the control of living things is both desirable and possible. We speak of being *in charge*, how we are *making it work*, all we have to do is *whip it into shape* and we'll *have things under control*. This view so permeates our culture as to have become largely unconscious, and we assume that other cultures view the world similarly. The basic assumption is that we can run the show better than if we let the show happen by itself. We can do nature's job better than nature—an amazingly presumptuous point of view, if you think about it. But we charge on, pretending that we control communism, crime, drugs, prices, technology, and morals. In Houston we have enshrined this myth at its ultimate, for there we have: *Space*

Control. At home we control our emotions, our children, and our sex drives. At least we talk about doing it. The basic assumption is made and never questioned again that control is both desirable and possible. But we never really do "control" anything. We only manipulate. And sometimes destroy.

So, not surprisingly, in the name of birth control we have more than a dozen ways to master nature. And because control doesn't work, no matter how many people think it does, we have in more than a dozen different ways been unsuccessful in "controlling" birth.

In a study published in 1973 and covering 6,752 women, N. B. Ryder found that in spite of new devices which have cut the pregnancy rate in half, still forty per cent of all women have unwanted pregnancies.

I was familiar with contraceptive methods and tools, but I decided to take a closer look at how they work and what they actually do to our bodies. With the single exception of the unreliable rhythm method (which expects women to ovulate at a predictable time), I found all the techniques used today to prevent conception operate on the principle that the way to prevent babies is to do violence, in some way, to the body—usually the woman's body. The procedure, whether it aims to kill the sperm, convulse the uterus, or overload the hormonal balance, is always violent and never takes into account the natural synchronies of a healthy body.

THE PILL

According to Planned Parenthood, about eight million women, or one in five women of childbearing age in the United States, take the pill regularly. Each of the twenty-eight versions on the market in 1973 is composed of synthetic hormones, which attempt to duplicate a natural substance. Leaving aside the issue of how well that simulation is effected, I first considered what it means to intrude something into an organic whole.

Perhaps one of the most important lessons of ecology

is that in tampering with the natural order of things there is no possible way to do "just one thing." So in medicine we have created a revolution in health by adding antibiotics to a doctor's repertoire, thereby causing the evolution of bacteria stronger, more numerous, and resistant to attack, in agriculture, with one hand we added pesticides and accomplished the same thing for insects as we did for bacteria, while with the other hand we've been fertilizing the land into exhaustion; in engineering, dams have changed weather, moved populations, created epidemics, salted the land. Every added "advance" has its price, and sometimes the price is too high.

I saw that our attempt to control has meant manipulation to a point beyond excess, where we now face crises on several ecological fronts, not the least of which was my own body. I knew that some things consumed in excess can put the body into a state of disease. Too much vitamin A causes decalcification of bones and loss of hair; too much alcohol destroys nerve cells and overloads the liver. In fact, too much of anything is dangerous to a living organism. Nature has limits. Our information about the effects of our technology lags far behind the technology itself, and so while we have learned to recognize some of the disasters, there are large numbers yet unknown. Frequently, the line between safe and disastrous is very thin. The balance is always precarious.

The pill adds a simulated natural product in abnormal proportions in a deliberate effort to throw out the balance of the body, to create an unnatural state. That action must have repercussions; there are always dues to be paid when you tamper with the balance of nature.

In fact, the dues we already acknowledge are considerable. The hormones contained in the pill are carried by the bloodstream into every cell, every organ, and affect nearly every bodily function. According to many endocrinologists, more than fifty metabolic functions are affected. Never before in the history of our

species have so many people consumed such powerful medicine with so little idea of what they were doing.

The 1973 *Physicians's Desk Reference* (Huff), a standard annual compilation of statements by the drug manufacturers about each available drug, devotes a great deal of space to the description of hormonal oral contraceptives and includes an extraordinarily lengthy standard statement as a preface to each listing. Space and copyright restrictions prohibit quoting them at length, but I will give you an accurate summary of the information divulged there, because it is significant:

Commercially marketed in the U.S. since 1960, the oral contraceptives "provide almost completely effective contraception."* The pregnancy rate for the combination pill is lower than that for the sequential pill.

Studies in Great Britain and the U.S. have shown an increased risk of thromboembolic disease associated with the use of oral contraceptives.**

They note that the incidence of high blood pressure, reduced tolerance to carbohydrates, and liver disease haven't yet been "quantitated with precision."

Lengthy, high doses of both natural and synthetic estrogens in animals other than the human have increased the frequency of some cancers. Because direct comparisons cannot be made, the possibility of carcinogenicity due to estrogen cannot be either proved or disproved. † Further studies of women taking the pill are necessary.

*According to N. B. Ryder, pill users average a six percent failure rate. Pill users, of course, are only those women who can tolerate the "side effects", many women cannot.

**The risk was greater in Britain than in the U.S., perhaps because the British population has a higher percentage of women in blood groups other than O, A, B, and AB types are more susceptible to clotting than is the O type.

†It will be at least twenty years from the mass-marketing date before we will know about any connection between the pill and cancer because it takes that long for a carcinogen to show itself in an increased cancer rate. Breast cancer incidence (and death rate) has remained fairly stable since the thirties; it will be a good indicator to watch for around 1980.

The *Physician's Desk Reference* goes on to advise doctors not to give the pill to any woman suffering from: thrombophlebitis, thromboembolic disorders, cerebral apoplexy, or a past history of these conditions; impaired liver function; known or suspected breast cancer; known or suspected cancers depending upon estrogen; any mysterious genital bleeding.

The doctor is also warned to discontinue the pill immediately if the woman becomes partially or totally blind or if any other visual disorder sets in suddenly. And because the effects of the pill on embryos are not known, it should be discontinued if pregnancy is suspected. Nursing mothers are advised not to take the pill because it has been shown to be excreted in breast milk, and the long-range effects on the infant are undetermined.*

Additional precautions include the necessity for examination of each woman's breasts and pelvic organs (including Pap smears) both before she takes the pill and periodically while she is taking it, because of the known connection between estrogens and cancers in other animals. Endocrine and liver function tests may be affected by the pill, so they are not reliable indicators of the body's health.

Further, doctors are advised by the *Physician's Desk Reference* that uterine** fibroid masses may grow under the influence of estrogen-progesterone and that because the pill may cause fluid retention, women with epilepsy, migraine, asthma, heart or liver dysfunction may be adversely affected. Women with a history of psychic depression may suffer relapses, and in a "significant percentage" of women on oral contraceptives glucose tolerance is decreased. The mechanisms are unknown, but depressives and diabetics should be watched carefully.

*Subjecting a baby to adult sex hormones is a risky business any time. Boy babies, in particular, are susceptible to serious and possibly permanent glandular disturbance if given female hormones.

** And, as in my case, apparently breast fibroids as well.

Oral contraceptives have been proved to be the cause of gastrointestinal cramps and bloating; nausea, vomiting; spotting; breakthrough bleeding and other changes in menstruation; absence of menstruation both during and after pill therapy; water retention (edema); breast changes including tenderness, enlargement and secretion; weight loss or gain; cervical erosion and secretion; drying up of breast milk after childbirth; jaundice; allergic rash; migraine; depression and high blood pressure in susceptible women.

Oral contraceptives *may* (no final proof has yet been shown) be responsible for permanent cessation of ovulation; chronic premenstrual syndrome; libido and appetite changes; kidney problems; headache; hairiness or loss of scalp hair; dizziness; fatigue; redness of the skin; subcutaneous hemorrhaging; itching.

That inventory will be significant to anyone knowing the meaning of even a third of the words. Keep in mind that this information is supplied as an admission of the drug companies, as required by the Federal Food and Drug Administration. Even this notice does not include a good percentage of the whole can of worms. There is much more information available on many more pathological conditions connected with the pill. I read study after study in the medical journals and didn't begin to exhaust the available literature. I stopped researching only because I was exhausted.

Some of the additional connections I found are:

1. A three hundred percent increase, among pill users, of cervical dysplasia (cellular changes of the cervix, preliminarily considered to be nonmalignant).
2. While women who have stopped taking the pill are sometimes more fertile, a higher rate of spontaneous miscarriage exists in women who conceive after coming off the pill, and there is a higher rate of chromosomal abnormality in the aborted material.
3. Gum disease is greater in pill users, who also take

much longer to heal until they discontinue its use. This may be related to an increased need for vitamin C in pill users.

4. Pill therapy causes rapid deficiency in some vitamins and minerals, particularly the B-complex. Absorption of folic acid may be reduced by as much as sixty percent in women who have taken the pill for as little as six weeks. This can lead to anemia. Moreover, for unknown reasons, copper levels are raised to high concentrations in pill users. Copper in very high amounts can be toxic, although these levels apparently are not approached as a result of pill use.
5. The vagina of some women on the pill becomes much more susceptible to infection. The pill changes the sugar and water content in the vagina, making a cordial bed for yeast and other fungi and leading to secondary bacterial infections.
6. Women become more susceptible to gonorrhea, too. The progesterone in the pill not only increases a woman's susceptibility, but encourages the rapid spread of the disease into all the other genital organs, frequently without any warning symptoms to alert the sufferer.
7. The pill creates a higher risk of blood clotting when the woman is subjected to physical stress such as surgery. An anticoagulant, heparin, can be used to counteract the effect of the pill before surgery, but it is unsafe to use regularly, so, what of the woman injured in an auto crash or other bloody accident?
8. Androgenic steroids accumulate in the body of the pill user. This syndrome is associated with an increased risk of subsequent breast and liver cancers. Another liver disease, benign hepatoma, has recently been linked with the pill. While this tumor is not cancerous, it can cause fatal hemorrhaging.

When you add all the manufacturers' admitted cautions to all the unadmitted ones, you are still dealing

only with the known consequences. The unknown lie ahead.

I turned from my study of the effects of the pill and pursued the question of how it actually works. Again the literature was voluminous—and frightening. No one knows all the different ways the hormones act to prevent conception. The two groups of hormones, estrogens and progestogens, act in concert to produce a body music overshadowed by one part of the orchestra—too many timpani, in this case. But the body still plays together, even if discordantly. This discordance creates a situation in which the body is being acted upon in at least six different ways to effect contraception. (That is, these are the effects for which the pill is prescribed, as opposed to the numerous "side" effects described earlier):

1. Normally, on the fifth day of the menstrual cycle, the pituitary gland in response to a signal from the hypothalamus through the bloodstream, sends out a message to the ovaries (FSH) to start the ripening process in one of the eggs. The message is triggered by a low estrogen level. In the body of a woman on the pill the missing estrogen is added, so the message never goes out, and the egg never ripens in the follicle. The ovaries, normally in a constant state of cyclical change, are almost dormant.
2. Normally, too, the endometrium (lining of the uterus) goes through a cyclical change, from thin and dry to plump and blood-enriched and back to its original state, varying accordingly in its ability to receive a fertilized egg. The pill stops this process. During the twenty to twenty one days the pill is being taken, the endometrium is a hostile medium for the implantation of a fertile egg. Of course it is hostile during the menstrual period (more accurately called the pseudo-menstrual period), too.
3. If the pill is not taken, the cervix goes through a

monthly cycle of its own, from tight and firm to loose and droopy to soft and moist and back again. The pill-user's cervix doesn't do this. It stays firmly plugged, thick and dry, moistening only with the release of the "menstrual blood."

4. The progestogen appears to prevent the ability of the spermatozoon to enter any egg which may have slipped past the previous preventative measures. How it does this is not known, although there seems to be evidence that the effect occurs in the uterus. As the egg must be fertilized in the fallopian tube, this mechanism of the progestogen apparently works on the sperm itself as it passes through the uterus, rather than on the egg. It is known that the sperm cell carries hydrolytic enzymes which aid in the penetration of the layers around the egg. Once one sperm cell has penetrated the egg, its membrane thickens, and no more sperm can get into it. Possibly it is this capacity of the sperm that is inhibited by the progestogen in the pill, through changes in the uterine pH, temperature, or chemical balance.
5. The cilia in the oviducts, those tiny, hairlike structures that facilitate movement in the tube, move in a continuous wavelike motion as do the muscular contractions of the oviduct walls. This motility seems to be altered by the artificial hormones, which paralyze the oviducts so that any egg that escapes from the ovary never meets the sperm.

6. And finally the pill has lately been implicated in some direct effect on the ovary's capacity to release an egg, apart from the indirect effect it exercises through the hypothalamus.

To summarize briefly: In order to do what it is prescribed to do, the pill overrides the hypothalamus, impoverishes the lining of the uterus, dries up the cervical mucus, stills the cilia of the tubes, cripples the sperm, and shuts off the ovaries.

Wham, bam, thank you, ma'am.

It is no wonder the body is so affected. If doing just one thing has so many repercussions, imagine what doing six separate things does. Of course, this figure of six is itself deceptively small. It does not take into consideration the so-called nondirect—that is, effects not prescribed for—and undesirable repercussions to the body's metabolism. The metabolism is the collective balance of all the biochemical activities that work together to keep life going in the body. And if the pill puts that metabolism into a state of imbalance in more than fifty different ways . . . I could not consider exposing my body to such a threat once I understood that.

SURGERY

Sterilization through surgery is permanent. Whether the operation is a tubal ligation, in a woman, or a vasectomy, in a man, the result is generally irreversible. This fact is the primary one. It is the biggest possible contraceptive decision, a lifetime commitment.

This is such an important form of surgery that the law has taken an interest in the subject. More than half the states have legislated for compulsory sterilization for eugenic reasons. These laws have been confirmed as constitutional by the United States Supreme Court in a precedent-setting 1927 decision in the case of *Buck vs. Bell*. "Three generations of imbeciles," wrote Justice Oliver Wendell Holmes, "are enough."

"Eugenic reasons" generally refer to hereditary mental defects, but also include insanity, habitual criminality, and sexual perversion. These compulsory sterilization laws have undergone varying degrees of enforcement since the first one was passed in Indiana in 1907. The procedure requires, in most cases, a court order and the consent of a guardian. In total numbers only a few thousand people have been sterilized under these laws, and the number per year has been dropping.

However, there are other nonvoluntary ways people

get sterilized, and the number of those cases has been increasing. In 1973 a case hit the newspapers of two sisters who had been subjected to sterilization, apparently without any knowledge of the kind of operation they were having. This new phenomenon is almost always directed at women, and comes up when a woman asks for an abortion or welfare or gives birth under public assistance. It has come up so often that it has a name: "Mississippi appendectomy." A Ralph Nader-connected organization, Health Research Group, found that many women, most of them poor and black, were being pressured into sterilization in hospitals all over the country. Sometimes they were given release forms to sign while in labor or minutes before being wheeled into an operating room for caesarean section, without any prior discussion about the matter. Some East Coast states have been debating the female sterilization issue hotly because several courts have been requiring welfare mothers either to be sterilized or lose their state subsidy.

In January of 1974 the federal government announced it was about to release new rules implementing "guidelines" issued by the Department of Health, Education and Welfare in the summer of 1973 in response to public outcry over the Southern cases. When the rules were published in February, constitutional and legal challenges were immediately raised in federal court, and the government deferred the new rules for thirty days. The outcome is uncertain, and legal moves and countermoves will probably keep it in doubt for quite a while.

Even voluntary sterilization has become a matter for legal concern in a few states. Two states have expressly outlawed voluntary sterilization for contraceptive purposes: Utah and Kansas. Utah and Connecticut allow sterilization only under "medical necessity." In other states no laws allow or prohibit voluntary sterilization; laws covering other matters apply when a disputed case comes to court. The legal point at issue

may be a malpractice suit or some other violation concerning the violence done to the patient by the operation. Surgery can legally be considered a "violence."

One fascinating aspect of the law concerns the concept of being maimed, which is defined as some injury that permanently lessens an individual's ability to fight and defend himself, or diminishes bodily vigor. The kicker is that this law applies only to men because women are not expected by the law to fight or defend themselves. Thus they cannot experience a lessening of ability or diminishing of vigor! Women cannot, legally, be maimed.

Does a person have the right to consent to have violence done him? That is another disputed legal question. And if not, can the surgeon be charged with assault and battery? Still another legal point raises speculation about just what the "public policy" should be—if any—on the limitation of one race or another, or even the species itself.

The fact that so many legal consequences evolve from such a speedy, simple surgical act indicates its importance. In about twice the time it takes to create one child, an operation can permanently prevent someone from ever having any more.

According to Nader's Health Research Group, about one million men and one million women undergo surgical sterilization every year in this country. There is some indication that people do think a lot about the significance of sterilization before committing themselves to the act. In one follow-up study at Mt. Sinai Hospital in New York, conducted four years after the operations, ninety-five percent of the people interviewed were satisfied with their decision.

The other five percent have little recourse. A few isolated successful attempts have been made to reestablish fertility, but most have failed. A plastic plug or valve, inserted into a man's sperm ducts, was hailed in 1973 as the way toward fully reversible vasectomies,

but in another report delivered at the same American Fertility Society meeting in San Francisco, it was announced that as many as sixty percent of reversibly-vasectomized men tested in a U.S. Army study had developed antibodies to their own sperm, which caused the sperm to cluster in groups and stop their essential swimming movement. So even if the operation could successfully be reversed, and the sperm again freed to be ejaculated, conception might not follow for these men. The same meeting also heard a report on the use of liquid silicone, injected into the oviducts, as a possible female form of reversible sterilization. Liquid silicone within the body has previously presented a lot of problems. So, while the standard operation for women has been modified with a simplified new surgical method that requires only cauterization of the tubes at the entrance to the uterus, performed through small incisions in the abdomen, almost no success has yet been made in reversing female sterilization. A woman, then, particularly, is struck with her decision.

CONCEPTION INTERRUPTERS

The IUD, the mini-pill and the morning-after pill all interrupt pregnancy within a matter of days after conception. Strictly speaking, these methods are not contraception, which refers to the prevention of egg from meeting sperm. But the instant quality of these three methods tends to mitigate guilt feelings in women who generally view abortion as morally unacceptable, because their primary action prevents implantation.

IUD: The precise mechanism of the workings of this device is unknown, but it may increase the motility of the oviducts so that the egg is rushed along the tube to the uterus before the endometrium is ready. The egg, although fertilized, does not implant.

According to a *National Observer* survey last year, about three million women are currently using an intrauterine device, and probably three million more have used one unsuccessfully and have quit.

Aside from the known hazards (cramping, hemorrhaging, uterine punctures, infections, swift transmission of VD), IUD's also tend to fall out without notice or allow pregnancy even while in place, sometimes with disastrous effects. The *Observer* article found that the chances of a woman's miscarrying, if she becomes pregnant while the IUD is in place, are fifty-fifty. In about five percent of these cases pregnancy occurs outside the uterus, either in an oviduct or in an ovary itself.

Some models are more efficient than others, and some more dangerous. Dozens of different kinds have been tested, and most have been removed from use as unsafe or ineffective. The designs and materials used have a lot to do with both effectiveness and danger. The latest devices are made of a very malleable plastic, wrapped around metal. The metal enables the IUD's location to be determined by x-ray, should the device wander out of the uterus as it sometimes does.

The most widely used version, the Dalkon shield, contains copper embedded in the plastic to increase pliability. The copper diffuses into the blood stream, where it may rarely be harmful. The Dalkon shield has recently been called off the market so that no new ones are being inserted. However, women who already have the Dalkon shield are advised to keep it in unless it causes trouble.

The first IUDs were used by Egyptian women several thousand years ago. Overall safety and effectiveness have improved since IUDs were introduced in their modern form in 1930, but some medical problems have remained. The foremost problems are chronic inflammation of the uterus and calcification around the device, which even in milder cases require that it be replaced every two or three years. The body encases the IUD the way an oyster does a pearl, and for the same reason: protection against a serious irritant.

Nevertheless, some women, as with the pill, seem to be able to get what they want from an IUD without

suffering any noticeable consequences. About two-thirds of all women who try them can use them, although one-half of those who begin quit within two years. In the remaining half, it is roughly ninety-five percent effective—about the same as the pill.

The mini-pill: This recently developed variation on the regular pill contains only progesterone, taken in small doses every day of the month. Its effects are the same as those caused by the progesterone in the regular pill: thickening the mucus in the cervix and disrupting the endometrial cycle of tissue building in the uterus so that it will be hostile to the implantation of a fertilized egg. Progesterone alone is highly antiestrogenic and causes masculinization as well as other problems in some women already low in estrogen. The mini-pill is not so effective a contraceptive as the combination or sequential pill and always creates menstrual irregularity and breakthrough bleeding.

Several other versions of the progesterone-only treatment are under study on a large scale in other countries—usually Third World countries, where the patients are the prolific poor. These drugs have not yet come into common mass usage.

Another version of the progesterone treatment is a plastic, called silastic, which is formed into a tiny pillow of progesterone and implanted under the skin, often under the arm or inside the thigh. Side effects are comparable to those occurring in other progesterone methods. This treatment tends to last only about a year, and then some sort of compensatory body mechanism takes over and the pregnancy rate goes up. Nature prevails.

Still a third variation, also silastic filled with progesterone, is formed into a ring about the same diameter as a diaphragm and is worn in the vagina for twenty-one days of each month, after which it is removed to allow for a sort of menstrual period. This method is considered to have the lowest "side effect" rate among the progesterone-only methods.

The morning-after pill (Diethylstilbestrol, or DES): DES is a synthetic estrogen that has been available for about forty years. For decades it was fed to cattle to fatten them up for market, but in 1972 the FDA ruled against further use for that purpose on the basis of tests showing it had marked cancer-inducing properties in animals, now farmers are allowed to implant DES only into the ears of the cattle. That practice, too, is under serious question.

However, the Washington, D.C., United States Court of Appeals ruled in January of 1974 that the Food and Drug Administration acted illegally in 1973 in banning the use of DES in cattle feed and said a hearing would have to be held. In the meantime manufacturers are permitted to make it, and farmers to feed it to cattle.

DES was used medically for a long time to treat women who appeared to be in danger of miscarriage or other fetal loss. Within the past few years it has been shown to be the direct cause of vaginal adenosis and has been linked to cervical and vaginal adenocarcinomas in adolescent daughters of women who took DES during pregnancy.

Diethyl stilbestrol has been used for several years as the morning-after pill. Given for five days, starting within seventy-two hours of "unprotected intercourse," stilbestrol is one hundred percent effective in preventing the pregnancy from continuing. The daily dosage is very large—about fifty times the amount of estrogen in the regular pill—and causes severe nausea and vomiting. The long-range effects, and connections with cancer in this use, are still unknown. Of course, it causes many metabolic changes, too.

As of November 1973, manufacturers of DES had to include with the pills an FDA-approved pamphlet explaining the risks and benefits of the drug.

DES and the mini-pill are not the only hormonal pregnancy interrupters. Another hormone-like substance, prostaglandin, can terminate pregnancy in the first or second trimester. It is described later in this chapter, in the experimental section.

BARRIERS

The simplest way to prevent conception while still practicing sexual relations is to put something in the path of the sperm so that it cannot reach the egg. These methods have the fewest "secondary effects" on the body.

The condom: Judged by the number of side effects, the condom is the safest form of pregnancy avoidance on the market. Unfortunately it is subject to failure on many different counts. It can be put on improperly or too late; it can be used in conjunction with petroleum jelly, which causes rubber to disintegrate; it can contain minute holes even before purchase; it can be removed improperly; it can come off too soon or break. All these reasons explain why its effectiveness is only eighty to ninety percent, lower than many other methods. In addition many men and some women object to its "unnaturalness" and say it interferes with their pleasure.

The diaphragm: Serving the same purpose as the condom, this method uses a back-up technique of spermicidal cream because the crucial part of the feminine anatomy is less easily encapsulated. The diaphragm is subject to all the same problems as the condom, but the cream works so well that the diaphragm turns out to be about equally effective. Failure of the diaphragm (when it is used) is usually attributed to the fact that in a woman who has given normal birth to several children the vagina tends to be more relaxed and the device can become dislodged. In addition Masters and Johnson found that some love-making positions, where the woman is on the top, can make the diaphragm ineffective, as does the common practice of men to completely withdraw and reinsert themselves several times during a lovemaking session which, in some women, may dislodge the diaphragm. Also the spermicidal cream used in conjunction with the diaphragm can cause adverse reactions in some people, making this method unsuitable for them.

Vaginal jellies, gels, creams and suppositories: Used

in conjunction with a diaphragm or alone, these things are inserted into the upper vaginal area. They contain a spermicidal chemical, phenylmercuric acetate, in a low surface-tension cream base. This chemical and its older version, phenylmercuric nitrate, have been used since 1944 for the control of human fertility. It is considered to be the most effective spermicidal agent available that has an acceptable risk of toxicity. Actually its toxicity risk is unknown. The chemical is an organic form of mercury that is absorbed into the bloodstream and can be found in the urine in measurable quantities as long as twenty-four hours after use. This means that the chemical has been filtered through the kidneys. Organic mercury is known to be damaging to kidneys.

The creams, jellies, etc., are effective in direct proportion to the amount of phenylmercuric acetate contained in them. They are effective in descending order as follows: creams, jellies, gels, suppositories. Reliability ranges between sixty-five and seventy-five percent. Aside from the long-range effects, these ointments can cause severe local irritation to both users and their lovers. Ulcers, blisters, and pus develop in hypersensitive people applying the most effective brands. A bad chemical burn can cause permanent scar tissue.

In spite of this, chemical-contraception research is aimed at improving availability, lowering cost, and simplifying use, rather than toward finding new antisperm chemicals. Phenylmercuric acetate works by inhibiting the activity of enzymes so that the sperm are immobilized. Detractors complain about the slick, greasy quality of the base, which they say interferes with gratification. Others point out that the creams make oral/genital sex impossible. Would you want to put something in your vagina that you wouldn't put in your mouth?

Foams and tablets: Also vaginally deposited spermicides, these products generally contain another agent,

acid carbon dioxide. Tablets were used until the 1960's, but faded out in favor of aerosol foams, which are more effective and easier to handle. No other apparatus is necessary. Their drawbacks are similar to those of the creams: irritation, artificial medium, unpalatability. There are also problems with the aerosol effect itself. First, the unwary woman can find her aerosol can empty unexpectedly, because the cans have a tendency to run out suddenly. Secondly, the effect of the "inert medium," the gas freon, which propels the goop into the vagina, is unknown. Some asthma patients using freon inhalers have died, and the evidence points not to the active agents in the inhalers, but to freon itself as the cause. All aerosol use is now under question. It is probably too early to know the long-term effects of foam use. It is about eighty percent effective.

Douches, sprays and other so called feminine hygiene products: Ineffective as spermicides, their value lies mostly in the peace of mind of a woman worried about offensive odor. The insertion of these materials is destructive to the natural internal ecosystem and invites infection. "Vaginal deodorants" are downright dishonest, and women who use them are sadly ignorant of their own physiology.

If the vagina itself has an offensive odor, there is probably something wrong, an infection of some sort, and the woman should visit her doctor. This can easily be checked by inserting a clean finger, and then smelling it. The odor should be slightly sweet. It almost always is, if the vagina is undiseased and "untreated." This is not to deny that some women have a pungent odor issuing from between their legs. The odor, however, usually does not come from the vagina, but from the area of the clitoris (which isn't even next door, in the orifice department). The foreskin of the clitoris secretes a sebaceous material, small, whitish curdlike particles termed in the vernacular "smegma." Daily washing with plain soap (not an antibacterial or detergent variety) and water removes this problem

neary. Vaginal deodorants not only provide a solution in the wrong location, but even if used as directed (especially in aerosol form) can cause medical problems.

EXPERIMENTAL METHODS

Researchers now have under study, or have preliminarily investigated without follow-up, a lot of other similar contraceptive methods that are just more of the same—violence to the body with dubious side effects—and a few intriguing biological possibilities. Most of the new ideas involve chemicals that interfere in one way or another with normal hormonal balances. Many more invite hope than pan out.

The biggest bust was the much-heralded male pill, a chemical called bisdichloroacetyl diamines, which seemed to have all the qualities for success. The pill affected no organ but the testes, apparently posed no threat to blood circulation or liver, worked in about seven weeks, and was reversible without side effects. It interfered with the normal process of transformation of immature sperm cells into spermatozoa. A year-long test on a large number of prisoners was so successful that two groups of men, in New York and Los Angeles, were quickly organized for further study. Serious embarrassment for the experimenters followed. The subjects showed marked gastric problems, vertigo—and a violent intolerance to alcohol. Just half a can of beer would result in bloodshot eyes, vivid flushing, dilation of blood vessels, dizziness, and fainting. Not surprisingly, eight-five percent of the men in both studies dropped out immediately.

Even worse, of the small number of families left in the study, there were three pregnancies in cases in which the husband's sperm count was well below the level thought to be the margin of minimal fertility. Infertility is frequently found in couples where the man has a low sperm count, and it had been thought for years that the total number of sperm determined the fertility potential of a man. If this were not true, complete protection against conception using an antispermato-

genic drug would require total azoospermia—that is, a sperm count of zero.

A form of once-a-month treatment, composed of a concentrated dose of estrogen, turned out to provide inadequate protection (failed to prevent pregnancy among five to seven and one-half percent of tested subjects) and created menstrual irregularities and other problems, including nausea, vomiting, and diarrhea. One study comprising 152 women found only 35 still taking this pill just two and a half years later. The high drop-out rate was attributed to the severity of the side effects. Some women did not resume ovulation when they stopped taking this pill.

In 1972 two British researchers announced that aspirin may have a potential as a male contraceptive pill. They found it interferes with a prostaglandin in the male prostate gland. Aspirin has also been shown to interfere with the function of IUD's.

Medroxyprogesterone acetate, marketed as Depo Provera, was approved for limited use by the FDA in late 1973. The only injectable contraceptive, Depo Provera is a synthetic progestin and has been tested on both men and women. In women it causes a marked estrogen deprivation and symptoms typical of that state (masculinization, breakthrough bleeding, superfluous hair, etc.), yet it seems to offer one to two years' worth of protection to women who can handle the "side effects." The FDA warned that the drug presented the risk of infertility when discontinued. It works by inhibiting the hypothalamus.

In men Depo Provera is effective in the suppression of sperm production, also by working (via the hypothalamus) on the pituitary, but the question of reversibility seems to remain open for men, as well. There is also the matter of the number of spermatozoa necessary for fertility. If fertilization can occur even with a low sperm concentration, a simple lowering of the count is not an effective contraceptive measure.

Depo Provera is also in use for treatment of cancer of the uterus, even though it has been implicated as the

direct cause of cancer in dogs. When the FDA released it for the market, Ted Kennedy's Senate subcommittee on health issued a strong protest, as did the Center for Law and Social Policy. In October, 1974, Health, Education and Welfare Secretary Caspar Weinberger blocked Federal Drug Administration approval. Now new hearings will be held.

The difficulties involved in finding a safe hormonal contraceptive are immense. Dr. Dolores Patenelli, an investigator at the independent Merck Research Laboratories, and one of the world's leading authorities on male fertility, has been quoted as saying, "We have not been able to find a compound without serious side effects. Male sex hormones can be toxic to the liver. . . . As a matter of fact, female hormones are somewhat toxic to the liver but to a lesser degree."

An Australian doctor proposed in the fall of 1973 that high doses of Vitamin C (500 mg. per day and more) reduced female fertility. Dr. M. H. Briggs in Melbourne said he had a number of patients who had been unable to conceive until it had been found that they were supplementing their diet with large amounts of ascorbic acid and had stopped, whereupon they all quickly became pregnant. He pointed out that the state of the cervical mucus is known to be critical to reproduction, and speculated that the vitamin C dried up the mucous membranes, impeding the mobility of the sperm. Suggesting that high doses of vitamin C at mid-cycle would have a contraceptive effect, he solicited readers of *The Lancet*, a British medical journal, to share their relevant experiences.

Two Irish doctors (Wilson and Loh) working in Dublin replied, among other things, that ascorbic acid is always released just before ovulation, and that ascorbic-acid levels in tissues are greatly reduced after conception. They quoted other researchers who had determined that vitamin C was crucial to healthy embryos and mothers.

Dr. Briggs retorted that he agreed with the Irish

doctors completely, but their information did not preclude the validity of his theory. He also reported that he had heard from other physicians who had patients on high doses of vitamin C without any apparent contraceptive effect—they got pregnant without any trouble. This led Dr. Briggs tentatively to conclude that since people varied in their ascorbic acid needs, some would find vitamin C to have a contraceptive effect while others wouldn't. It would depend upon how much more a woman was ingesting than she needed, the excess, if any, would be secreted and would dry the mucous tissues.

Another area of interesting contraceptive research relates to temperature and the male scrotum. Alteration of the temperature of the testes markedly affects the production of sperm and hence the sperm count. Researchers at the Rock Reproductive Clinic in Brookline, Massachusetts (Robinson, Rock, Menkin), found that heat applied to the scrotum brought the sperm count way down, while cold tripled it. The efficacy of this method is unquestionable, but the treatment is so involved that it is not a practical long-term practice.

Some of the current experimental research concerns pregnancy interrupters that work some time after conception and might be considered alternatives to the traditional D & C (dilation and curettage) or vacuum-suction methods.

Orthodox researchers have concentrated on prostatic glands, a group of liquid-soluble unsaturated hydroxy fatty acids first found in human semen and thought to be a product of the prostate gland. Later investigators found it also in menstrual fluid and the endometrium, as well as many other body tissues. The prostaglandins have both an inhibitory and stimulatory effect on the uterus, and are administered either intravenously or orally for the induction of labor and intravenously or cervically for abortion. In the fall of 1973 Mocsary and Csapo reported that they had used two synthesized

prostaglandins to induce menstruation when the period had been missed by ten to twelve days; Karim reported similar results. All the women aborted, although several had side effects. This method has an advantage over a D & C because cervical dilation with prostaglandin is usually spontaneous. Women who have D & C's (especially for a first pregnancy) tend to have trouble in later pregnancies with premature delivery; the D & C can create what is delicately termed an "incompetent cervix."

Immunology is a totally different approach to the prevention of conception, first studied in the early 1900's but just now experiencing a renewal of interest. The concept is to sensitize the egg and/or sperm so that the two never live long enough to meet. Men might be sensitized to their own sperm, so that those that were produced would be killed off by the man's own sperm antibodies before they ever left the body. A woman might be sensitized to the sperm of one particular man. In this last case each sexual event between the two would renew the antibody effect—so they would be reinforcing the contraceptive effect each and every time they made love! In such a case the woman would have to be monogamous, but the effect would be permanent.

This approach would seem to offer the most reasonable, safe method of manipulating the body processes. The big question, after the one concerning its possibility, is the one about cancer. Each day brings us closer to understanding the implications of the immunological processes in cancer. But we don't have those answers yet, and until we do have that understanding we are better off not tampering with our own immune systems.

ACTS OF WILL

For a variety of reasons, the remaining methods of avoiding pregnancy are not very satisfactory.

Two are unfortunately inaccurate old wives' tales. One is the belief that if a woman doesn't have an

orgasm she won't get pregnant. This is a variation on the old myth that good medicine hurts, and the best medicine hurts most. The fact is that there is no necessary connection between ecstasy and fertility. Another uninformed opinion holds that so long as a woman nurses, she won't ovulate. In fact, a nursing mother can become fertile within six weeks after birth. The first menstrual period is always preceded by ovulation, so there is no warning.

Two other methods of dubious benefit involve forms of male self-discipline. *Coitus interruptus* is as old as Onan, who spilled his sperm on the ground rather than impregnate his sister-in-law. This practice is familiarly known as "being careful." Not only does this method have a wet-blanket effect on the act of love, but it isn't even completely effective, because many sperm are released before ejaculation—it can happen anytime after erection—and only one sperm cell has to make it to the egg. This is especially important to know in light of the previously described experience with the men's pill.

Coitus reservatus is a special form of torture requiring that the man, at the very moment of orgasm, hold back his flood. This is physically possible, with practice, but very difficult, and most men are understandably unwilling to learn. The seminal fluid drains back into his seminal vesicles where it is absorbed into the bloodstream. This practice can be painful and damaging to the prostate. It doesn't even work as a birth control method, for the same reason that *interruptus* doesn't work.

The final two methods of avoiding conception involve determining the time of ovulation and avoiding intercourse during that time. In theory, at least, this is the most safe and obvious way.

A Czechoslovakian doctor claimed to have had amazing success at predicting ovulation through computer analysis of the angle of the moon at birth. He believed that time when the angle recurred was the best indicator of monthly fertility. He claimed a very high

percentage of effectiveness in predicting ovulation, and two books have been published in this country based on his findings. There was just one problem: His method of contraception requires as many as eighteen days of abstinence a month. This is strictly a method for people who don't enjoy sex very much.

The other variation, the rhythm method, has a long history. The idea of a safe period was known to the Babylonians, Greeks, and many other ancient cultures. As a concept for a "system," the idea has been around since the first part of this century. A German first proposed his own Capellman system, which, although the right idea, was all wrong about the fertile period. The time of month Capellman figured safe from the threat of pregnancy included the actual fertile time.

In the early 1930's Pope Pius XI issued his encyclical *Casti Connubii*, which endorsed the rhythm method. Not long afterward, Ogino in Japan and Knaus in Austria, working independently, reported that menstruation follows ovulation on about the fourteenth day and that variations in menstrual cycle-length were dependent upon irregularities between menstruation and ovulation. There is some question today about whether or not this is true. Knaus outlined the theory and method pretty much as it exists today. His system required that the woman keep a record of the timing and duration of menstruation for a year. Assuming she was not already pregnant by then, her fertile times could be forecast and a certain number of days proscribed out of each cycle. This method didn't work very well, either, but it was a definite improvement over the Capellman system.

A later variation on the Knaus method added a daily record of the "basal body temperature," or BBT, as it is known. This required that a woman take her temperature each morning at the same time, before she got out of bed. Because body temperature usually shows a marked drop and then a steep rise just before, during,

and immediately after ovulation, this method is a fairly reliable way to know when ovulation has occurred. Unfortunately, it supplies the information after the fact, and if ovulation takes place at some time earlier than the predicted date, the woman is caught unaware. Moreover, all women do not get up at the same time every morning, nor is it always convenient for them to take their temperature at that time.

With all the latest refinements taken into account, the best the rhythm method can do, in terms of percentages of effectiveness, is about eighty-five percent for "rigorously selected and carefully instructed wives who, with their husbands, are intelligent and strongly motivated" (Tietze).

So "birth control" doesn't really control birth. What is accomplished is a reduction in the birth rate at the expense of gross bodily manipulation. The only method that actually takes into account the normal workings of the body and needs no devices or unguents is the rhythm method. And it is unreliable because ovulation does not always come at a predictable time.

I decided that I didn't want to practice "birth control" at all. What I wanted was some way to put my body into some kind of a balance with nature through an intimacy with its function. Perhaps then I could know when ovulation was about to occur. If I could know that ahead of time, all the rest of the medical paraphernalia would be just so much historical debris.

But if not "control," then what?

4 / Cross-Cultural Womanliness

They are a pollution; therefore separate yourselves from women in their courses, and go not near them, until they be cleansed.

—KORAN

Menstrual blood may be a vehicle for the transmission of blood-borne diseases in general. . . . Assuming that menstrual discharge is infectious, the effectiveness of this route of transmission would be extremely sensitive to manipulation by cultural factors.

—THE LANCET, APRIL 7, 1973

Our prevailing cultural method is to conquer, to meet the challenge and overcome, to get into control. So while it was easy to decide that I wanted to change my own personal perspective away from a manipulative frame of reference, it was not so easy to find discussion about alternative ways of looking at myself, my environment, and other people from a medical point of view.

It wasn't until I read *Man Adapting* by biologist René Dubos that I figured out that understanding meant I had

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LUNACEPTION

to get away from my own personal situation and understand fertility and contraception on a broader level, on a species-wide level.

Dubos talks about the history of medicine in terms very different from those we know today. Not so very long ago, and all the way back to the beginnings of medical history, health was seen as living in harmony with one's environment. The whole medical perspective has undergone an about face. Whereas before we worked toward a positive end, now we fight off a negative. We now do as we damned well please, in spite of the environment, and pay the medical profession to patch up the consequences.

Harmony with today's environment would require either instant evolution of leather lungs and steel stomachs, or living as an underprivileged hermit. How can I know whether or not what I am doing to my body is good for me? I can't always know. And in some cases, even knowing the price, I may decide to pay it.

I have discovered a couple of reliable guidelines I can use, questions to ask myself on the face of any action:

Did the species (and race) evolve doing this?

If not, what effects will doing this have on me?

Asking those two questions about ordinary, everyday activities turns out to be a very thought-provoking pursuit. We all do dozens of things to ourselves every day that no ancient ancestor ever did:

We travel enclosed in metal and plastic containers at speeds greatly exceeding our reflexes' ability to respond.

We strain our eyes reading and watching television—tasks for which our eyes were not designed.

We consume nonnutritious foods and drink in quantity.

We move vast distances away from the ecosystems of the areas within which our ancestors evolved.

We apply soaps, creams, and unguents to our eating and cooking utensils and our body surfaces without knowledge of their content.

We move abruptly between extremes of climate, altitude and time change.

We absorb man-made radiation, chemicals, vibrations and electronic impulses.

We refine many items to their smallest constituents, even synthesize them (e.g., sugar, vodka) before consuming them.

We live in tiny social units within concrete, glass, steel, and plastic enclosures, often set as a self-sustaining, defensive body against a crowded world of similar units.

We hurry all the time.

We are subject to noises which our ears cannot handle.

We have so many social encounters each day that we must play roles.

We perform abstract tasks (e.g., paper work) with no immediate reward (next week's paycheck) for a "living."

We manipulate the environment around us toward some reflection of how things should be (e.g., schools without windows, where students won't be distracted by the world surrounding them).

Our leaders and criminals are strangers.

So are the people who tell us about them.

What effects will doing all this have on me? I can only measure myself against people who are not removed from their genetic inheritance the way I am.

I became particularly interested in how other, non-Western cultures viewed their bodies and their sexuality and their fertility, suspecting that they might have something to teach me. So I burrowed into the field of anthropology.

The overall impression I came away with, upon reading through the anthropology of reproduction, was an overwhelming feeling of sameness and continuity. It's very reassuring. Even consciousness-raising.

Science, technology, the global village—all are incidental to what our lives are really all about. The options are still the same as they always were: to marry or not

to marry; to have children or not; to earn a living one way or another; to believe one world view or another; to look at and deal with other people in this way or that; to continue living or to die.

The choices within the larger options vary enormously, but the framework itself is eternal. We choose today, as people have always chosen, a mate, a place to live and a style to do it in, a way to handle our children and neighbors, a way to pay for it all, and a dream to keep us going. Science, technology, etc., are only our particular *facilitating* mechanisms. They aren't at all *necessary*.

Anthropology as an academic discipline is only about one hundred years old. The first fifty years were characterized by armchair theorists who relied on the letters and books of travelers—frequently missionary priests. Not having much to work with, they speculated a lot.

Today, on the other hand, the trend has gone to the opposite extreme. If you scrutinize the bloated body of modern anthropological literature you find it pregnant with facts and short on generalizations. It isn't good form today to make generalizations. Someone will come along to present an exception, and there you'll be with egg on your face.

Still, enough facts have now been gathered so that some generalizations may safely be made, and a few brave anthropologists have been sticking their necks out.

These professionals call their work "cross-cultural comparison." G. P. Murdock, W. N. Stephens, M. F. A. Montagu, B. P. Whiting and Margaret Mead are among the foremost anthropologists engaged in this work, and the information that follows comes from their studies (except as indicated).

Some human practices can safely be called nearly universal, and of these many concern male/female/child relations and sexuality. Almost always:

People practice some sort of incest taboo.

A woman who is a mother is expected to be married

and to live in the same house with her young children. Some sort of division of labor along sexual lines is made for some kinds of work.

Women are rarely more privileged and powerful than men, although they may divide responsibility and authority equally with them.

Personal names are not used between some family members.

A menstrual taboo—that is, avoidance customs between men and menstruating women, based on beliefs concerning the dangerous properties of menstrual blood—is nearly universal.

That these practices are so nearly universal is no proof of their necessity, but that they are uniform to such a degree is impressive and would seem to demand our respectful attention.

The family, in some form or another, is one of those near-universals, although you'll notice that the list does not include any requirement that the husband and wife actually live together. For the species to perpetuate itself, social mechanisms protecting mother and child are essential. After all, if a boy or girl is born normal and manages to reach sexual maturity, there is really only one major option either can take that will affect the future of the species: to conceive or not to conceive another generation. And that decision must ultimately be made by the woman.

Margaret Mead, among others, has pointed out that the family is a logical result of the human condition. Among nonhuman primates, as among other animals, sexual activity is subject to the periodic readiness of the female, and the male interests her only when she is ready to receive him—which is when she is fertile. In our species the male is capable of sex with a relatively unaroused female, yet she can and frequently does prevent him from taking her, unless he threatens her with superior force.

In most human families the woman at least partially abrogates her right to say no to sex, in return for

security for herself and her offspring, and so it is a social invention that has high survival value. There is also some evidence that the cycle of sexual readiness that other animals have in common is not totally extinct in human beings; women tend to have days during their cycle when they are particularly receptive and other days when they have absolutely no interest. What is qualitatively different between humans and other animals is that the idea of a woman rejecting a man's advances at certain times has acquired the status of a general principle.

This is where the nearly universal taboo against sexual relations during menstruation comes in. One school of thought within anthropology believes that women elevated their rejection of male advances to a principle and that it was the first universal taboo human beings ever had (see Robert Briffault, J. J. Bachofen, M. Esther Harding, E. G. Davis, Helen Dinerl). Whether or not it was the first taboo, it occurs almost everywhere. Our own Western, Christian society is one major exception, and this development is recent and not true for all.

In other cultures the violation of the menstrual taboo is supposed to have caused a wide variety of disasters. Briffault gives a list twenty-five pages long and indicates it is only a sampling. Death was most frequently asserted as a consequence of coming into contact with menstrual blood but there were many other suggested repercussions: Plants would die in the fields, and fish in the waters, mirrors would dim and horses' backs would break. So potent was this women's weapon that some cultures turned it to their advantage by sending menstruating women around the cultivated fields to destroy every caterpillar, locust, or worm in the vicinity. Menstruating women as pesticide—that's something I haven't read about in *Organic Gardening*.

Simone de Beauvoir in *The Second Sex* quotes an 1878 article in the *British Medical Journal* as saying, "It is an undoubted fact that meat spoils when touched by

menstruating women." Common folk belief in Europe today counsels that sugar will blacken, mayonnaise will not set, cider not ferment, and bacon not cure, that wine turns to vinegar and milk goes sour, if touched by a menstruating woman.

Ancient people had the same rational powers we possess today. What they did not have was a reliably accurate understanding of cause-and-effect relationships between events. (We like to think we do today, but that is an open question.) Still, magic and science both work on the assumption that there is an order in the cosmos; both try to discover that order by determining relationships between things that are superficially different. The species-preserving function is obvious: People—ancient or modern—scan for patterns in everything, and when they find a behavior pattern that has a history of success, they stick to it. In such a situation life becomes a persistent application of recipes for what it takes to get a particular result.

It is easy to laugh at menstrual taboos from our "enlightened" perspective. How could such an idea have gotten started, and why on earth was it so universal? Any prohibitions, such as one against sexual relations during menstruation, must have been imposed in the first place in a very direct and categorical form, i.e., must have been forced upon people as an unquestionable necessity, not by human authority but by some fundamental natural condition. The fact that the taboo exists almost everywhere suggests that there must have been some actual reason for it, some perceived need. We can assume, from our modern perspective of wider knowledge, that all those people may have been ignorant. But we cannot assume they were stupid.

Lederer reports several biochemical studies that have shown recently that all this apparent foolishness may have been wisdom, after all. The study quoted at the beginning of this chapter found some infectious diseases theoretically transmissible through menstrual blood. Lederer tells of several biochemists who have

found a substance they call menotoxins, which they believe to be proteins that—because of impaired functions of the liver during menstruation—have been inadequately metabolized. These menotoxins are reported to cause disturbance to infants nursing from menstruating women, and to kill rats injected with them. Lederer admits with embarrassment—why is *he* embarrassed?—that he has read a report proving that some specific emanation of certain menstruating women actually wilts flowers. In fact, an old wives' tale warns that a corsage worn by a menstruating woman will quickly wilt.

As bizarre as the practices of some peoples may seem to us, their recipes for acceptable behavior may be successful in the sense that they accomplish specific, necessary ends. Some of the recipes are truly wonderful. Who is to say which are foolish and which display wisdom? The important thing is for the recipe to work.

A classic, rather extreme, example comes from the Woego people of New Guinea. Hoggbin, who studied them extensively, calls the habitat of these people "the island of menstruating men."

To the Woego the world is a contradictory place, where life's greatest pleasure, sex, carries the heaviest price. The major problem, as they see it, is that the sexes pollute one another. (The idea that women pollute men is common all over New Guinea, but only the Woego and the Arapesh think men also can pollute women.) The Woego believe their whole society suffers because of this contamination, through disease and bad fortune. Ideally, they think, the sexes should live entirely apart, but no one can expect to achieve this ideal. After all, small children would die without their mothers, and husbands and wives are economically interdependent. Even more important, human adults have powerful sex drives, which they can control only briefly and intermittently, and then with great difficulty. Sex is tremendously enjoyable, and there is nothing morally wrong with it, but there is no getting around

the fact that it is dangerous. One has to expect to pay the price.

The Woego have social mechanisms to deal with this problem of mutual pollution, of course, or else the situation would have gotten out of hand a long time ago. The first solution is actually a minimization of the problem: Men and women are careful not to touch one another's genitals with their hands, and they bathe—separately—immediately after intercourse. In addition nature has provided a solution for women. They are periodically cleansed by the normal body process of menstruation, when contamination flows away by itself. The process is disinfecting, but the blood itself is poison.

A menstruating woman must stay at home and cannot leave through the door when she goes outside to urinate or defecate. Instead, at those times, she must exit and enter through a hole in the floor or wall. Nor can she touch anyone, for to do so would be to kill them. She does not perform her normal household and agricultural chores, for her touch is considered infectious, and no one would eat anything she prepared. She follows a modified fasting regime during menstruation, and what she does eat she cooks for herself in separate utensils. She cannot put her hands to her mouth, or even touch herself. When she eats, or scratches herself, she must use a tool. She also wears a special skirt for identification purposes, so that no one will approach her by mistake. Needless to say, she indulges in no sexual activities during this time.

Just after childbirth women also bleed, and this nine months' accumulation of impurities is judged so potent by the Woego that she must spend the period in a specially constructed hut, away from the village. She will not have slept with her husband during pregnancy, but she has been cooking his food, and they've spent time together. The postpartum isolation period is much lengthier than the monthly one. She cannot go home until the next full moon. At that time she tears down the hut and throws it into the ocean.

The men are in a stickier situation. They have no such convenient outlet as menstruation, and so they must literally take matters into their own hands. Where another might pray for his soul, the Woego bleeds for his health. That is, he creates a male version of menstruation by slicing his penis until the blood pours out.

Men aren't expected or required to "menstruate" every month, but the idea is common that they should do it with some regularity, and not let their impurities accumulate too long. In practice, as with believers in prayer, the tendency is to put the obligation off until something goes wrong or some important undertaking approaches. No warrior would leave for a raid, for example, no trader would carve himself a canoe, or hunter begin weaving a new pig-trapping net, without menstruating first.

The operation itself is highly ritualized. First of all, the man must catch a crab or crayfish and cut off a claw. On the day he has chosen, he eats nothing all day. Late in the afternoon he finds a deserted beach, to which he takes some medicinal, soothing leaves, and the captured claw. He takes off his clothes, and walks out into the water until it reaches his knees. There, with legs wide apart, and still facing out to sea, he creates an erection for himself, exposes his glans, and slices it with the claw, first on the left side and then on the right. He cannot allow any of the blood to fall on his hands or legs.

When the cut has started to dry and the blood no longer reddens the water, he turns and walks back to shore (gingerly, no doubt), where he wraps his penis in the healing leaves, dresses, and walks back to the men's clubhouse. He stays there for two or three days, keeping warm and observing food taboos, just as the woman does during her menstrual period. He cannot touch anyone for fear of death. Then he can go home, but sexual relations are forbidden until the next full moon. He will be sore for a while, anyway.

So what does all this "foolishness" accomplish? Quite a lot, actually. For instance, the woman's

restrictions insure that whatever menotoxins or blood borne diseases she might otherwise spread are isolated. If liver function actually is impaired during menstruation, her fasting gives her liver a break. Since she does not perform her normal duties, her family learns some self-reliance, while at the same time, because they must take over for her, they gain an appreciation of her role. She gets a rest, too. Her postpartum period in the menstrual hut not only accomplishes the same thing, but reinforces her connection with her baby, and the relationship they both have with their environment, through her observance of lunar cycles. The ocean disperses her poisons.

The man's ritual, although less immediately functional, still has many social benefits. He has the gratification of fulfilling his spiritual duty and has the opportunity to prepare himself mentally for the task ahead. His ties with the other men of the village are strengthened by the use of the men's clubhouse, and his relationship with the cosmos is honored through his own lunar observance.

K. E. Paige reported that one study showed that the most rigid societies with the greatest degree of male solidarity had the strongest menstrual taboos. Paige herself believed, on the basis of a sample of 114 societies, that menstrual taboos reflect the importance a society places on stratification along sexual lines and that menstruation taboos and rituals are a means of controlling women and their fertility.

Other anthropologists have speculated that women themselves had a lot to do with maintaining this taboo, simply because it suited their own purposes. Even today, every woman wants to have the option to say no to sexual activity, and a social practice that reinforces that option is quite to her advantage.

If periodic sexual abstinence were one aim of the taboo, one would expect to find other social mechanisms operating to reinforce it. There is another mechanism, it so happens, and it, too, has its roots in a natural force—universal fear and awe of the moon.

The authority of the menstrual taboo was increased enormously by the connection made between the marvel of women's reproductive abilities and the marvel that was the moon in the sky. Who could ignore the fact that the moon and women's bodies danced to the same rhythm? There must be, they decided, some mysterious bond between them.

I found literally hundreds of different references to connections between women and the moon, and between menstruation and the moon. A connection was universally assumed, throughout recorded time.

From the virtual beginning of time the moon was regarded as a powerful and dangerous influence, dreaded and courted and appeased. The moon *was* time, the only precise measuring tool available. Every so many days, the moon returned to the same phase—every time. People could count on it. And they did.

People first understood the year as a period of consecutive moons. The first of each month began with the new moon. You can find associations between the new moon and the Sabbath repeatedly mentioned in the Old Testament, reflecting an ancient belief that some marvelous and terrible thing happens at each new moon. The original, very ancient Sabbath was a day when doing anything would bring disaster, so no one did anything. Any culture sophisticated enough to have a calendar invariably correlated phases of the moon—especially the new moon—with days particularly unsuited for any undertaking. The week was originally only a measure of the moon's quarters, and remains so in a number of days.

Briffault, who made a voluminous cross-cultural survey in order to substantiate his theory that women originally had all the power, collected several hundred pages worth of data from all over the world concerning the connection primitive cultures had made between women and the moon. Regardless of the validity of his views, most of his data probably are correct.

He found, "there is no more constant and universally recognized cause for that unpropitious character of

particular days than certain phases of the moon . . . and the dangers arising from that evil influence are considered to be greatest during certain phases of the lunar cycle. Ideas as to which phases are fraught with the most danger vary with different peoples, but the new moon and next to it the full moon, and more generally, every transition from one phase to another, are usually looked upon as periods of most accentuated danger."

He did not doubt that "the original ground for the dangerous and maleficent character universally ascribed to the moon is its direct association with the sexual functions of women. The correspondence between the cycle of lunar changes has forced itself upon the notice of even the rudest and most primitive peoples. . . . The moon is the regulator and, according to primitive ideas, the cause of the periodical functions of women. Menstruation is caused by the moon; it is a lunar function, and is so commonly spoken of as 'the moon.'"

The majority of the world's languages have a common root word for "moon" and "menstruation"; our own word comes from *mensis*, Latin for month, and both are related to the word "moon." Pregnancy, as well as menstruation, was believed to be dependent on, or caused by, the moon. Menstruation was expected from the new moon, while the full moon impregnated. Buddha himself was conceived by the moon.

A woman's ability to produce life from between her legs, certainly a most mysterious power, and her other traditional activities, such as making things grow, preparing food, and nursing young, were all tied together in people's minds with the power of the moon. As the ultimate generator of life, the moon also held the power of death and was not a force to be antagonized. A tremendous quantity of protective ritual was built up in response to the threat the moon imposed.

The literature on the subject is so enormous that I couldn't begin to give you more than a taste of the ritual that has grown up around women's functions and the

moon. One of the most pervasive myths I found concerned the practice of women going away together at the new moon to the menstrual hut. I spent a day in November of 1973 at the Stanford University Library, where the anthropological Human Relations Area Files are on microfiche. These files are the most comprehensive cross-cultural source available; but although I found hundreds of references to connections between women and the moon, and menstruation and the moon, I was not able to find any record of a study done of a culture where all women went away together to menstruate.

One thing I did learn was that our own superstition about walking under ladders comes from the practice of sending women away to special huts (entered by a ladder) to menstruate.

In many places people hold a newborn baby or infant up to the moon to give it strength or good health. The Murray Islanders portrayed the moon as a young man who at certain periods defiled women and girls, causing a bloody discharge. Frequently the moon is seen to be menstruating at the time of the new moon. Others called first menstruation "defloration by the moon." The Mixtecs of Mexico measure pregnancy from the time a woman's "moon disappears" and believe that if a pregnant woman sees a lunar eclipse, her baby will "lose moisture" and will be born with defects such as a harelip or crippled extremities. In the Chinese *I Ching* the new moon hexagram is the hexagram of the cyclic return of life. Even during this century, and perhaps still today, Cajun window shutters in Louisiana were closed tightly at the new moon to exclude the possibility of the slender light of the crescent entering the house. A great many people still plant by the moon, believing growth to coincide with a moon becoming full, and advising wedding and hoeing around the new moon.

The Desana Indians of Colombia live without electricity in the Amazonian jungle, where they have had little contact with civilization. Their myths and ways of life are little changed since time began for them.

Their creation myth includes the following story:

The Sun raped his prepubescent daughter on a rock near the rapids, and her blood flowed into the water. Since then the women menstruate as a periodic reminder against the crime of incest. When the Moon, who was in love with the daughter of the Sun, witnessed the attack, he was so filled with grief that he cried and hid his light, which until then had always lit the darkness, for three nights. And in memorial, ever since then he has hidden his light for three nights every month, coinciding his cycle with the menstrual cycle of the women.

If all those people, all over the world, believed that the new moon caused menstruation, and men and women practiced abstinence during menstruation, then it would seem logical to assume they had noticed that the new moon and menstruation coincided.

It seems reasonable to assume that most of the people in the world made a connection between women and the moon because the connection was easily observable. However, this old myth didn't make much sense to me because, while I've certainly felt the romantic effects of the moon, I knew my own menstrual periods to be quite irregular and not at all in phase with the moon or with those of any other women. The only time I had ever had menstrual periods coinciding with anyone else's, on a regular basis, was when I lived with a female roommate.

So was this just an old myth, of no more value than Briffault's theory? I couldn't find any further answers in anthropology, although my study did give me a much greater sense of sisterhood and participation in the femaleness of being human. I resigned myself to the fact that it was not enough to understand my own body physiologically, and it wasn't enough to know myself as a part of womanhood. Clearly I had to search further and look into the matter of myself as one human female on this particular planet. The circle broadened and broadened.

PART III

The Cosmic Context

5 / *The Macro-Dance*

In the beginning God created the heaven and the earth. And the earth was without form, and void, and darkness was upon the face of the deep. . . . And God said, Let there be light: and there was light. And God saw the light, and that it was good: and God divided the light from the darkness. And God called the light Day and the darkness he called Night.

—GENESIS

Ah, yes. *Today we will study the cosmos.* The absurdity of my presumption made me laugh. Where do you start with a project like that? The thread I wanted to follow concerned cycles, periodicities, rhythms, and pulses. That would seem to limit the field of study somewhat; but looking around me, I could see the pulse of life everywhere. In fact, when I began to look for rhythms, I found so many, all interrelated, that I finally understood I could never even enumerate them all, let alone put them into a linear, rational framework.

Our universe abounds with rhythms in an immense dance to the measures of the stars, the sun and moon, the seasons, and the tides. In precisely calculable units

of time—a day, a month, a year—the earth turns on its axis, the moon circles the earth, the earth revolves around the sun, the sun moves around the center of the galaxy. The dance results in patterned changes all around us in the temperature and pressure of the air, the pull of gravity, the force of electromagnetic fields and in cycles of light and darkness. And whatever lives on the earth, whether it be a maple leaf or an eagle, a shark, a fruit fly or a human being, performs many or most of its biological activities in harmony with these cosmic cycles. To miss the beat, to any serious extent, is to die.

A baby experiences rhythms from the very beginning, even in the womb, where the embryo hears the beat of the woman's heart, feels the rhythm of her breathing and her walk. These are, in fact, the very first awarenesses we have. As infants we are calmed by rocking and patting. As we grow older our play is frequently rhythmic, much to a mother's chagrin. The continuous bang, bang, bang, of two or more pots being beaten together frequently drives her to distraction long before the child's interest is exhausted.

So rhythms exist in our environment, in our bodies, and in our expression. And they are all pervasive. We dance to a rhythm, make love to a rhythm, laugh, and even hiccup to a rhythm, all through life. Even our most elementary particles, the electrons, protons, and neutrons of our atoms, vibrate in a balanced rhythmic pattern.

Balance: That's the key word. All life is balance. There can be no linear framework because rhythms simply are. They cannot be *controlled*. One can only come into balance with them.

I had finally found the concept I had been seeking.

I plunged into study of what rhythms and cycles do and how they work, growing more and more fascinated as I went. This is another of those fields that have a lot of specialized terminology with which we, the public, are just beginning to become familiar; I had to

understand the definitions before I could start to understand the complex relationships between the various rhythms.

Cycles, it turns out, not only exist throughout the universe and in every biological entity, but they also have profound manifestations, interlocking and inter relating with one another. Science has divided these manifestations into two categories, calling them endogenous when referring to those cycles that operate internally, within a living creature, unaffected by the environment, and exogenous when the cycle affects the biological entity from outside. An example of an endogenous cycle is the daily rise and fall of the normal body temperature of all mammals.

Exogenous cycles reflect such environmental effects as the alternations of light and dark, day and night. Diurnal animals sleep at night and are active during the day, and nocturnal animals become alert with the coming of darkness. But all animals have regular and predictable sleep and waking periods.

The longest known cycle that has an effect on living things on the earth is the eleven-year solar cycle of sunspot activity. Every eleventh year is the peak of a cycle, when giant solar flares reach out, far beyond their normal range, to send an extraordinary quantity of high-energy-charged particles out into the solar system. Many of them reach into the ionosphere of the earth, greatly affecting the planet's electromagnetic fields and triggering various other events on the earth. Their effect is noticeable, for example, in tree rings.

The annual cycle is the next largest rhythm affecting life. We can all recognize seasonal changes in the world around us and in ourselves. Even in the depths of Manhattan's canyons the most civilized among us can experience the joyous lift of spring, the quickening of fall, the burden of winter. These responses are not only conscious, but operate on an intuitive level.

The next shorter period is the lunar cycle of twenty-nine and one-half days, between one apparent

full moon and the next.* The lunar period affects both the level of the tides and the behavior of living things.

Cycles covering twenty-four-hour periods are known as circadian rhythms, *circa dia* in the Latin, meaning "around a day." They can be endogenous or exogenous in origin.

Smaller still are cycles referred to as "ultradian," which are units of time smaller than a day and range down to a split second, they cover everything from ninety-minute hunger periods that the normal human adult experiences down to the charge vibrations of an atom.

All these beats going on all the time, and we seldom even hear the music, let alone acknowledge our fellow dancers.

An overwhelming sense of the wholeness of these cyclic patterns struck me forcibly, making me see the concept of "birth control" as not only audacious but foolish. Was there some way I could, on some practical basis, come into a balance with all these rhythms in a way that would enable me to avoid conception when I wanted to? And, conversely, wouldn't any such way also enable me to get pregnant when I wanted to? If biological entities all have clocks, triggering signals (so to speak) at various times to determine various functions, then it would seem that I had only to discover the necessary conditions, and the triggering mechanism, in order to learn the key moment—in this case, the fertile moment. Then I could either circumvent or take advantage of that moment.

What I was really thinking about, I realized, was a way to make the rhythm method work. That possibility presupposed that reproduction is one of the biological processes coordinated by rhythms. I decided to pursue

*This apparent cycle is called the synodic period. The period of some twenty-seven and a fraction days the moon actually takes to return to the same relationship with the earth is called the sidereal period. The disparity is caused by the fact that the earth has moved in its own orbit during the month.

that possibility, on the assumption that the connection existed.

The most potent and ubiquitous trigger of biological rhythms is light, and so I chose it as the likeliest mechanism. I was also influenced in my decision by a newspaper story noting that farmers leave lights on in chicken coops to improve egg production. That seemed to me to be excellent evidence that light affected the balance of the reproductive cycle.

When I dug into this subdivision of a subdivision of a subdivision of science, thinking that there, surely, was a discipline small enough for me to grasp, I was dismayed to find that this one little field had been recently organized under the auspices of the Academy of Sciences and the National Research Council into the American Society for Photobiology—comprising fourteen specialty subgroups.

Well, what's a laywoman to do? I began to have serious doubts about my ability to court successfully the cosmic connection. But I had already put so much time and thought into the search—and I had become so horny—that I just couldn't quit.

Gay Gaer Luce, a science writer, has outlined and delineated biological rhythms—body time, as she calls it—in two books remarkable in their scope and depth. She tells of many effects of light on life, adding that much is not yet known; only the tip of the iceberg has been explored. Just the effects of light on life that have a cyclic rhythm are too many for me to list here.

Plants flower, birds build nests, fish swim, and insects move in response to patterned exposure to light. Visible light from the sun and the moon, and even ultraviolet light invisible to humans, all have critical effects on living things. The light not only has to exist, but it has to exist within a certain tolerance—that is, it has to be of a certain intensity, for a certain length of time, at a specific period within a larger period—for the mechanism to be triggered within the organism.

The seasonal increasing or decreasing length of light

in the day tells thousands of plants and animals when to reproduce, when to grow and in what way, how and where to move, and when to rest. So salmon run, whales migrate, bees communicate with one another, and birds increase their gonadal size from infinitesimal up to as much as one quarter of total body weight.

Meanwhile the light/dark circadian rhythm, one of the most influential of the known light-instigated cycles, is busy taking care of daily routine. As long ago as the 1700's, knowledgeable gardeners planted flowers that opened and closed on a predictable schedule ("10 A.M.—Common Nipple Wort closes; 11 A.M.—Star of Bethlehem opens," etc.) so that a quick glance at them could pinpoint the time.

What precise instruments are living things!

We know that sunlight is one of the few basic ingredients of life. Yet it is such a familiar part of our life that we seldom think about it at all. We miss the sun when it's hidden by clouds and curse it when it burns our skins. It enables us to see; it warms and dries us; it fades color and deodorizes clothes.

But if you pursue the matter to that point and then look just a little bit further, a whole new vista opens up. It's like coming out of Plato's cave into the sunlight; once you've seen the light, you can't see things from a cave perspective anymore. Suddenly you have seen the sun as conductor of the orchestra of life.

It shines, and in doing so makes things happen. Then—and this is just as important—it stops shining for an interval. The fact that it stops is just as crucial as the fact that it starts. Only light is precisely regular in its cycle. That is, *natural* light is regular.

To understand how light affects living things, it is necessary to know something about its nature. Technically speaking, light is a form of energy that issues from a source, as do sound and heat and electromagnetic waves and x rays. The most familiar attributes of light are color (wavelength), duration, and intensity. Any of those attributes can inhibit or encourage plant or

animal cell activity. The way light synchronizes biological and physiological rhythms is called photoperiodism.

Plants have biological clocks to determine growth patterns and blooming. The length of each day—the number of hours of daylight—is vitally important in preparing the plant for blooming. Using a type of soybean, K. C. Hamner and A. Takimoto at UCLA first showed that with too much light, which proved to be eighteen hours a day, the plant would not flower at all. Returned to a shorter day, however, it soon budded. Thereafter, switching back to longer days enhanced budding, but the number of buds it produced was directly proportional to the number of shorter days it had been given immediately prior to the changeover to long days. Winter could not be entirely circumvented. Evidently there is a critical point in the plant's circadian cycle at which light inhibits growth and prevents budding.

How do plants "know" how to respond in this manner? Plants inherit particular rhythmic reactions to light, and these will work even in the absence of light. Even in the dark their leaves will still move to different positions, just as though they were responding to the movement of the sun across the sky.

The leaves of plants studied by Dr. Erwin Bünning of Tübingen, Germany, followed a twenty-four-to-twenty-six-hour rhythm. When he bred plants having a shorter cycle with those having a longer cycle, the circadian rhythm of the resulting hybrids had a photoperiod halfway between those of the parent plants.

But light is needed to get the rhythms going. Seedlings raised in darkness have no rhythm; however, a single exposure to light is enough to entrain them—that is, to set the cycles going. After thirty years of experimentation Dr. Bünning concluded that plant responses to light indicate an inheritance of an environmental time-map. In effect, the plant reacts in relation to an innate rhythm of its receptivity to light,

possibly in accordance with its diurnal cycle of enzyme production, metabolism, and photosynthesis. Thus, biological clocks in plants allow them to anticipate the seasons. They also trigger periods of dormancy, during which the plant's slower metabolic rate helps it to resist cold, heat, or dry spells, as well as prepares it for the stages of growth and flowering.

Insects, too, make use of an interior clock cued by light in order to match their life cycles to the appropriate season in the year. By collecting information about the length of light and darkness in each day the insects can perceive impending seasonal changes; this is particularly vital to those insects living in temperate zones, which must adapt to each seasonal change or die. Their life cycles must take place under favorable climatic conditions and at a time when there are enough host plants (food sources) available.

Unfavorable seasons for growth and reproduction are bridged by a dormant condition called diapause, which must be prepared for well in advance. The shorter fall days act as a trigger. This seasonal active/inactive cycle is a longer version of the daily cycle.

An insect well known for its accurate sense of time is the honey bee. It can learn to recognize any time within the day; hence it is able to locate a feeding place discovered at the same time the day before. The first published observation of this time recognition was made by a psychiatrist, Forel, who was accustomed to eating his breakfast outside in the garden during the summer months. Every morning at the same time honey bees came to sample his marmalade. Then one day Forel didn't bring the marmalade. The bees buzzed the area anyway, and at the usual time. They even came when he didn't bring the table.

This time precision enables the bees to adjust to the equally precise cycles of the plants they visit, whose blooms open and close according to their own cosmic rhythms.

In a more complex way mammals and birds, too,

behave in ways that seem obviously guided by a physiological sensitivity to light as a synchronizer for activity. For example, migratory birds respond to seasonal light changes by accumulating fat, after which they migrate as a flock, breed, and then once again molt and become inactive, increasing fat deposits for the return journey.

Daily behavior cycles are also influenced by light. The length of the day as it changes through the months gradually shifts the time at which diurnal and nocturnal animals become active. Light accelerates the cycles of diurnal animals and delays those of the nocturnal ones. This means that the earlier it is light, the earlier the diurnal animals become active. Likewise, as days grow longer, nocturnal animals will become active later. So, as the days lengthen in spring and light intensity increases, nocturnal animals correspondingly delay their activity period while the diurnal animals awaken progressively earlier.

The mechanism of response to light and dark in animals is very different from that of plants. And while the importance of biological rhythms is a recently revealed truth in biology, it is actually another example of science rediscovering and validating an aspect of Eastern religion. The Orient called it yin and yang, and saw it through a third eye.

What the third eye sees, and how it works, is a whole 'nother story. But it ties in, as you will see.

The story of light and dark and life has an ancient and honorable history, but most modern versions start with René Descartes, the seventeenth-century philosopher, mathematician, and theoretician of the physics of life. Descartes viewed the mind and the body as two very distinct entities and resolved to find the location of the necessary connection. So, parallel with his philosophical understanding of reason as the mind's province, Descartes was also making detailed anatomical observations of the human body after death (after a murder, he

would appear and claim the body), and developing mechanical theories about its workings. In his *Treatise of Man* he not only described human physiology in detail, but came to a judgment about the point where the mind and body met. That place, he said, was the seat of the soul: the pineal gland. And it could see light.

The pineal gland is the legendary third eye. Descartes' drawings, showing how the nervous system works, and how the eyes are connected to the pineal, were brilliantly conceived mechanical models, in which he made liberal use of strings and tubes to make things work. He got a little carried away as he listed the tasks for which he considered the pineal responsible, but he has recently been confirmed as correct in assuming that light input to the eyes can affect the gland directly. He was the first to outline clearly how the eyes and the gland could interact.

Descartes' speculations were generally pooh-poohed right up until a dozen years ago. In the biomedical sciences, as in other areas, new knowledge accumulates unevenly. There may be little interest in a topic for decades, or even, as in this case, centuries. Then it is rediscovered or becomes fashionable and is subjected to intensive investigation. The pineal is such a topic.

Western culture chose until recently to take the Eastern reference to the pineal as the third eye in a metaphysical rather than an actual sense. Now it is known that the pineal does see—or, at least, it responds to light.

The fossil record tells us that many extinct animals, including amphibibia, fishes and reptiles, as well as mammals, possessed third eyes. There is evidence that third eyes were once prominent organs, possibly image-producers. An additional eye would have had high survival value, especially if it were, for example, on the top of the head of a prey species normally attacked by an airborne predator.

Many species still have pineals. The contemporary Western Fence Lizard has a third eye right on top of its

head. The eye has no eyelid, consequently it stares at whatever lies above it: sky, tree—or predator. In this particular lizard the third eye has a lens, a retina with conelike receptor cells, and nerve fibers leading to the brain. This eye is severely damaged by lack of vitamin A.* Light shining on captive laboratory specimens induced electrical activity in nerve tracts leading from the third eye, demonstrating that it was indeed reacting to light. It also appears to function as a mechanism to tell the lizard when he's had enough sun, and plays a role in regulating twenty-four-hour body rhythms.

Although many contemporary animals have a pineal, in most of the higher evolutionary forms the eye does not see in the conventional sense—that is, it has no light-sensitive photoreceptor cells to transmit a direct image to the occipital (visual) region of the brain. Birds, rats, mice, monkeys, cats, and humans have pineals that respond to light in some way, but each responds in a slightly different manner. The pineal of a bird or mammal can receive light information from the retina but cannot itself react to the light as it can in some lower animals, such as certain fishes, frogs, and lizards. Their pineals react directly to light. Now scientists are studying the organ intensively, seeing how external inputs are translated into information, or signals, which can influence the functioning of glands and body rhythms. It's a question biologists had deftly sidestepped for at least a hundred years. They tended to answer such questions as how light is translated in the body into electrical and chemical information, or signals, with labels like "instinct." "Instinct" is to the classical biologist what "force" is to the physicist or "ego" to the psychiatrist: a convenient smokescreen word that allows you to feel content that you've

*This is significant because vitamin A is essential for making the light-sensitive pigment found in the eye's retina. Night vision, in particular, fails when the body—and thus the eye—does not have enough vitamin A.

explained a phenomenon you don't really understand at all. Now the answers are coming in thick and fast, but only a beginning has been made.

Through evolution the pineal organ of mammals has lost most of its light-sensitive cells and has been transformed into a pinecone-shaped glandular structure about the size of a large pea. It receives light information from the retina indirectly, converting these nerve impulses into hormonal secretions.*

What does the pineal do? Because the gland is partially calcified in human adults, scientists up until recently assumed that it couldn't possibly have a function in people and didn't look for one. A major medical physiology book of 1181 pages, published in 1961, devoted only a third of a page to the pineal (Guyton). Clearly this author regarded the gland as some sort of cerebral appendix, a vestigial structure worthy of no concern in the twentieth century, and passed it off with, "In adults the pineal gland often becomes completely calcified; this does not cause any significant physiologic effect on the body, which makes it doubtful that the pineal gland has any significant function."

Yet as soon thereafter as 1968, Wurtman *et al.* wrote in a whole book on the pineal: "There is now

* Apparently the light information reaches the pineal in the following way: The retina of the eye contains specialized cells (rods and cones) that absorb the light coming in through the lens of the eye. Upon absorbing the light, the rod and cone cells convert the light energy to electrochemical energy in the form of a nervous impulse. This impulse is carried for a short distance by the optic nerve. Then, at the optic chiasma, optic nerves from the two eyes cross, and parts of each goes to the opposite side of the brain. At this point each nerve splits. Most of the impulses are eventually sent to the occipital cortex of the brain, where they are interpreted as vision. The rest of the impulses, carried by an accessory optic tract only recently discovered, pass back through the brain and down the medulla oblongata, where the brain attaches to the spinal cord. There the impulses go out of the cord, still carried by nerves, until they reach the two superior cervical sympathetic ganglia, which lie on each side of the neck. From there the impulses are sent to the pineal gland.

considerable documentation that the mammalian pineal participates in the affairs of the gonads, the thyroid, the brain and several other organs and organ systems. One can also find evidence to support the argument that sub-mammalian pineal organs influence pigmentation and behavior."

It may also affect pigmentation in humans. A Reuters news story out of Rio de Janeiro not long ago reported that the skin of a twenty-three-year-old white Brazilian woman had turned black because she had a benign tumor the size of a lemon pressing on her pineal. It was removed, and she was expected to lose the pigmentation and return to her former whiteness within a year.

The pineal has many and different functions in animals and human beings. However, I concentrated only on what is known about the pineal, light, and the reproductive system, because to report on current pineal research would fill several books, and I am interested at this point only in the gonadal connections. Another limiting factor on any discussion of the pineal is the fact that most research has been done on animals other than humans, and what applies to one animal doesn't necessarily apply to others.

It is known that the human pineal gland, like the pineals of most other mammals, contains relatively large amounts of the biogenic amines known as noradrenaline, histamine, and serotonin, and that it is the site of melatonin manufacture. We also know that variations in light exposure influence a number of metabolic processes inside the gland, and these variations can be measured by changes in weight, oxygen consumption, and serotonin content, among others. Concentrations of serotonin, 5-hydroxyindoleacetic acid, and melatonin within the pineal vary according to a day and night, light and dark, rhythm.

From here on I have to talk only about animals other than humans, except as noted, because no studies appear to have been done in an attempt to make a direct connection between light, the pineal, and human reproduction.

The Dutch and the Japanese have both always been particularly attuned to their farms and gardens and creatures resident therein. So it isn't surprising that it was they who discovered, independently, hundreds of years ago, that they could get songbirds to sing during the winter, when they were normally silent, by exposing the birds to a longer lighting period in the fall.

Then, in 1925, a Canadian zoologist named William Rowan, investigating further the influence of light on the gonads, studied a small bird called the junco finch. In their natural environment the ovaries and testes of these birds are larger in the spring, just before the breeding season. During the rest of the year they are much smaller. The question was: How did the gonads know spring was coming? What told them to get ready for breeding by enlarging? To test the answer he suspected was correct, Rowan extended the day for the birds, using an electric light bulb. He turned the bulb on at sunset, starting in October. Each "day" thereafter was made slightly longer than the day before. Soon, the ovaries and testes of the birds were enlarging, well ahead of spring. He proved his point. Light, in the form of an extended day, was indeed responsible for the changes in the gonads.

This was one of the first substantial clues pointing to a functional relationship between light and the nervous and endocrine systems. Many subsequent studies have shown that light from the environment influences gonadal maturation and function. For example, experiments were done with ferrets, weasel-like animals that come into estrus, or heat, just once a year. An artificially lengthened day stimulated the ferrets to anticipate their breeding season, just as the junco finches had. It became increasingly apparent that light was acting as a synchronizer of reproductive rhythms.

It wasn't until Virginia Fiske discovered that light reduced the weight of the pineal gland in rats that any of these diverse pieces of data began to come together. Descartes was vindicated at last. Here was direct

physical evidence of the effect of light on the mammalian body—reduced pineal weight.

According to Kitay, the active substances in the rat's pineal exhibit a cyclic pattern of high and low levels, depending on the time of day or night (or laboratory-produced day and night). Serotonin, for example, is low at night and peaks at midday. Melatonin, in contrast, reaches a low in the pineal during the daytime and peaks at the onset of darkness.

Speaking at the University of California, Berkeley, in early 1973, Julius Axelrod, Nobel prize-winning biochemist, was asked by a member of the audience, "What is all that melatonin *doing* in the pineal all night, anyway?" Dr. Axelrod replied, with a big grin, "Use your imagination." The audience roared. There was no doubt in anyone's mind that whatever it was, it had something to do with sex.

Glandular function was formerly assumed to be controlled by signals arising from within the body. Glandular activity was generally considered to be relatively stable. Exceptions were attributed, when discovered, to diet irregularities, disease, and domino-like mechanisms that allowed for the buildup of one hormone triggering secretion of another.

Now it can be said that as a general rule glandular function can be attributed to a response to the natural rhythms of the environment within which the particular animal has evolved. This isn't the only coordinating mechanism for glands, but it is the key.

Nature even provides backup mechanisms in a natural fail-safe provision. In the absence of variations in lighting, experiments with rats (such as with animals born blind or kept from birth in continuous light or dark) revealed that other factors worked to induce the estrus or fertility cycle. Rhythmic changes in temperature provided the stimulus. When both light and temperature were kept constant, variation in humidity could sometimes make estrus occur.

In other words, if light doesn't work, temperature will

reinforce a response, and if neither proper temperature nor light variation are available, the animal will judge by the humidity. The next step was to manipulate those three factors and see what happened.

Constant illumination speeded up the sexual maturation process in female rats and shortened the estrous cycle. Sexual maturation was delayed in rats reared in total darkness or who were blinded. Researchers were also able to reverse the light/dark cycle completely and thus the time of day in which the estrous cycle began.

Scientists define a "phase" as the interval from the beginning of one specific cycle to the beginning of the next. For example, a twenty-four-hour phase can be measured from a peak or trough in the normal daily fluctuation of body temperature that all mammals have. Someone who works at night and sleeps by day will have a phase different from one who sleeps by night and works by day. When the stimuli that regulate the phase are disturbed, the phase itself is disturbed, and the body makes an adjustment. This adjustment is called a "phase shift." Many scientists have determined that constant exposure to light is itself a phase shifting stimulus. They have been able to desynchronize the normal sexual rhythm of rats under strictly regulated lab conditions, and then resynchronize them by the judicious use of an artificial environment that duplicates the effects of a natural cycle.

In these experiments the pineal seems to be a crucial biological element in the connection between light and the gonads. Yet there is still some question about its exact role. Dr. Michael Menaker at the University of Texas has been working for several years studying house sparrows. Using "cool white" fluorescent lights, Menaker and his group have performed many experiments on the birds and have made some startling discoveries.

Blinded sparrows still responded to light cycles, so it was clear that the light was not being perceived through the eyes alone. Then Dr. Menaker used another kind of

light, a commercially available night light that emits only one-thousandth as much visible light as the "cool white" lights—a light roughly equivalent "in intensity, although not in color, to bright moonlight." But although half the blinded sparrows continued to respond to the light and maintained their normal activity cycles, the other half reacted as if they had been placed in permanent darkness. This experiment not only strengthened the investigators' case for what the scientists called an "extra-retinal receptor for entrainment," but also had accidentally determined a crude threshold for the operation of the receptor.

Working under the assumption that the bird's receptor was somewhere in the head, the team devised ways to change the amount of light perceived. They plucked feathers from the heads of several of the group of blinded birds who had not responded to the night light. These birds then responded to the light. Feathers plucked from other parts of the body had no effect. They found, in fact, that removal of the head feathers was responsible for from a hundred to a thousand times more light reaching the top surface of the brain. Then they injected ink under the surface of the skin to try to restore the opacity of the tops of the birds' heads, and the birds again failed to respond to the light. When they removed both the skin and the ink underneath it, the birds again responded to the light.

Was the pineal gland responsible for the reception of light? Wondering about this, they removed the pineal from some of the blinded birds, but the birds continued to respond to light and dark cycles. This finding indicates that the pineal is not the only locus of photoreception in the brain. Interpretation of these results is, however, complicated by the fact that removing the pineal interferes with the circadian rhythm of locomotor activity itself. So the pineal may constitute part of a more complex system, yet unknown, in these particular birds.

The eyes of the birds do have something to do with

these rhythms, because they determined that sighted birds can perceive even lower levels of light than blinded ones.

The group then went on to investigate the role of light—through the eye or otherwise—in testicular growth. In the spring the gonads of normal male house sparrows increase in size by as much as forty to fifty times their size during the rest of the year. Their gonads grow in time for mating, after which they shrink again. This is a survival factor, for it allows the birds to carry less weight—and thus need less food—during months when less food is available.

The results indicated that the testes of blind and normal birds grew at the same rate and to the same size when exposed to artificially produced long days. They concluded that these sparrows thus also have an "extraretinal receptor for photoperiodism"—to differentiate between this kind of response and the response the birds gave to their circadian entrainment. Another experiment demonstrated that the eyes were not involved in this gonadal response to light, while they were involved in the circadian response. This particular result is in question, however, because of the type of light used. As Menaker points out, there is some irony in the fact that it is the role of the eyes and not that of a brain photoreceptor that is still in question.

I found numerous other examples of light-triggering reproductive cycles. At the University of Oregon Medical School in Portland, Oregon, Alan L. Rogers is working with dogs, using five groups of matched bitch colonies. The control group is outdoors and subject to natural environmental light. Four groups inside in windowless rooms all have identical environmental stimuli—temperature, barometric pressure, and humidity. The only exception is light. Light is on for the same time in all four rooms, but the kind of light varies. One room has incandescent light, another warm white fluorescent, a third uses mercury arc vapor lights, and the fourth has the broad-spectrum specialty light developed for horticulture.

The fertility of the four groups that were brought inside dropped close to zero. Their rhythms had been broken. Then gradually, they returned close to normal. But even three years after the start of these experiments, no inside group was "on time" compared to its outdoor sisters. There was much greater variation in the cycles of all four inside groups than there was in the control. Of the four, the incandescent-lighted dogs showed the greatest variation from the norm.

While Dr. Rogers isn't yet ready to present conclusions, he said that light rhythms definitely seem to affect the reproductive patterns and even the psychology of dogs.

At the Oregon Regional Primate Center, in Beaverton, Dr. Richard Van Horn is studying the effect of circadian light rhythms on ringtailed lemurs from Madagascar. These animals normally have a breeding season that lasts just a few weeks out of the year, and the seasons in their natural habitat on the other side of the equator from us fall on the opposite time of year. Brought into a windowless laboratory and treated to continuous light, the lemurs ceased to have a breeding season at all. Artificial seasons, created in the lab, brought about corresponding breeding cycles. Dr. Van Horn isn't reluctant to say that there is a definite relationship between light and reproduction in his lemurs.

Are the cyclic rhythms of the human gonads ruled by the pineal? No one knows. It must play a part, but there are probably other, still unknown factors involved, too.

This organ, worshiped in ancient times, has a lot of peculiarities about it. Its normal output of hormones amounts to a glandular "off" signal. In darkness, without any stimulus at all, the pineal will produce melatonin. Melatonin turns off the gonads. Understanding now how the gonads operate on a rhythmic basis, I can see why such a switch would be necessary. Without an off signal the gonads would develop and secrete their hormones at a very rapid rate, as they do when random or continuous light stimulates the eyes. The light shuts down melatonin synthesis in the pineal, so the gonads

are allowed to mature, develop sex cells, and secrete their hormones. Darkness turns on the production of melatonin.

You can see that melatonin is the key to the light/gonad reaction, because not until light information has been translated into a hormone can the pineal affect another organ. When melatonin reaches the gonads, via the bloodstream, it inhibits almost everything they do. It slows down sexual maturation, depresses ovulation, and reduces the weight and hormone secretion of the ovaries and testes.

It becomes clear, then, that a light-depressed, underweight pineal reduces its hormone output, and that gonad function changes as a consequence. If that is the case, then what effect does constant, artificial light, as we urban Westerners know it today, have on you and me? Studies have shown that urban young people mature earlier today than rural young people. What else does artificial light do? Might it also be chronically disturbing our normal sexual cycles? I wasn't even sure what our normal cycles were.

I wondered. For some people, artificial light constitutes most of the light they live with. Further, the number of lumens of exterior night lighting grew by an incredible factor of twenty-three percent per year in the U.S., just between 1967 and 1970 (Riegel).

I also wondered about the light of the moon. Was its light ever significant in reproductive cycles? Might there be something after all to those old myths about a connection between the moon and women? I had to learn more about normal human rhythms and find out about any possible connection between reproduction and the moon.

6 / *The Micro-Dance*

Keep the hole on the top of your head open.

—OLD HOPR EXPRESSION

As I studied the choreography of human rhythms I was reminded of Rachel Carson's admonition that in disturbing the balance of nature, you can't do just one thing. Jet travel spurred scientific investigation of circadian rhythms because the crossing of time zones swiftly turned out to have significant health consequences. As is so often the case these days, it was only after we had pushed our technology beyond the limits of biological safety (we had it all under control, of course) that we realized what we had done. So now we have hundreds of learned papers explaining the perils of jet lag, and the message has begun to sink in that disturbed rhythms cause disturbed people. Jet travel isn't the only cause of disturbed rhythms, and the existence of disturbed rhythms can be an indication of disease.

During a typical twenty-four-hour period, the human body goes through a lot of activity cycles. There are daily cycles for: sleep/wakefulness, urine excretion, pulse rate, temperature, tissue growth, protein metabo-

lism, hormone production, blood coagulation, red/white blood cell ratio, skin-cell division and death . . . nearly everything.

What does it mean when cell division, for example, takes place nonrhythmically? Dr. Franz Halberg and his co-workers at the University of Minnesota found that an early symptom of mammary tumors in animals—one that occurs before there is any other indication of pathology—is an irregularity in the cell division rhythm in the cells of the skin of the ear. This deviation from the animal's former circadian rhythm of cell division preceded the gross physical signs of disease.

Other illnesses besides cancer display circadian rhythms at some level in their symptoms. People who feel pain in their stomach at about the same time every day (if they haven't drunk milk or eaten some stomach-coating food) may have a peptic ulcer. Sufferers from peripheral arterial disease demonstrate a circadian rhythm in the flow of blood in their legs. Their feet may feel colder at a certain time of day. Hospital patients with intermittent spasms or blood flow obstructions often show a circadian rhythm that reaches its peak in early evening, and drops between midnight and four a.m.

Circadian rhythms have been shown to be reflected in the symptoms of allergies, epilepsy, kidney disease, depression, tuberculosis, several emotional illnesses, diabetes, and cardiac and glandular diseases. There are also daily rhythms that affect our resistance or vulnerability to drugs, stress, allergy, infection, and pain. For example, Luce cites an experiment in which a large dose of amphetamine given to a group of rats at the end of their activity cycle killed six percent of them; when they got the injection in the middle of their activity cycle, the same dose killed seventy seven percent of them.

Richter says periodic illness clocks have been determined for periods of twelve hours, twenty-four hours, forty eight hours, seven days, fourteen days,

seventeen to nineteen days, twenty to twenty-one days, twenty four to twenty-five days, twenty six to thirty days, fifty to sixty days, four to five months, and annually.

Daily variations in the time of onset of reproductive functions show a circadian rhythm, too. Writing in consecutive articles in one issue of the *Annals of the New York Academy of Science*, Kaiser and Halberg, and Malek *et al.* collected data regarding onset of spontaneous labor and, in the Malek study, the daily onset time of menstruation. Both papers agree that there are peaks and troughs in the incidence of onset of labor, but different locations have an influence on the times of their incidence. Kaiser and Halberg quote a study published in 1959 that showed the rhythm in mice could be manipulated even to the point of producing a permanent phase shift through the reversal of light/dark cycles. They describe another study, in which curves were plotted for human births occurring spontaneously as against births requiring medical intervention. Each group exhibited a clear circadian rhythm—but they were not the same rhythm. Presumably in the latter case the doctors' convenience was being measured.

Malek found that human labors begun during statistically peak times were shorter and less likely to need surgical intervention. He also found some evidence that the daily rhythms of labor onset can be affected by a larger cyclical rhythm, that of geomagnetic intensity, and that weekly rhythms operate, too.

Malek's studies of the menstruation patterns of student nurses in Prague showed parallel indications. He found the nurses more regular than the women studied and reported on in Chapter 2. He observed: 1) First menstruation tended to occur at age thirteen, more often between November and January, and least often between February and April; 2) an inverse correlation existed between geomagnetic intensity and frequency of the onset of menstruation; 3) there was no connection between onset of menstruation and either atmospheric

pressure or weather; 4) menstrual bleeding lasted longer, as did the intervals between periods, in winter than in summer; 5) nearly fifty-five percent of all the onsets occurred between the hours of four A.M. and noon; 6) periods begun between eight A.M. and noon had shorter bleeding times than those begun in the afternoon; 7) periods most frequently began on Sunday and Wednesday or Thursday.

Malek also reports lunar/menstrual correlations, saying that some relationship exists between the onset of menstruation and the synodic moon. However, he simply states it as a characteristic and does not give any evidence, as he does for his other statements, nor does he mention it in his analysis or discussion of menstruation.

The effect of the moon on reproductive cycles of earth creatures has been studied for several decades. Back in the 1920's C. Amirthalingam, a marine biologist working in England, found a lunar periodicity in the reproductive cycles of a type of scallop, and Fox found the same thing to be true with sea urchins. At that time it was not known if the periodicity reflected the gravitational pull or the light of the moon.

The moon creates a gravitational pull, which, combined with that of the sun, actually deforms the surface of the earth by as much as a foot. The surface of the ocean, being more tractable, is pulled up into a bulge by several feet. What we see as the tide is the difference between the deformation of the earth and the deformation of the water. The range between high and low tides is not always the same, either. Each lunar month brings two times of wide range, at the full and new moons, and two times of particularly small range, at the first and last quarter moons. These two ends of the range are called "spring" and "neap" tides, respectively.

More recent studies have indicated that gravity has only a minor influence, if any, on the observed connections between the moon and reproductive behavior. It is the *light* of the moon that affects marine

organisms. And now the list of species known to be so influenced includes several sea worms, mussels, various other plant and animal sea forms, as well as some algae and also inland-water organisms.

What the connection is and how it works in each case depends on the species itself. For example, many Californians who live near the coast are familiar with the sight of the summer grunion phenomenon, when the beaches are alive at the high tide after full moon with fish struggling up to the tideline to lay their eggs, then squirming back into the water. The eggs hatch just one lunar month later, when the high tide again reaches the hole in the sand that contains the eggs.

Dr. Frank A. Brown has studied lunar periodicities of marine life forms for many years. He calls the list of organisms, animals, and plants so affected "formidable," and notes that "it is perhaps significant to point out here that the persistent cycles of the type just described appear to have their maximal precision when the external conditions are most constant, and where, if light is a constant factor, it is kept at a very low intensity level. . . . Once set, the cycles tend to persist with the same phase relations until reset again by another effective stimulus. . . ."

His point is important because the light of the full moon, according to the *Larousse Encyclopedia of Astronomy*, is comparable only to a forty-watt lightbulb at fifteen yards, or only about 1/500,000 of the intensity of sunlight. Not very much at all.

Bunning believes that these cycles are endogenous, with the triggering light acting to set the phase in reinforcement of an already existing internal mechanism. He makes the point that timing is important to the working of the cycle because even high-intensity light will not work as a trigger at the wrong time, while low-intensity light works easily at the right time. That means that a moonlight-triggered mechanism will still work when the moon is hidden by clouds for two or three months.

The light of the full moon affects more than sea creatures. Hora and Williams showed that moonlight was intimately related to the reproductive cycles of several insects, as well, and others have found lunar periodicities in rodents and other mammals.

But the most exciting discovery occurred in 1962 when a group of Yale researchers observed an apparent lunar periodicity in the sexual cycle of some primates—lemurs and lorisois. Cowgill *et al.* reported that "the data appear to suggest a *prima facie* case for a correlation between peaks of sexual activity and the lunar cycle. . . ." They also pointed out that many (sexual) display movements of lemurs and lorisois appear to the human observer to be enhanced by the light of the moon, the white and silver tail hairs reflecting moonlight very seductively.

Well! That information led me to the biggest question of all: Does the moon affect human reproduction? If so, how? And does artificial light remove that effect?

Research demonstrated to me that the moon certainly does have something to do with human reproductive activities—at least in women. Women who live above the Arctic Circle, for example, are plagued with menstrual irregularities during the long winter. Frequently they stop menstruating altogether for several months, and they apparently do not ovulate during that time. Other evidence suggests that some women who live in the Arctic ovulate more than once a month during the summer.

Back in 1898 Svante Arthenius charted the menstrual periods of urban Swedish women. He found that the onset of menstruation peaked on the evening before the new moon. Some more recent studies have also noted peaks near the new moon, although one investigator found no such correlation. The conflict of these observations is probably a result of a lack of standardization in the studies. No record was kept concerning city vs. country dwellers, for example, or the incidence of artificial night lighting in general. That is a very pertinent question, as you will see.

Anthropologist Gregory Bateson tells the story of a study done in a university town in England in the early 1900's, where a count was made of sanitary pads floating down the river. The researchers hoped to find some periodicity. As he recalls, they didn't find any.

In a review written in a German gynecological magazine in 1950 entitled "Are There Solar and Lunar Influences on Birth and the Menstrual Cycle?" H. Hosemann speaks of the subject as still unresolved, but he quotes the author of an 1821 medical text as saying (when translated) "In warmer climates [many] women menstruate at about the same time in relation to the phases of the moon. Only women who live in a more or less simple way of life and those women belonging to the so-called primitive tribes will mostly menstruate under the influence of the moon."

The hallmark of civilization might be considered an artificial environment—most notably, artificial light.

Still, it wasn't until 1959 that anyone brought a good part of this information together. Then, writing in the *American Journal of Obstetrics and Gynecology*, Dr. Walter Menaker and his brother, Abraham Menaker, addressed the question of lunar periodicity in human reproduction and came up with a lot of data and some pretty strong conclusions.

The brothers initially wondered about the coincidence in length of menstrual and lunar months and the periodicity of multiples of that month in the normal term of pregnancy. They conducted studies on a total of 510,000 births in both municipal and private New York City hospitals, taking into consideration such variables as induced labor occurring on weekdays vs. weekends, etc. They found a significantly high incidence of births around the full moon and a significantly low incidence around the new moon. Ovulation and conception were presumed to have occurred at the full moon where the baby was born on the full. "The day of geophysical biology and medicine is at hand," they declared, and went so far as to suggest that the lunar month is a unit of biological time throughout human life.

Following this report several others confirmed the lunar periodicity in human births, and when in 1967 Dr. Walter Menaker published another report in the same journal, confirming his earlier hypothesis, the issue seemed to have been settled.

Meanwhile, Edmond M. Dewan, a theoretical physicist, was pondering the same question. As he tells it:

"In 1963 I was at a dinner table with two people. They were talking about the rhythm method and wondering how to perfect it. I wanted to change the topic to what I had in mind: biological clocks and how one can synchronize them to light-dark schedules. The conversation turned to 'how can you measure ovulation?' and so on. Well, it struck me suddenly that they were talking about a biological clock which, in principle, could be synchronized just like the circadian rhythms. My suggestion was to phase-lock the ovulation cycle and you would not need to measure it—you would control it. The idea of using light came a few days later. It was based on the fact that a human menstrual cycle has an average duration close to the cycle of the moon. If this were not a coincidence, you could look to a light-dark schedule similar to the moon's.

"To make a long story short, I used my wife as a subject and deliberately 'forgot' to turn off the light on the 14th through the 16th or 17th nights of her cycle. She was unaware of the experiment."

His wife had had an extremely irregular menstrual cycle of between thirty-three and forty-eight days. The light he used was a regular one-hundred-watt incandescent bulb in a bedroom table lamp with a shade, which was placed on the floor at the foot of the bed so that the light was projected off the ceiling and the walls and the illumination was indirect.

The results were spectacular. She had two consecutive twenty-nine day cycles. The following month the light was turned off before dawn and her cycle was thirty-five days long. In the next three cycles the light was left on all night on days fourteen through

seventeen, and she had cycles of thirty-one, thirty, and then twenty-nine days. When the light was no longer used, she gradually became irregular again.

Dr. Dewan then tried a different method with a second subject. He asked her to use the light only on the night of the fourteenth cycle-day. She was a woman who occasionally experienced abdominal pain in mid-cycle, presumably *Mittelschmerz*. On the two monthly occasions when she used a seventy-five-watt bulb shining indirectly on her during sleep, she experienced an intensified form of cramps on the day following the use of the light. Dr. Dewan published these results in the *American Journal of Obstetrics and Gynecology* in December, 1967.

Excited by his findings, Dr. Dewan contacted Dr. John Rock, the famed fertility expert, and presented the idea for a larger experiment. Dr. Rock was intrigued and authorized the study to be carried out in the Rock Reproductive Clinic in Brookline, which specialized in dealing with irregular, apparently infertile women who wanted to have children. Dr. Terry T. Howard, then a medical student, Dr. Ibrahim M. Seradi, and Miriam F. Menkin, a longtime co-worker of Dr. Rock, organized and conducted the experiments that followed.

Fourteen women who came to the Rock Clinic during 1966 and 1967 with complaints of infertility were eventually included in the final paper reporting the study,* along with two others, a sixteen-year-old patient complaining of irregular cycles, and a twenty-six-year old mother of two, not a patient. Of the total of sixteen subjects, thirteen reported a history of menstrual irregularity and/or abnormally long cycles. In half of the infertile couples the husband had a low sperm count or poor sperm motility. Except for the sixteen-year-old, the women ranged in age from twenty-one to thirty-four.

*"Photoc Effects upon the Human Menstrual Cycle: Statistical Evidence," Edmond M. Dewan, PhD, Miriam F. Menkin, MA, and John Rock, MD. In preparation.

During the test months each subject was instructed to sleep with a one-hundred-watt bulb burning all night about ten feet from the head of the bed, on the fourteenth, fifteenth, and sixteenth, and usually the seventeenth nights of the menstrual cycle, counting the first day of the period as Day One. All other nights of the month were to be spent sleeping in total darkness. During control months the women used no light.

From a statistical study of the data, Dr. Dewan believes they have a promising idea with encouraging experimental evidence. The evidence involves two aspects. The first consists of a significant increase in the regularity of the menstrual cycle-lengths when the procedure with light was used. Secondly, the distribution of cycle-lengths peaked very prominently at twenty-nine days (no correlation was made with phases of the moon).

I first learned of this experiment from a newspaper article, and grasped at it with fervor. Here was a real possibility! It all fit together so neatly that I wanted it to work if for no other reason than because it was such a beautiful idea.

So I tried it myself.

7 / *Plugging In*

*Twinkle, twinkle, little light,
How I wonder at your might:
High above my bed you lurk,
Making the rhythm method work.*

—MIRIAM F. MENKIN

Beginning in October, 1971, I used a variation on the Dewan experiment. I kept a daily oral temperature chart, recording it each day immediately upon awakening, and between midnight and one A.M., when I normally went to bed. I measured my temperature both times because I wondered which time would be more accurate. I also experimented with various brands of thermometers, finding that cheap ones, in spite of their guarantees, would give different readings within a period of minutes. The more expensive models—around \$4.00—didn't do that. At this time I was still abstinent.

For the first two months I just kept a record of my temperature, charting it on a piece of graph paper. On the fourteenth, fifteenth, and sixteenth nights of the third month I slept with a light on, a twenty-five-watt night-light. In later months, I used a seventy-five-watt

bulb in the closet across the room, the door half shut.

All the other nights of the month I slept in a completely dark room. That wasn't so easy to accomplish, because there was a streetlight right outside my window, and the headlights of cars flashed in on me intermittently. I put up some heavy dark drapes and stuffed a bath towel in the crack under my door. Sometimes I felt rather foolish about the whole thing and considered abandoning my plan. But my lack of alternatives, and a growing interest in one particular man, kept me going.

At first I could find no pattern in the ups and downs on the chart. I didn't know what it was supposed to look like, so I didn't know what I was accomplishing, if anything. I just kept doing it.

In the meantime I talked about the idea with people I knew. My friends expressed great enthusiasm, caution, and a lot of hilarity. "Do you mean," asked one incredulous man, "that I could know, by standing outside and looking up at my lady's window at night, whether or not it was safe to go in?"

Another man grudgingly admitted that I might have a sound idea but professed greater confidence in "that old standby, two aspirins pressed firmly between her knees." Still another urged me to market a trademarked lightbulb, while one more advised me to buy Westinghouse stock.

My women friends were less amused and saw personal, practical applications rather than commercial possibilities. (Can I infer from this anything about the differences between American male and female psychology?) Many decided to try to chart their body rhythms for themselves. They didn't see why they couldn't continue to use a diaphragm or foam or condoms while they used a temperature chart and light to capture an image of how their body worked. No risk was entailed. In fact, I didn't find one woman off the pill who didn't express a willingness to try the idea. They had nothing to lose and a great deal to gain.

My chart began to make some sense to me after the fourth month. Most obvious was the dip and then jump up of temperature on the fifteenth and sixteenth days. My cycles had been shorter than usual, and on the fourth month after beginning use of the light, my ovulation fell into synchrony with the full moon. This wasn't a development I had anticipated! Thereafter, my periods and ovulations kept perfect step with new and full moons, respectively, for nearly a year, until a series of severe emotional stresses apparently threw me out of step again. After six months I returned—again through shorter menstrual cycles—to a match with the universe, where I stayed until the end of 1973, when I went through another serious emotional stress and was again thrown out of rhythm.

Each month my temperature chart followed roughly the same pattern. From the beginning of my menstrual period until the night before I first slept with the light on, the temperature would remain about the same, within a range of two- to five-tenths of a degree. Within the next day or two my temperature would show a marked fall and then a steep rise the following day. Sometimes the rise would exceed an entire degree. Then the temperature would stay at the higher level, varying as much as half a degree up or down, until the next menstrual period started, when it would abruptly fall back to its original place.

My midnight readings were consistently higher than those I took upon arising, but I could see that the two were dancing to the same tune. I learned to read my chart like a piece of music and *feel* the rhythm of my body. For me the chart came to be a better representation of "the real me" than any photograph.

The mid-month-dip followed by a steep rise signals ovulation. *The light triggers ovulation.* I found a six- to thirty-hour lag between the first sign of the crucial dip in my midnight reading and the morning reading. So, while it appeared to me that the morning readings were a more consistent and reliable guide to my hormonal

balances, the night reading gave me an early warning signal. I continued for more than a year and a half to take my temperature at both times.

Everyone doesn't have a temperature chart just like mine, but some things are consistent among almost all women who ovulate: From the menstrual period until the phase shift the temperature is relatively low; then it rises and stays high until the next period begins, or soon after it, when it drops again.

Since March of 1972 I have used light-entrained ovulation and concomitant abstinence as my only pregnancy-avoidance measure. I don't take my temperature anymore except to reestablish the cycle when other factors throw it off. I am not now nor have I been pregnant. Among the women I know who have been using this formula, one has used it to get pregnant (it worked the first month and she'd never been pregnant before), and many others are using it to avoid conceiving. Another half-dozen are working to establish their patterns to their complete satisfaction before they throw away their diaphragms. Judging from my own, initially bewildering, experience, I would say that is a good idea.

Among twenty-nine women through a total of three hundred and forty four menstrual months, two pregnancies have occurred unintentionally. One was conceived with the light on (an inherent liability of any concept requiring an act of will) and the other in a woman who was just two months past delivery of another baby. Her body had not yet readjusted to a balanced state of nonpregnancy (as opposed to its equally balanced state of pregnancy).

Use of the light-and-dark schedule has enabled all the women in my test group except one to entrain their ovulation. Now that they know when they are going to ovulate, they can take steps to avoid conception—or court it—as they please. But discretionary fertility is not the only benefit they have found.

First of all, they have all noted that they are much

more aware of ovulation now. Not only does the chart give them a visual image of their body changes, but they can feel other things, too. They notice that their vaginal mucus discharge increases dramatically at ovulation, and that they frequently even have a slightly runny nose at the same time. Their sense of smell markedly improves, and also they perspire more then, too, so they are especially aware of their own odor.

Second, because they see the light and ovulation as just one part of a whole cycle they experience each month, they have noticed other things about their bodies that are repeated, with predictable regularity, during other times of the month. They tend to have little premenstrual tension, for example, although they may feel a surge of energy just before their periods. Menstruation itself tends to be of much shorter duration and may be heavier. Several are also charting their monthly cycles in interest in sex, mood, physical-activity level, and self-image. They find they have regular cycles for these things, and one told me she used her chart to schedule a party and an application for a job, and was successful in both.

These women have also told me of several things that have apparently been responsible for throwing them off the schedule they had established with the use of the light. One woman reported that she was thrown off her schedule by flying across the country. (That happened to me, too. Three reported that serious emotional disturbances made them irregular.

Nine women have achieved synchrony with the moon. These women have used the formula the longest.

All the women found they were able to entrain themselves again after being thrown off, with one or two months' use of the light. And all the women are more regular than they ever have been before (not counting the phony regularity of pill use).

That light is doing something to them, and to me. And no unexplained pregnancies have occurred because of it.

How do I know what I am doing to my body is good for me? I ask myself: Did the species evolve this way? And the answer is yes. Lunaception is a capacity apparently built in to women's bodies, operating in response to predictable influences of the environment. It is a revolutionary frame of reference for looking at your own body; a biologically gratifying way to come into a personal balance with the universe; a tool for health; and a means to discretionary conception.

I wanted to find some way to put my body into a balance with nature and gain an intimacy with its function, wanted to break the dichotomy between known and felt knowledge, wanted to avoid conception without violating my body. Lunaception fulfills all those qualifications, and gives me much more besides.

When I think about all I have learned about my body and its place in the universe, I am humbled. What I thought was a personal problem turned out to be something a great deal more important. After being pooch-pooched for centuries the idea that there very well may be a real connection between women and the moon gains credence.

Like most other animals, the human being evolved in a consistently light and dark world, day and night always alternating. Yet there are certain times when night is not dark: around the full moon. I've come to believe that the human species evolved a genetic response to the moon, nearly all women ovulating at the full moon and menstruating at the new moon. Customs developed around menstruation and the moon precisely because the new moon coincided with that event. The idea that women might have rhythms would have been no surprise to ancient people who followed so many other rhythms of nature. It was all so obvious to them.

When you've looked, as we have, on how the body works in so many synchronous ways, with a perpetual endurance you can count on, it becomes harder still to swallow the kind of birth control that predominates on

the Western market. Why should it be necessary for us to jeopardize our health in order to prevent conception? And when we can see in how many ways we are plugged into the rhythms of the planet we inhabit, it is easier to comprehend the feasibility of a moon/woman connection. Other creatures respond to moon cues. Other creatures mate to a moon rhythm. Are we different?

The studies of all those thousands of women menstruating and giving birth in urban areas show that even there, under extreme conditions of light pollution, the tendency prevails. What is the connection between light and fertility in humans? To find a tentative answer it has been necessary to study astronomy, biology, physiology, anthropology, biochemistry, and modern medicine.

Light is the most potent and ubiquitous trigger of biological rhythms; that is certain. Yet the light not only has to exist, but it has to exist within a certain tolerance—a certain intensity, for a certain length of time, within a specific period within a larger period—for the mechanism to be triggered.

This brings up the question of artificial light. What effect does it have on us? Even different kinds of artificial light have different effects, as the experiment with dogs at the University of Oregon Medical School shows. It is clear to me that artificial light has profound consequences, and we are only just beginning to learn the dimension of the problem.

In the history of the human species artificial light is so recent a phenomenon that no evolutionary adaptation has yet had a chance to be made. Even moths, which live and die in cycles much swifter than our own, are still attracted to flames in which they perish, because they are evolutionarily adapted to flying toward light (sun or moonlight) as a survival mechanism.

So if artificial illumination has affected us profoundly, and if we want to regain our natural balance, we must do something.

The journey to the end of this search was, for me, a

story of an ever-increasing awareness of the importance of making links between living processes, in wider and wider circles of connection. The importance of the links was not something new to me, but personal involvement in a snarled link tends to increase interest and urgency. People are notably likely to ignore problems until they require immediate attention. But if you have lumps in your breasts, you start thinking over some crucial matters mighty quickly. Something like that makes you stop and pay attention to what you're doing. You begin to take a personal interest in your suddenly obvious need to put your body into a more healthy balance with the environment.

The Lunaception connection of the body with the environment is not just an abstract concept. It is a gut-level *knowledge* that changes the way you look at life, gives an honest biological gratification, and makes you feel good. Once you have made the connection on an abstract level—by reading this book—you still must experience it personally before you can experience the gratification.

Once people experience feeling good, it's hard to get them to stop. Nature has her methods; she has endowed us with the ability to enjoy deeply those things that are good for us. Eating is a gratification, lovemaking is a gratification, creating beauty is a gratification. Nature made those and other things feel good, I can't help but think, because she wanted us to keep doing them.

And I can tell you wholeheartedly that lying in bed at night, with a full moon streaming in through the window and washing over my body, is one of the biggest thrills I've ever experienced. It is not only a psychologically fertile moment. When I'm in tune with the lunar rhythm, I feel a profound sense of biological gratification that is a very strong inducement to make a baby. I think nature set it up that way.

And like all gratifications, moderation is required. I am still not ready to get pregnant.

I can imagine that there are those who would say it is dangerous to come that closely in touch with our primordial levels. But refusing to recognize the very real connections that tie us to the cosmos does not make them go away. We can ignore the moon and sleep through the night with the TV on, while we continue to take our pills. But we cannot change the fact that our bodies will be affected—possibly seriously.

If we want to experience what it means to be fully human in all the wonderful ways there are to be, then we must not be afraid to explore all the levels we can discover, from the primordial to the exalted. The body is a good place to begin.

PART IV
Doing It

8 / *Putting Your Body Back Into Balance*

It's truly a spiritual experience!

—JULIA COOPERSMITH

You can do it yourself. You can make a picture of how your mind and body work together, in observable patterns, month after month. Once you have done it, you will not only have a visceral understanding and appreciation of the meaning of health, but you will know what it means to feel your body as an integral part of a larger whole. And on a practical level you will know when you ovulate, at last making pregnancy an option without drugs or implements.

If you really want to get into it, you can also chart your interest in sex, your moods, your physical activity levels, and your changes in self-image. You may even be able to find patterns in the subject of your most private thoughts.

Practicing the Lunareception formula requires, at a minimum, that you spend five minutes a day by yourself, some time at the end of the day, and always at the same time. I like to curl up on my bed with my chart and a breadboard writing surface, my thermometer in

my mouth. I reflect on my day, thinking particularly about how I got along with people, and how well things went in general. Some days I can't seem to get anything done, and other days everything goes swiftly and smoothly. There are days when my dealings with people are cordial, frank, and happy. Other days I argue with everyone, and nobody will do anything the way I'd like. Some days a spark of intimacy flies between me and any man I talk to, and other days I don't like any men at all. And then there are all the days in between, when things are what we call, for lack of a more precise definition, "normal."

That five minutes is a very nice interlude. I spend the time taking my temperature, checking my vaginal mucus, filling in my chart, and preparing my bedroom for the proper light/dark routine for that particular day. You can appreciate the need for privacy during this time. You will also probably enjoy making this a personal little ritual; it is a natural response to a natural rhythm, after all.

Following you will find instructions for making your chart, checking your mucus, insulating your bedroom, using the light, reading your chart, and using it as a pregnancy avoidance tool. A more elaborate chart is also included for those of you who are willing to spend a little more time to learn a great deal more about yourselves.

Using a graph on which you will record your temperature, you will chart your menstrual cycles and ovulation dates. By sleeping with the light on three nights a month, you will entrain your ovulation to a regular rhythm.

To do this you will need:

1. The charts with this book or one you make.
2. A pen or thin felt-tipped marker.
3. A good-quality oral thermometer.
4. Some form of insulation from light in your bedroom.
5. A night-light, lamp, hall or closet light.

6. Conscientious attention to this routine for five minutes a day on a regular basis.

THE BASIC CHART

Use the charts that come with this book or make one, as follows:

Buy plain quarter-inch ruled (1/4") graph paper where stationery supplies are sold. Nine sheets of 8 1/2 x 11 inch paper will, when laid end to end the long way, give you more than a year's worth of information.

The charts with this book are heavier paper, so they can be used on both sides. They list temperatures down the left side of the first page. Tear them off at the perforation and scotch tape them together. There is room for more than a year's worth of information, using both sides of the paper. If you are making your own chart, write or type in the temperatures as shown in Figure 1.

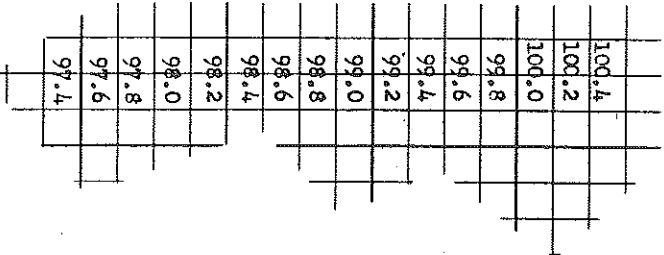


Figure 1.

As long as you are not using the pill, you can start your chart any time. Today, for example. To set up your chart write or type in across the top of the graph the dates, one to a square, starting with today's date or whatever date you decide to begin. See Figure 2.

Decide on an appropriate time of day when you will take your temperature. The important thing is to do it the same time every day. A few minutes either way won't matter, but not more than fifteen minutes either way. Every day, seven days a week. Thus, while it may be convenient to take your temperature when you get up each morning, because you get up the same time each day to go to a job, if you are in the habit of sleeping late on the weekends, then that idea won't work. The most effective way to establish a routine is to tie it in with some other daily routine, like meal preparation, makeup removal, etc.

Keep your chart, pen, and thermometer together in a convenient place. I don't have a bedside table, so I keep them under the bed.

Each day take your temperature. Don't eat, smoke, drink, or brush your teeth for ten minutes beforehand. Leave the thermometer in your mouth, under your

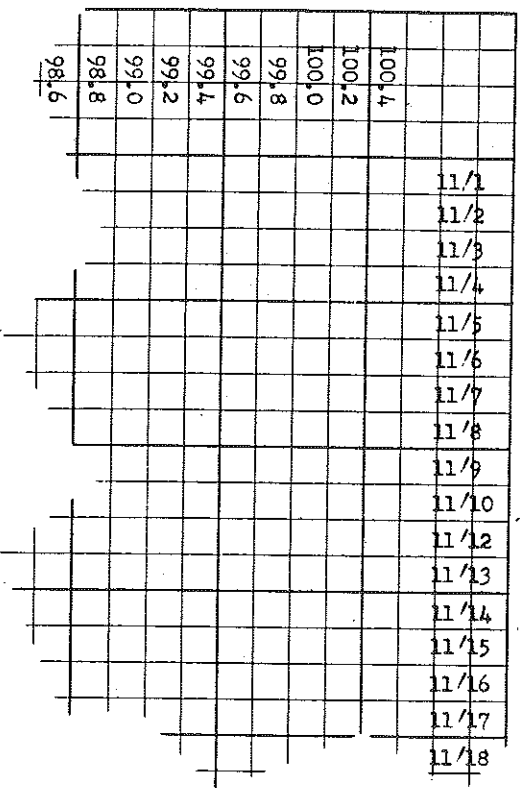


Figure 2. Add dates across the top.

tongue, for at least four minutes. If you have a cold or other infection, your temperature may not be normal. This is one reason why you should chart your temperature over many months.

If you do not know how to read a clinical thermometer, ask your druggist to show you how when you buy it. A good (i.e., not the cheapest oral thermometer is essential because cheap ones are frequently inaccurate and will throw the whole thing off. Thermometers are fragile. If you buy two, you won't be caught without one.

Make a dot on the graph in the column below the date, exactly opposite the temperature the thermometer shows. Note that even-numbered tenths of a degree are to be recorded in the middle of the square, while odd-numbered tenths are recorded on the line. See Figure 3.

Draw a line from yesterday's dot to today's.

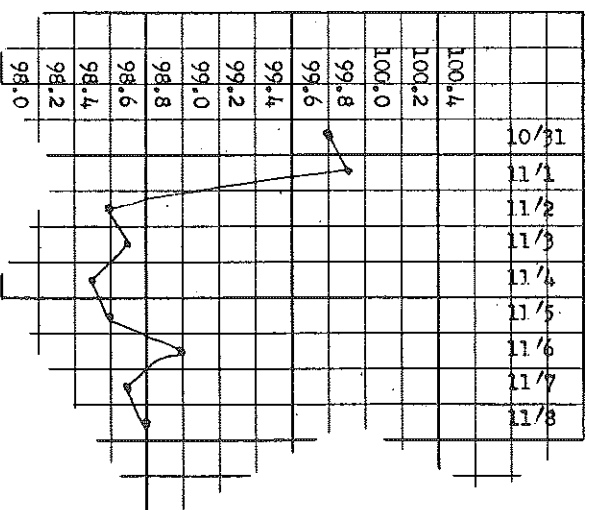


Figure 3. Enter a dot in the square directly below the date and exactly opposite the temperature shown on your thermometer. Note that even-numbered tenths of a degree are recorded in the middle of the square, while odd-numbered tenths are recorded on the line.

THE MUCUS TEST

If you are alert to them you will notice changes in your vaginal discharge at ovulation. These changes are significant and easily recognized by any woman with just a couple of months' experience. This vaginal mucus discharge is the most reliable guide to the recognition of ovulation. Except for your use of the light, it is the only way you can know ahead of time that ovulation is impending, and it will give you a way to double-check to see if you are on your normal schedule.

Every woman who is not on the pill, sterilized, or past menopause has the following vaginal mucus cycle:

1. Starting with the time of menstruation, the vagina is extremely wet with a bloody discharge, and sexual relations during at least part of this time are sometimes less than satisfactory because the discharge creates a high friction level that can be painful.
2. When the period is over, the (unstimulated) vagina has a dry feeling. You can learn to identify this feeling without using your hands, but you will get a better idea of what is meant by dry if you insert your finger. This dry sensation will last for several days or as long as a week, depending on how long your menstruation lasts, and how long the cycle is. If you do not have a cycle at least twenty-six to twenty-seven days long, you may have no dry days.
3. The beginning of mucus production can be recognized by the fact that the sensation of dryness has disappeared, and a finger will find more moisture.
4. For the next few days the mucous secretion increases in volume and changes from thick and cloudy to smooth and transparent. If there is enough of it to measure, you will be able to stretch it between thumb and forefinger, like the white of an egg. In long cycles the mucous symptom comes and goes for a day or two at a time before there occurs a sequence of several days, leading up to ovulation, when it is very wet all the time.
5. At about the fourteenth day, or mid-cycle, the mucus

reaches its peak of stretchiness, it is smooth, slippery, and very lubricative. A sensation of wetness is obvious. Nature literally gives the white carpet to the sperm when a woman is fertile.

6. After ovulation the vaginal mucus again changes, back to thick and cloudy, sometimes yellow, and perhaps slightly tacky, and gives an uncomfortable feeling. Another dry period may follow until menstruation begins again. Sometimes this entire interval after ovulation is rather dry most of the time, with an occasional day of mucus.

You are conceivably fertile from the time the mucus starts to increase day by day until three days after it reaches its peak. This is, in a normal cycle, from about Day Twelve to Day Seventeen. (Your temperature chart will reflect this same buildup and leveling off.) Check your mucus daily, and mark mucous days on your chart, two lines down from the date, with an M. On the days the mucus is most fluid, and wet, underline the M.

INSULATING YOUR BEDROOM

I think that the technology man has made is responsible for the fact that most women's cycles are not regular. Streetlights, building lights, automobile lights, hall lights, television . . . the list of light pollution additives is enormous in any even semirurban community. Most urban women today find it nearly impossible to sleep in the dark unless they make special provisions to do so. That is what you must do, one way or another. You may have to buy a window shade, or rehang your drapes closer to the window, and/or put something along the crack at the bottom of your hall door. See what you can work out. An eyeshade may not be the answer; if your body responds to light not "seen" by your eyes, as is the case with other animals, you will defeat the purpose with an eyeshade. Until we know how the light is registered, it's better to sleep with your entire body in complete darkness, except as indicated below.

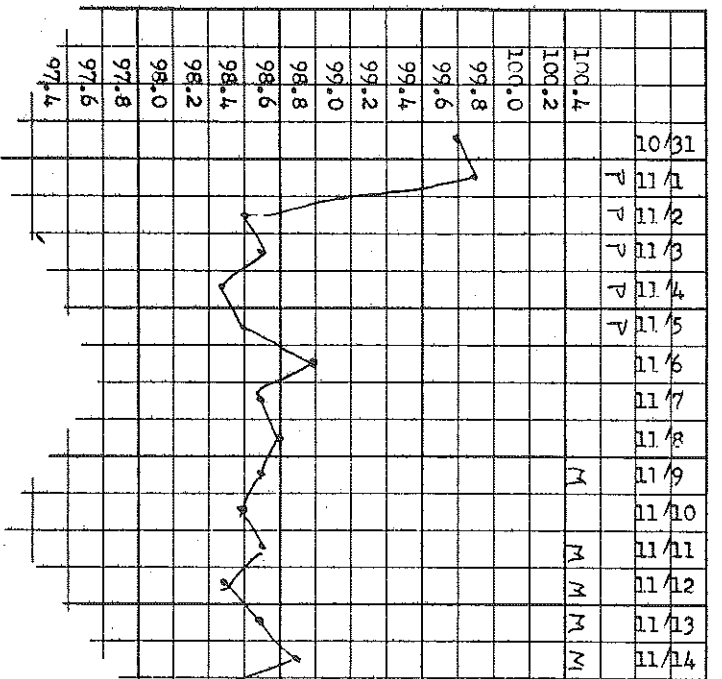
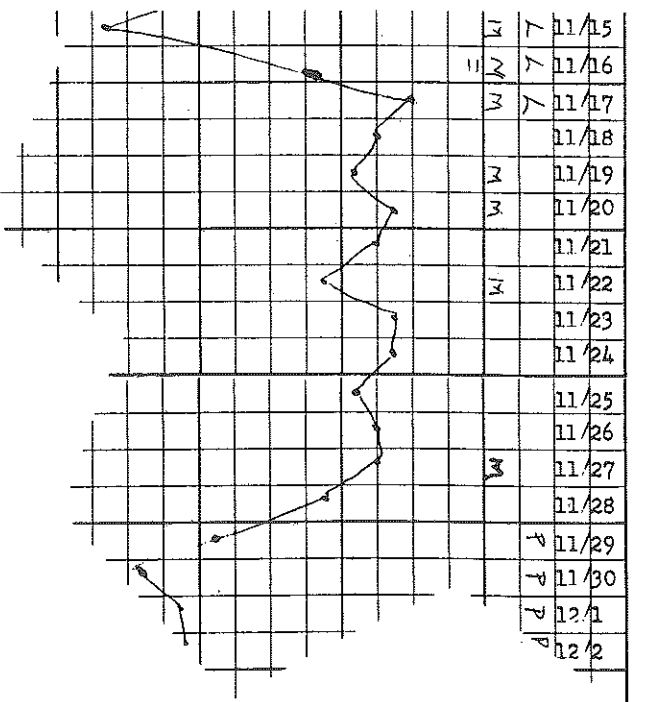


Figure 5. The temperature remains the same from the beginning of the period for about two weeks, when there is a drop followed by a steep rise. (This is the phase shift and

ovulation takes only a few moments, and fertility lasts only about eight hours, twelve at the most. You cannot know when those eight hours are, unless you feel the *Mittelschmerz*, or middle pain, which may accompany the actual release of the egg from the ripe follicle. If you do feel that, you can know for sure that after twenty-four hours have passed you are again safe from pregnancy for this menstrual cycle. If you want to get pregnant, these hours are the time.

THE ELABORATE METHOD

You can chart many things other than your tempera-



signals ovulation.) Thereafter the temperature remains high until the beginning of the next period, when it drops down again.

ture and mucus. If you really want to get a graphic picture of your body's rhythms, you can spend another few minutes a day and end up with a vivid image of your own patterns of thought and behavior.

Use the charts that come with this book, or add to the chart you have made for yourself the following:

Under the column of temperatures, add two more columns, one underneath the other, of numbers one to five. Entitle them I and II. See Figure 6.

Along the bottom of the chart, block in a continuous row, beginning under the first date you write in the corresponding block along the top. See Figure 7.

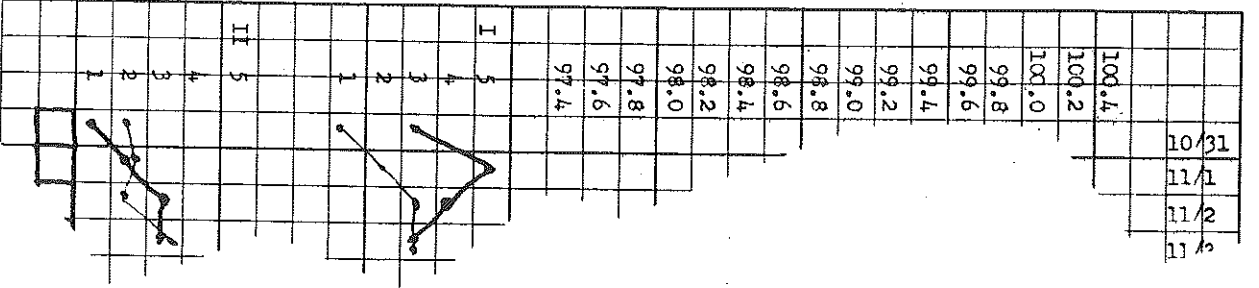


Figure 8. Pencil and pen entries for four days. See text for November 2 entry to be sure you are marking the columns properly.

When you have your few minutes of privacy to take care of the Basic Chart, rate yourself on each of the four interest and behavior areas. For example, if you rated yourself for November 2 under I as Interest in Sex—4 (marked in pen) and Mood—3 (marked in pencil) and under II as Physical Activity—3 (pen) and Self-Image—2 (pencil), then your chart would look like Figure 8. Each day enter your score, and draw a line from yesterday's pencil dot to today's pencil dot and yesterday's pen dot to today's pen dot for each of the two columns.

The blocks along the bottom of the chart are for the placement of numbers that symbolize your major topic of thought during the day. For this section you make up your own list.

In the space below or on another handy piece of paper, list topics that you normally think about a lot. These things don't need to be in any particular order, the numbers in this case are simply a method of entering a topic in the smallest possible space. Your list may include such subjects as sex, money, politics, interpersonal conflict, family activities, personal growth, children, some craft, art, music, or area of personal study. This list should not include thoughts you have only been paid a salary to have, and which you would not have had otherwise. They should reflect your own, self-motivated, concerns. (Maybe you are lucky enough to be paid for your own concerns.)

You can add numbers (and topics) to your list anytime. Each day, after you have charted the four areas in I and II above, decide what topic occupied your thoughts most during the day and enter the number you have designated for it in the box for that date. You may find that you have only four or five things that dominate your thoughts. Or you may find you have twenty-five. The object of this part of the chart is to look for duplications of the same number and to determine if there is a regular rhythm in the intervals between days when you marked it. Also, you may very well find that there are corresponding points between certain subjects

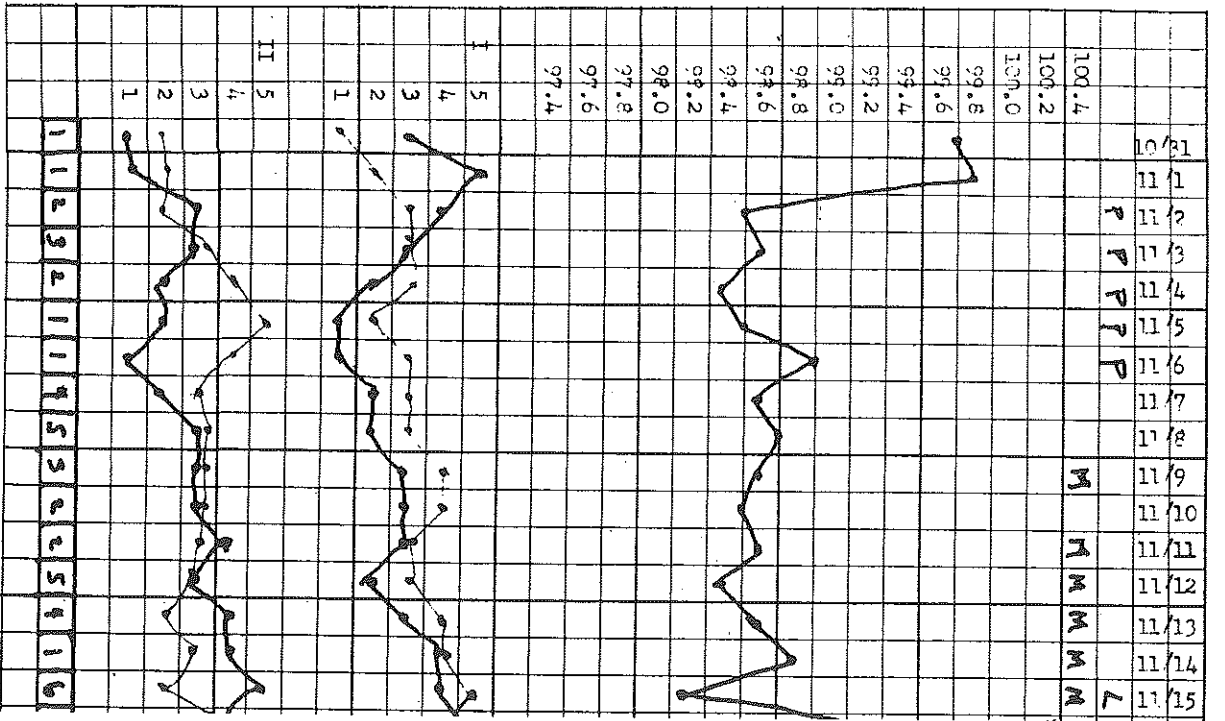
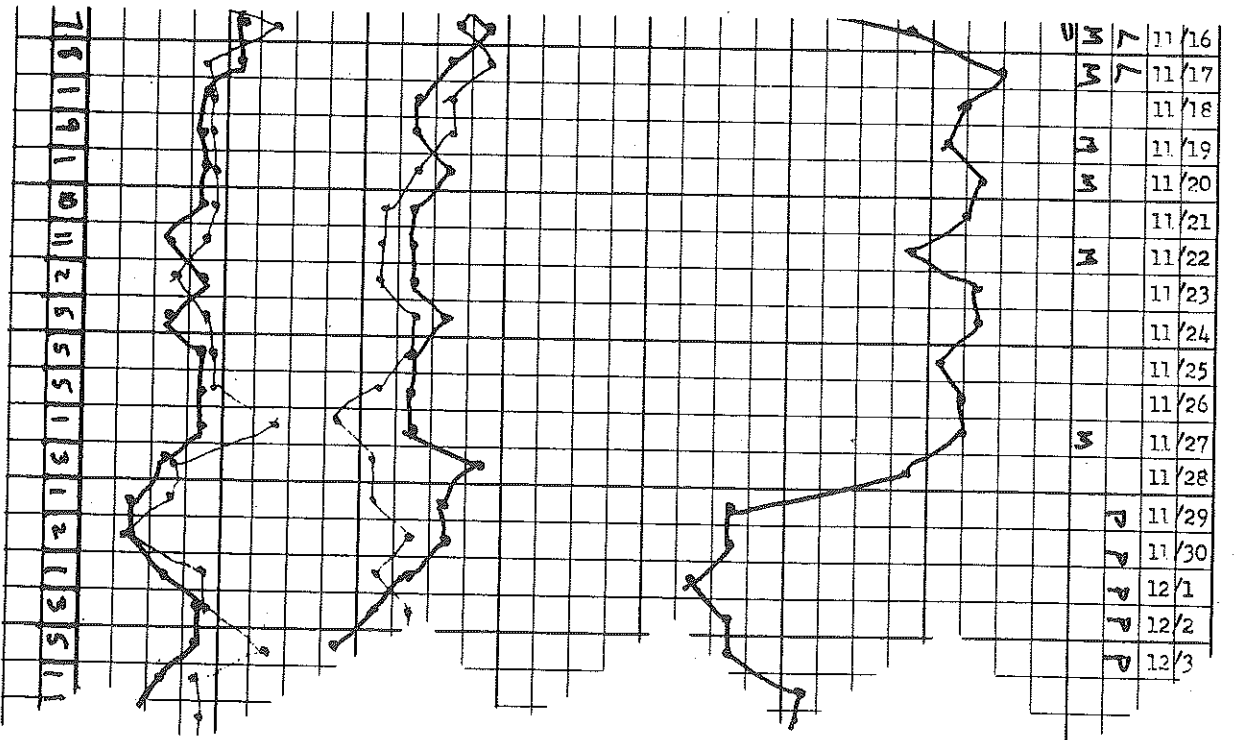


Figure 9. A typical chart. Yours

LUNACEPTION



will be different. That is all right.

PUTTING YOUR BODY BACK INTO BALANCE

of mental interest and high or low points in your temperature, physical activity level and/or any other of the matters you are charting.

Figure 9 is a sample chart, filled out, so that you can see an example of how the whole thing fits together.

List below your major areas of thought, and transfer the corresponding number to your chart, daily, as applicable.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15

USING YOUR CHART AS A PREGNANCY-AVOIDANCE TOOL

To know when sexual relations can safely be enjoyed without risk of pregnancy, you have to keep the following things in mind about conception:

1. In short cycles (e.g., twenty-four to twenty-six days) ovulation may occur prior to the middle night of the month.
2. In longer than normal cycles ovulation tends to occur at about the midpoint, whenever that is.
3. If you have been irregular (as most of us are) the

- lighting rhythm will make your cycles more regular.
4. Half of all conceptions follow sexual relations enjoyed before the lowest temperature recorded, and half occur following relations occurring between the low and peak temperatures, the following day.
 5. Twenty-four hours after you have recorded a rise that has followed a dip around the middle of your cycle, and twenty-four hours after your mucus has reached its peak, you are again safe.
 6. Sperm aren't likely to live more than thirty-six hours, and almost always (except in very exceptional men) cannot live beyond sixty hours. The ovum is fertile only for an eight-to-twelve-hour period.
 7. Your fertile period rests within a range of four and a half days around the day when you first turn the light on.
 8. Mucus reaches maximum fluidity and wetness at ovulation.

After you have established a regular cycle using the light, look back over your chart and add up the number of days in each cycle. If your cycle is twenty-eight or twenty-nine days long, you should turn the light on for the fourteenth, fifteenth, and sixteenth days of the month. You can consider yourself fertile from the morning of the twelfth until the morning of the seventeenth. If you want to find out more precisely when you are fertile, you can push up the schedule by a day at either end. But you may have a baby to show for your proof.

If your cycle is not twenty-eight or twenty-nine days after several months of using the light method, see if it hasn't settled into a regular pattern of another period, such as twenty-seven or thirty days. If this is not the case, look for a pattern of ovulation from month to month. Did you record a phase shift a certain number of days after or before menstruation? Did your mucus reach its peak in a recognizable pattern month after month?

If you are still irregular, check for sources of light pollution again. Is your husband getting up in the middle of the night and turning the light on? And check your diet and/or sleeping and eating patterns. Regularity is beneficial to health on all levels, and irregularity can throw off the body's rhythms.

If you are regular in habit, have a good, nutritious diet, and are following the instructions given above, and you are still irregular, you should check with your doctor because gross cyclic irregularities can be an indication of illness.

You can count on being fertile three days before the phase shift shows on your chart—and the mucus reaches its peak—and two days after that. That means that you should not have unprotected sexual relations the two nights prior to first turning on the light, and during the three nights the light is on.

Appendix

APPENDIX
Miscellaneous
*Exhortations, Reminders
and Sidelights*

Avoid aspirin use before and during menstruation and at midmonth. It interferes with normal prostaglandin production.

A woman in an unlit rural area may find she is already synchronized with the lunar phases. In that case she doesn't need the light regimen. She already marks the new moon with menstruation and the full moon with ovulation.

There is some evidence that LSD and mescaline can induce ovulation if taken near midmonth. These drugs have an anti-serotonin effect, and should not be used between days ten and seventeen.

Masters and Johnson have said that some women—a very small number—*sometimes* ovulate when they have an orgasm. You can find out if you are one of these exceptional women by keeping a close watch on your temperature chart. A temperature dip after orgasm and a sharp rise thereafter would be the indication, especially if it happens more than once. If you are one of these women, you will need more protection than Lunaception can give you.

If you are coming off the pill, you may ovulate more than once a month for several months. While the lighting schedule should bring

you back to normal within a few months, it is important for you to use another efficient form of contraception, such as a diaphragm, until you are sure your body is back to normal.

Any woman wanting to apply the Lunaception concept to the practice of conception avoidance should use another form of contraception until she has firmly established a recognizable pattern in her cycles. Times of heavy emotional stress, crossing time zones, and drug use all may throw the pattern off. During those times the mucus test must always be used as a double-check, and particular attention paid to all the body's signals.

I do not recommend hormonal manipulation of any kind as a birth-control mechanism. I won't use it again myself.

Vitamin supplementation with B and E, as described in Chapter 1, is good for regularizing reproductive health and normalizing sexual glandular function.

Any contact between the reproductive organs of any fertile man and woman around the time of her ovulation can conceive a human being.

It is a good idea for a woman to share with her man, on a regular basis, her knowledge of her cycle and some of what the chart shows. She does not have to explain those things that are very private to her. This way he participates in the responsibility for the decision to conceive or not to conceive.

You can put all kinds of things on your chart. It can be a real reproductive diary. The longer you think about it, the more things you will want to record. It will finally reach a point where the time expended does not justify the results.

The sperm of some men—it is not known how many—can live in the bodies of some women—again, the proportion is not known—for as long as a week. So far as is known, ninety-two percent of all conceptions take place between Days Ten and Sixteen. This figure includes all light-polluted women, of course. The normal lifespans of human germ cells are eight to twelve hours for the egg, and thirty-six to sixty hours for the sperm. Thus, if the sperm are introduced into the woman's body at any time from two and one half days before ovulation until twelve hours after ovulation—a period of three days—the possibility of conception is good.

The mucus test should be done late in the day, rather than early.

You may want to abstain from sexual relations entirely for a month in order to recognize your own mucous secretions as separate from your man's semen. Once you have come to recognize your own, you will not then confuse them.

The use of Lunaception as a method of conception avoidance shares a similar problem with the other forms that require an act of will: The will has to be there.

Some women who use Lunaception have reported that their cycle length increased or decreased for several months until they fell into step with the moon, after which they followed a regular twenty-nine day cycle, in time with the moon's phases. The women so reporting are those who have used the method the longest. It may be that this will happen in most cases. I don't know.

Don't be afraid to touch and understand your body. It is your primary right in life.

You can use Lunaception to chart your rhythms and understand your place in the cosmos without committing yourself to using it as a conception-avoidance method. Simply keep your chart as usual and also use some form of contraception other than the pill or one of the other hormones.

Sleeping in the dark during menstruation may make your periods shorter and correspondingly heavier. Many women have had their duration of bleeding cut in half.

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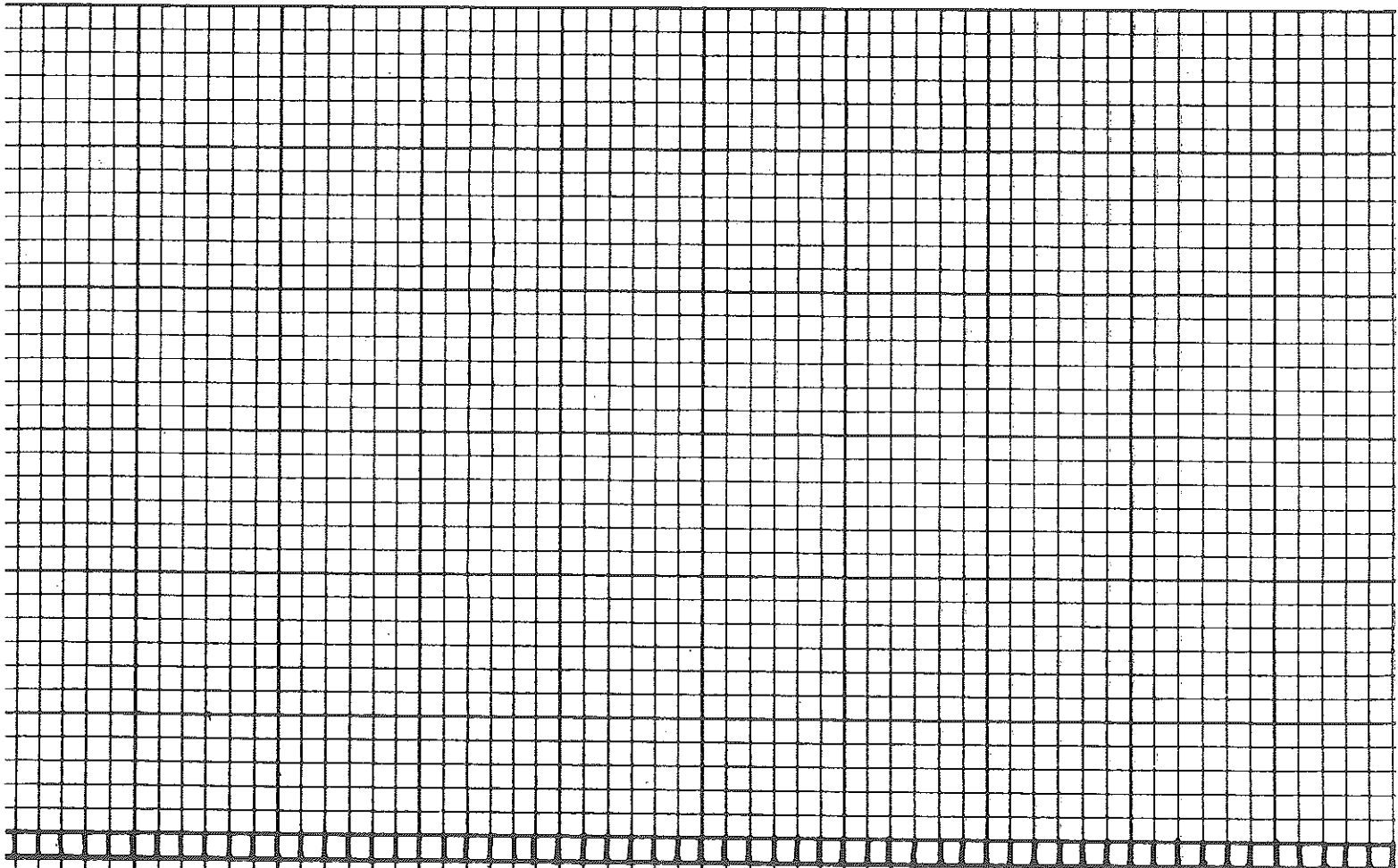
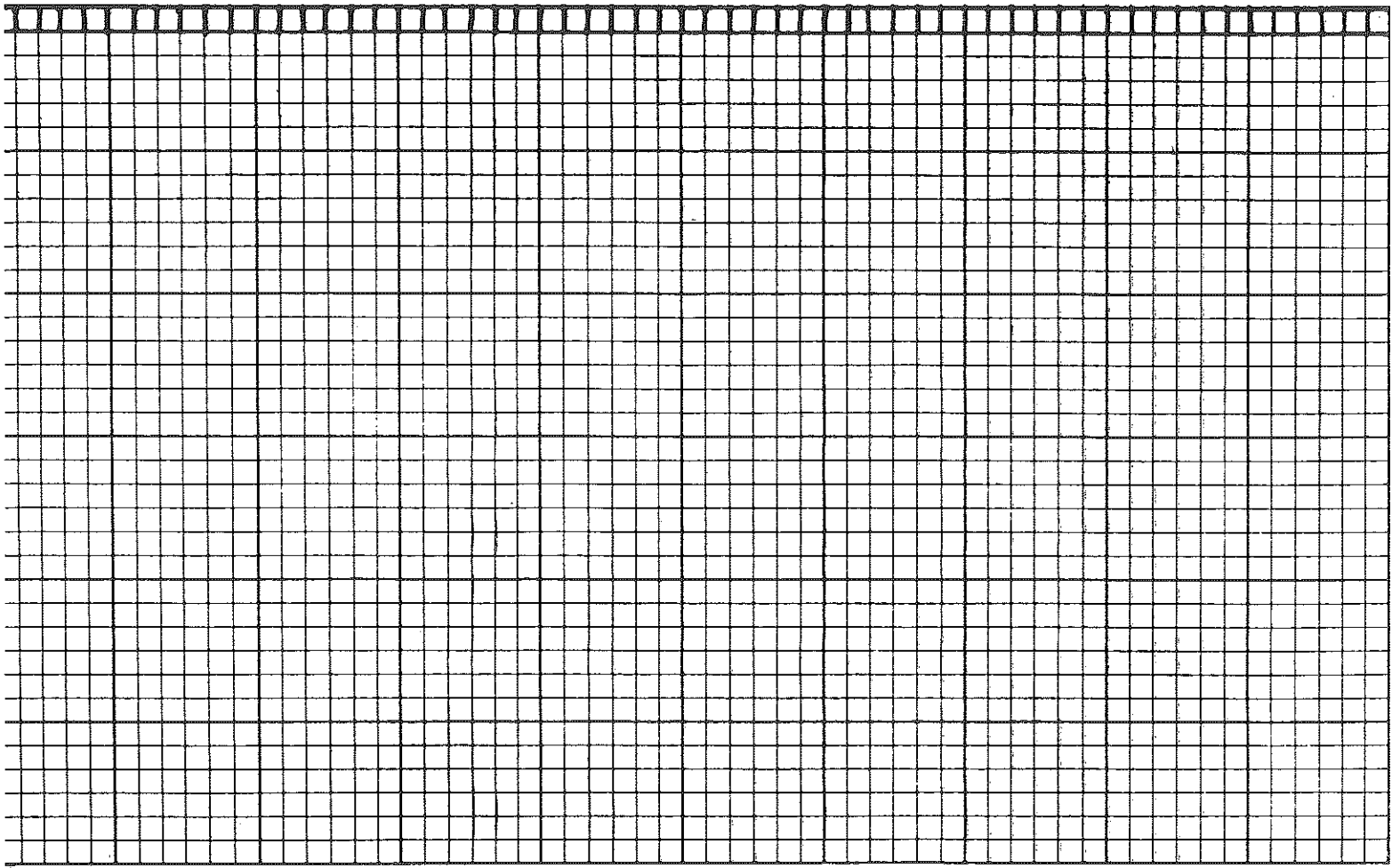
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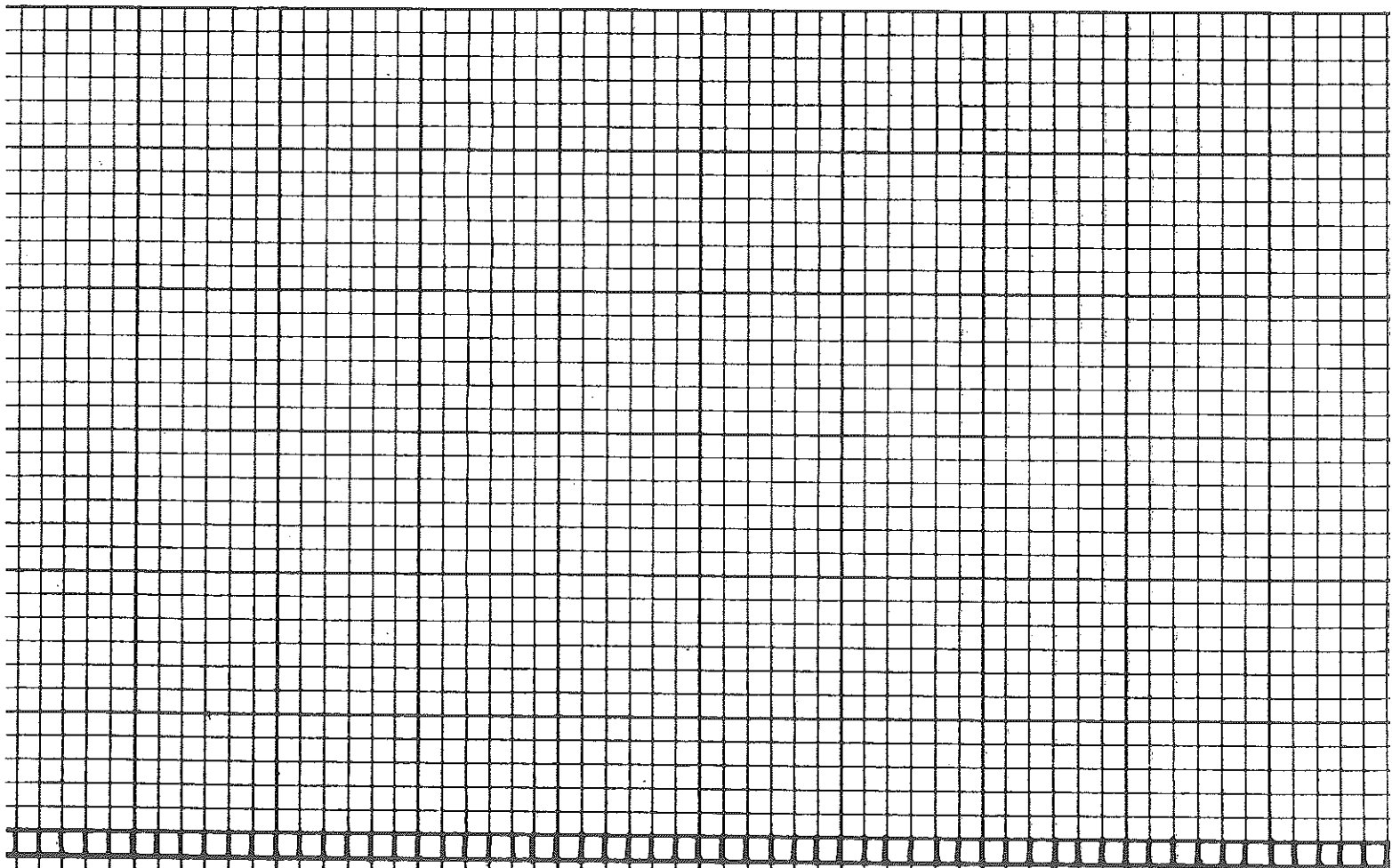
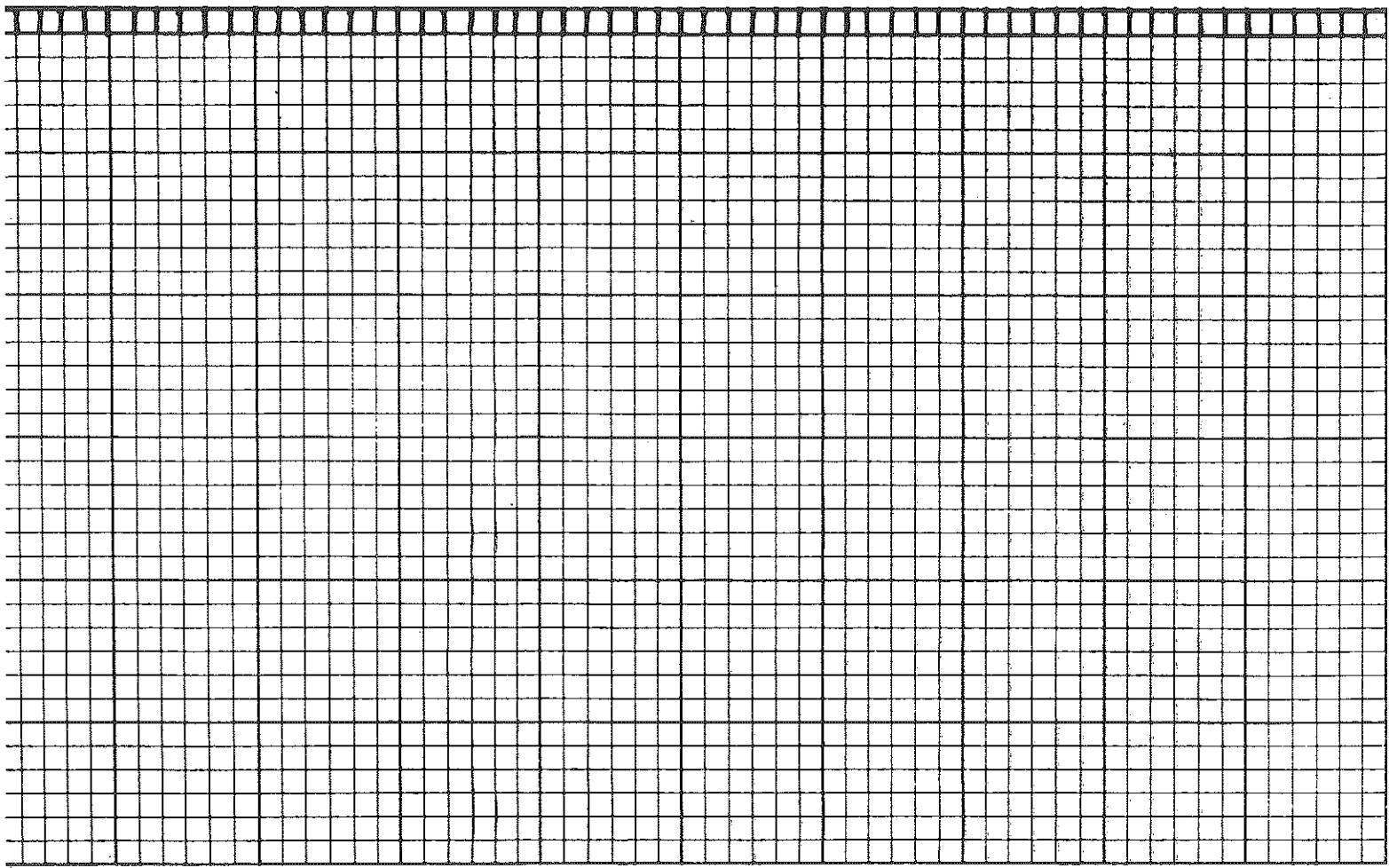
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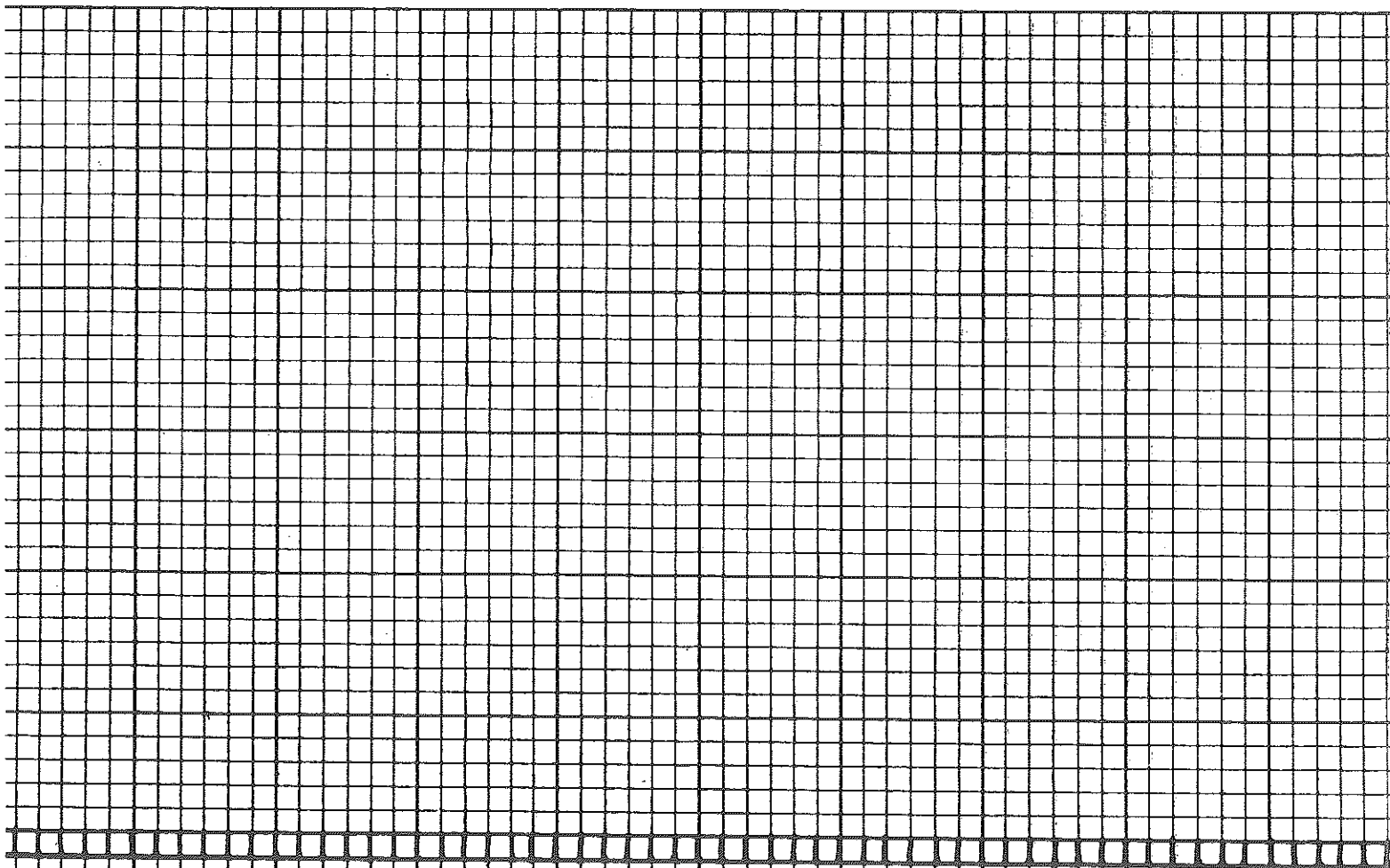
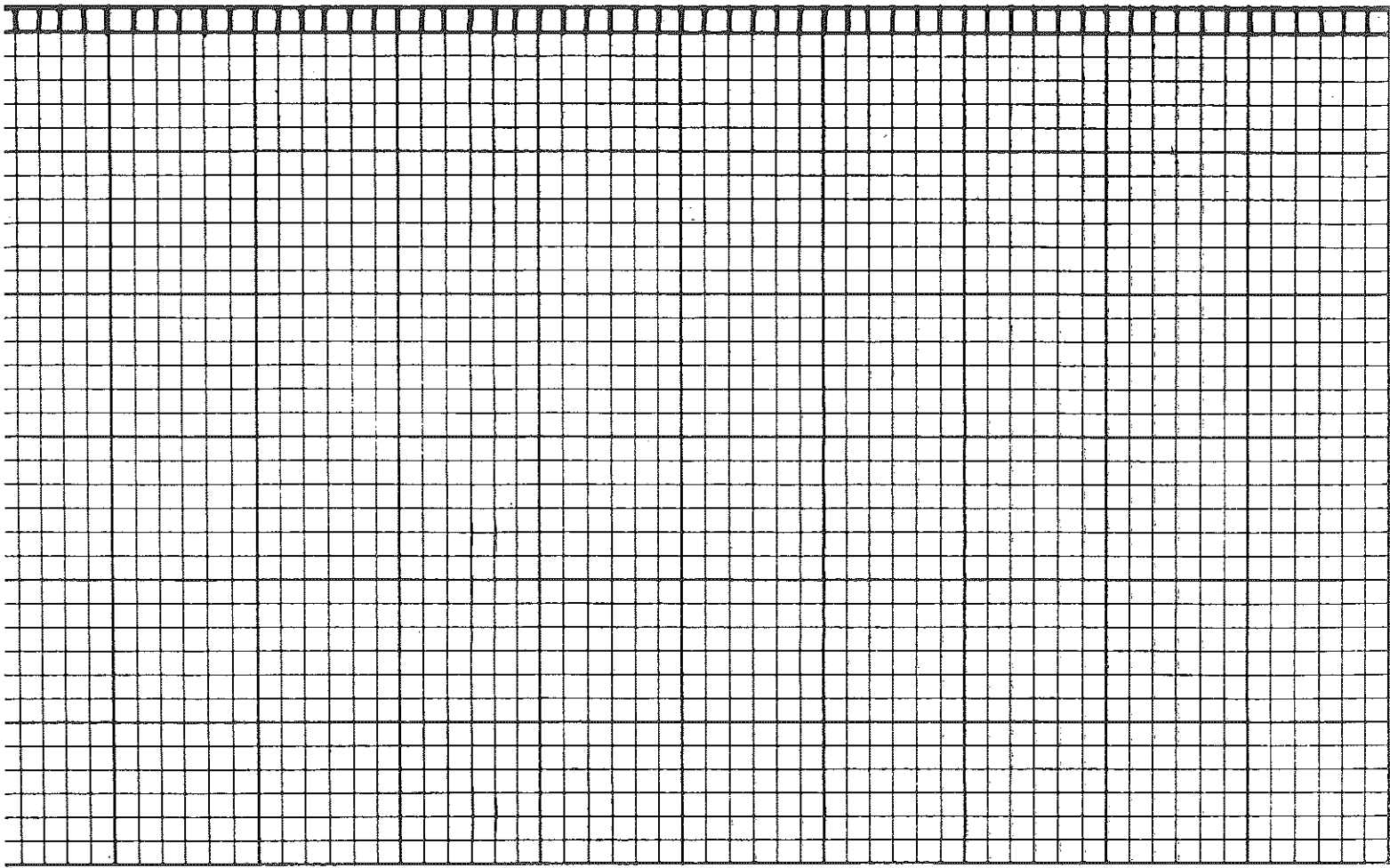
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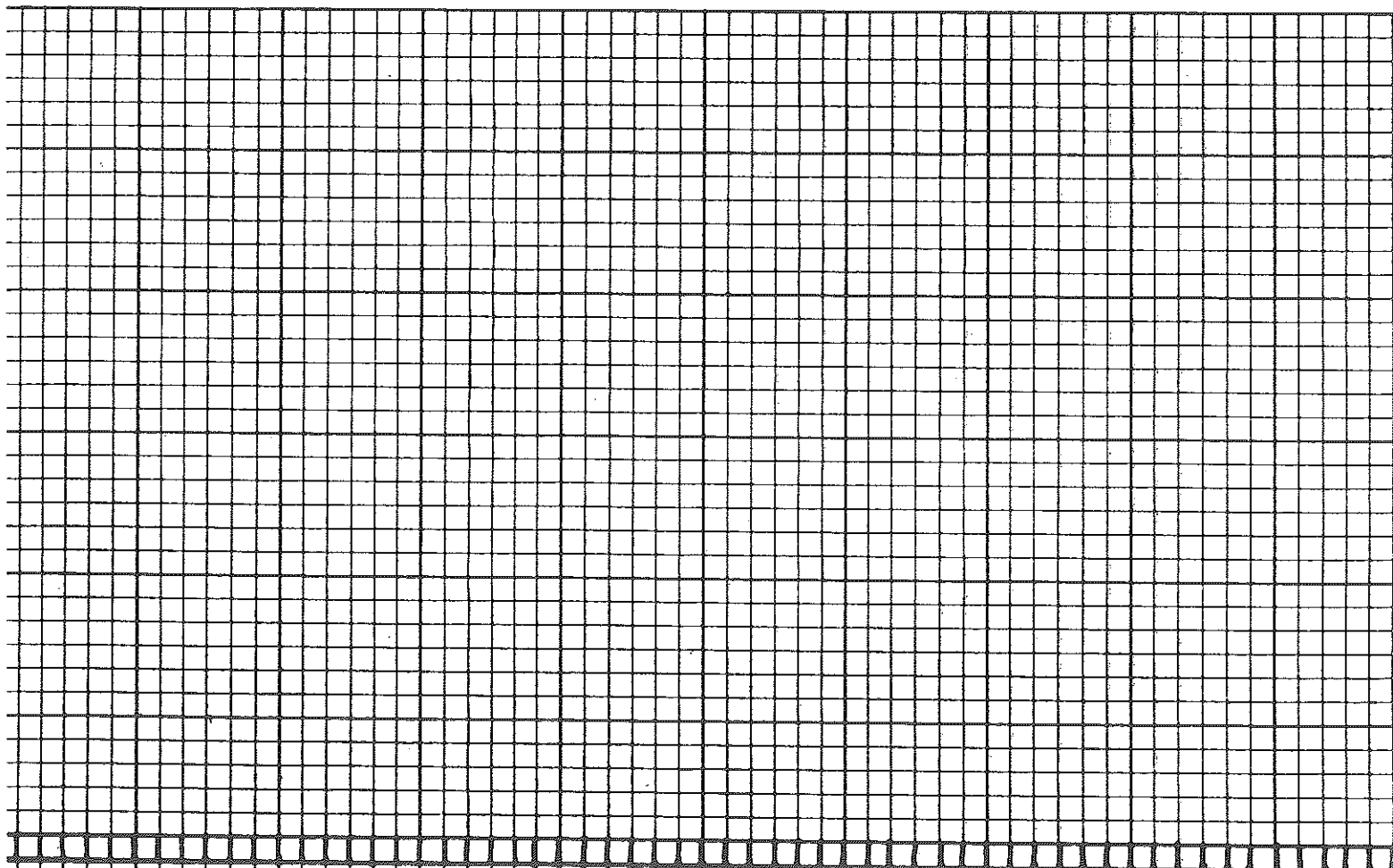
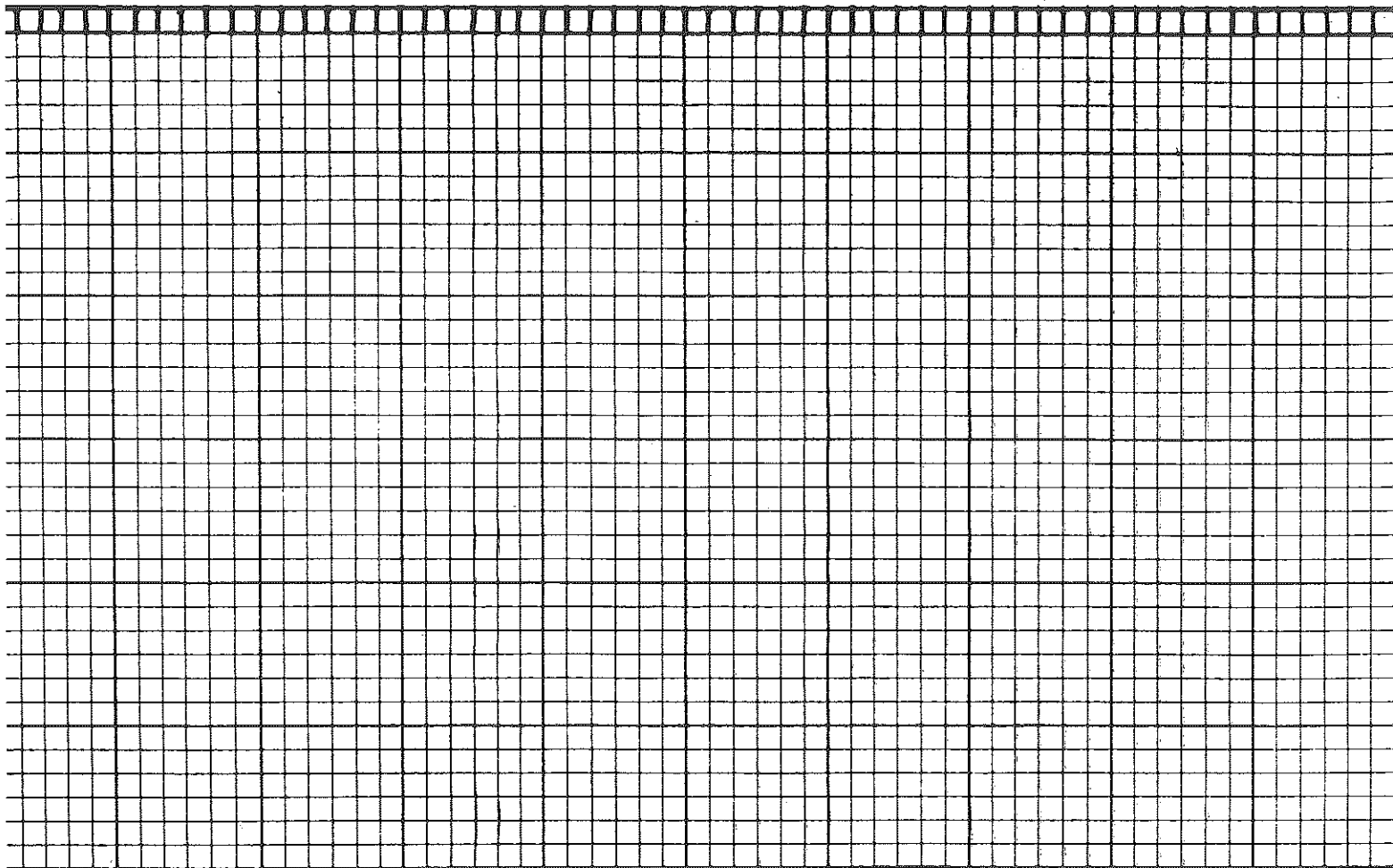
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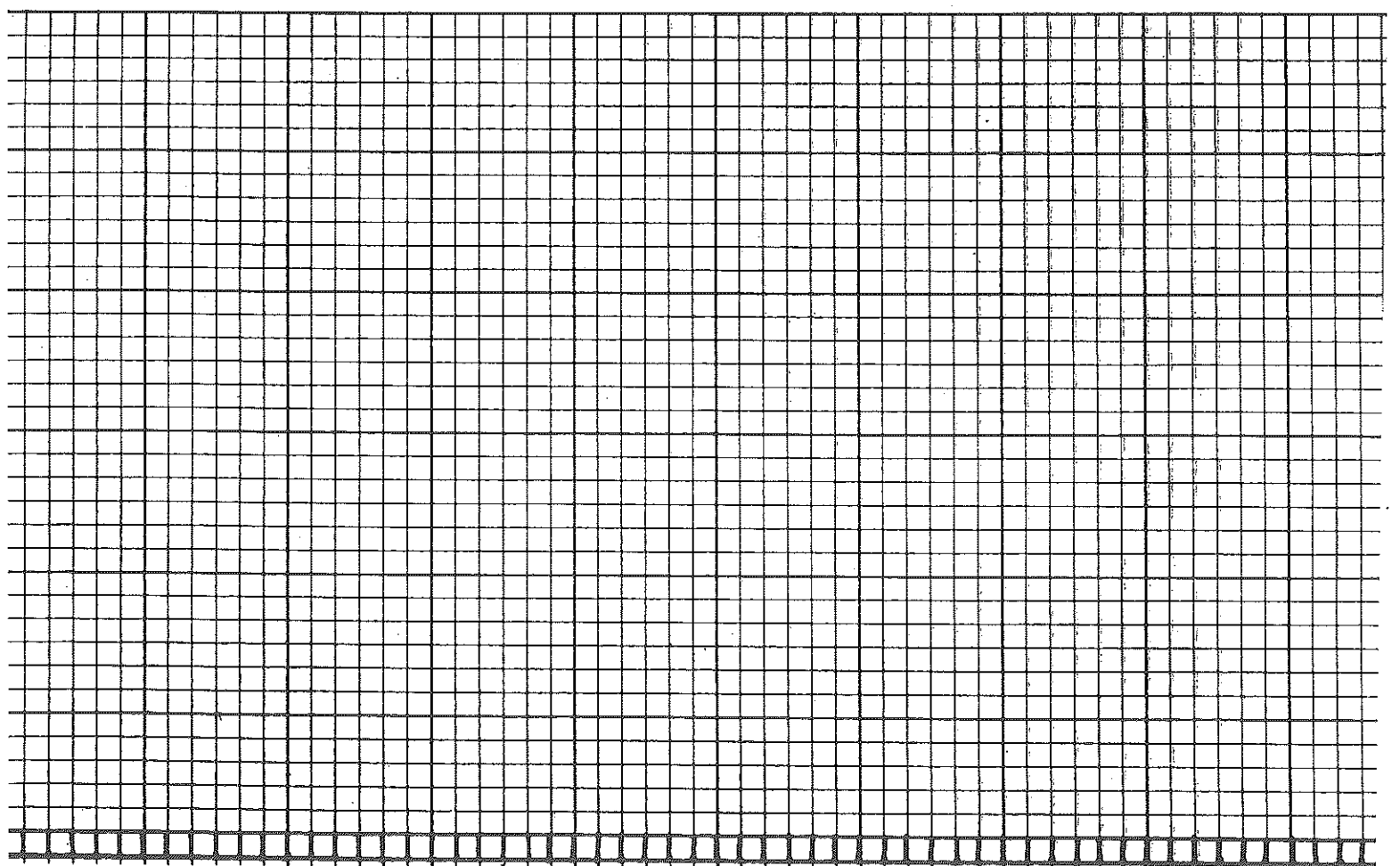
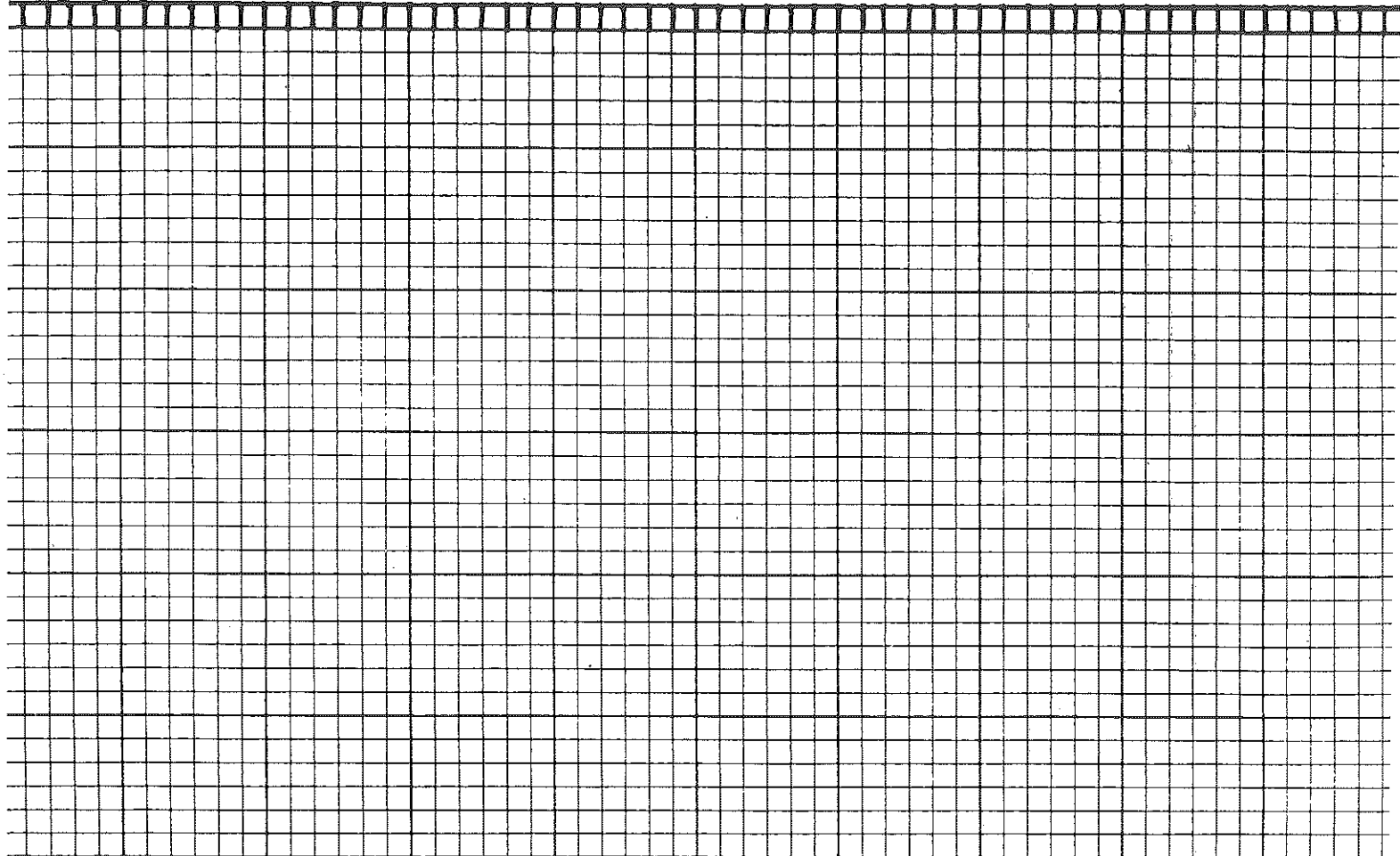
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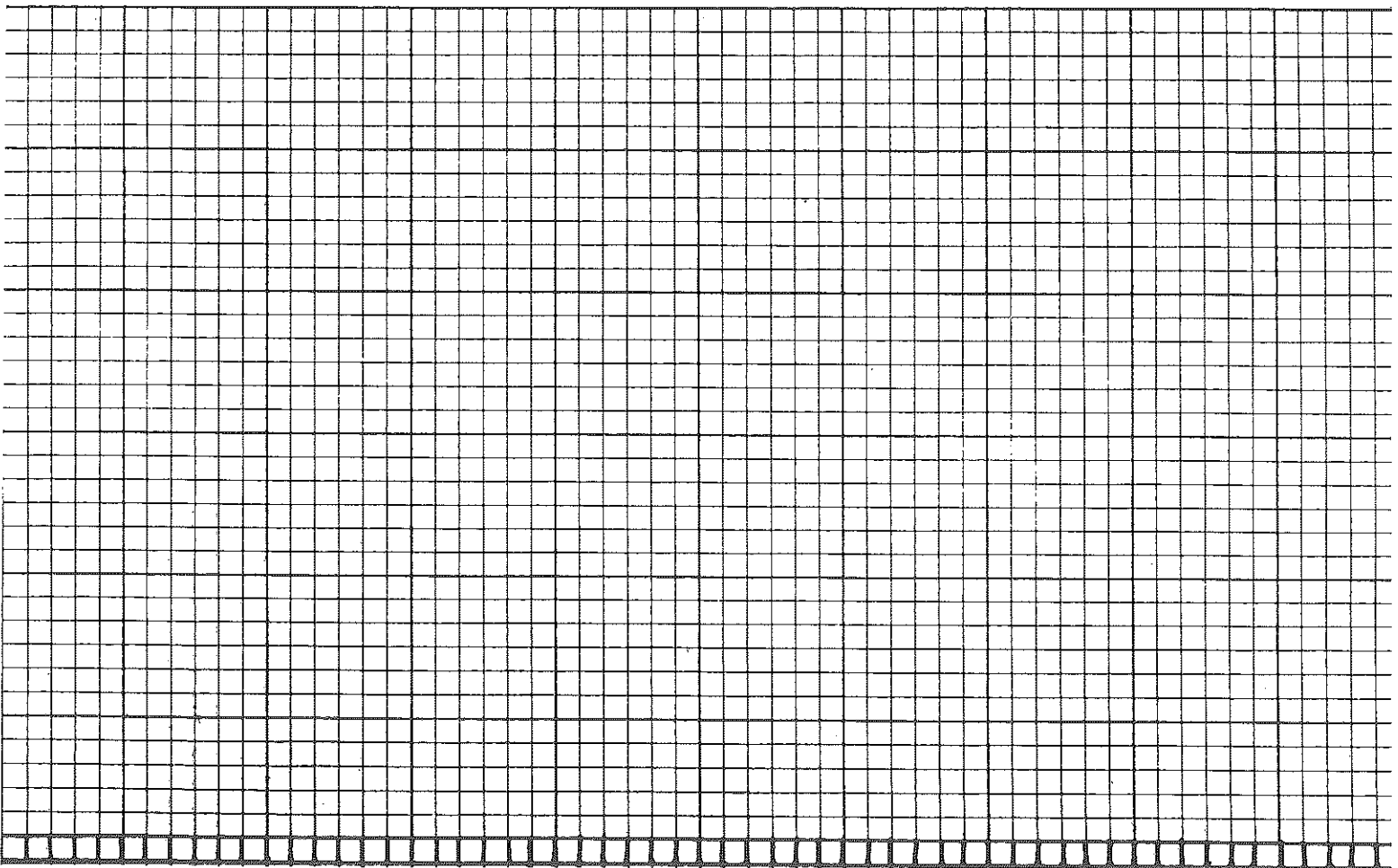
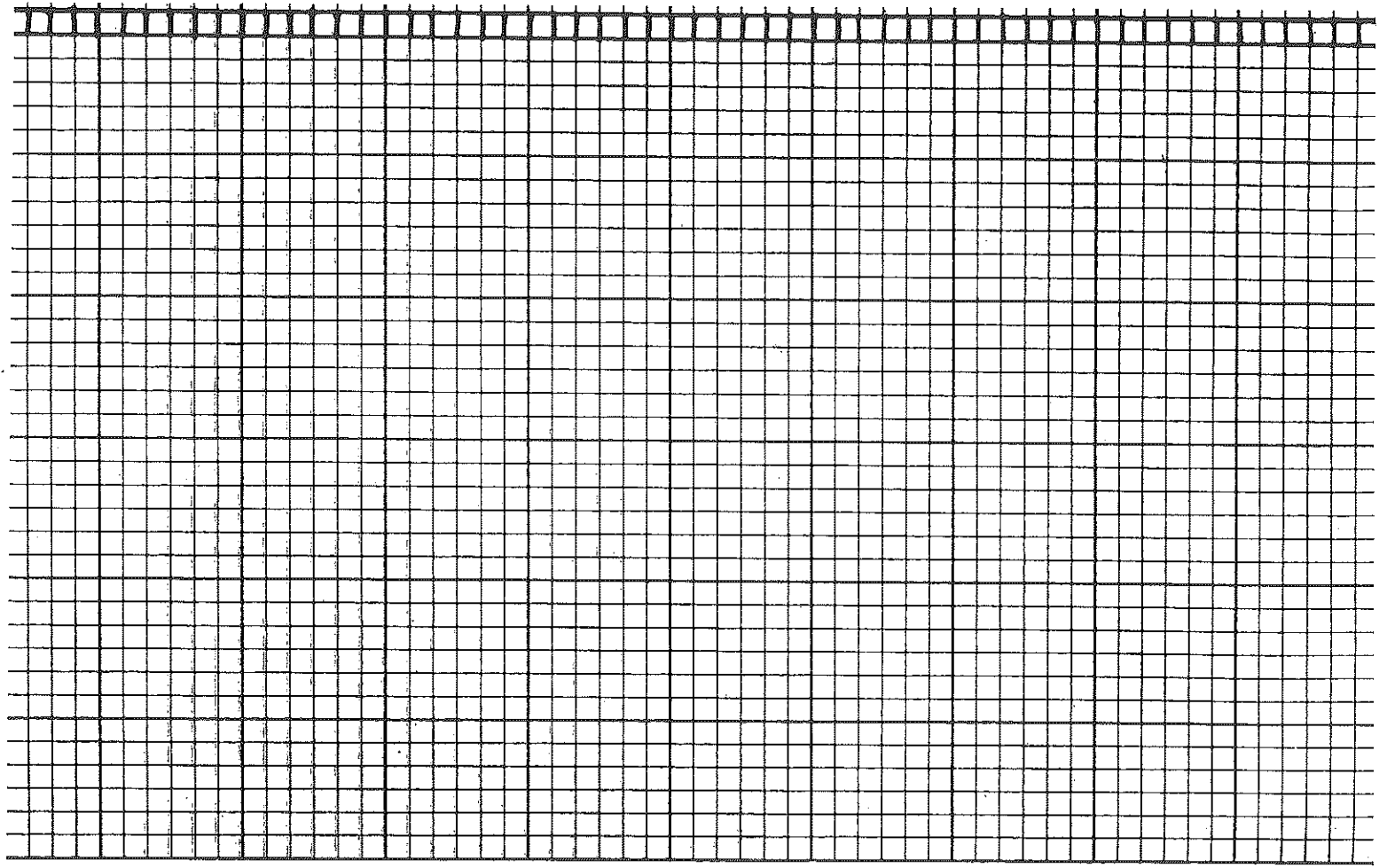


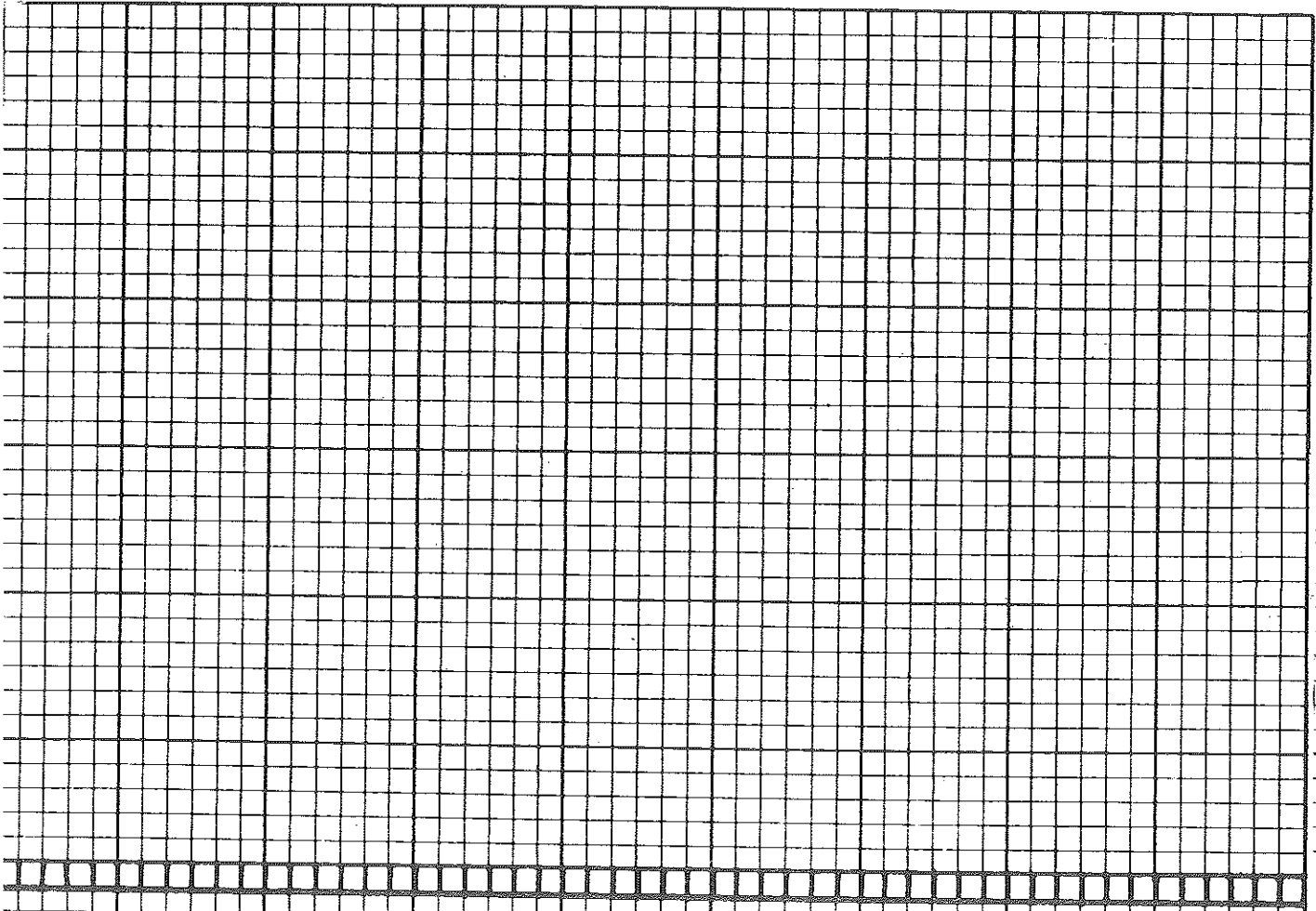
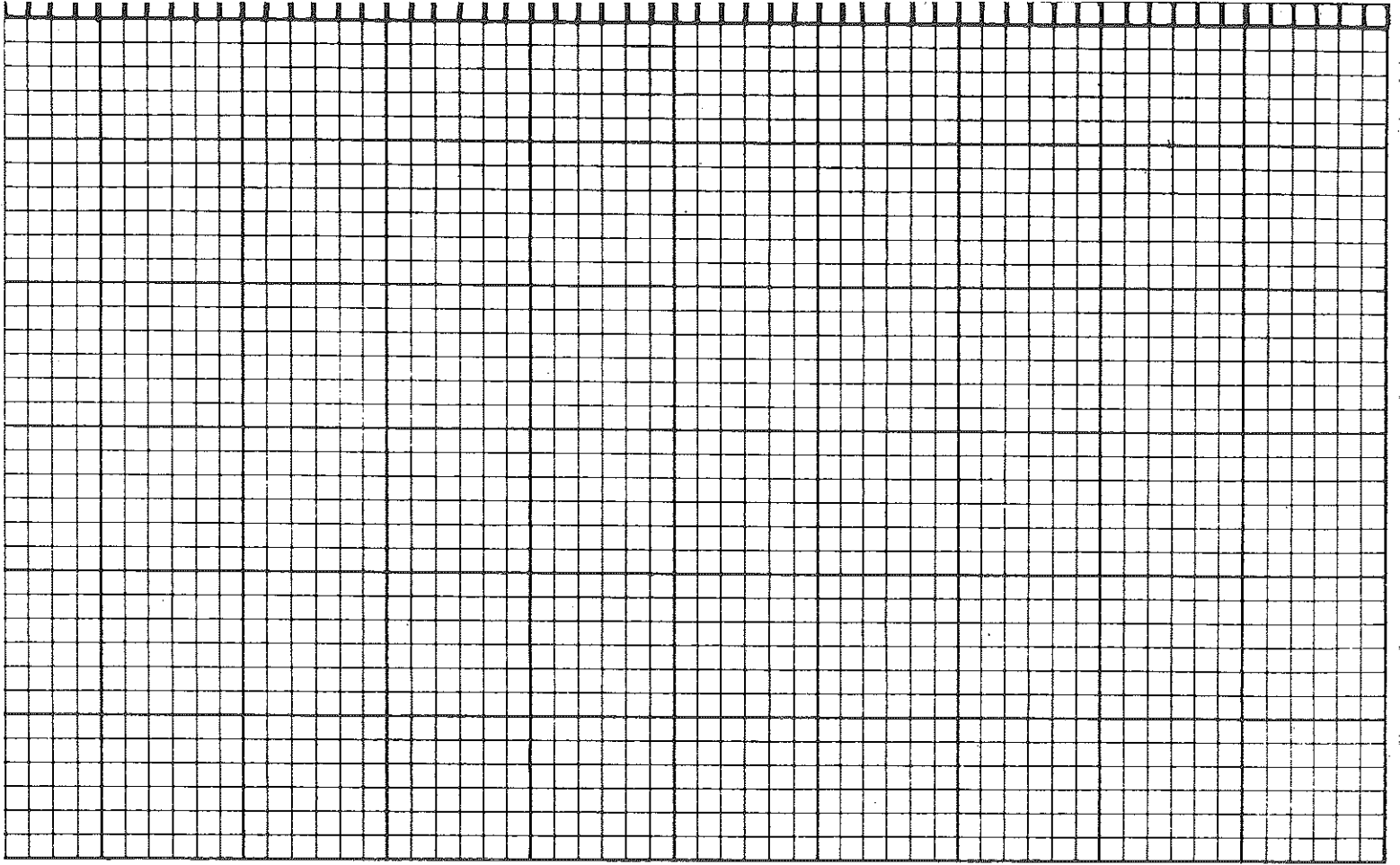












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