

**MCDB 150 Global Problems of Population Growth
Lecture 1 Notes**

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BRING A SKULL

VESALIUS SLIDE 1

This is Global Problems of Population Growth
MCDB 150b

The course takes a very broad view of human population dynamics and we look at it from a great variety of perspectives.

The first 3 lectures discuss animals and have a socio-biological orientation.

After that it's all about humans.

We look at what archaeology and anthropology have to tell us.

Then we look at the problem from an historical point of view, a demographic point of view, an economic point of view.

We end up with an environmental point of view.

What level this course is aimed at? There is no particular level.

Basically, no other course covers anything like this material.

So there is no course that can be required as a prerequisite.

I think the course is as comprehensible to a Freshman Art History major as it is to a Biology Junior or an Environmental studies Graduate Student.

The only prerequisite is to be interested in the topic.

As you can see, the course is being recorded in High Definition for international distribution.

The course will be one of the "Open Yale Courses", funded by The William and Flora Hewlett Foundation.

So, this is exciting, but you and I are supposed to ignore the recording.

The class should be as normal as possible and you should have the unique experience that is teaching and learning at Yale.

I am happy to answer questions during the lecture.

In fact I encourage you to ask questions.

However, since we don't have microphones for all of you, your voices will probably not be heard.

So, I'm supposed to remember to repeat any question that you ask.

But I know that I forget, often. So, please, please –

if I don't repeat your question, call out to me to repeat it.
Equally, if you ever can't hear me for any reason – please shout out.

BE RUDE!

I will work very hard to provide you with Pearls of Wisdom

But if you can't hear me - it doesn't do anybody any good.

I tend to speak fast and deliver a lot of information.

If you are busy taking notes – you won't really be able to listen to the flow.

So: my lecture notes will be posted on the web – almost verbatim.

MECHANICS

Reading List is on the web.

Reading packets at Tyco. Ready one at a time.

EXAMS:

Two Midterms and a Final.

Each midterm (25% of final grade each) will cover material on the preceding 1/3 of the course.

The first half of the Final exam will cover the material from the last 1/3 of the course (25% of final grade). The second half of the final will contain comprehensive questions (25% of final grade).

In the past students have preferred the 2 midterm system

- a) It moves time of the midterms so that they don't conflict
w/ midterms in every other course.
- b) Each midterm covers only 1/3 of the course,
so there is less material to study for each midterm.
- c) Most important, it prevents the final from being a do or die exercise.

Rather than having almost the whole grade dependent on one exam

- the final, you have 1/2 of your grade in the bag just after Spring break. That takes a lot of pressure off you on finals week.

Students have the option of submitting a paper of 10-15 pages (double spaced) instead of taking the second half of the final (25% of final grade).

Due Date: A Last Day of Reading Period (April 30, 2009).

That's a few days into reading period and gets the deadline away from the crush of all the papers that are due at the end of reading period.

Short essays. 15 minutes. Major topics of course.

Exams straightforward. Not fancy. 5 of 7.

There will be discussion sections starting next week. More on that next time.

DISCUSSION SECTIONS

Everything we cover in the course is controversial.

We're going to cover sex and violence, women's status, the practices of other cultures and birth control and abortion.

In fact we're going to touch on almost all the hot button issues of today.

I usually won't have time to present all sides of each issue and each day some of you will disagree (or even be angry) at the tack I've described.

In fact, I hope to make at least some of you upset every day.

That's great.

That really makes you pay attention to the material.

It's a pedagogical technique.

I can only guarantee that different ones of you will be upset on different days.

The sections are places where you get your chance to argue out all these issues.

There's no PC in the course.

I want you to get enough information from the course to either support your previous points of view or to change them.

The only important thing is for you to be able to back up your opinions with good solid information and arguments.

It's NOT a good course for people who want a science gut.

There is a lot of really fascinating material to cover

But because of the volume of material, it's not an especially easy course.

On the end of term evaluation forms,

the students in past years have rated the amount of work in the 4th category:

'somewhat above average'.

Today I want to start off with a few stories from the newspapers.

Tehran:

New York Times 11/5/00

One afternoon, Fatima Eskandari opened the front metal gate of the shelter she runs for runaway girls in central Tehran and was confronted by two men armed with knives and rifles. "Who are you", she asked. We are the uncles of a girl named Ranach. We were told that you are keeping Ranach.

Indeed, Ranach, a 16 year old, was inside nursing the bruises she suffered at the hands of these same uncles. She had run away from home to escape them.

The uncles had driven from Sanandaj in the northwest corner of Iran, hundreds of miles away. They demanded to see their niece.

The uncles said she had shamed the family by leaving home a few days before. They had come to behead her.

Staten Island New York.

A 17 year old girl worked as a cashier in a convenience store. The store-owner said that the girl was stealing from the register and he was going to fire her. The girl went to her father and said that the store owner had groped her.

The father flew into a rage, grabbed a baseball bat and gun and went down to the store and killed 2 people.

Islamabad, Pakistan

"Zahida Perveen, 21 years old, was pregnant in 1998 when her husband, Mehmood Iqbal, bound her hands and feet with a rope.

First he shoved a rod in one of her eyes, blinding her, then cut off her nose and ears. He suspected her of seeing another man."

Tuscaloosa, Alabama NYT 9/28/98

Felecia Scott already had two sons – but she had an obsessive desire to have another baby. She convinced her boyfriend to help her get one. So they went out, shot a pregnant woman and cut the full term fetus from her womb.

Saudi Arabia NYT 1/4/08 p1

A young woman was raped by 7 men. She pressed charges. The Saudi court sentenced HER to 200 lashes. (A very large #).

Dominican Republic Crucita Medina is 18. She has been married for a year in which her husband José beat her constantly. She had the courage to separate from him, but she met with José after their separation when he asked her to talk. He took her to a desolate street on his motorcycle and they had an argument.

He grabbed a container he had filled with "the devil's acid" - a mixture of gasoline, hydrochloric acid, car battery acid, urine and other chemicals.

He threw it at Crucita.

The liquid disfigured her permanently. It burned her face, her arms, the right side of her chest and a portion of her legs.

She is still trying to bring her ex-husband to justice. IPPF Reaching Out 22: Spring '02.

Gosarigaon, Bangladesh.

NYT 6/24/00

"The village elders met under a litchi tree to put a value on Peyara Begum's grotesquely ruined face. A young man had become obsessed with her, but she was married and he was turned away. He took his revenge with sulfuric acid, to erase the beauty that had once enchanted him and to empty her life of happiness. Her cheeks melted. Her right eye was blinded and hollowed like a crater. The husband had to bribe the prosecutors before they would take up the case. Eventually, the perpetrators family had to pay \$3,000.

In 1999 174 acid attacks in Bangladesh were officially reported. Many more are not reported. The article mentioned a 13 year old girl who was attacked as she slept. Some victims die. Some are forced to marry their attacker, another was forbidden to come home until she allowed her husband to take a 2nd wife.

These stories are, of course, somewhat extreme. But they serve to illustrate the extremely deep roots, the extreme strength and emotionality of human male-female relations. It shouldn't surprise you that sex is not particularly driven by rational calculation.

Although these stories are extreme, they are just the tip of the iceberg of a very widespread phenomenon. In the long course of human history and across the world women are, in general, treated very badly. There is a huge amount of battering of females in the US and around the world. In a later lecture you will learn that there are about 100 million females missing in the world because they were either aborted, killed by infanticide or were allowed to die because they didn't get food or medical treatment anything equal to what their brothers got.

From a Biological point of view, this abuse of women seems really weird.

Males can only reproduce via a female.

Females are a male's only means to reproductive success.

In most species, males want their females to be as healthy, well fed, and well protected as possible.

But humans, in general, in almost all places and throughout history, have treated their females atrociously.

The last thing a male should want is a hungry, sick, abused female to carry his children.

The infants will be underweight or sick, the mother will die in childbirth.

The mother will be too sick or weak to take care of the children.

On the level of individuals, the level at which evolution works, it's a disaster.

Yet humans do that.

And, on the species level, can eliminating 100 million females be a good survival tactic?

Why do humans have this weird social system?

Basically, I found no sensible reason for this in the anthropological literature, the sociological literature the feminist literature, or anywhere else.

To make a long story short - to find a reasonable explanation I had to go way back to the beginning - In fact to the evolution of sex.

So that's the topic I'm going to start with today.

1. REPRODUCTION IS DIFFICULT

One day, I was sitting under a large Oak tree with some Forestry faculty.

The ground was covered with acorns.

I asked how many acorns that Oak Tree produced. The faculty did some estimation and came up with about 750,000 acorns a year. I checked the literature and found that a large oak tree can produce 500 pounds of acorns a year. Many sources said that an oak tree produces millions of acorns in its lifetime.
Heizer and Elsasser

Then I thought, how many of those millions of acorns survive to make a tree like its parent? Think about the millions of years that Oak trees have been in existence. If, on average, each tree produced more than one acorn that survived, the world would quickly fill up with oak trees. If, on average, each tree produced less than one, then oaks would die out and we wouldn't see them here today.

If the number of oak trees in the world has stayed more or less constant over the ages, the average number of surviving acorns must have been very close to one.

The same accounting holds true for fish, which put out thousand of eggs or elephant males putting out billions of sperms.

So for any species that is not, over the long term, either taking over the world, or dying out, the average number of descendants per individual is ONE. No matter how many eggs or sperms or seeds it puts out. No matter how much sex it has.

If any individual in a species leaves a lot of descendants – then that's telling you that other individuals are leaving no descendants. In fact, the vast majority of individuals of almost any species leave no descendants over the long run.

It is brutally difficult to reproduce.

To give you an example – take Genghis Khan. Genghis now has 16 million descendants. NYT 6/8/04 pF2 But how did he do this? By conquering a vast territory, killing the men and inseminating huge numbers of the women.

And that's just Genghis. The rest of the Mongol Horde did quite a lot of killing and raping also. Almost every army the world has ever known does a lot of this.

So it is very difficult to reproduce and evolution has fashioned a myriad of really strange behaviors by which an individual can try to succeed at reproducing.

It is brutally difficult to reproduce.

2. SEX IS NOT FAIR

Sex goes way back in evolution.

Even Bacteria mate. Two identical looking bacteria come together and can merge their DNA. The two partners are equal.

But when you come to higher organisms, you get a very different story.

SLIDE 1

Chickens have to spend their time and energy growing huge eggs.

Roosters contribute only an almost invisible speck of protoplasm.

The only part that most mammal males play in reproduction is to have a quickie. They do their thing and then they're gone.

Meanwhile, the females bear the whole burden of pregnancy and child nurturing.

That seems unfair. Why can't the egg and the sperm be the same size?

Why can't males and females share the burden of childrearing equally.

Why has evolution usually created such an unequal system?

Well, going way back to evolution in the ocean,

Early organisms couldn't move themselves around very much. Many of them just floated in the sea. Others were stuck down on rocks or on the bottom.

How were they going to mate if they couldn't move around?

What they did was to just squirt their eggs and sperms (together called gametes) out into the sea and hope that they drifted into another gamete of the same species.

The problem is that, in the vastness of the sea,

Such a meeting would be an extraordinarily rare event.

So each parent would have to squirt out millions of gametes. But if an animal has to make millions of gametes, then each would have to be very tiny.

If two gametes managed to meet up, the embryo would start out as the sum of two really tiny things. The embryo would be eensy and would have a very small chance of survival. Bad solution!

Division of labor is a better solution. Let one parent be responsible for the spewing out of billions of gametes and let the other parent be responsible for packing a lot of food into a (comparatively) small number of gametes of reasonable size.

Bingo, you have a zillion small sperm and a few big eggs. You have male and female.

The sperms' job is long-distance travel to find the egg – they evolve a motile tail.

The eggs' job is to provide sustenance for the growing embryo – eggs evolve a lump of yolk.

The male would use up as much protoplasm in making billions of sperms as the female uses to make her few big eggs.

Equal Investment: still fair!

The catch comes once the species evolves the ability to locomote; the males and females can come into close contact. She can lay her eggs and he can deposit his sperm directly onto them. Or they can even evolve internal fertilization. In either case, he doesn't need to waste zillions of sperms.

This beginning sets up one of the basic motifs of sexual conflict:

To make big eggs, a female puts a lot of resources into each egg and she doesn't make a whole lot of them. Her eggs are expensive and rare.

Males, on the other hand, still make tiny sperms – only now they have a great surplus of them.

His sperms are cheap and plentiful.

Her eggs are expensive and rare.

3. SEXUAL DIMORPHISM LEADS TO DIVERGENT REPRODUCTIVE STRATEGIES.

What is evolution going to do with this excess of sperm?

Well, it could evolve backward so the male makes fewer sperm.

This would save him some energy, but wouldn't otherwise increase his number of offspring.

Or he could use the sperm to fertilize more than one female.

He could really increase his number of offspring.

Sperms are cheap and plentiful.

Eggs are expensive and rare.

It also sets up a situation where males are expendable. (NYT 8/14/07 F3)

A certain female wasp lays its eggs in a caterpillar. When they hatch, they all compete for the fixed amount of food which is the caterpillar's body.

Evolution has arranged that "the females kill off many of their brothers." "A few males are more than enough to fertilize thousands of female wasps. Any more males inside a host are just competition for their sisters."

We will see human echoes of this when we discuss the demographic insignificance of the loss of vast numbers of young men in warfare.

This sets up the war between the sexes.

Males have different evolutionary strategies from females.

Males can inseminate many females.

Females want to worry about the survival of each egg.

Consider humans: no matter how much sex a female engages in, she can have at most one young every year or two.

A male on the other hand, can fertilize an almost unlimited number of females.

Different evolutionary paths: Sexual dimorphism.

In many species, the female wants to be inseminated only by the male with the best genes.

The females want to choose the best male.

But sperms are so cheap to make that males don't have to choose only the best female.

They can mate with as many females as they can find.

And each female, once she's fertilized, couldn't care less how many other females the male fertilizes.

This doesn't mean that females are monogamous.

There are many reasons a female may want to mate with more than one male

1. To get resources from several males
2. To have offspring with a variety of genotypes because she can't tell whose genes are better
3. Or, in an unpredictable environment, whose genes are going to be better in the environment that's coming.
4. to allow each male to think he is the father so that he won't attack her babies.
5. to allow for sperm competition
6. etc.

Social & sexual monogamy.

A fair number of animals are socially monogamous.

That is they form pairs and stay together for at least one breeding season.

But now that we can do DNA testing of the offspring – we realize that these pairs are usually not sexually monogamous.

There is a lot of hanky-panky going on.

I read recently that there is only 1 species known to be 100% sexually monogamous. The male and female are physically fused together NYT 3/18/08

In all other species, 10% to 70% of progeny have been sired by someone other than the resident male.

A flatworm that lives in the gills of a fish. The bodies of the males and females physically fuse together – so they can't come apart.

So 1) Eggs are rare and expensive.

2) Sperms are plentiful and cheap.

MALES generally have to find and gain access to eggs.

Males have basically 2 strategies.

A. Make more and better sperm. Let the sperms compete.

This is basically the case for the first billion years or so of animal evolution. Early on, primitive animals live in the sea and just release their sperm into the ocean. The sperm from different animals compete to find the females.

B. Males can compete w/ each other for control of females.

This can happen once animals are mobile and can fight and control a territory.

Coral reef fish fight each other for territories and the access to females that comes with the territory.

In lots of land animals, the males fight each other for dominance and use the dominance to gain access to females.

4) FEMALES live in a world where they are offered more sperm than they can use.

They also have two basic strategies.

1) Get the male to provide resources other than sperm.

Nuptial gift (DUNG BEETLES). Ball rolling

Dung Beetle

Most extreme case is Preying Mantises. Ken Roeder, Nerve Cells & Insect Behavior

Mantis: Nature 4/10/03 p564 2

Here the whole male is the nuptial gift.

Female eats the male. MALE DOES NOT OBJECT.

Preying Mantis mother's warn their son's not to Lose Their Heads over some girl.

But the kids never listen

Here he is saying "take me, I'm all yours",

SLIDE B 3

She, being an intellectual, maybe a Yalie, proceeds to take him literally and cerebrally

And here he is, ABSENT MINDEDLY, copulating away till the end

SLIDE C 4

What a way to go!

Key is that this is a SPARSE SPECIES. A male, if he can find a female at all, he is lucky. He is very unlikely to get a second chance.

So, it's do or die.

It is in his evolutionary interest that the female have as much protein as possible to grow the most and the best eggs possible. Mantis Cartoon 5

2) So one important strategy of females is to try to get resources from the male.

The second strategy of females is to try to have her eggs fertilized

by the male with the best genes.

In order to do this, the female has to be able to control which male will fertilizes her eggs.

If a female just spews her eggs out into the ocean, she totally loses control of which male fertilizes them.

Insisting on a nest, increases her choice – as well as increasing the survival of her young.

One of the strategies females employ to gain control is internal fertilization.

We all love internal fertilization - it provides us with enormous amounts of fun.

It has many advantages: protects the fetus, allows the mother to provide nutrition and waste removal constantly, etc.

But it's also part of female control strategy.

With internal fertilization females gain a lot of control over which male fertilizes her.

Generally, if she doesn't allow a mating - it won't happen.

Very few species are capable of coercing an unwilling female into intercourse. We'll talk about rape in animals later.

In humans, females have a vulva.

The word is the same as the Latin word for valve.

If the female wants to mate, she gets excited. Her vulva swells to an open state and she secretes a lubricant which helps in penetration.

Behaviorally, she's receptive and helps the male by assuming an appropriate posture.

If any of these things don't happen – intercourse is difficult.

If the vulva doesn't become lubricated entry is very difficult.

In a real rape, the vagina doesn't lubricate and that's why there's a lot of lacerating and tearing of the vaginal walls.

Female arousal and the lubrication that follows is an evolutionary mechanism for female choice of mating partner.

So, how does a female know which male has the best genes?

She must have some mechanism for observing the males compete or knowing the outcome of an unseen competition.

In some birds, a hundred or so males will gather together in what's called a lek. They will dance furiously to attract the females and let them know how much stamina they have.

The females stand in a circle outside and watch the competition until they can choose a great dancer. They mate and then (in sage-grouse, for instance) the female lays and hatches the young and raises them up w/o any further help from the male.

For other species the physical competition may be violent. Males fight.

The animal who can do more violence becomes more fit.

(Fit only means 'has more offspring' nothing else).

The most violent male gets the female, or maybe a whole harem,

the loser gets nothing.

The females are then very happy to join the winner's harem.

Because that ensures that her children get whatever genes allowed the father to win his battles.

And thus increases the possibility that her sons will also become harem masters.

So it's evolutionarily advantageous for the females to choose the most violent males. Both male and female reproductive strategies collude in the favoring of male violence.

In evolutionary lineages where males fight with each other, the larger males are often the winners.

Thus, as evolution proceeds large males leave more descendants and the males of the species become larger.

They become bigger than the females. Sexual dimorphism.

This opens up a second strategy for reproductive success.

Instead of fighting it out with the other males, a male can be successful by coercing a female into sex.

If, indeed, males start being successful by violent coercion of females -

then it becomes evolutionarily advantageous for females to start choosing those males who are most violent against females.

So again, both male and female reproductive strategies can collude in the favoring of male violence. These strategies can favor not only violence of males against males - but also of males against females.'

The Great Ape line of evolution - to which we belong- seems to specialize in male on female violence.

Consider Rape:

Rape is the coercion of an unwilling female into intercourse.

Outside of mammals, there are only a few species where rape occurs: Scorpion flies are the best known: normal sex occurs when a male offers a female a dead insect or other food mass. After she accepts, she allows copulation to proceed. This is a classic case of the female demanding resources from the male as a prerequisite to copulation.

Sometimes in this species, sex happens in quite a different way. A male w/o an offering ambushes a female and she tries to escape the whole time while he tries to grab her with his genital claspers. The reading has a description of this.

In vertebrates, rape occurs in several species of ducks.

There are only 3 species of mammals where rape is routine:

elephant seals - Orangutans and humans.

Rape occurs occasionally in 3 other species:

Chimps, howler monkeys and (captive) Gorillas.

So, 5 of the 6 mammalian species where rape has been observed are primates, and 4 of those five are apes.

There are only 5 living species of ape - rape occurs in 4 of them.

These statistics are way out of the range of chance: there is something special about ape evolution that has led to rape.

It is probably the extreme unavailability of eggs!

It is extremely rare to find a female ape with an egg ready to be fertilized. Why?

Well, first, primates take many years to become sexually mature.

In Chimps and humans it's about 12 to 13 years.

Then, primate mothers have long gestation periods. 8 months in Chimps, 9 months in humans. Thus, just counting gestation and the recovery from childbirth females can have only one young a year.

But, then the females lactate for several years and go through lactational anestrus

(while they are breast-feeding, females usually don't cycle and so don't ovulate).

The average for Chimps is 4 years.

After that, Chimp mothers still stay with their young for another couple of years before resuming their estrous cycle.

The average birth interval for Chimpanzees is 5 1/2 years (Jane Goodall) or 6 years (Japanese group). For orangutans it's 8 years.

Gorilla females only have a baby every 10 years.

So you have a Chimp community with 45 to 55 individuals,

Maybe 10 or 12 sexually mature males - about the same number of females.

But only 2 of those females are going to get pregnant that year.

So, in the whole year – only 2 eggs are available for fertilization.

You can believe that a lot of male-male competition is going to happen

- some of it violent.

So one of the things we value most highly about primates - including ourselves - is the tremendous investment we put into child rearing. But that means that we are going to have very few children (compared to other animals) and that sets up the conditions for a lot of male competitive violence.

And that male-male violence spills over into male on female violence.

We belong to an order of animals called primates

Within this group, monkeys are our fairly distant relatives.

The group to which we belong are called the Great Apes.

There are a lot of similarities within this group.

→ORANG THAT LOOKS LIKE ME! 6

It doesn't take a whole lot of evolution to go from this (slide) to this (my face).

Which would you choose for an advisor?

I've seen this guy – he really makes his students think.

Chimp w/ finger in mouth

There are 5 species of Great Apes

---->Great Ape Tree Wrangham 7

Sequence of branchings.

Orangutans are farthest away from us, then Gorillas

Finally three very similar species - Chimps, Bonobo's (pygmy chimps), and Humans

All 3 species are 98.5% genetically identical to each other.

So we are genetically and evolutionarily right in the middle of the great apes.

How significant is the 1 –2% genetic difference between chimps, Bonobos and humans?

We don't know. You would have to be deaf, dumb and blind to not realize that chimps and humans are different. On the other hand the genetic difference between human males and females is also about 1 to 2% (HHMI Bull 9/03 p23).

So, on current knowledge, whatever you think of the genetic difference between chimps and humans, you must think the same about the difference between human males and females.

But, this genetic information is all very new and we will be learning a lot more very rapidly.

Any conclusions would be premature, big surprises are certain to come!

Each of the great apes has evolved a different social system with different forms of violence - and in one case almost no violence at all.

Orangutans are the least social of the apes. Mother and children are the only stable social unit. Offspring stay with their mothers until early adolescence, about 10 years. For most of the 8 years between births, a mother has no sexual interest in males. ---->

Orang mother and baby 9

Orang baby eating durian Slide 9

Two kinds of Orangutan males: A large one and a small one. The big males are about 90kg (200 lbs). The females and small males are less than half the size (40Kg=90 lbs). These males develop up to adolescence and then don't increase their size further nor change their features into those of a full adult: like beards, crests, throat pouches etc. But they are completely fertile with a normal complement of testosterone. They can stay this way for up to 18 years. They probably don't grow big until the dominant male in the region dies or is weak enough to be usurped.

When a female starts her estrous cycle again, about 8 years after her last pregnancy, she prefers to mate with a big male. In a mating between a female and a big male, sex is relaxed, it takes on a languorous, erotic quality.

Matings can begin with oral or manual manipulation of the partners genitalia, initiated by either male or female.

When they finally engage in intercourse, the couple often do it face to face, missionary style.

Coitus takes about as long as for humans - an average of 11 minutes up to half an hour.

The big males are ponderous - they can't move fast.

The females are light and can move fast.

They can easily escape from a big male.

But for sex they prefer the big males and do not try to escape.

What about the small males? They spend a lot of their life being unattractive to females.

They have only one advantage: they can go as fast as a female and can catch her. Mother evolution has gone to work on this raw material and used it to give the small males some chances to reproduce.

They catch and rape the females.

The females are usually alone with their young.

If they are found by a small male, they are chased and sometimes caught.

The females show fear and struggle to escape; the males sometimes strike or bite them.

The females scream, their dependent young scream –

they bite, hit and pull the hair of the males while the rape copulation is going on. The rapes last about 10 minutes.

One ethologist reported a range of mating behaviors, depending on how much the female resists. In this study, about 1/3 of Orang matings involve some degree of forcing of the female by the male. Japanese observers reported that 88% of copulations were rapes and that these were of the severe kind. A Dutch observer judges 1/2 of the copulations he saw to be rapes.

A woman primatologist reported that an Orang, who had lived with humans for a part of his life, actually raped one of the human female cooks at the camp. This was apparently full rape. The husband, unusually for Indonesian society, took it easily. Her husband reasoned that since the rapist was not human, the rape should not provoke shame or rage.

He said: "Why should my wife or I be concerned? It wasn't a man."

You may ask - if it is their aloneness that makes the females subject to rape by less desirable males, why hasn't a social structure evolved where the females stay close to the big males who can defend them??

The answer is, not a dense enough supply of food for a male and harem.

But in the closely related species, the Gorilla - the females do stick close to the males.

---->Gorilla Slide 10

Gorillas are for the most part quiet, relaxed and affectionate with each other. They live in stable family troupes with a single adult male silverback, 3 or 4 adult females and their offspring.

There is very little to no aggressiveness from male to females or among the females.

But, if one male controls 3-4 females, that means that there are 2-3 unmated males.

Again, what do the Bachelor males do?

They follow the breeding troops for months attempting to break in and get to one of the females.

The bachelor may be chased twice an hour and get into a fight with the silverback.

What he's trying to do is not usually to fight and defeat the silverback

- that would be very dangerous.

He just wants to prove to the females that their current silverback can't protect them.

He follows the troupe from the uphill side. When the silverback is not watching for an instant, he charges down the hill into the troop, he charges straight at a female with an infant – He grabs the infant right out of her arms and immediately smashes it into the ground killing it.

It doesn't matter if, after that, he is stopped by the silverback and repelled.

He has made his point.

Now, what do you think happens next.

These are smart animals that know each other as individuals and have long memories.

You would think that the mother would fear and hate the intruder for the rest of her life.

However, on the contrary, the female usually leaves the old mate within a few days and joins with the killer.

Here she may make a stable alliance lasting for the rest of her life – or he may lose her to another male in a few months.

These are not isolated instances, but the ordinary way of life. In Dian Fossey's site they had data on 50 infants. 38% of these died before they were 3 and 37% of those were from infanticide. About 1 infant in 7 overall dies from infanticide. Each female Gorilla has at least one of her children killed this way.

The females are trapped in a vortex of male-initiated violence. At any moment a male may come crashing through the jungle to kill her infant. Apparently, the best way for her to prevent the same thing happening to her next infant is to go off with the intruder and be protected by him.

She lives in a world of baby killers and she needs protection.

Chimpanzees have evolved to yet another solution to the primate reproductive problem of egg scarcity

Unlike Orangutans and Gorillas, the males are not solitary

Related males stay together in a lifelong community.

---->2 Chimp Slides

Chimps live in groups of 40 or so individuals with a dozen or so adult males and a similar # of adult females.

As with Orangs, chimp females spend most of their time alone with their young –

and they are not separated from their young until the young are several years old.

Chimp Politics – mother and young

The males defend a rather large territory within which the females range.

The males spend their time searching for food, patrolling the borders of the territory.

They are often with other males and they also visit the females to see if they have come into estrous.

The females come into estrous only about 6 years after their last young was born.

The females have 35 day cycles; are sexually receptive for 15 of these days.

A female is most fertile during the last 2 to 3 days of her monthly menstrual cycle.

Females advertise when they are receptive: by a dramatic red ano-genital swelling

Why? To get all the males together to compete w/ each other.

She mates (most) w/ the winner.

Her reproductive strategy is to elicit male violence.

When a female is swollen, she attracts a lot of males and the competition among the males becomes overwhelming, especially if the community's alpha male is not supremely powerful.

The females are herded about and have to run around to escape the clashes and chases of the males. They regularly receive wounds when they are chased or when they fall out of trees while they are escaping. And remember they are 50 feet up, so falling out of a tree is not a healthy thing to do.

The infants and juveniles are still dependent on her at 3 to 7 years, and try to keep close to her. But they can get hurt if they are caught in the middle of a fight.

So they keep away from her and they are alarmed and lonely.

The mating situation has so much violence associated with it, that when a male comes up to a female, she is not sure when he is going to attack or is going to try to mate.

He must give a very clear signal that he wants to mate.

So they have a rather spectacular display:

---->Male Advertising 11

Humans and penis cones:

---->New Guinea penis cones 12, 13

When a male does get to start copulating, it won't be long before the other males see this and rush over to interfere.

Hence, males have a very short time to complete the copulation.

Ejaculation occurs after an average of 15 seconds and 8.8 pelvic thrusts.

But, the females make up in quantity what they don't get in quality.

The females appear to be quite promiscuous in their sex partners.

In the community followed by Jane Goodall, in each estrous cycle,

each female had at least one bout of intercourse with every male.

They average 6 encounters a day (but this still is only 1 1/2 minutes)

100 or so bouts of intercourse in each monthly sexual cycle

Not known if females have orgasms.