

POKÉMON DNA IN SACRED PHOENIX

In Sacred Phoenix, the personality value of the Pokémon will be on 128 bits.

The personality value represents its DNA which, as in reality, will be present in 2 copies in the Pokémon's genes (a total of 256 bits).

The 256 bits are divided into 16 pairs of "chromosomes". When Pokémon reproduce, each one inherits one copy of each pair of chromosomes: one per parent.

The DNA serves as a "checksum" for the characteristics of the Pokémon and will detect if it is hacked.

List of chromosomes

Each chromosome actually works in pairs: a dominant (which determines the actual characters of the Pokémon) and a recessive (which affects its genetic diversity).

Chromosome #1 - Pokémon Lineage

10-bit size: 10 useful bits (1024 possibilities)

The lineage is different from the species. If the species matches the lineage, the Pokémon is not hacked on this criterion.

Bulbasaur, Ivysaur and Venusaur are for example from the same lineage and will therefore have the same chromosome.

This is the first criterion used to determine what will come out of an egg.

This chromosome never mutates.

The dominant chromosome will be that of the mother (or the Pokémon that acted as the mother). Mew or Ditto cannot pass on their species chromosome in case of hybridization, it will always be the partner's chromosome that will be passed on in full.

If the recessive chromosome is from a different lineage, the Pokémon is a hybrid and will be infertile.

The recessive chromosome is just used to detect hybridization. It is not involved in the genetic diversity factor.

Chromosome #2 - Pokémon Form

11-bit size: 6 useful bits (64 possibilities) + 5 random bits (genetic diversity)

Some forms depend on the conditions

It is therefore necessary to differentiate the innate forms (such as the letters of Unown, normal or Alolan Ninetales, or the flower color of Floette) from the acquired forms (seasonal forms of Sawsbuck, Mega-Evolution...)

The first one impacts the DNA, not the second one. It will be necessary to code a list of lineages where this chromosome will impact the forms or not.

It is the only chromosome that can mutate during the life of the Pokémon. This happens during certain evolutions that depend on the current climate (Ex: Alolan Exeggutor).

The dominant chromosome will be randomly one of the chromosomes (dominant or recessive) of the father or mother if both parents are from the same lineage. (A normal Vulpix and an Alolan Vulpix who mate will therefore randomly give their offspring one of their two forms. If both parents are of the same form but one of them is heterozygous, it will be one chance on 4 to see the second form appear). If there is a hybridization, the dominant one will always be the one inherited from the mother (otherwise it could give surprises on the form of the Pokémon).

Note: For the vast majority of Pokémons, forms are limited to 32 or less. (Only Alcremie has 63 forms, but this is determined during its evolution and not at birth). The first bit determining the form + the last 5 bits will therefore play a role in genetic diversity.

Chromosome #3 - Innate nature

11-bit size: 11 bits in all (2048 possibilities), payload modulo 25 (either 81 or 82 combinations for genetic diversity)

This chromosome has a high rate of mutation (1 in 2 chances of having at least one bit altered, the recessive chromosome can also mutate).

Thus, a baby has a 1 in 2 chance of inheriting the same nature as one of his parents. Otherwise of a "pseudo" random nature among 11 other possibilities. (Nature index offsets will be 1, 2, 4, 8, 16, 7, 14, 3, 6, 12, or 24 depending on which bit has mutated.)

Everstone forces the carrier's dominant chromosome to be inherited as dominant by his or her offspring, without mutation.

Since one bit can mutate, genetic diversity is established when at least 2 bits of that chromosome differ.

Note: a consequence of this division is that the last 2 natures of the database are very slightly less common than the others (81 chances out of 2048 instead of 82 chances out of 2048).

If the nature of the Pokémon does not match this chromosome, it is hacked.

Note that the game differentiates between the innate nature and the battle nature. The battle nature can be modified to alter the stats, but this does not affect the personality of the Pokémon (especially its taste preferences).

Chromosome #4 - Ability

8-bit size: 8 bits in all (256 possibilities), 5 significant, 3 insignificant (genetic diversity)

In Sacred Phoenix ...

- The ability n°1 has 128/256 chances to express itself (value between 0 and 127)

- The ability n°2 has 120/256 chances to express itself (value between 128 and 247)
- The hidden ability has 8/256 chances to be expressed (value between 248 and 255)

It depends on the value of this chromosome.

This chromosome has a 1 in 4 chance of mutating on 1 of the 5 bits of the payload. Genetic diversity is therefore established if at least 2 bits of the first 5 bits differ or if the last 3 bits are not all identical. Another consequence is that it offers a (slim) chance that a hidden ability will appear in an offspring of parents with no hidden ability.

Conversely, if a parent has a hidden ability, it increases the probability that the offspring has one too. (And even more so if both parents are.)

If the Pokémon has only one ability, its ability will be this one regardless of the value of that chromosome.

If the Pokémon has only one main ability, its ability will be this one, no matter if the value is between 0 and 127 or between 128 and 247.

If the Pokémon has no hidden ability, it will be ability #2 if the value is between 248 and 255.

If the Pokémon has an ability that does not match its species and chromosome, it is hacked.

Chromosome #5 - Shininess

8-bit size: 6 useful bits (64 possibilities) + 2 random bits (genetic diversity)

If a Pokémon is shiny lock, the first bit will always be 0.

If a Pokémon is shiny forced, the 6 useful bits will always be 1 (and its 6 IVs at least 12)

There are a total of 30 bits to determine if a Pokémon is shiny:

- The 6 from this chromosome (1 chance on 64)
- 24 for the stats (3 per stat): the eligibility is true if the most significant bit is on 1 or if the two following are on 1 ("or" inclusive). (About 6% probability, that is 1 chance on 16,77).

This gives 1 chance in 1074 if the chance is total.

During fertilization, the payload is susceptible to mutation (1 bit randomly altered with a 1 in 2 chance).

In case of Shiny Charm owned, the 6 significant bits and the IVs have the right to a second roll if the first roll is not shiny.

Note: IVs give a strong control to increase its chances of being shiny, especially via breeding (IVs are displayed in clear, so it immediately gives an indication to the player that the Pokémon has 6 "good" genes out of the 12 required. Pokémon with forced IVs will also have a significantly higher chance of being shiny, 3 guaranteed IVs between medium to perfect increase the chances to 1/262 (case of Legendaries), 6 guaranteed IVs between medium to perfect to 1/64 (case of Starter).

One of the major consequences of the shiny trait being dependent on inherited genes is that it greatly increases the chances of transmission. (2 shiny parents will have about a 1 in 4 chance of having shiny offspring).

If the Pokémon is shiny when the combination of its genes is not compatible, it is hacked.

Chromosome n°6 à 11 - IVs

Size 6×8 bits: 5 useful bits, 3 random bits (genetic diversity) per IV

The three most significant bits for each IV are also involved in determining shiny! (6×3 bits in all.) The 6 IVs must be at least 12 for a Pokémon to be shiny (about 6% probability in full random).

These chromosomes have a high mutation rate (1 chance out of 2 to have at least one bit altered on the payload, the recessive chromosome can also mutate).

Since one bit can mutate, genetic diversity is established only if 2 of the 5 bits differ, or if the 3 random bits have at least 1 difference.

In case of a "power" object carried by a parent, this parent will transmit its IV gene corresponding to the object for sure as a dominant chromosome, and without mutation.

If the Pokémon has IVs that do not match its IV genes, it is hacked.

Chromosome #12 - Sex chromosome

8-bit size: 3 useful bits (8 possibilities) + 5 random bits (genetic diversity)

In Sacred Phoenix, the vast majority of Pokémon are 50/50 sex ratio. A few rare cases are 87.5% female, like Combee.

This is the only chromosome whose "payload" is generated completely at random. Only the non-random part, inherited from both parents, is used to detect genetic diversity.

It also intervenes on the spots of Spinda (which for a reason of technical constraint will be limited to 16 combinations: 8 male variants and 8 female variants).

If the Pokémon is of a hermaphroditic lineage, this chromosome is ignored. The same goes for asexual lineages.

The 6 low-order bits are considered in the diversity, unless it is 87.5% one sex (in which case, it is the 5 insignificant bits).

If the binary gender Pokémon has a sex that does not match its chromosome, it is hacked.

Chromosome #13 to 16 - genetic diversity chromosomes

4×6 bits size: 24 random bits (genetic diversity)

These 4 chromosomes are just used to detect the genetic diversity of a Pokémon and do not interfere with its characteristics. If the dominant chromosome is identical to the recessive chromosome, there is inbreeding (with a 1 in 64 chance of a false positive).

As a result, there is never a mutation on these 4 chromosomes.

With the IVs and the current level of the Pokémon, these 4 chromosomes will be able to influence the size and weight of the Pokémon.

Fertility during reproduction

The objective is that inbreeding leads to a decrease in fertility.

Basic fertility (draw every 256 steps): 75%.

Oval Charm possessed: fertility $\times 1,5$

Divine Pokémon: 0% fertility (Divine blood - golden flower with Arceus crystals)

Undead Pokémon: 0% Fertility (Undead - dried up flower)

Juvenile Pokémon: 0% fertility (Juvenile - unhatched bud)

Chromosome n°1 different (hybridization) : 0% fertility (Hybridized - Frankenstein flower)

On the other 15 chromosomes, their dominant and recessive versions are compared:

0 identical chromosomes: 100% fertility (Perfect - flower with all its petals)

1 identical chromosome: 87,5 % fertility (Excellent - flower with 7/8 petals)

2 identical chromosomes: 75 % fertility (Very good - flower with 6/8 petals)

3 identical chromosomes: 50 % fertility (Good - flower with 5/8 petals)

4 identical chromosomes: 25 % fertility (Average - flower with 4/8 petals, minor inbreeding)

5 identical chromosomes: 12,5 % fertility (Low - flower with 3/8 petals, medium inbreeding)

6 identical chromosomes: 6,25 % fertility (Very low - flower with 2/8 petals, serious inbreeding)

7 identical chromosomes: 3.125% fertility (Near zero - flower with 1/8 petals, major inbreeding)

8 or more identical chromosomes: 0% fertility (Null - flower with 0/8 petals, total inbreeding)

The fertility of the two mating Pokémon is multiplied to determine the probability of an egg.

Mating of Pokémon of the same evolutionary stage and lineage: fertility $\times 1$

Mating of Pokémon with different evolutionary stages but the same lineage: fertility $\times 0.75$

Mating of Pokémon of different species but compatible: fertility $\times 0.375$

Mating of Pokémon of the same sex (except hermaphrodite): fertility $\times 0$

Mating of incompatible species: fertility $\times 0$

The original trainer or nationality of the Pokémon does not affect the fertility of the couple.