強者の戦略

１年間を振り返ってみて、「あっという間だった」と感じることはよくある、というよりもほぼ毎年そうなのですが、その“質”はどうかと問われると、高校３年間の、特に最後の１年間ほど充実したものはなかなかないように思います。私が「あのときもっとこうしていれば…」と悔やむとき、真っ先に浮かぶのは高校３年生の時ですが、多分それは、あの時期の自分の頑張りなら、もっと良い結果が望めたのではないか、という思いが燻っているからなのだろうと思います。反対に、「あの時の辛さに比べたら…」と自身を奮起するときに真っ先に思い浮かぶのも、高校３年生の時です。自分はあそこまで頑張れたのだという経験は、今後の自分のアイデンティティを決める大きな要素になったのだと思います。

さて、人生の（ちょっとだけ）先輩の韜晦はここまで。こんにちは、英語科の池吉です。今回は、貴方が頑張るに値する問題を投げかけてみたいと思います。

今回の一題は、2008 年度の東京大学後期日程から。前回までメインで扱ってきた要約問題に加え、今回は下線部和訳問題もあります。もっとも、下線部和訳問題は特別難解な文法・語法が用いられているわけでもなく、要約問題も前２回で述べてきたアプローチに従えば十分対処できます。但し、分量が多い上に、このタイプのテーマにあまり親しんでいない人にとっては読みにくいと感じるかもしれません。制限時間は 50 分を目安にしてください。

それでは、解説編で再びお会いしましょう。

問．次の文章を読み，後の設問に答えなさい。

Mosquitoes have been targeted by some of the world's most intense pesticide*1 programs and, as a result, have come up with many strategies for avoiding control. In 1989, 114 different species of mosquitoes resisted at least one insecticide*2. Many had developed resistance to more than one insecticide, especially to the powerful nerve poisons. (1)Resistance comes from a number of different cell mechanisms that prevent the attachment of the insecticide to the insect's nerves. In some cases, an enzyme*3 called esterase*4 attaches to the insecticide before it gets to the nerve ending*5, blocking insecticidal action. (2)When there is a lot of insecticide around, this strategy works like shoveling the snow in front of your house during a heavy snowstorm — it's successful only if you have a lot of shovels. But these mosquitoes have a lot of chemical shovels (the esterase enzymes) to remove the insecticidal snow because, not so long ago, they invented a way to increase the production of their chemical shovel many times over.

Sometime, somewhere, while large quantities of nerve-poison insecticides were first being used, the esterase gene was duplicated*6 many times inside the cells of a mosquito. (3)Many copies of a gene produce much more protein*7 than a single gene. This overproduction increases the amount of protective esterase, which can make even massive quantities of the insecticide harmless. The new strategy was extremely successful, and from its first recorded appearance in 1986 quickly spread around the world.

How did this mutation*8 — i.e., the gene duplication — appear so suddenly and so widely? Two possibilities exist — that the mutation appeared several times independently or that it spread like lightning from one place. (4)Careful research on DNA from resistant individuals of the mosquito *Culex pipiens*9 from around the world tells us that the DNA surrounding the duplicated genes is identical in mosquitoes from California, Pakistan, Texas, and Egypt. Because we expect such duplications rarely to happen independently in four different parts of the world, it seems that just one single mutation — a drastic one — caused esterase duplication in this species. Live adult mosquitoes fly internationally, hidden on airplanes, and easily leap across continents. So duplicated esterase genes soon went on a global tour, leaving offspring everywhere they stopped.

But evolutionary changes such as those observed in the mosquito, like contracts with the devil, carry a cost. A great amount of raw materials is needed to make overproduced esterase, and insects that needlessly make so much of the extra protein are selected against. Field studies show that, in the absence of insecticides, mosquitoes without the overproduction of esterases grow faster, survive longer, and reproduce better than the resistant types, and that areas without heavy pesticide use have fewer mosquitoes with the duplicated esterase genes. Natural selection against resistant individuals reduces their frequency in following generations — as long as the insecticides are not used.

Nevertheless evolution can run subtly, driven by selection to reduce the costs of insecticide resistance — and mosquitoes that pay the devil a discount price can thrive. For example, most mosquitoes make too much esterase and wastefully spread it throughout their bodies into tissues where insecticides have no effect. Other mosquitoes produce the protective protein only in their nerve cells, the tissue that needs protection most. This second group does much better than the first in growth rate, survival, and pesticide resistance.

Other kinds of mosquitoes also produce esterases in the intestine and the cuticle*10, where the insecticides enter the insect body. These may act like tiny organic robots attaching to the insecticide, making it harmless before it gets close enough to nerve cells to do any damage. This difference in the position in the body from which the esterase begins its defense is a continuing experiment in the evolution of increased pesticide resistance.

(注)

*1, *2　pesticide, insecticide: a chemical used to kill insects

*3　enzyme: 酵素(触媒作用のあるタンパク質)

*4　esterase: エステラーゼ(酵素の一種)

*5　nerve ending: 神経終末

*6　duplicate(d): to make copies of

*7　protein: タンパク質

*8　mutation: 突然変異

*9　the mosquito *Culex pipiens*: アカイエカ

*10　the intestine and the cuticle: 腸と角皮

強者の戦略

[設　問]

(1)　下線部(1)を和訳しなさい。

(2)　下線部(2)を和訳しなさい。

(3)　下線部(3)を和訳しなさい。

(4)　下線部(4)を和訳しなさい。

(5)　最後の 3 段落(But evolutionary changes...から終わりまで)を 120～150 字の日本語で要約しなさい。句読点も 1 字に数える。