

Immune System Response to a Changing Pathogen

Natural selection favors parasites that are able to maintain a low-level infection in a host for a long time. *Trypanosoma*, the unicellular parasite that causes sleeping sickness, is one example. The glycoproteins covering the trypanosome's surface are encoded by a gene that is duplicated more than 1000 times in the organism's genome. Each copy is slightly different.

Q1. Describe the benefit to the parasite of having so many different versions of the surface glycoprotein gene.

Researchers measured the abundance of parasites in the blood of a single human patient during the first few weeks of a chronic infection.

Table 1: Number of parasites in blood during infection

Day	Number of parasites (millions) per mL of blood
4	0.1
6	0.3
8	1.2
10	0.2
12	0.2
14	0.9
16	0.6
18	0.1
20	0.7
22	1.2
24	0.2

2. Graph the data.

3. a) Describe the pattern in the number of parasites in blood during the infection.

b) Assuming a decrease in the number of parasites in the blood indicates an effective immune response, suggest a hypothesis to explain the pattern you described in (a).

Table 2 shows the relative abundance (from 0 to 1) of two different antibodies produced against the parasite's surface glycoproteins during a *Trypanosoma* infection.

Table 2: Titer of two Ab during *Trypanosoma* infection

Day	Ab specific to Glycoprotein Variant A	Ab specific to Glycoprotein Variant B
4	0	0
6	0	0
8	0.2	0
10	0.5	0
12	1	0
14	1	0.1
16	1	0.3
18	1	0.9
20	1	1
22	1	1
24	1	1

4. Add the data from Table 2 to your graph.

5. a) Describe the relationship between the ab titer and the parasite concentration.

b) Do the data support or refute the hypothesis you proposed?

6. It is actually possible to identify the abundance of trypanosomes recognized by each of the two antibodies. Predict the number of each individual variant of the parasite by adding two more lines to your graph showing their numbers over the course of the infection.

7. How is the human immune system able to defend against parasites such as this that are able to change their surface glycoproteins?