

How Clean is a Clean Room?

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This work is concerned with **PLANETARY PROTECTION:**

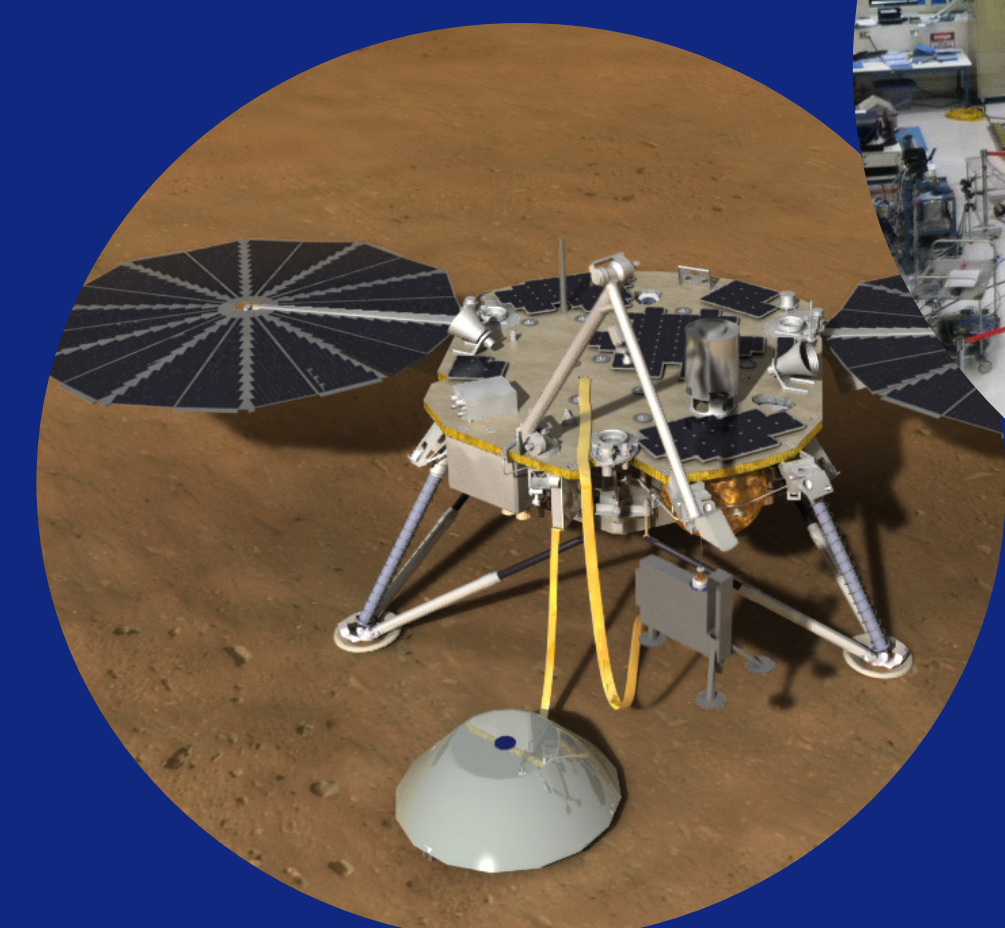
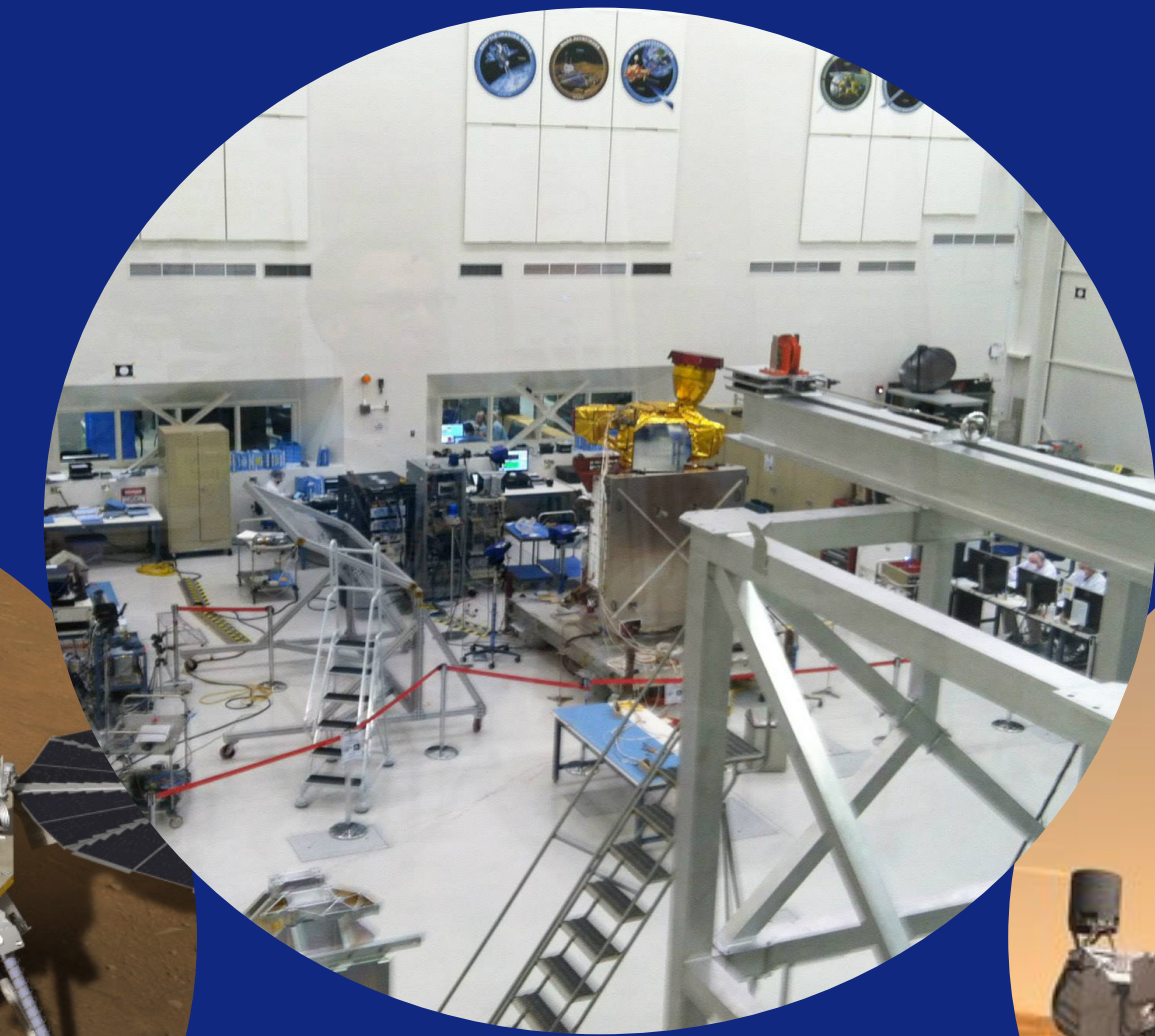
We do not want to contaminate other planets or moons with Earth-life.



We also do not want to bring anything back to Earth that might be biologically harmful.



Spacecraft are assembled in clean rooms to limit contamination.



InSight 2016



Mars 2020

Clean rooms are never 100% clean of microbial life.



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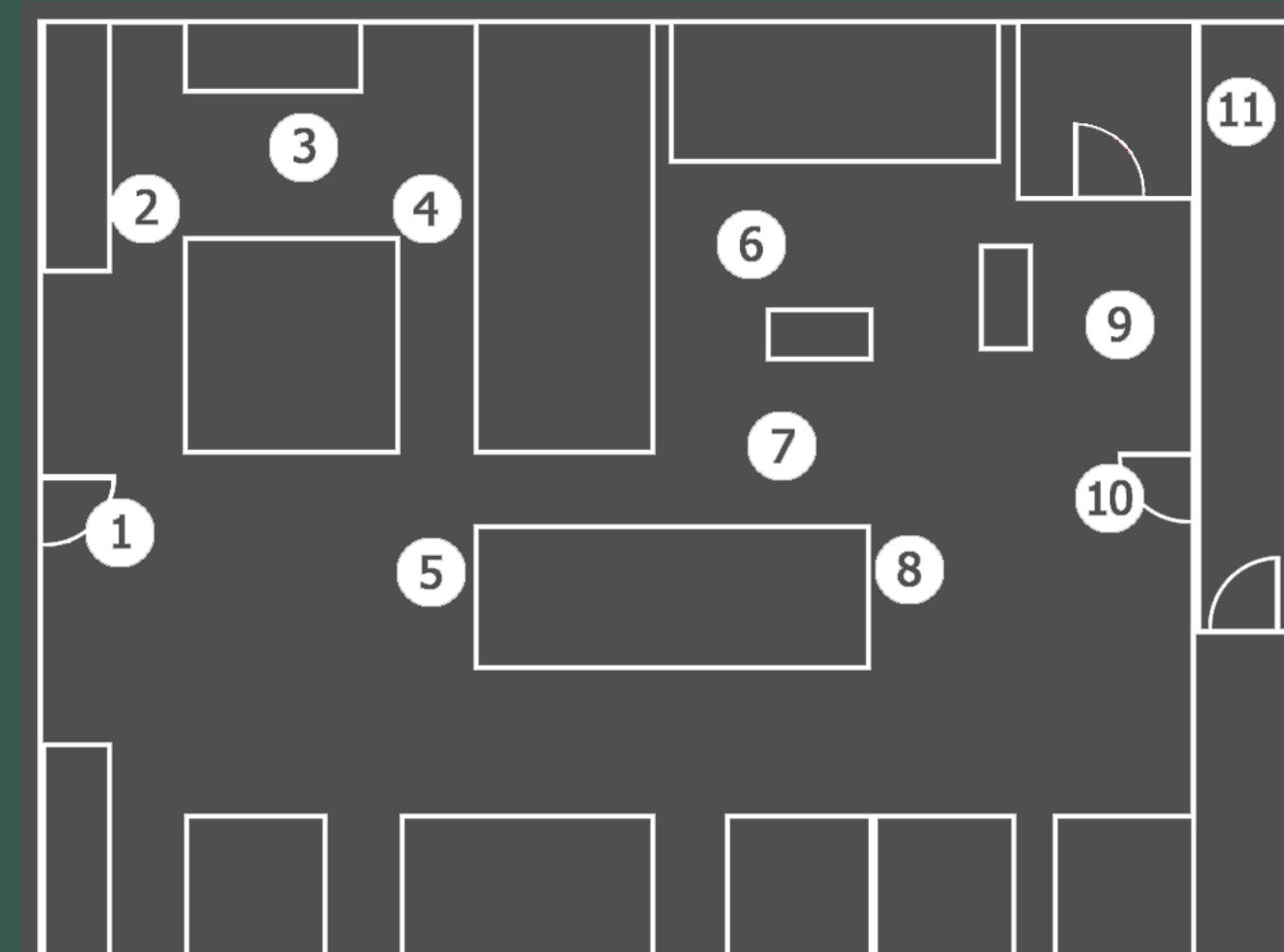


ATGCGGC

ATTGGCC
ATATCGT
TTGCCCA
CGGCCCT
.....

A genomic database of what has been found in the clean room is kept so that if life is found elsewhere we can tell if it actually came from Earth.

We wanted to monitor the microbial life in the clean room where the InSight 2016 lander is being assembled.



Each month, ten locations inside the clean room and one location outside the clean room were sampled.

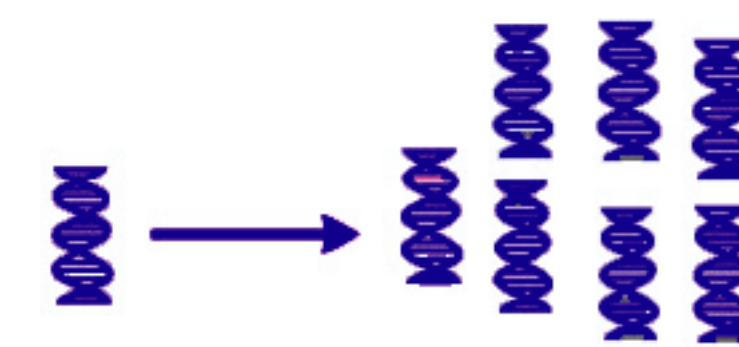


No assembly had occurred prior to the first sampling. Intensive cleaning procedures were not yet in place.

To determine how much microbial life was present we looked at the amount of:

DNA

A process called qPCR was used to amplify a portion of 16S rRNA gene from microbes in the samples. This allowed us to take a measurement that could be back calculated to the original amount present.

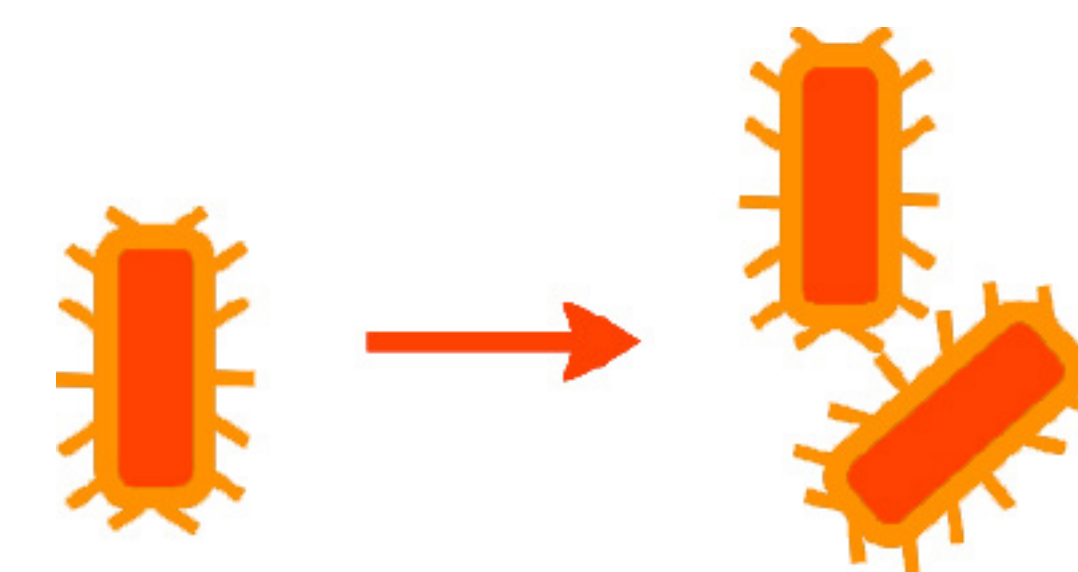


Propidium monoazide (PMA) was added to prevent the DNA of dead organisms from being amplified.

To determine how active the microbial life was we looked for:

ATP

More ATP would indicate the microbes were living and growing.

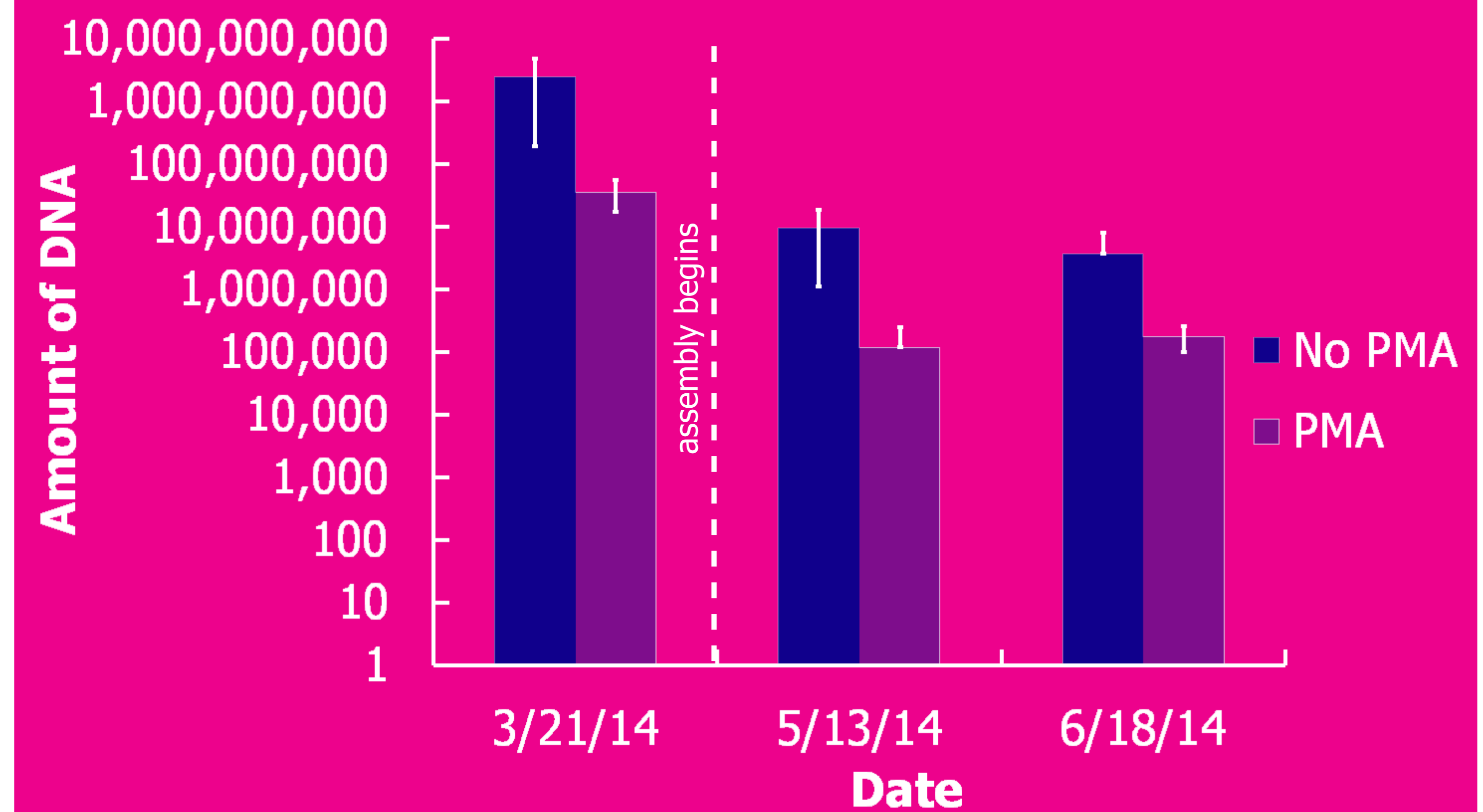


A luciferin - luciferase reaction was used to indicate ATP levels.



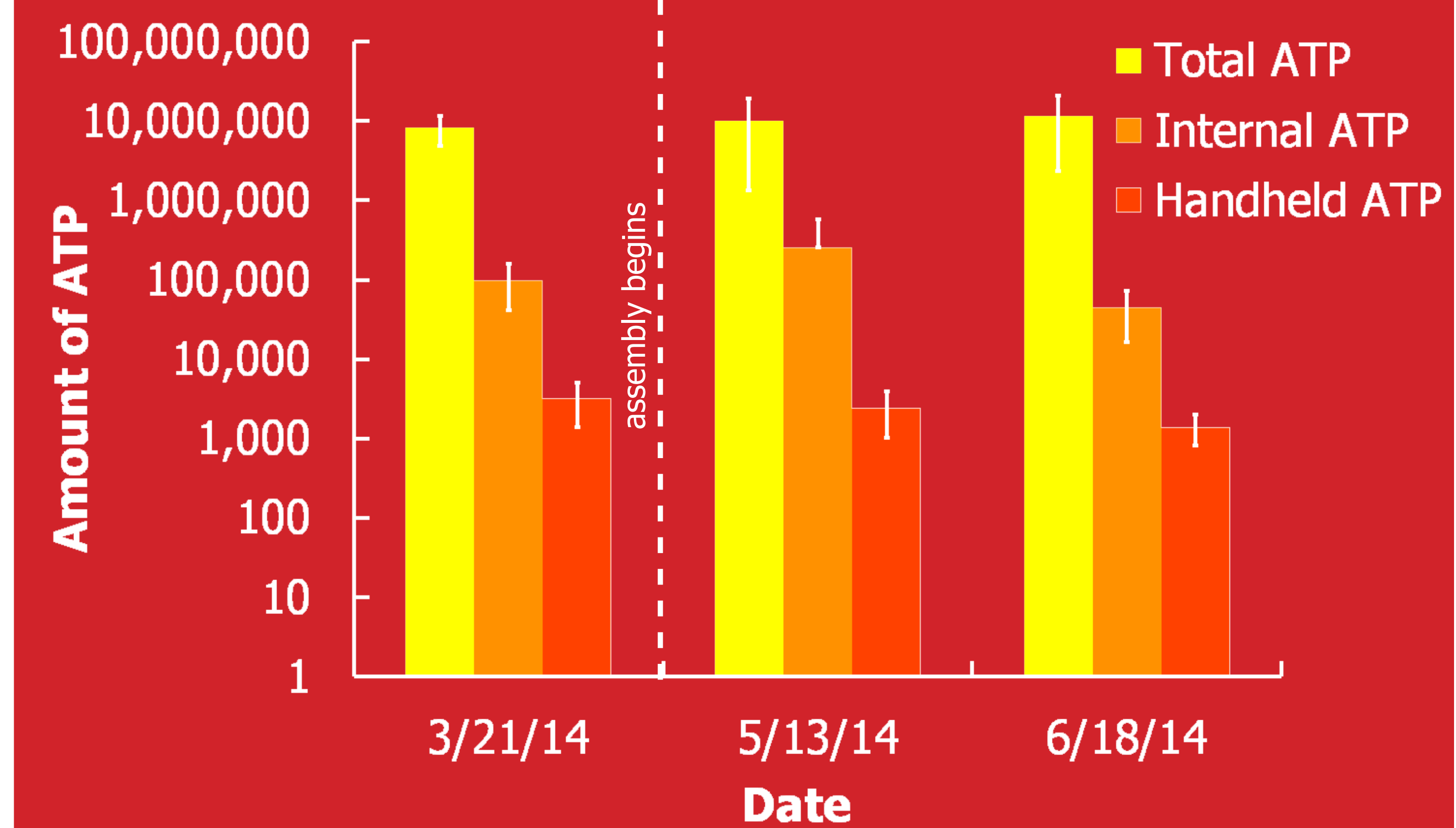
If more light was produced by the reaction, more ATP was present.

HOW MUCH DNA WAS FOUND?



More 16S rRNA gene copies were found on the first sampling than on the second or third. An approximate ten fold difference in 16S rRNA gene copies was found between PMA treated and untreated samples.

HOW MUCH ATP WAS FOUND?



ATP decreased between the second and third samplings according to the internal ATP and handheld ATP measurements. All other measurements showed no change.

The bioburden of the clean room decreased as a result of assembly activity and increased cleaning efforts. The clean room will continue to be monitored through an additional three months.



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