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research and education

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INA HEA 'OE
NĀ MEA MŪ
'IKE 'OLE 'IA
E KA MAKA

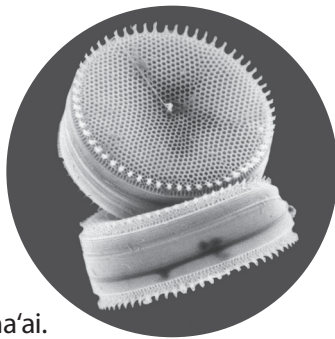


O 'oe...

Thalassiosira weissflogii!

Hülö! O 'oe *Thalassiosira weissflogii!*

Loa'a 'olua ka 'ike i ka ho'onoho'ana. Ho'okomo 'ia ka hunaola i loko o lökino li'ili'i. Penei, aia na öewe i loko o ka nukeliu. E hiamoe 'olua i ke kihi o ka pö no ka mea, ke ho'ohana mai 'oia i ka pāla'ela'e o ka lā no kā'ama'ai.



Diatom ke 'ano 'o *T. weissflogii* a ho'omalua 'ia me mau pā pa'akiki. E like me ho'okomo 'oe makaaniani, kükulu nā diatoms ko hunaola pā o silaka, 'ūmaupa'a hapa nui o aniani.

Pailaha 'ia iā: F. Hinz, Alfred-Weneger Institute, Germany.

Kükulu 'ia ko'u lumi a kau 'ia kēlā me kēia ma ko lākou wahi pololei.

(Hele ma ka 'ao'ao 14)

Mökākī ko'u lumi moe a na'u nō e maopopo kahi i loa'a ai ko'u mau mea.

(Hele ma ka 'ao'ao 2)

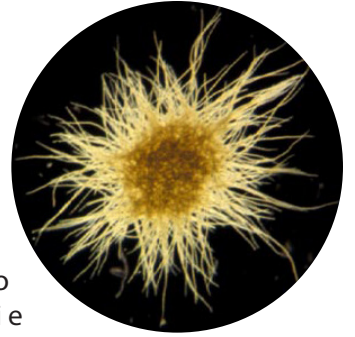


O 'oe...

Trichodesmium erythraeum!

Hulō! O 'oe *Trichodesmium erythraeum*, a e kapa ia "Tricho"!

E like me 'oe, mōkākī kēia mea mu'ike 'ole. Neoneo ko mea hunaola. E like me 'oe, mōkākī kēia mea mu'ke 'ole (a'ole kūkulu kona mea loko). Make-make 'olua e hui pū me hoaloha; ho'ohua o Tricho mau pū'ā me hunaola kahi e a'e. Nanea 'olua nā mea 'ai kuke 'ia ma ka home a hiki ke



F. subglobosum e ola mai kā'ama'ai. I ke 'ano pololei, ho'ohua kēia mea mu'ike 'ole he lupalupa limu a 'ike 'ia mai ka lewa lilo!

Pailaha 'ia iā: starcentral.mbl.edu/microscope/portal.php.

Ma ka moe ka'a, 'o ka papa luna ko'u makemake.

(Hele ma ka 'ao'ao 3)

Ma ka moa ka'a, 'o ka papa lalo ko'u makemake.

(Hele ma ka 'ao'ao 10)



O 'oe...

Synechococcus!

Āiwaiwa nō! O 'oe *Synechococcus!*

Mehameha 'oe 'o kēia mea mu'ike 'ole pū. E like me 'oe, makemake kēia mea mu'ike 'ole ka "moa ka'a luna", ma laila hiki 'oia ke omo ka mālamalama o ka lā no kā'ama'ai. A kā'ama'ai noho'i! Ho'ohua kēia mea mu'ike 'ole nā kā'ama'ai hapahā i ka moana.



E like ma makemake 'oe nā anilā 'ano like'ole, e ola *Synechococcus* anilā ko'eko'e a he ili pū'uo pālaha ma mua kona 'ohana.

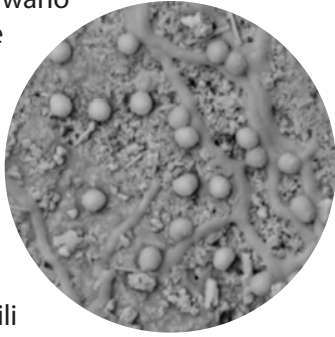
Pailaha 'ia iā: Dr. R. Wagner, www.dr-ralf-wagner.de.

O 'oe...

Salinispora tropicalis!

Hū kamaha'o! O 'oe *Salinispora tropicalis!*

Makemake 'olua e 'ai ma waho o ka home — Makemake 'olua e 'ai ma waho o ka home — ke 'ai nei kēia mea mu'ike 'ole ma ko'ohune kūola a meakino ma kahi o ho'ohua kona mea 'ai. E like me kou puni no ka waiho'olulu poni, kūhili poni kēia mea mu'ike 'ole e pa'a ai me ka wai pōpolohua no ka 'imi 'ike ka hakakino o nā mū 'ike 'ole.



A'ole e 'umi i ka hanu loa 'olua pū, no ka mea koi 'okikane no ke ola. Aia ā 'imi i 1991, e 'ike mua 'ia e ho'ohua kēia mea mu'ike 'ole kupaianaha mau pūhui kū'ē ma'i 'a'ai!

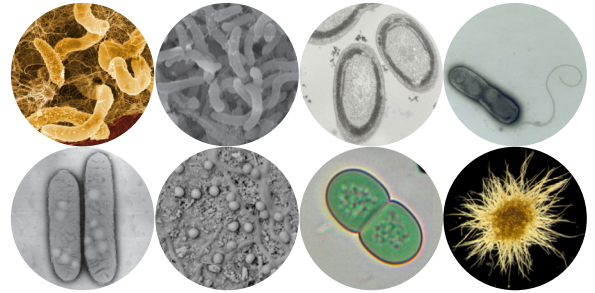
Pailaha 'ia iā: Eric Gontang, Scripps Institution of Oceanography, SIO.

Nanea au i nā mea 'ai kuke 'ia ma ka home.

(Hele ma ka 'ao'ao 4)

'Oi ka makemake e 'ai ma ka hale 'aina.

(Hele ma ka 'ao'ao 6)



O 'oe...

Rhodoferrax ferrireducens!

Hūlō! O 'oe *Rhodoferrax ferrireducens!*

E like me 'oe, mōkākī kēia mea mu'ike 'ole. Neoneo ko mea hunaola — kōhu like mōkākī kou mau kākini! E lanakila *R. ferrireducens* 'oe i nā'ū — hiki ke ola me ka 'okikane 'ole!



Makemake 'olua e 'ai ma waho o ka home — ke 'ai nei o kēia mea mu'ike 'ole ma na mea pa'upopo i loko o ke ko'ana kai. Kupaianaha maui nō ka ho'owali 'ana o kēia mea — ua noa ikehu a hiki ka ikehu no uila ma ka hale! A laila, ho'okumu kēia mea mu'ike 'ole konapiliahi he uila palekana.

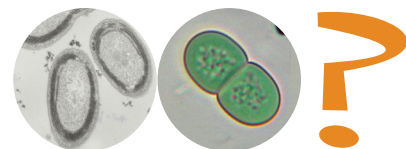
Pailaha 'ia iā: Derek Lovley, University of Massachusetts.

'A'ole makemake au i ke anilā ko'eko'e.

(Hele ma ka 'ao'ao 30)

Makemake au i nā anilā like'ole.

(Hele ma ka 'ao'ao 35)

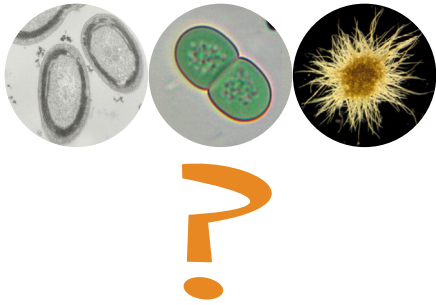


I ko'u manawa ka'awale, 'oi ka make-
make e noho ho'okahi wale.

(Hele ma ka 'ao'ao 5)

I ko'u manawa ka'awale, 'oi ka make-
make e hui pū me ku'u mau hoaaloha.

(Hele ma ka 'ao'ao 37)



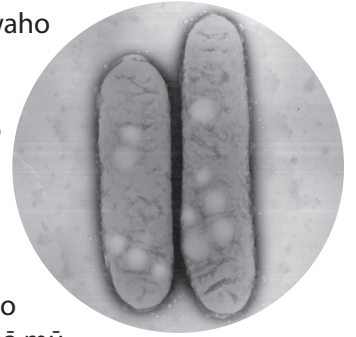
4

O 'oe...

Ruegeria pomeroyi!

Ho'omaika'i 'ana! O 'oe *Ruegeria pomeroyi*!

Makemake 'olua e 'ai ma waho
o ka home — ke 'ai nei
kēia mea mu'ike 'ole ma
ko'ohune kūola a meakino
ma kahi o ho'ohua kona
mea 'ai. E like me hoihoi
'oe ka waiho'olulu poni,
a'ole kēia mea mu'ike 'ole
e pa'a ka wai pōpolohua no
ka 'imi 'ike ka hakakino o nā mū
'ike 'ole.



A'ole e 'umi i ka hanu loa 'olua pū, no ka mea koi
'okikane no ke ola. Hiki *R. pomeroyi* ke loli kinoea
pālua meto sulafaside, ka mea i koi ai nō ka 'ōpua.
He ha'o wale ho'i!

Pailaha 'ia iā: Gonzalez et al. 2003 *Int. J. Syst. Evol. Microbiol.* 53: 1261-1269.

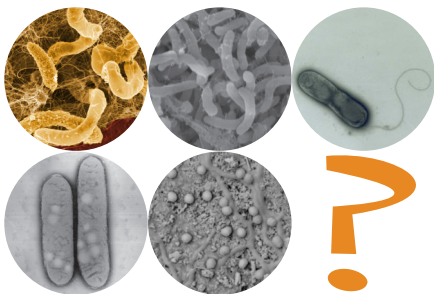
33

Hiki ia'u ke 'umi i ka hanu li'u.

(Hele ma ka 'ao'ao 9)

A'ole hiki ke 'umi i ka hanu li'u.

(Hele ma ka 'ao'ao 7)



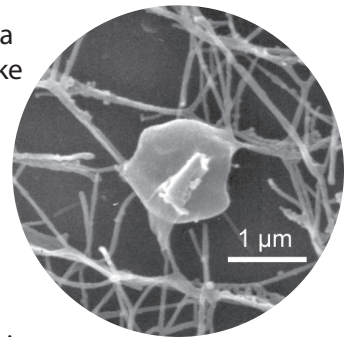
6

O 'oe...

Pyrodictium abyssii!

Maika'i loa! O 'oe *Pyrodictium abyssii*!

E like me 'oe, hina moe kēia
mea mu'ike 'ole ma lalo o ke
kai hohonu kokoke ma ka
papakū. Ili kou makemake
nō wai lemi i ka make-
make o kēia mea mu'ike
'ole nō ke 'ano 'akika ā hiki
i pH 4.7.



Ā e like me ko 'ohana apuni e
ho'onoho i ka honua holo'oko'a. he pua kēia mea
mu'ike 'ole iā he 'ohana e ho'onoho ma nā kai-
anoho apau. Hiki ke *P. abyssii* e 'alo i kai kō'eha'eha
a hiki 140° C (284° F), a e ola ka puale kai.

Pailaha 'ia iā: Gertraud Rieger, Karl O. Stetter, Reinhard Ravel, University of Regens-
burg, René Hermann, Zuerich, Switzerland.

31

O 'oe...

Prochlorococcus marinus!

Ā 'oia! O 'oe *Prochlorococcus marinus!*

E like me 'oe, makemake o *P. marinus* e ho'ohua kona mea 'ai. Kēia mea mu'ike 'ole no ka 'oi ma kā'ama'ai a loa'a iā ia ke kuleana no 30–80% o ke kā'ama'ai 'anai nā wahi māhuaola 'ola i ka moana!



Mehameha 'oe 'o kēia mea mu'ike 'ole pū. Eia nō na'e, e like me 'eha wale 'oe iā ke anu, makemake 'o *Prochlorococcus* e ola i ke kai welawela akā, 'ē a'e kona 'ohana.

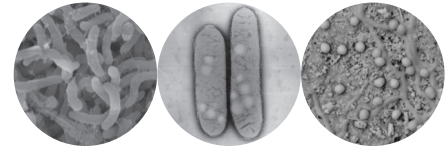
Pailaha 'ia iā: Claire Ting.

'O poni ku'u waiho'olu'u punahele.

(Hele ma ka 'ao'ao 34)

A'ole makemake ia'u i ka waiho'olu'u poni.

(Hele ma ka 'ao'ao 8)

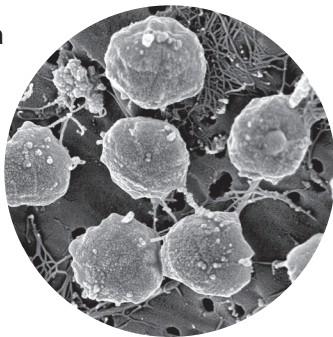


O 'oe...

Methanococcus jannischii!

Auwē no ho'ī! O 'oe *Methanococcus jannischii!*

E like me 'oe, mōkākī kēia mea mu'ike 'ole. Neoneo ko mea hunaola — kōhu like mōkākī kou mau kākini!



E like me 'oe, hina moe kēia mea mu'ike 'ole ma lalo o ke kai hohonu kokoke ma ka papakū. Ka mea mu'ike 'ole i kēia kī'i e hāpana mai ka puale kai ma ka hohonu o 2,600 mika!

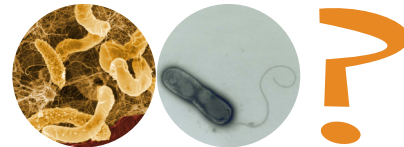
Pailaha 'ia iā: courtesy of B. Boonyaratanakornkit and D.S. Clark, Chemical Engineering, and G. Vrdoljak, Electron Microscope Laboratory, University of California, Berkeley.

Inā 'ai au i nā pāpapa, e palalī ana au.

(Hele ma ka 'ao'ao 21)

Kaka'ikahi ka nahu o ko'u 'ōpū ā palalī paha.

(Hele ma ka 'ao'ao 32)

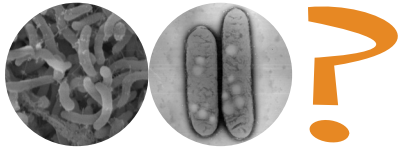


I ka manawa e ha'alele ai i ka hale,
ho'okomo ia'u nā mea pu'u holo'oko'a
no ka lā.

(Hele ma ka 'ao'ao 33)

Makemake au e ka'ahele mālana nei a
ho'olawe nā mea pu'u wale.

(Hele ma ka 'ao'ao 29)

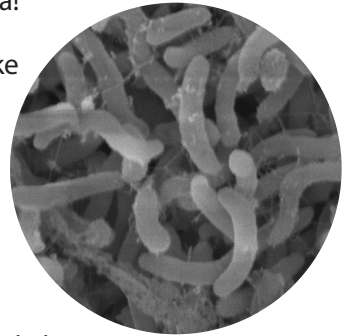


O 'oe...

Pelagibacter ubique!

Kupaianaha maoli nō! O 'oe Pelagibacter ubique,
a SAR-11 kōu inoa kapakapa!

Loa'a iā SAR-11 he 'ano e like
me ka mai'a a li'ili'i iā ia,
pēlā 'i'o nō he mea mu'ike
'ole, a kā 'oia ka mea ola
nui hewahewa i ka moana
a 'oi aku ke kaupona o
kēia mau mea mu'ike 'ole
ma mua o na i'a kai ma ka
honua nei! E like me 'oe, mōkākī
kēia mea mu'ike 'ole. Neoneo ko mea hunaola —
kohu like mōkākī kou mau kākini! Akā hiki 'olua
ke ho'okelakela e pili ana hā'awe 'ana mama —
loa'a iā SAR-11 ka oewe li'ili'i loa o nā meaola a
pau! A'ole e 'umi i ka hanu loa 'olua pū, no ka mea
koi 'okikane no ke ola.



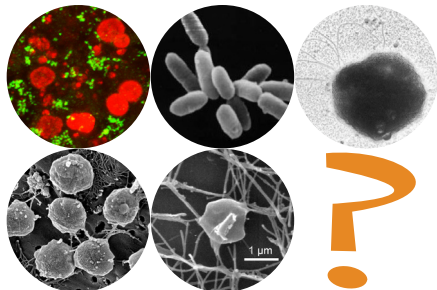
Pailaha 'ia iā: Kehau Manoj, C-MORE University of Hawaii. Under guidance of Megan Huggett and Michael Rappé.

Noho ku'u 'ohana āpau a puni i ka
honua holo'oko'a.

(Hele ma ka 'ao'ao 11)

Noho ku'u 'ohana āpau kokoke ia'u.

(Hele ma ka 'ao'ao 13)

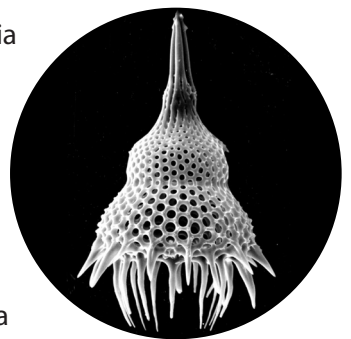


O 'oe...

Lamprocyclus maritilis!

Auwē ka māhie! O 'oe *Lamprocyclus maritilis!*

He radiolarian ke 'ano o kēia
mea mu'ike 'ole hie a hana
pūpū pohihihi u'i o silaka.
Loa'a 'olua ka 'ike i ka
ho'onoho'ana. Ho'okomo
'ia ka hunaola i loko o
lōkino li'ili'i. Penei, aia na
ōewe i loko o ka nukeliu. E
like kou lauoho kālōle, loa'a
kēia mea mu'ike 'ole peleleu
kālōle mai kona pūpū no ka ho'omalū.



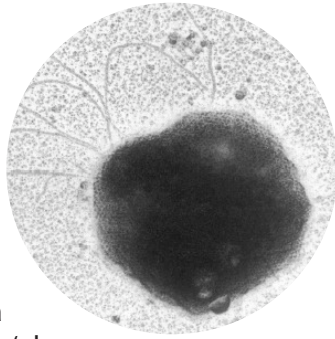
Pailaha 'ia iā: Kjell R. Børklund, National History Museum of Norway, University of Oslo.

O 'oe...

Hyperthermus butylicus!

Auwē ka 'eu'eu! O 'oe *Hyperthermus butylicus!*

Koho like e noho nei ka lumi mōkākī, neoneo ko mea hunaola. E like me 'oe, hina moe kēia mea mu'ike 'ole ma lalo o ke kai hohonu kokoke ma ka papakū. A noho ku'u 'ohana āpau apuni i ka honua holo'oko'a, hiki na 'ohana o kēia mea mu'ike 'ole e noho nei i nā kaianoho kini. E ola 'o *H. butylicus* i ke kai pua'ina a me nā ana wela 112° C (234° F) a ua 'ike mua ma ka kapa kai o São Miguel, Azores!



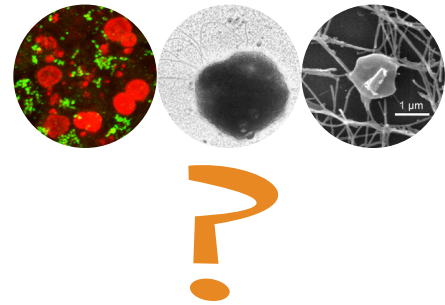
Pailaha 'ia iā: Zillig et al. (1990) *J. of Bacteriology* 172(7): 3959-3965.

I work well with others and see the benefits of team work.

(Hele ma ka 'ao'ao 20)

I can achieve more on my own and prefer to work independently.

(Hele ma ka 'ao'ao 12)

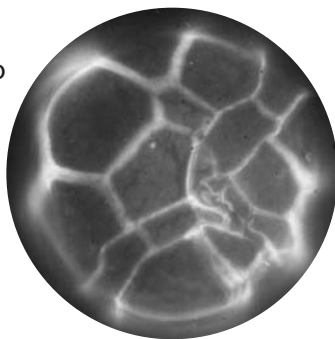


O 'oe...

Fragilidium subglobosum!

Laki no 'oe! O 'oe *Fragilidium subglobosum!*

Loa'a 'olua ka 'ike i ka ho'onoho'ana. Ho'okomo 'ia ka hunaola i loko o lōkino li'ili'i. Penei, aia na ōewe i loko o ka nukeliu.



E hiamoe 'olua i ke kihi o ka pō no ka mea, ke ho'ohana mai 'oia i ka pāla'ela'e o ka lā no kā'ama'ai. Hiki ke 'olua e lanakila i na kūlana like'ole ; aia nō ke 'ano, hiki ke *F. subglobosum* e ola mai kā'ama'ai ai'ole hahai 'ana, aia nō na kūlana.

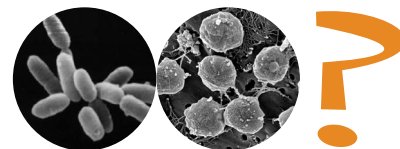
Pailaha 'ia iā: Alf Skovgaard, University of Copenhagen.

Makemake au ke 'au'au ma nā ki'o wai a me nā loko wai.

(Hele ma ka 'ao'ao 28)

'O ka'au'au kai nō ka 'oi !

(Hele ma ka 'ao'ao 25)

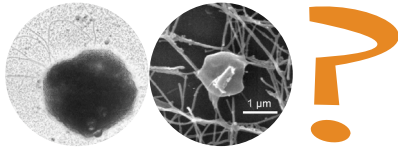


Makemake au e inu i ka waiū.

(Hele ma ka 'ao'ao 26)

Makemake au e inu i ka wai lemi.

(Hele ma ka 'ao'ao 31)



O 'oe...

Halobacterium salinariumus!

E 'ilio'aukai 'oe! O 'oe *Halobacterium salinariumus!*

E like me 'oe, mōkākī kēia mea mu'ike 'ole. Neoneo ko mea hunaola — kohu like mōkākī kou mau kākini! 'Oi ka makemake 'olua ke kai ma mua o ka wai, he nohona pa'akai kō *H. salinariumus*.



Noho *H. salinariumus* ia ke Kai Make, a hū ka li'u o kēlā wahi pana!

Pailaha 'ia iā: science.nasa.gov.

E ala au ā hiki i ke kuluaumoe.

(Hele ma ka 'ao'ao 15)

E hiamoe au i ke kihi o ka pō.

(got to page 16)

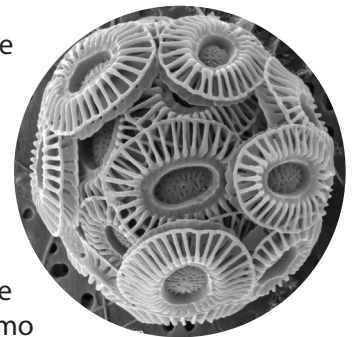


O 'oe...

Emiliana huxleyi!

Hipahipa hulō! O 'oe *Emiliana huxleyi!*

Ua kapa 'ia kēia mea mu'ike 'ole he "coccolithophore," a ho'omalua iā ia me 'a'ahu koho. E hiamoe 'olua i ke kihi o ka pō no ka mea, ke ho'ohana mai 'oia i ka pāla'ela'e o ka lā no kā'ama'ai. Loa'a 'olua ka 'ike i ka ho'onoho'ana. Ho'okomo 'ia ka hunaola i loko o lōkino li'ili'i. Penei, aia na oewe i loko o ka nukeliu.



Akā, pa'akiki 'olua a hiki *E. huxleyi* ke ola wale nei ia kā'ama'ai. I ke 'ano pololei, 'oi aku ka lupalupa o na limu ma mua o na lāhulu kai i ka 'ili !

Pailaha 'ia iā: Jeremy R. Young, Natural History Museum of London.

O 'oe...

Elphidium crispum!

Laki no 'oe! O 'oe *Elphidium crispum!*

He foramnifera ā “foram” paha ke 'ano o kēia mea mu'ike 'ole mimilo. Loa'a 'olua ka 'ike i ka ho'onoho'ana. Ho'okomo 'ia ka hu-naola i loko o lōkino li'ilii. Penei, aia na ōewe i loko o ka nukeliu. E like me 'oe, e ala 'olua i ke au-moe; hahai kēia mea mu'ike 'ole i ka po me ke ao. Kūkulu na foram pūpū poho nani. He 'ano poepoe ka pūpū o nā forma, e like me kau oho pi'ipi'i. Ho'ohuli kēia pūpū ia mō'alihaku a waiwai kēia mea no ke koho 'ana ka mahakihi o mau pohaku a ho'ohi'ohia wāwahie wihaku!



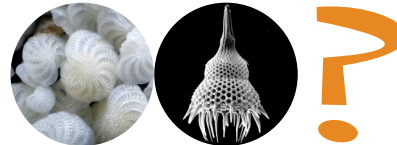
Pailaha 'ia iā: Spike Walker.

Kālolo hapa loa ko'u lauoho.

(Hele ma ka 'ao'ao 27)

Pi'ipi'i hapa loa ko'u lauoho .

(Hele ma ka 'ao'ao 22)

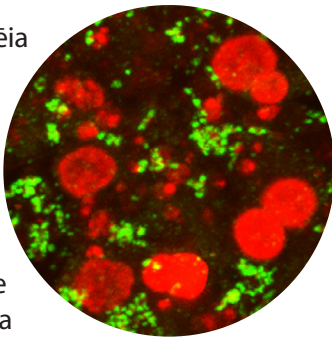


O 'oe...

Cenarchaeum symbiosum!

Le'ale'a wale! E like me mōkākī kou lumi, a'ole kūkulu ko *C. symbiosum* mea loko.

E like me 'oe, hina moe kēia mea mu'ike 'ole ma lalo o ke kai hohonu kokoke ma ka papakū. Make-make 'oe ka ho'ohui me kanaka oko'a. 'Ano like o *C. symbiosum*, loa'a iā ia he pili wehena 'ole me he hu'akai — e aho ia ko laua ola i ka ho'ohana pu.



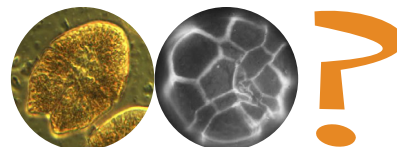
Pailaha 'ia iā: Christina Preston, Monterey Bay Aquarium Research Institute, MBARI.

Ho'omo'o au a hahai i nā lula laina kumu.

(Hele ma ka 'ao'ao 24)

Kolohe au a he mea ho'opōpilikia.

(Hele ma ka 'ao'ao 19)

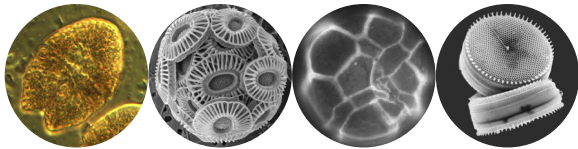


Napenape au a hiki ke ma'a aku i nā ka'a mea.

(Hele ma ka 'ao'ao 17)

Kūpa'a au a hō'alo lolina.

(Hele ma ka 'ao'ao 18)



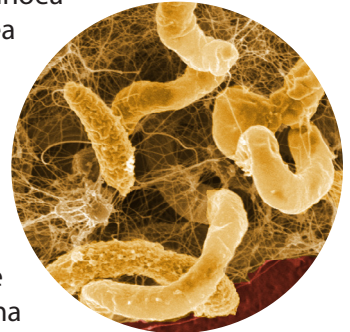
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O 'oe...

Desulfovibrio desulfuricans!

Maika'i nō! O 'oe *Desulfovibrio desulfuricans!*

Makemake 'olua e 'ai ma waho o ka home — ke 'ai nei o *D. desulfuricans* ma na mea pa'upopo i loko o ke ko'ana kai. He kinoea hauna ka hua o kā kēia mea mu'ike 'ole pūnao e like me hua moa pilau — he leo ma'a ia 'oe? Hiki 'olua ke 'umi i ka hanu no he manawa loa, a hiki ke *D. desulfuricans* e ola me 'okikene 'ole. Eia kekahi, ke 'imi nei na kanaka 'epekema ma ke Kīhāpai o Ikehu ke hiki o kēia mea mu'ike 'ole e hō'ololi keleawe kōheoheo ia palekana!



Pailaha 'ia iā: Alice Dohnalkova, Pacific Northwest National Laboratory.

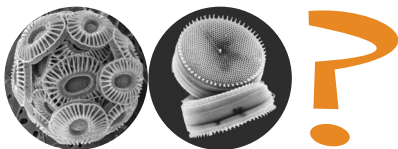
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Maika'i ko'u 'ike maka.

(Hele ma ka 'ao'ao 23)

Pono au e kau makaaniani.

(Hele ma ka 'ao'ao 36)



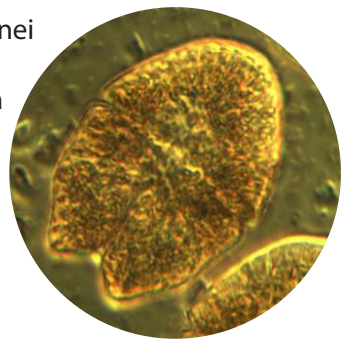
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O 'oe...

Akashiwo sanguineum!

'O *Akashiwo sanguineum!*

'Oia kā! E like me e kūkulu nei kō laila, maiau 'ia kēia mea mū 'ike 'ole 'ia e ka maka ia lōkino, he nukeliu paha. E like me kaunaloa 'oe, e 'ai ana o *A. sanguineum* ia kā'ama'ai ai ai'ole ho'opo'i nā mea like'ole — hiki ke ma'a aku i nā ka'a mea.



Akā, hō'eu'eu a kolohe 'olua; wi'u kēia lāhui, ho'okino iā ia lioho e pepehia ā make nā mea iwi mawaho.

Pailaha 'ia iā: Fernanda Mazzillo, Scripps Institution of Oceanography.

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