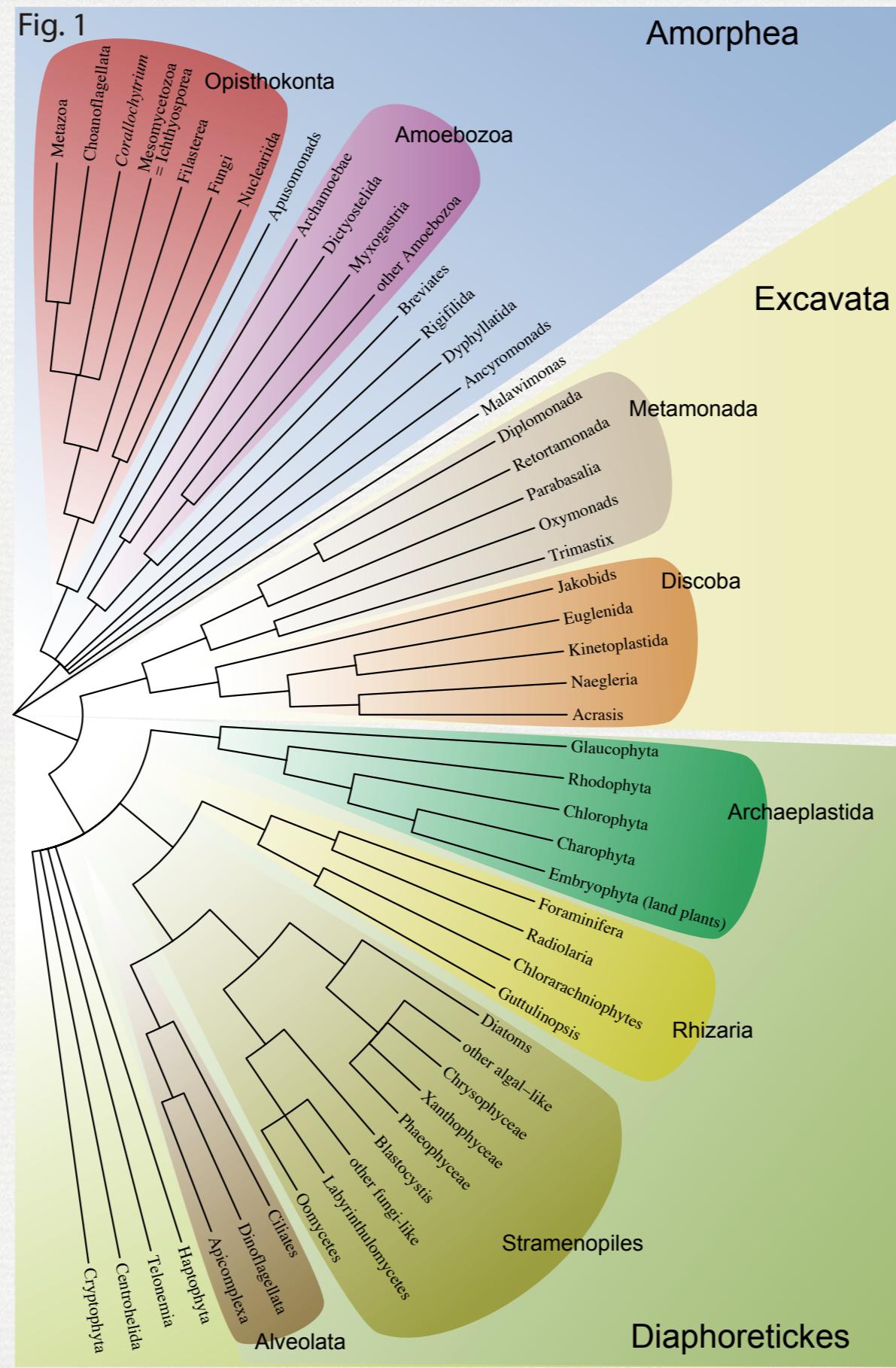




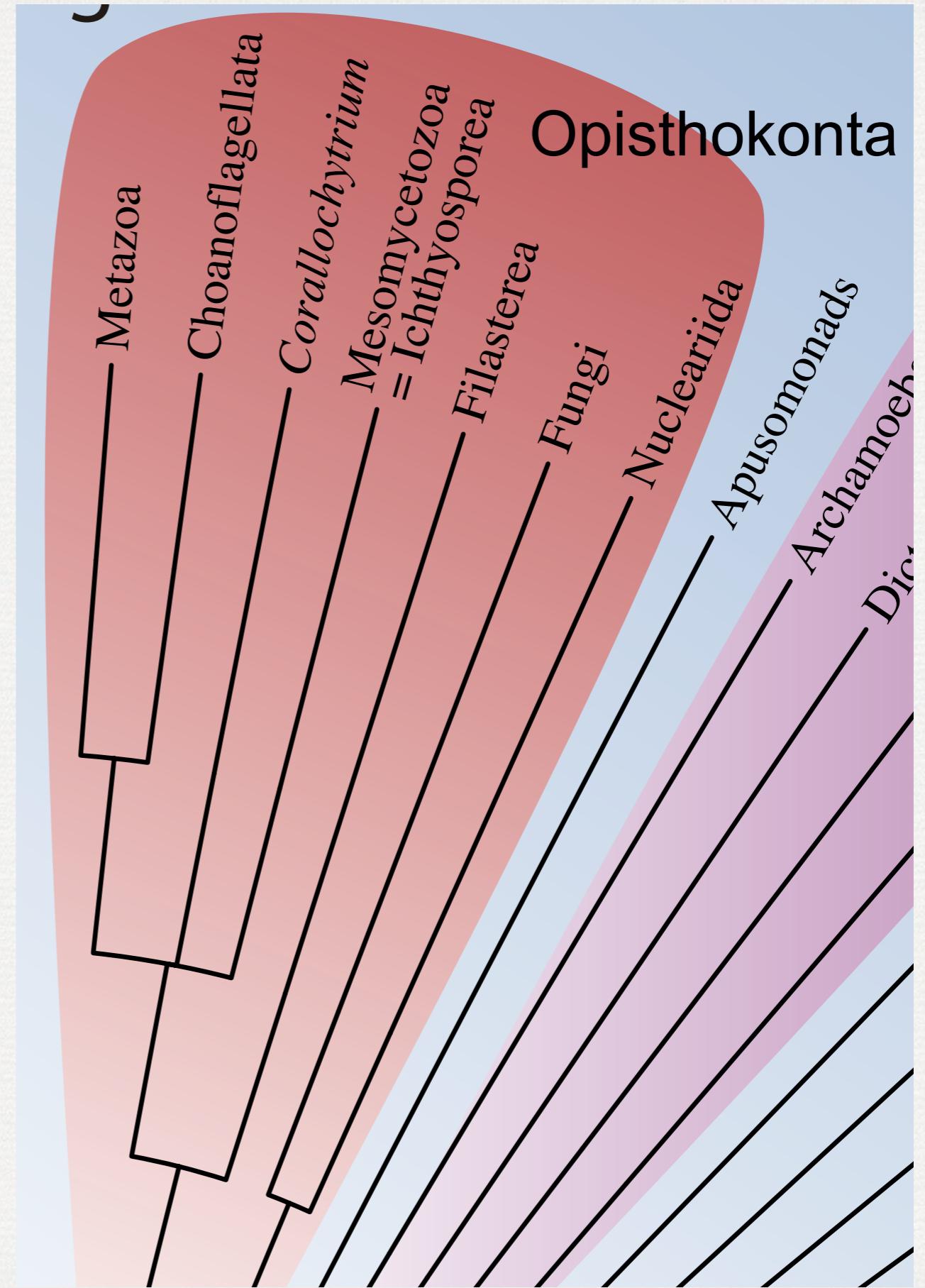
# The opisthokonts

Iñaki Ruiz-Trillo, Institut Biologia Evolutiva & Dept. Genètica UB.

Fig. 1



# the opisthokonts



# the opisthokonts

*opisto* means “posterior”

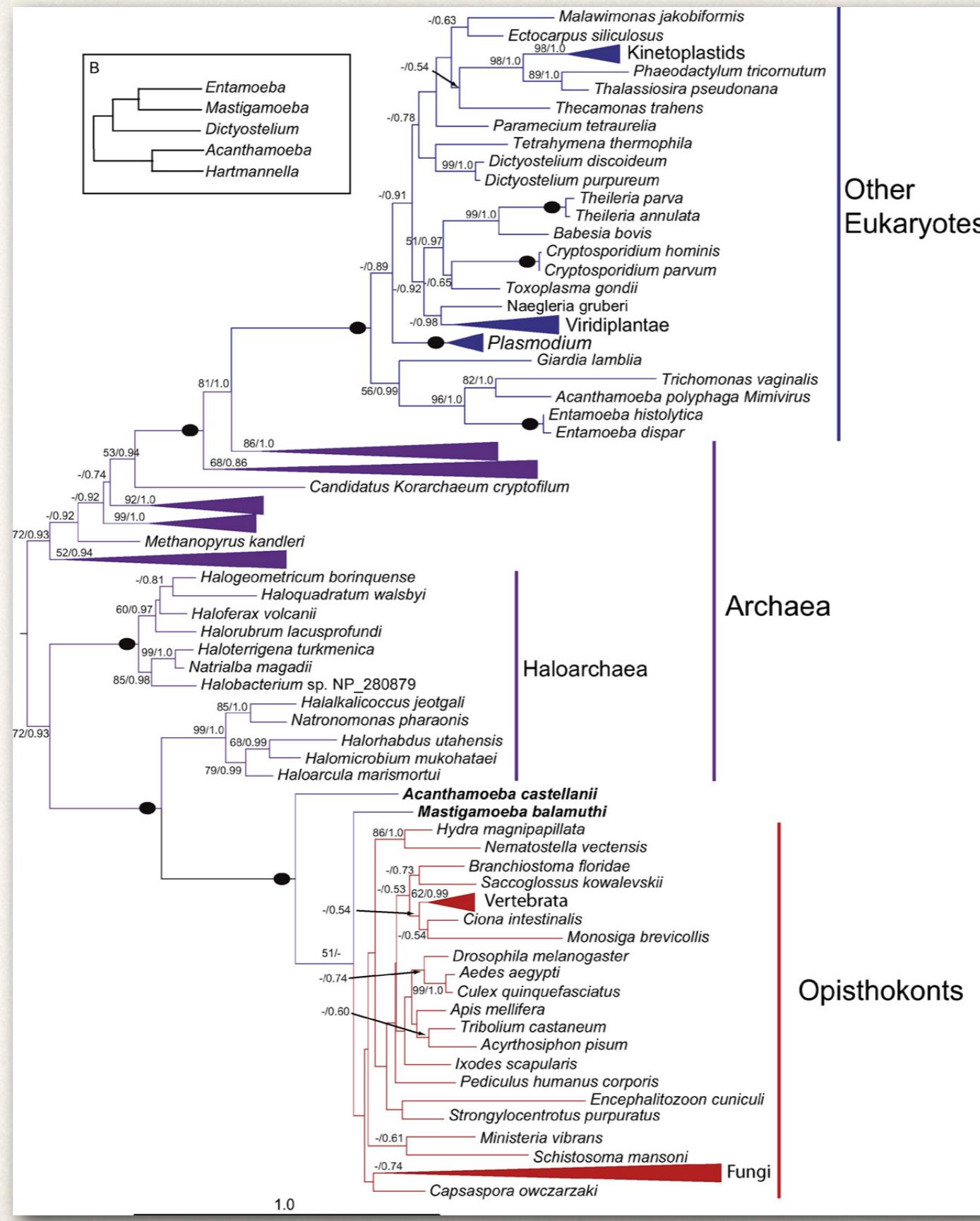
*Kontos* means “pole” (flagellum)

# Molecular synapomorphy: approx. 12 amino acid insertion in gene EF1-alpha

OPISTHOOKONTA

		153	168	198	238
METAZOA	<i>Homo</i>	NKMDSTEPPYSQKRYE	...	GDNMLEPSANMPWFKGKVTR-----	KDGNASGTTLLEALDCILPP
	<i>Drosophila</i>	NKMDSTEPPYSEARYE	...	GDNMLEPSEKMPWFKGWSVER-----	KEGKAEGKCLIDALDAILPP
	<i>Brugia</i>	NKMDSTEPAFSEARFN	...	GDNMLEPSPNMPWFKGWNVER-----	KEGNASGKTLLEALDAVIPP
	<i>Lottia</i>	NKMDSTEPPYSESFRD	...	GDNMLEKSQKMPWWKQWKIEQKD-EKGNMQTVTGETLSDALDSIQPP	
	<i>Dugesia</i>	NKMDSTEPPFSEPRFD	...	GDNMIDESNNMPWYKGWEITRKN-AKKEEIKTTGRTLLDALDSLEPP	
	<i>Trichoplax</i>	NKMDSTEPPYSEARYN	...	GDNMIEESTNMKWFKGWSVER-----	KEGNASGKTLFEALDAILPP
	<i>Nematostella</i>	NKMDSTEPPYSEARFK	...	GDNMLEKSENMPWFKQWTIERVDPATKKEANASGVTLFEGLDSILPP	
	<i>Geodia</i>	NKMDSTEPPYSQARYD	...	GDNMLEESPNMKWFKGWNVER-----	KEGNASGKTLFNPLDSILPP
METAZOAN ALLIES	<i>Monosiga</i>	NKMDSTEPPYSESRFN	...	GDNMIEASEKLPWYKGWEITR-----	KDGNAKGKTLLEALDAIIPP
	<i>Corallochytrium</i>	NKMDSIK--YSKDRFD	...	GDNMIEASTNMDWYKGWE-----	KDGSVGGKTLIEALDAVSPP
	<i>Capsaspora</i>	NKMDSIK--FAEERYN	...	GDNMLEASENMPWFKGWTIER-----	KEGNASGKTLIEALDAISPP
	<i>Ministeria</i>	NKMDSIK--YDEARFT	...	GDNMLDASTNMPWYKGWEVDRD-----	KNGKASGKTLIDALDAVLPP
	<i>Amoebidium</i>	NKMDSIK--FAQDRFN	...	GDNMVEPTDNMPWYKGWEVER-----	KEGNATGKTLLEALDAILPP
	<i>Ichthyophonus</i>	NKMDSVK--YSEDRFK	...	GDNMVAPTEMNPWYKGWTGER-----	KEGNTSGFTLLEALDNIQAP
FUNGI	<i>Ustilago</i>	NKMDTTK--YSEDRFN	...	GDNMIEPTKEMPWYKGWERET-----	KAGKVGSKTLLDAIDAIEPP
	<i>Neurospora</i>	NKMDTTQ--WSQTRFE	...	GDNMLEPSTNCPWYKGWEKET-----	KAGKATGKTLLEAIDAIEPP
	<i>Mucor</i>	NKMDTTK--WSQDRYN	...	GDNMLDESTNMPWFKGWNKET-----	KAGSKTGKTLLEAIDAIEPP
	<i>Allomyces</i>	NKMDMVD--WSEARFK	...	GDNLLTPSANMPWYQGWSRQSK-----	DGTVKVTGMTLIEAMDAVDPP
	<i>Batrachochytrium</i>	NKMDTNK--WSEERFN	...	GDNMLEPSANMPWFKGWTKET-----	KAGTSTGKTLNAIDSIEAP
	<i>Spizellomyces</i>	NKMDSDPAPYKKERYD	...	GDNLLKKSEKMSWYQGQEVTL-----	SGKKVKVHTLLDALDFEMP
	<i>Glugea</i>	NKVDTIDEKNRISRFD	...	GINIVEKGDKFEWFKGWPVSG-----AG--DSIFTLEGALNSQIPP	
FUNGI ALLIES	<i>Fonticula</i>	NKMDSCQ--YSEARFT	...	GDNMIEPTTNMSWWKGFEITR-----	GSAKLTGLTLLDALNHIEPP
	<i>Nuclearia</i>	NKMDTCK--YSEERFN	...	GDNMLEATPNMPWFKNWEIER-----	KSGKVTGKTLVDALDAIEPP
APUSOZOA	<i>Amastigomonas</i>	<b>NKMDADSVQFSQQRFE</b>	...	<b>GDNMLEPSSNMSWWT-----</b>	<b>GPTLLEALDSIKAP</b>
	<i>Planomonas</i>	NKMDDKSVNYSKARFD	...	GDNMTEPSANMPWYS-----	GPTLLGALDACEVP
	<i>Apusomonas</i>	NKMDDKTVKYSKDRYE	...	GDNMMEPSPQMGWWK-----	GGTLLEALDAITPP
AMOEBOZOA	<i>Entamoeba</i>	NKMDAIQ--YKQERYE	...	GDNMIEPSTNMPWYK-----	GPTLIGALDSVTTP
	<i>Dictyostelium</i>	NKMDEKSTNYSQARYD	...	GDNMLERSSDKMEWYK-----	GPTLLEALDAIVEP
	<i>Physarum</i>	NKMDEKSVNWSQARYD	...	GDNMLEKSANLPWYK-----	GPTLLEALDQITEP
	<i>Acanthamoeba</i>	NKMDNVN--WAENRYN	...	GDNMVDRTDKMPWYK-----	GPTLLEALDDIKPP
PLANTAE	<i>Arabidopsis</i>	NKMDATTPKYSKARYD	...	GDNMIERSTNLDWYK-----	GPTLLEALDQINEP
	<i>Porphyra</i>	NKMDDKNVNWSKERYE	...	GDNMLEKSTNMPWYK-----	GPCLLAEALDNCDP
HETEROKONTA	<i>Phytophthora</i>	NKMDSSVVMYQGARYE	...	GDNMIDRSSNNMPWYK-----	GPYLLEALDNLNAP
ALVEOLATA	<i>Toxoplasma</i>	NKMDSCN--YSEDRFN	...	GDNMVEKSTNMSWYK-----	GKTLVEALDTMEAP
	<i>Paramecium</i>	NKMDEKTVNYAQGRYD	...	GDNMLEKSANFGWYK-----	GPTLLEALDAVTTP
EUGLENOZOA	<i>Euglena</i>	NFKDDKTVKYSQARYE	...	GDNMIEASENMGWYK-----	GLSLIGALDNLEPP
	<i>Leishmania</i>	NKMDDKTVTYAQSRYD	...	GDNMIEKSDNMPWYK-----	GPTLLDALGMLEPP
HETEROLOBOSEA	<i>Naegleria</i>	NKFDDTSVNYAEKRYD	...	GDNMIEKSDKMGWYK-----	GPCLLDA LDNLIEP
	<i>Acrasis</i>	NKMDDKSVQYKEDRYK	...	GDNMLEKSTNMPWYK-----	GPTLLEALDALEPP
PARABASALIDEA	<i>Trichomonas</i>	NKMDDKTVNYNKARFD	...	GDNMTEKSPNMPWYN-----	GPYLLEALDSLQPP
DIPLOMONIDIDA	<i>Giardia</i>	NKMDDGQVKYSKERYD	...	GDNIMEKSDKMPWYE-----	GPCLIDAIDGLKAP
OXYMONADIDA	<i>Dinenymptha</i>	NKMDDKSVNWAESRYN	...	GDNMLDRSTNMPWYK-----	DPIIFDALDLLEVP
ARCHAEA	<i>Sulfolobus</i>	NKMDLTEPPYDEKRYK	...	GDNITHRSENMKWYN-----	GPTLEEYLDQLELP
	<i>Thermoplasma</i>	NKMDATEPPFSEKRFN	...	GDNVTKPSPNMPWYK-----	GPSLLQALDAFKVP

# haloarchaeal tyrosil-tRNA is NOT a synapomorphy of opisthokonts



# HOLOMYCOTA

Fungi



Opisthosporidia

Nucleariidae



Fonticula  
alba

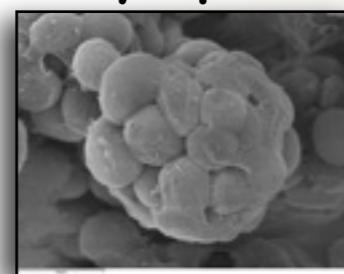
## HOLOZOA

Filasterea

Capsaspora



Ichthyosporeans



Choanoflagellata



Metazoa



# Holomycota

Fungi



Opisthosporidia

Nucleariidae



Fonticula  
alba

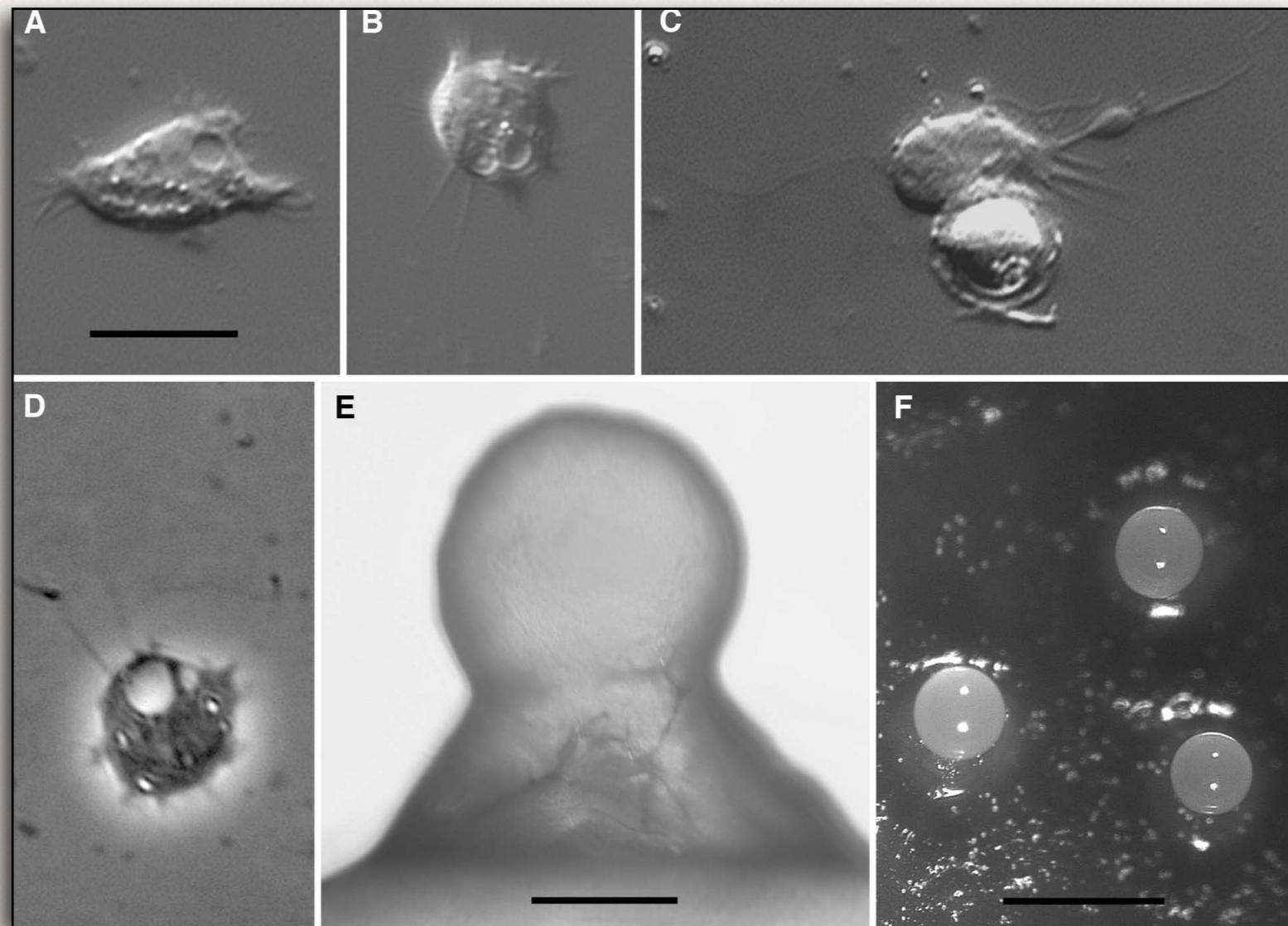
# Nucleariidae



free-living heterotrophic amoebas  
aprox. 11 species identified.  
some have branching filopodia.  
some are free-living algal predators.  
uni- or multinucleated.  
some have intracell bacterial symbionts.

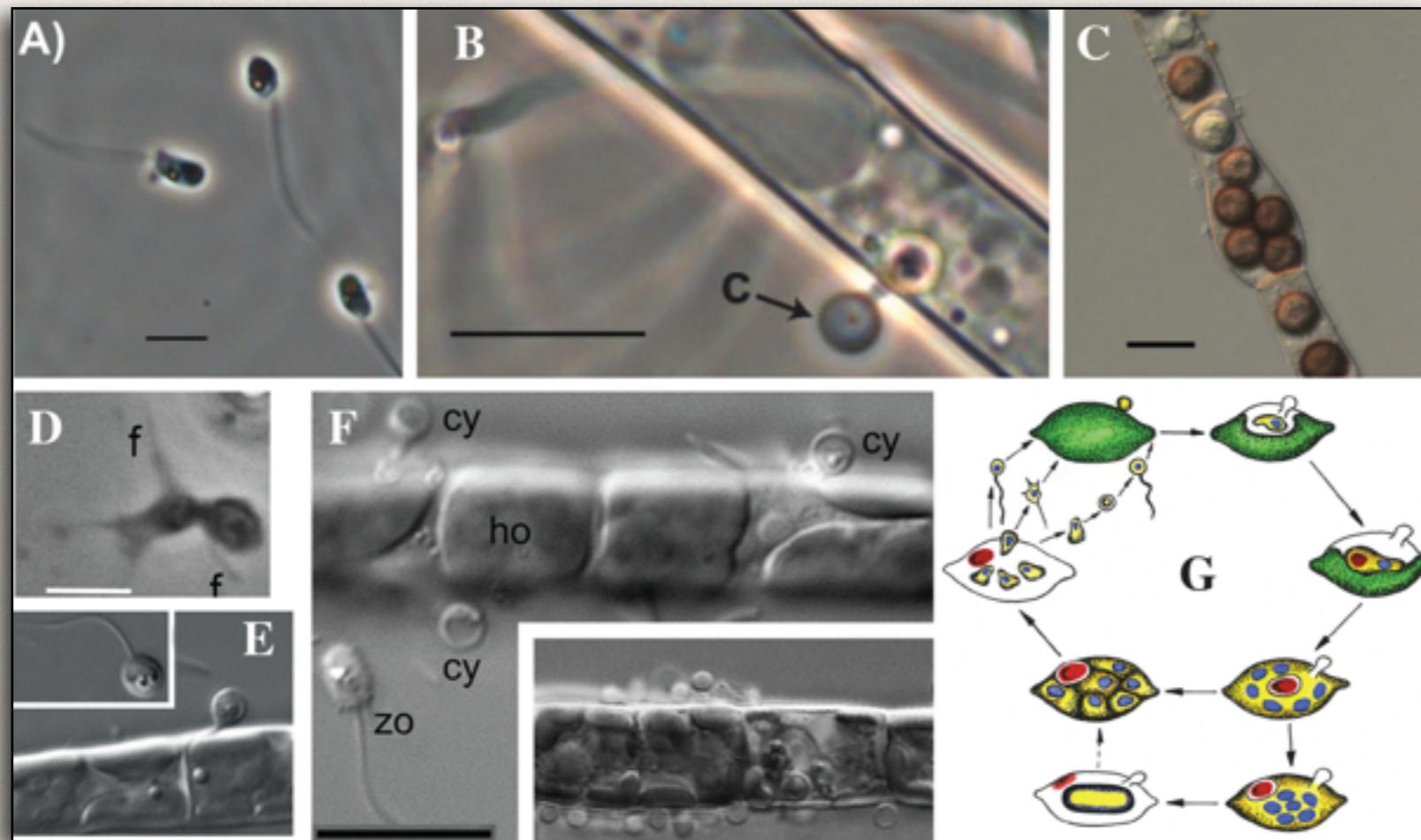
# *Fonticula alba*

Amoeboid protist that forms a multicellular body by aggregation of several individuals



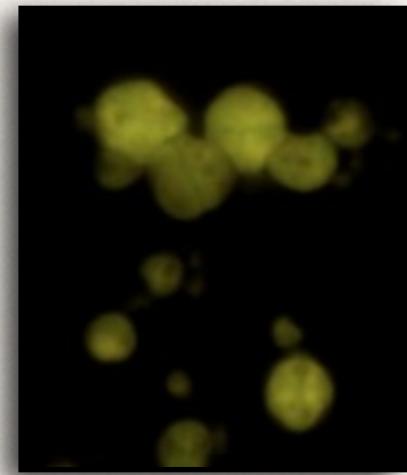
# *Opisthosporidia*

- Cryptomycota (Rozellomycota)**-parasites of fungi-like
- Aphelida**-parasites of algaea
- Microsporidia**-mostly parasite of animals

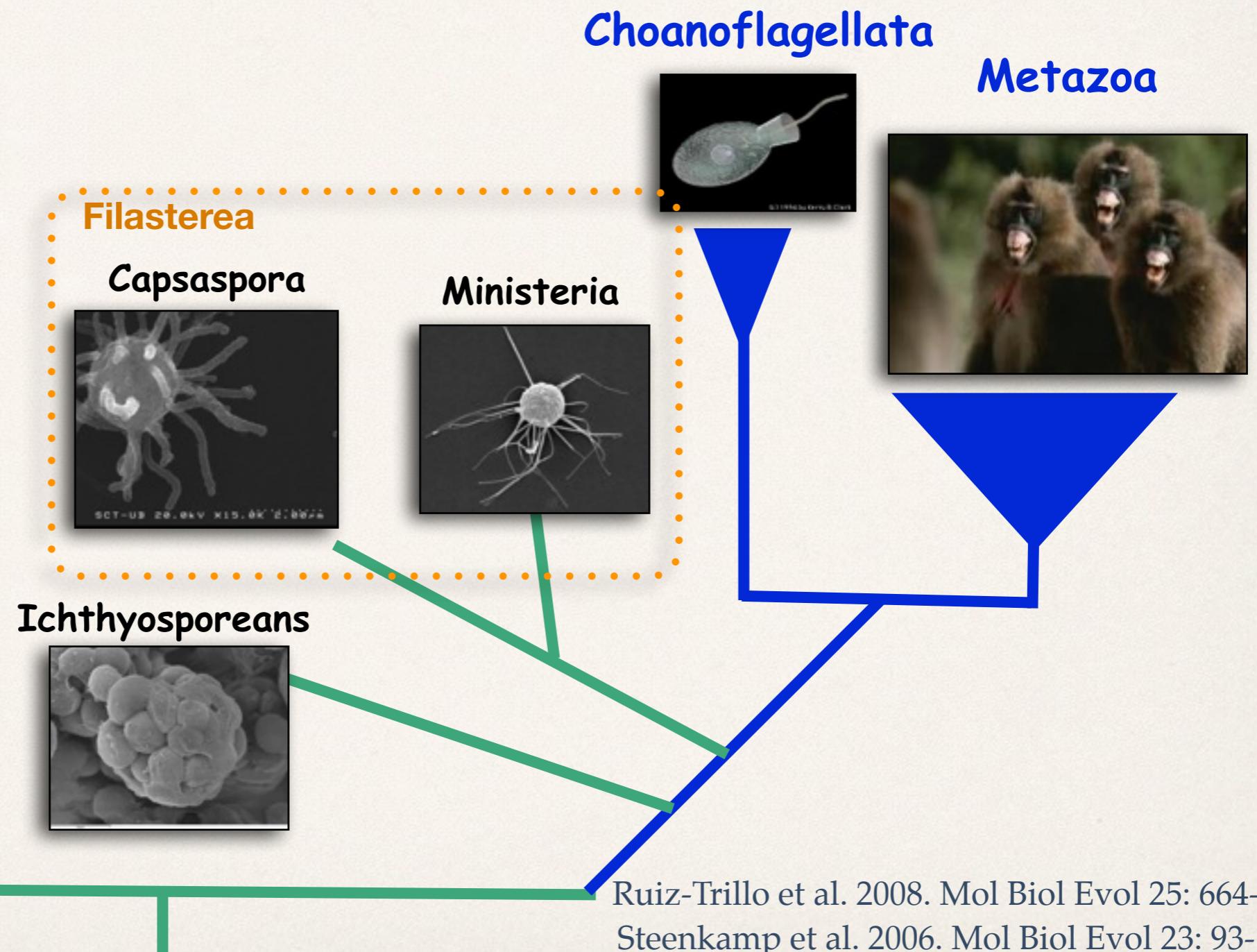


A-C Rozella; D-G Aphelida

# Holozoa

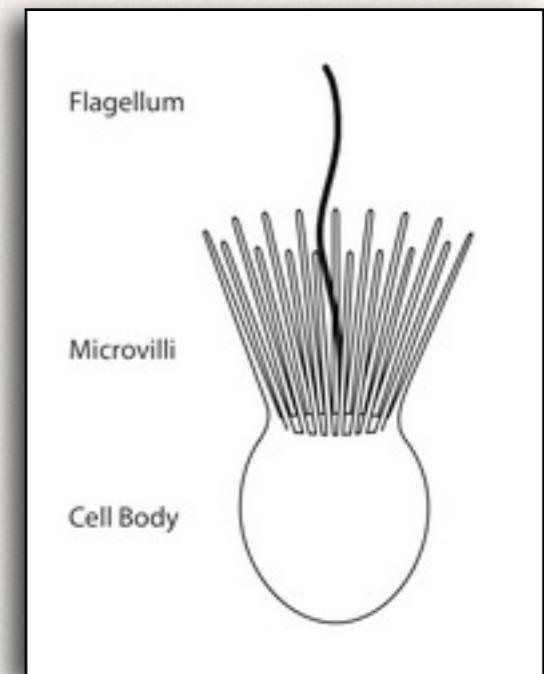


*Corallochytrium  
limacisporum*



# Choanoflagellatea

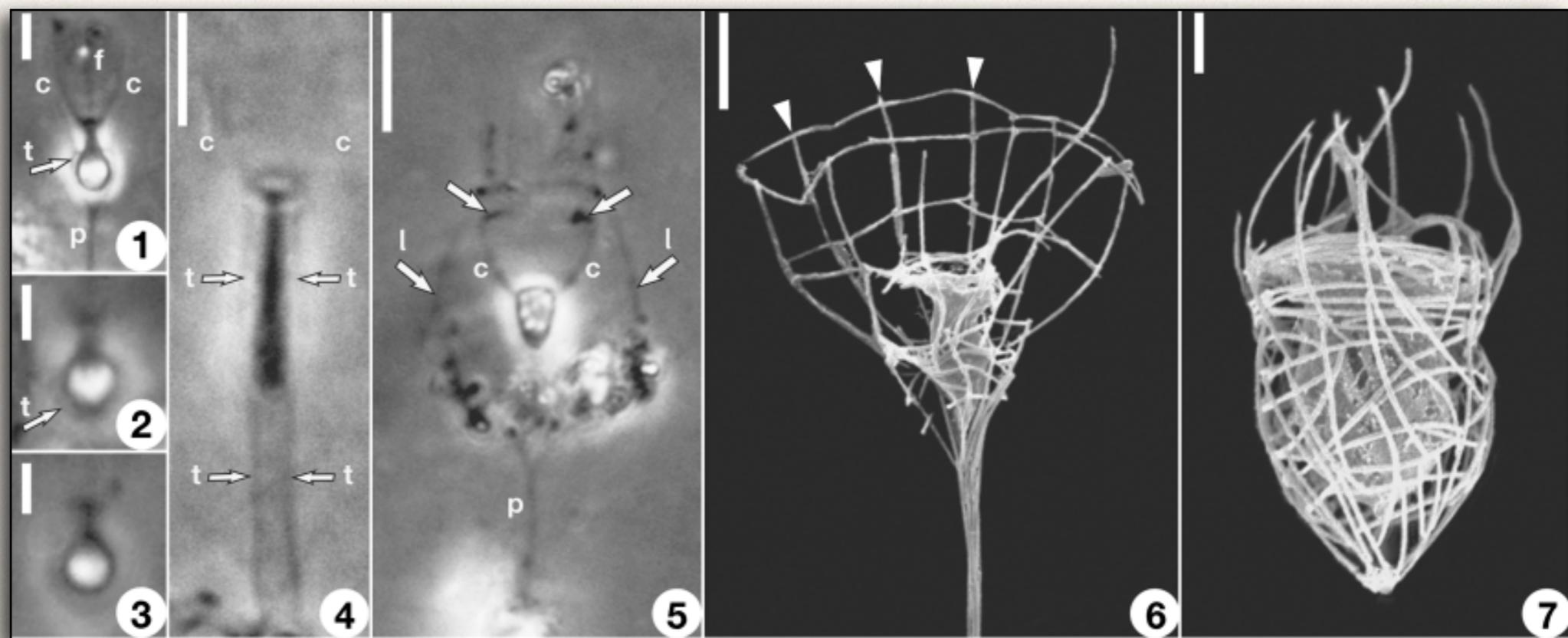
around 140 species  
marine or fresh-water  
flagellate  
heterotrophic  
some form simple colonies



King N (2005) Curr Biol 15: R113-R114.  
Carr et al. 2008. Proc Natl Acad Sci U S A 105: 16641-16646.  
Nitsche et al. 2011. J Eukaryot Microbiol 58: 452-462.

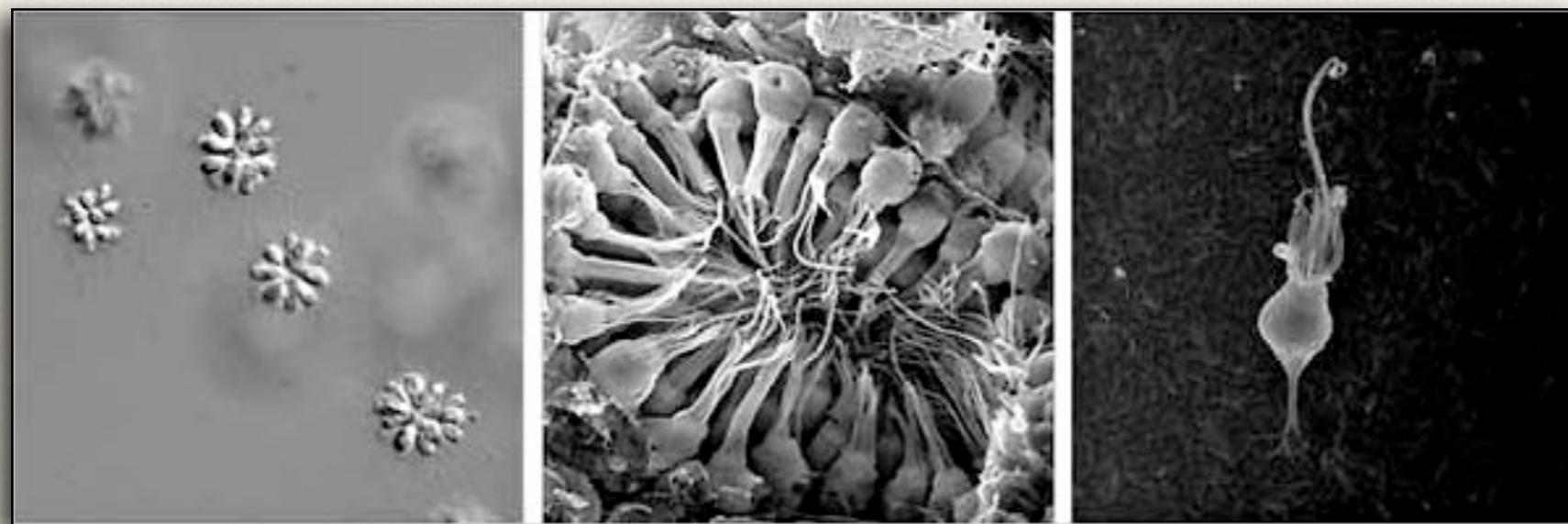
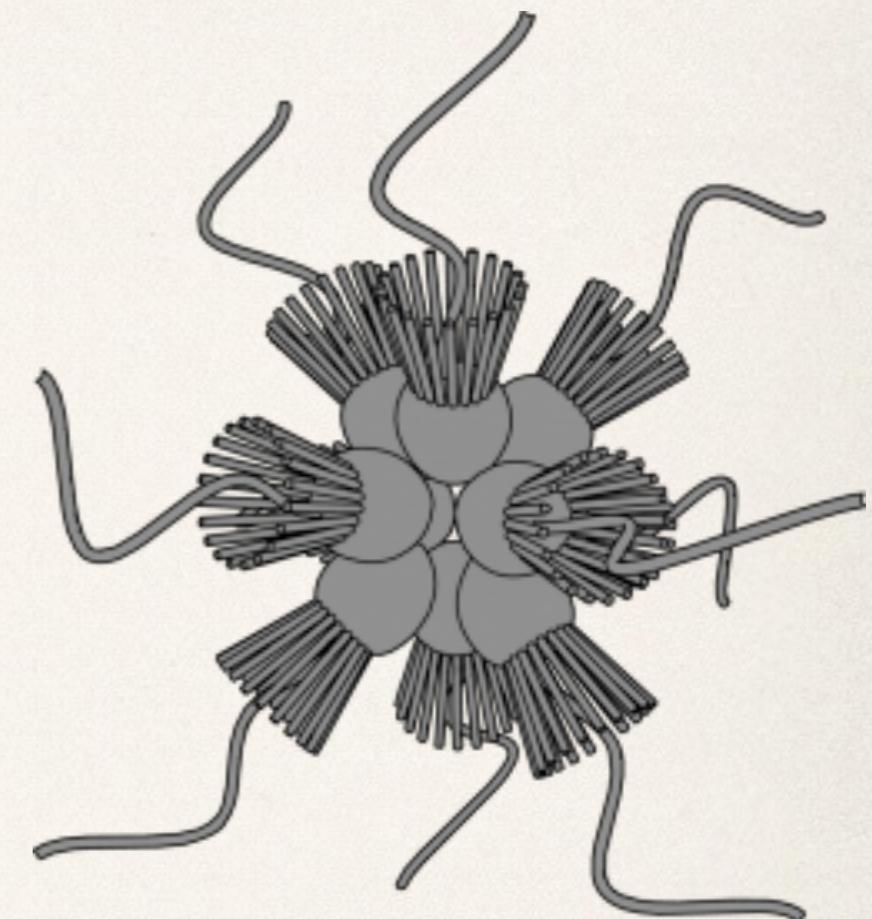
# Choanoflagellatea

Codosigidae (“naked”)  
Salpingoecidae-theca  
Acanthaecidae-basket (silica)



# Choanoflagellatea

colony *Salpingoeca rosetta*



# Choanoflagellatea



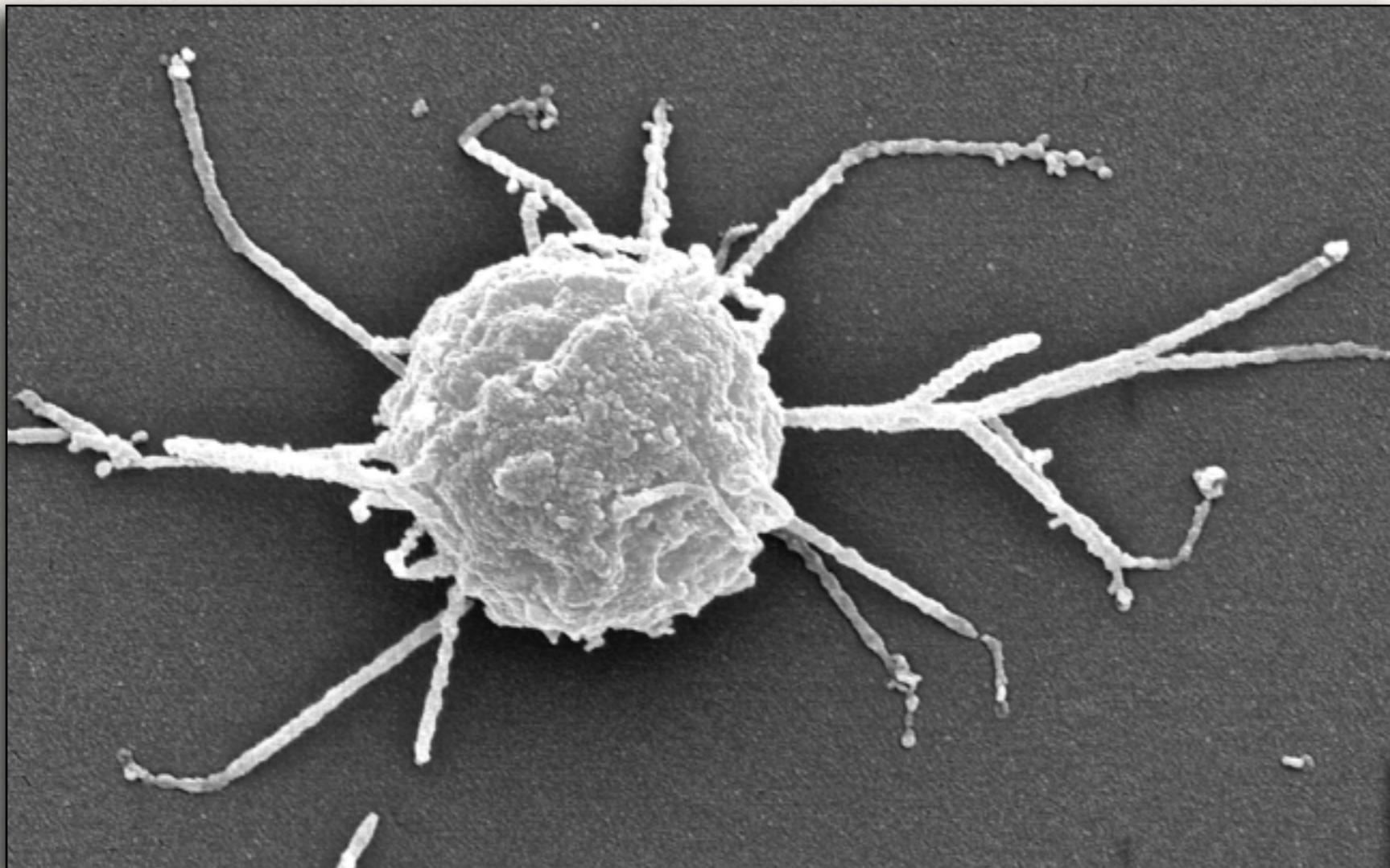
S.rosetta  
Fairclough et al. 2010

00:00:00

# Filasterea

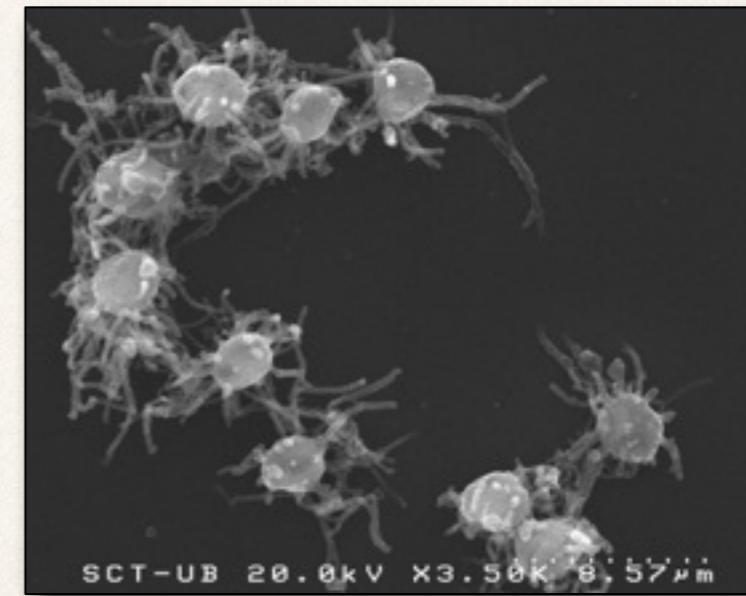
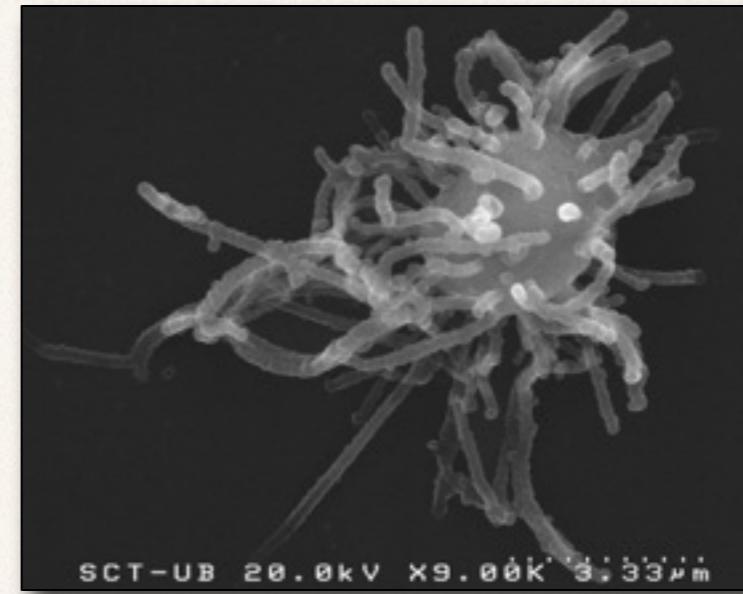
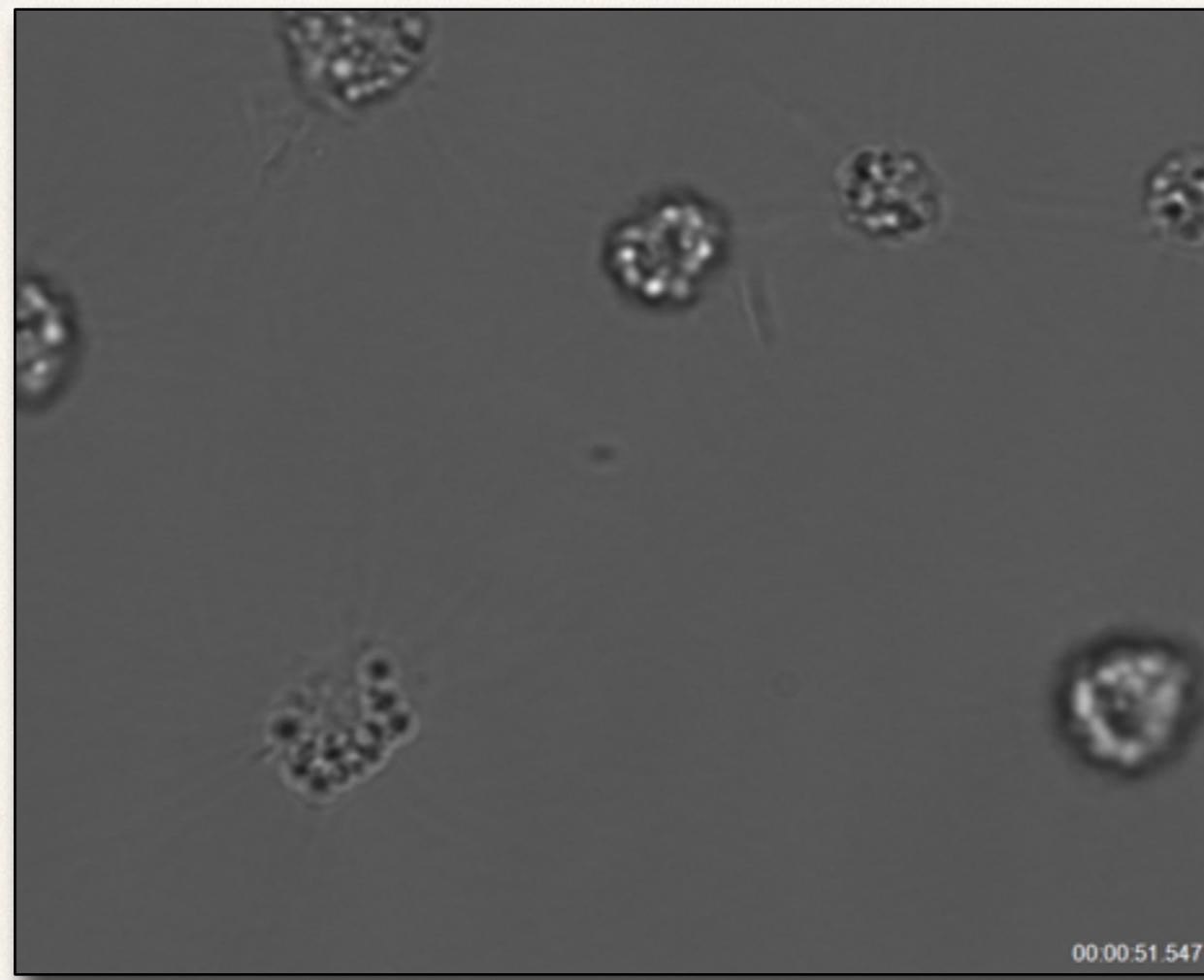
only two known species  
ameoboid, without flagella

# Filasterea: *Capsaspora owczarzaki*

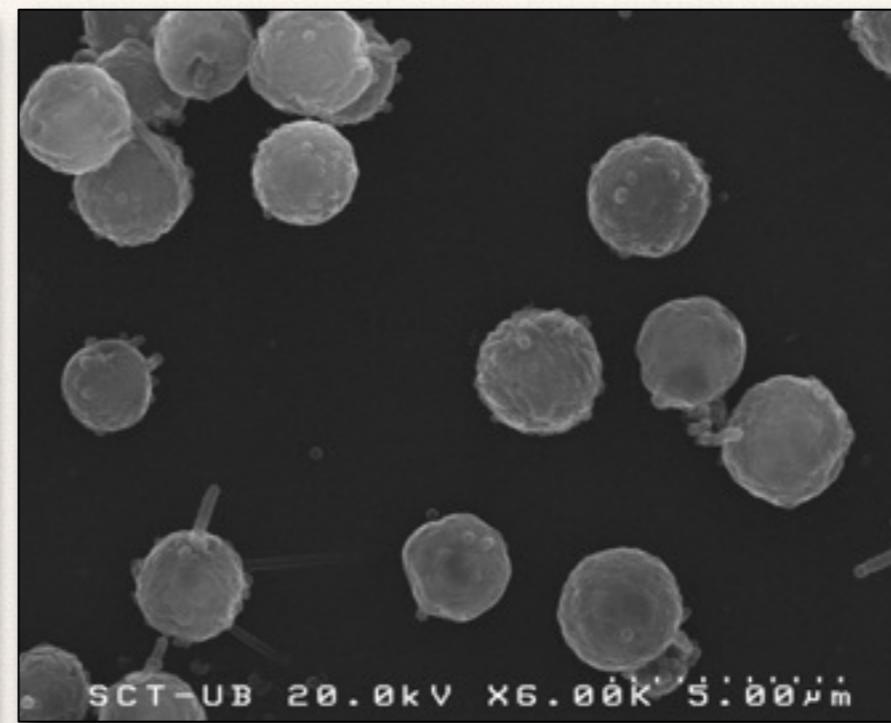


Hertel ET AL. 2002. Int J Parasitol 32: 1183-1191.

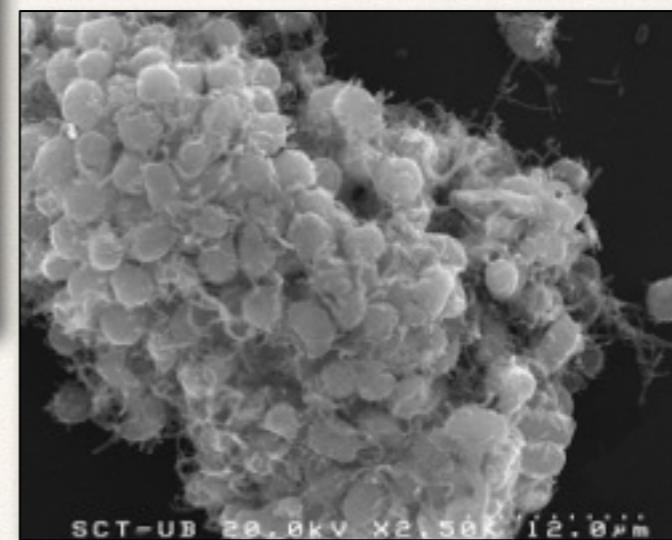
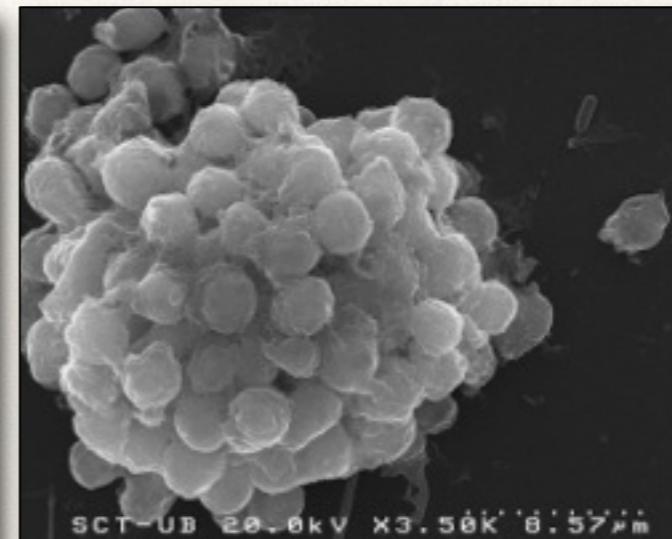
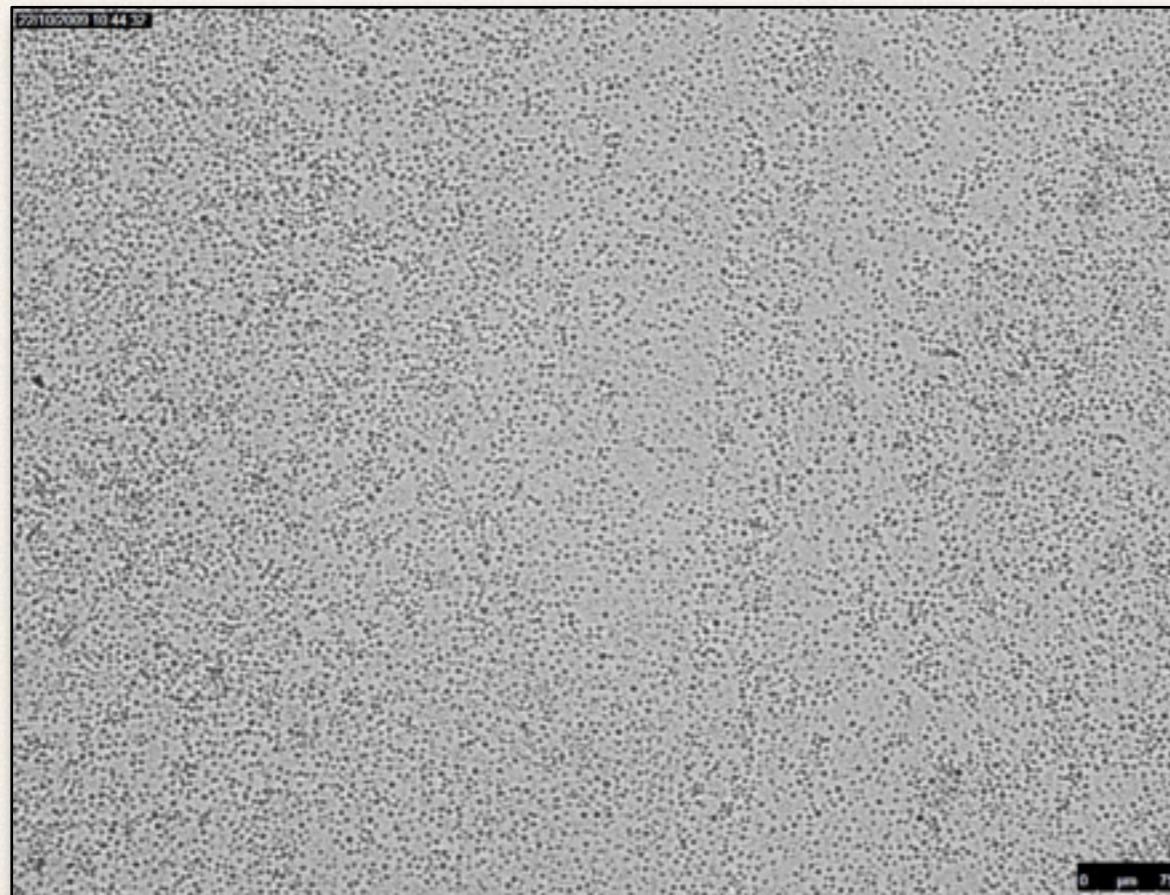
# *Capsaspora owczarzaki* attached/filopodial stage



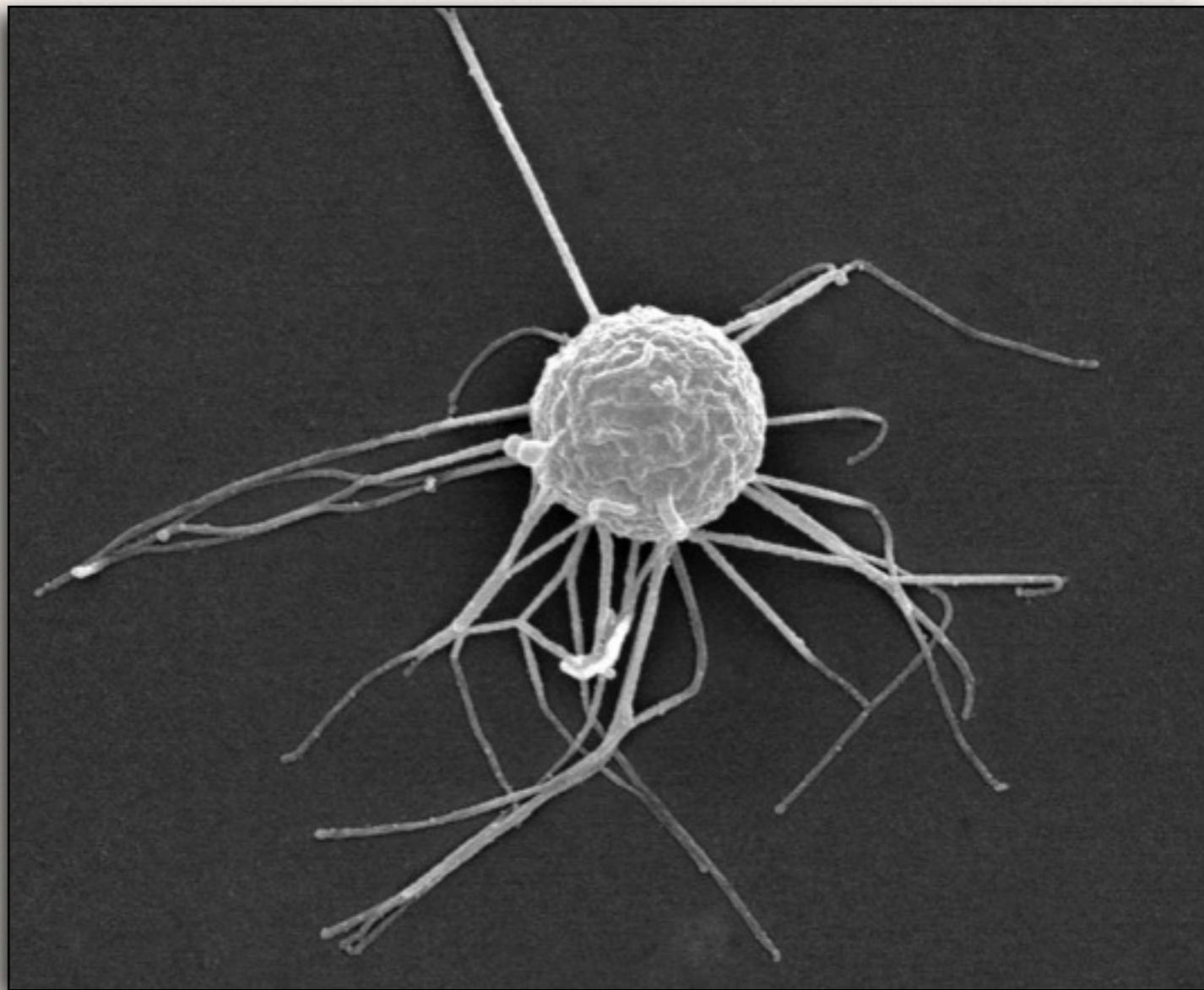
# *Capsaspora owczarzaki* cystic/floating stage



# *Capsaspora owczarzaki* aggregative stage



# Filasterea: *Ministeria vibrans*



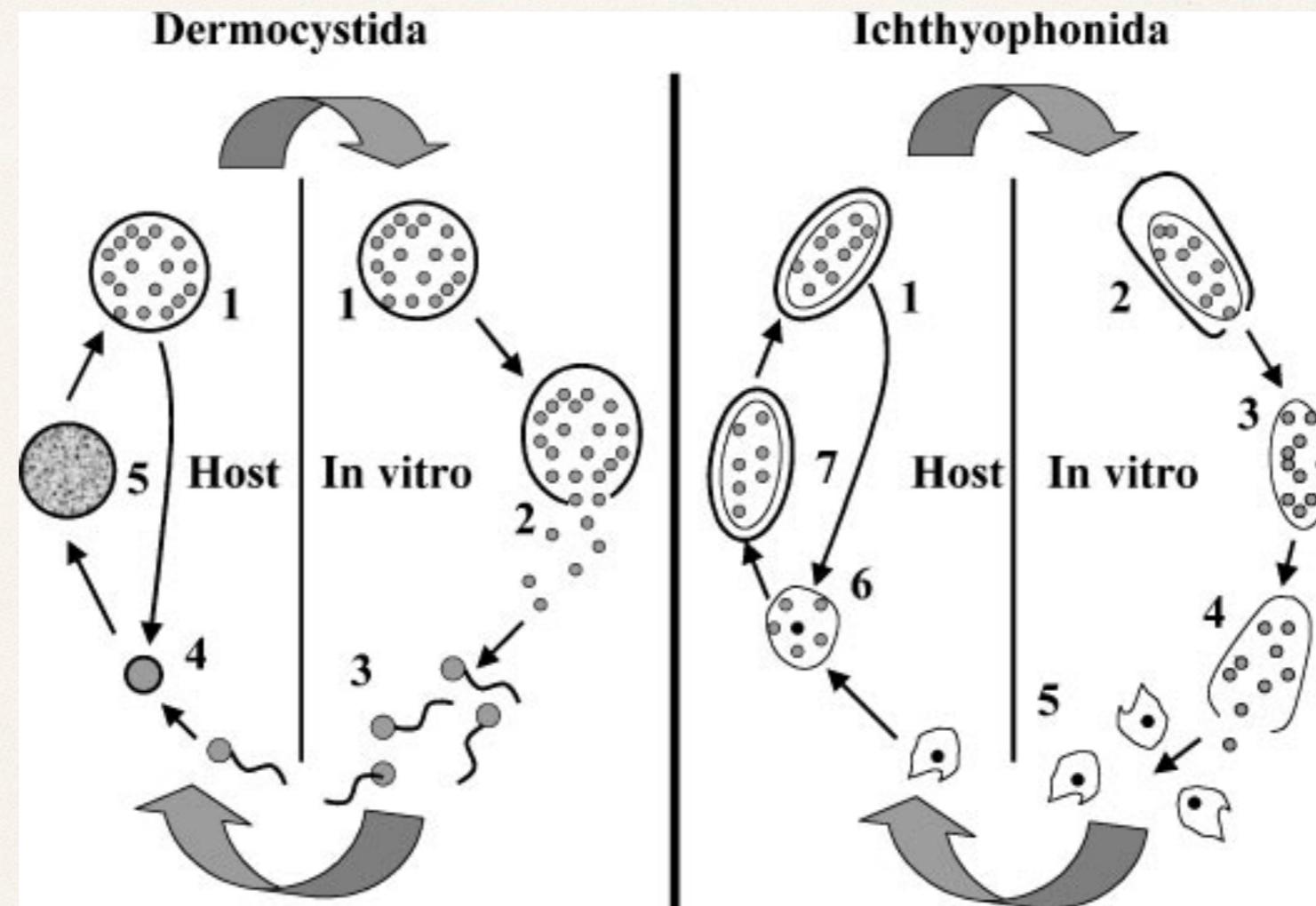
# **Ichthyospora**

also known as **DRIPs** (acronym of *Dermocystidium*, rossete agent, *Ichthyophonus* and *Psorospermium*) or **Mesomycetozoa**.

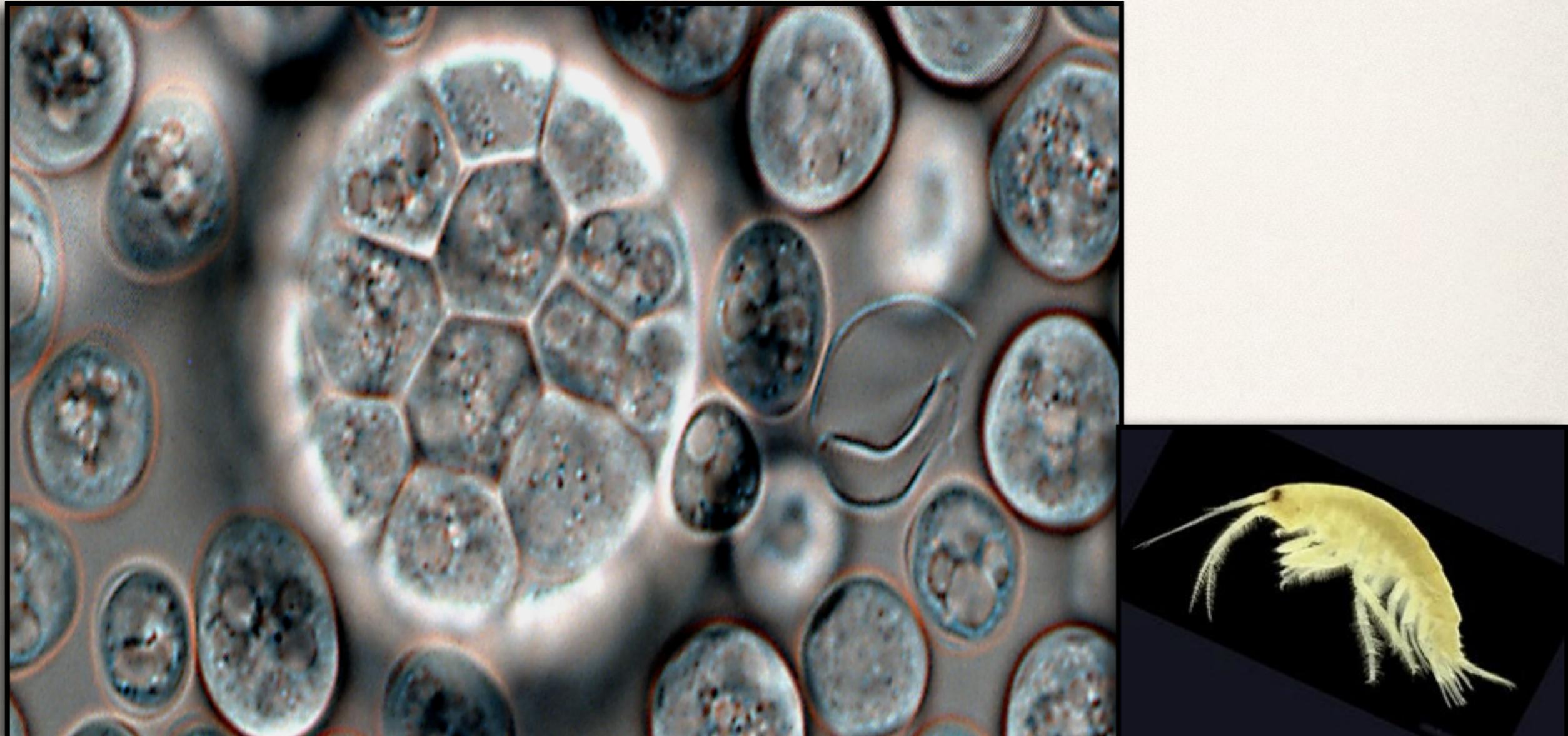
some form colonies  
most are animal parasites or endosymbionts

Mendoza et al. 2002. Annu Rev Microbiol 56: 315-344.  
Glockling et al. 2013. Fungal Ecology 6: 237-247.

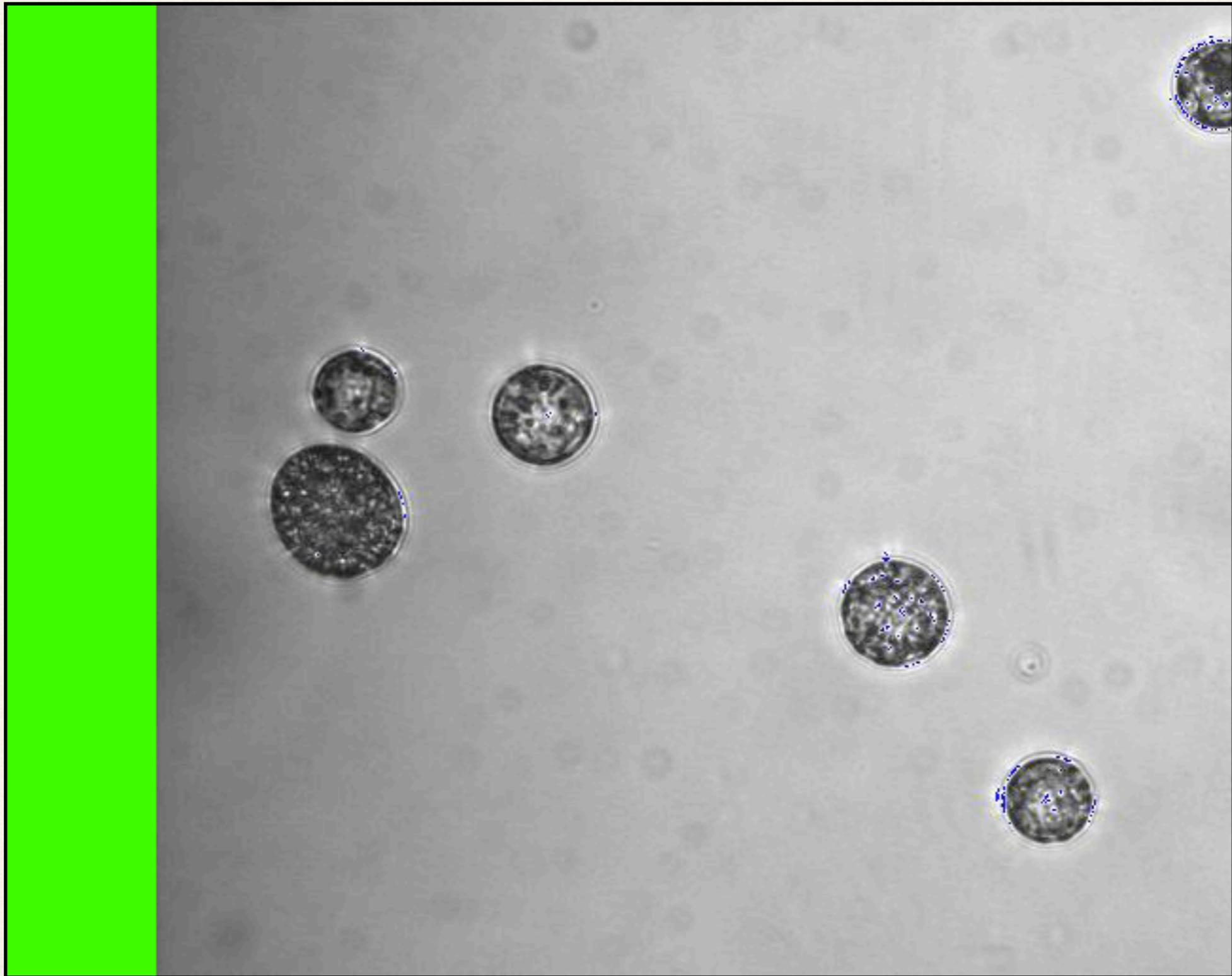
# Ichthyospora



# Ichthyosporea: *Sphaeroforma arctica*



# Ichthyosporea: *Sphaeroforma arctica*

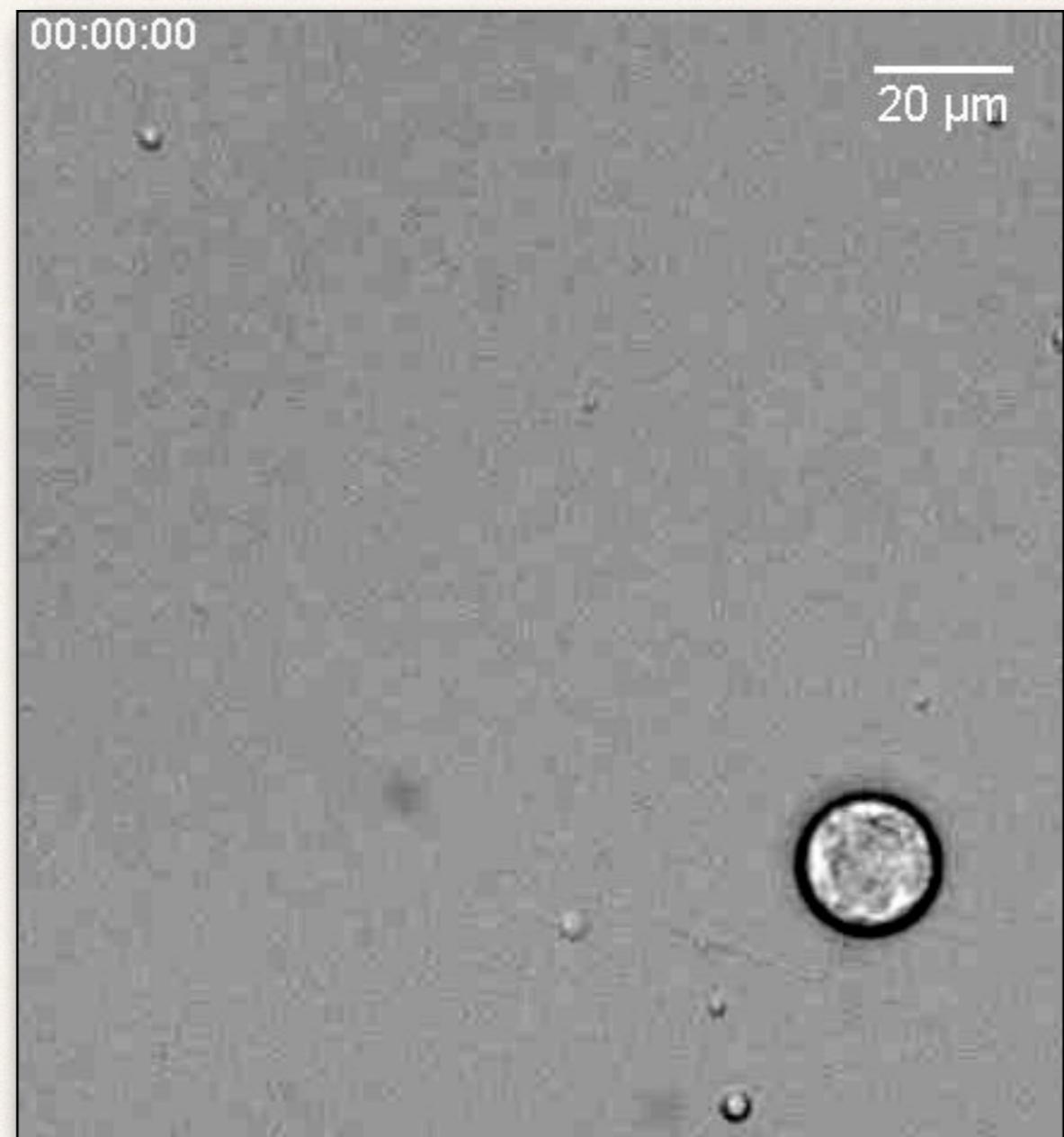


<http://www.youtube.com/watch?v=NwQk6xsqLJo>

the ichthyosporean *Creolimax fragrantissima*



the ichthyosporean *Creolimax fragrantissima*

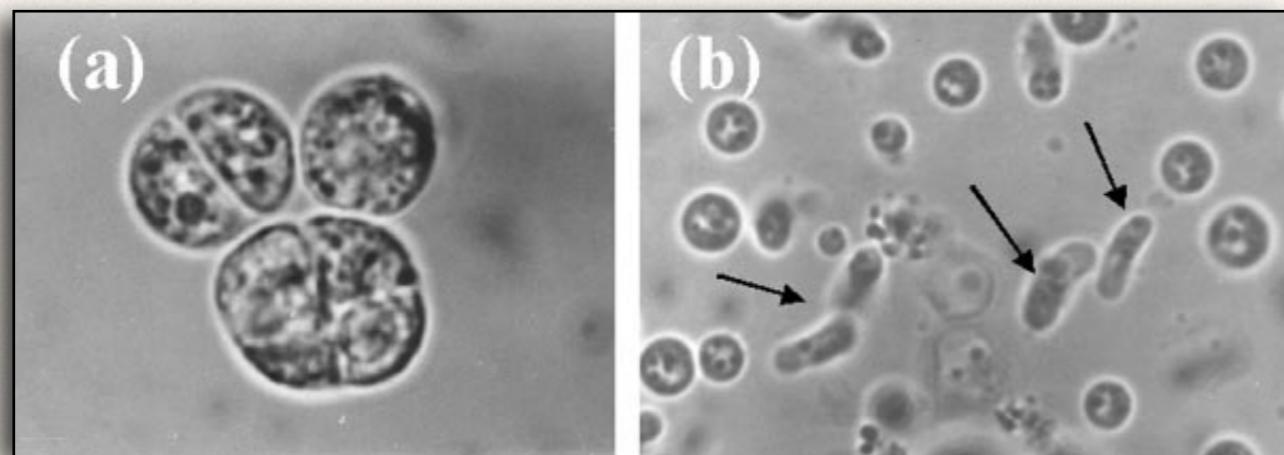


<http://www.youtube.com/watch?v=4ba7arVBKvQ>

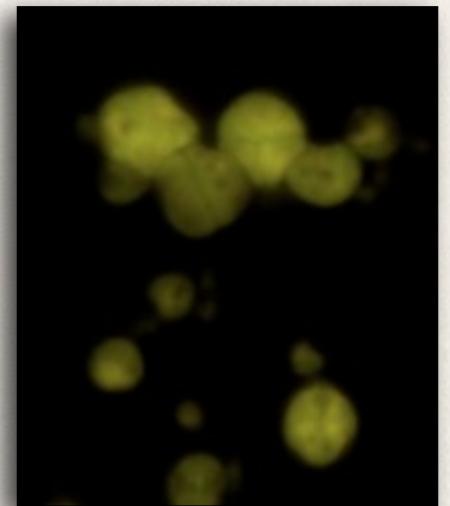
# Corallochytreia

so far, just one species described: *Corallochytrium limacisporum*, found in coral reefs in India

free-living  
marine



*Corallochytrium limacisporum*



*Corallochytrium limacisporum*

# the opisthokonts

