

**Appendix Ic. Households with Access to Safe Water Supply and Sanitary Toilet, 2004-2006.**

Year	Number of households	Households with access to safe water supply		Households with sanitary toilet	
		Number	Percentage	Number	Percentage
2004	15,848,779	13,112,276	82.7	11,003,197	69.4
2005	16,195,170	13,246,383	81.8	11,972,092	73.9
2006	16,277,026	13,502,242	83.0	12,279,703	75.4

**Appendix Id. Frequency of diarrhea in the Philippines, 2004-2006.**

Age Group (year)	2004	2005	2006
< 1	147,091	131,299	125,306
1-4	223,957	224,134	217,115
5-14	70,620	78,431	77,167
15-49	67,636	74,018	73,569
50-64	25,380	26,278	24,892
≥ 65	16,723	14,751	14,973

Source: Annual Report, National Epidemiology Center, Department of Health

## **Appendix IIa. Collaborating hospitals/clinics in Luzon.**

### LUZON

1. National Children's Hospital, Quezon City
2. San Lazaro Hospital, Manila City
3. St. Luke's Medical Center, Quezon City
4. Bangui District Hospital, Bangui, Ilocos Norte
5. Bayambang District Hospital, Bayambang, Pangasinan
6. Dona Josefa Edralin Marcos District Hospital, Marcos, Ilocos Norte
7. Gen. Roque B. Ablam, Sr. Memorial Hospital, Laoag City, Ilocos Norte
8. Ilocos Training and Regional Medical Center, San Fernando, La Union
9. Pangasinan Provincial Hospital, San Carlos City, Pangasinan
10. Piddig District Hospital, Piddig, Ilocos Norte
11. Region I Medical Center, Dagupan City, Pangasinan
12. Gov. Faustino N. Dy, Sr. Memorial Hospital, Ilagan, Isabela
13. Municipal Health Office, Echaque, Isabela
14. Bataan Doctor's Hospital, Balanga City, Bataan
15. Filcare Medical Laboratory, Balanga City, Bataan
16. Tarlac Provincial Hospital, Tarlac City, Tarlac
17. Guinayangan Medicare Community Center, Guinayangan, Quezon
18. Oriental Mindoro Provincial Hospital, Calapan City, Oriental Mindoro
19. Ospital ng Palawan, Puerto Princesa City, Palawan
20. Bulan Municipal Hospital, Bulan, Sorsogon
21. Family Care Clinic, Irosin, Sorsogon
22. Irosin District Hospital, Irosin, Sorsogon
23. Josefina B. Duran District Hospital, Ligao City, Albay
24. Matnog Medicare and Community Hospital, Matnog, Sorsogon
25. Rural Health Unit, Bulan, Sorsogon
26. Rural Health Unit, Matnog, Sorsogon
27. Sorsogon Provincial Hospital, Sorsogon City, Sorsogon
28. St. Louise Medical Clinic, Naga City, Albay
29. Sts. Peter and Paul Hospital, Sorsogon City, Sorsogon
30. Vicente Peralta Memorial Hospital, Castilla, Sorsogon
31. Baguio General Hospital and Medical Center, Baguio City, Benguet

## Appendix IIb. Collaborating hospitals/clinics in the Visayas.

### VISAYAS

1. Aleosan District Hospital, Alimodian, Iloilo
2. Antique Provincial Hospital, San Jose, Antique
3. Barotac Viejo District Hospital, Barotac Viejo, Iloilo
4. Cadiz District Hospital, Cadiz City, Negros Occidental
5. Cadiz Emergency Clinic, Cadiz, Negros Occidental
6. Corazon Locsin Montelibano Memorial Regional Hospital, Bacolod City, Negros Occidental
7. Don Valerio Palmares, Sr. Memorial District Hospital, Passi City, Iloilo
8. Dr. Ricardo Y. Ladrido Memorial District Hospital, Lambunao, Iloilo
9. Dr. Ricardo S. Provido Sr. Memorial District Hospital, Calinog, Iloilo
10. Dr. Rafael S. Tumbukon Memorial Hospital, Kalibo, Aklan
11. Dumangas District Hospital, Dumangas, Iloilo
12. Federico Roman Tirador, Sr. Memorial District Hospital, Janiuay, Iloilo
13. Guimaras Provincial Hospital, Buenavista, Guimaras
14. Iloilo Doctors Hospital, Iloilo City, Iloilo
15. Iloilo Mission Hospital, Iloilo City, Iloilo
16. Iloilo Provincial Hospital, Pototan, Iloilo
17. Jesus M. Colmenares District Hospital, Balasan, Iloilo
18. Riverside Medical Center, Bacolod City, Negros Occidental
19. Ramon Tabiana Memorial District Hospital, Cabatuan, Iloilo
20. Pedro Trono District Hospital, Guimbal, Iloilo
21. Roxas Memorial Provincial Hospital, Roxas City, Capiz
22. Sara District Hospital, Sara, Iloilo
23. St. Paul's Hospital, Iloilo City
24. Western Visayas Medical Center, Iloilo City, Iloilo
25. Western Visayas State University Hospital, Iloilo City, Iloilo
26. Borja Family Hospital Cooperative, Tagbilaran City, Bohol
27. Englewood District Hospital, Tagbilaran City, Bohol
28. MMG Hospital Health Services Cooperative, Tagbilaran City, Bohol
29. Ramiro Medical Center, Tagbilaran City, Bohol
30. Vicente Sotto Memorial Medical Center, Cebu City, Cebu
31. Calbayog District Hospital, Calbayog City, Western Samar
32. Calbayog Sanitarium and Hospital, Calbayog City, Western Samar
33. Clinica Gatchalian and Hospital, Ormoc City, Leyte
34. Eastern Visayas Regional Medical Center, Tacloban City, Leyte
35. Ormoc District Hospital, Ormoc City, Leyte
36. Ormoc Maternity and Children's Hospital, Ormoc City, Leyte
37. Remedios Trinidad Romualdez Hospital, Tacloban City, Leyte
38. Samar Provincial Hospital, Catbalogan, Western Samar

## **Appendix IIc. Collaborating hospitals/clinics in Mindanao.**

### MINDANAO

1. Zamboanga City Health Office, Zamboanga City, Zamboanga del Sur
2. Valencia Sanitarium and Hospital, Valencia, Bukidnon
3. Alexian Brothers Health and Wellness Center, Davao City, Davao del Sur
4. Davao del Sur Provincial Hospital, Digos City, Davao del Sur
5. Davao Sanitarium and Hospital, Davao City, Davao del Sur
6. Digos Doctor's Hospital, Digos City, Davao del Sur
7. Medical Center of Digos Cooperative Hospital, Digos City, Davao del Sur
8. San Pedro Hospital, Davao City, Davao del Sur
9. Mindanao Medical Center, General Santos City, South Cotabato

### Appendix III. Patient Information Sheet

Specimen Code  
(To be filled-up by RED staff)

Prevalence and Genotypic Diversity of Enteric Protozoa (*Giardia* and *Cryptosporidium*)  
Isolated from the Philippines  
Patient Information Sheet

INCLUSION CRITERIA			
<input type="checkbox"/> Watery/Loose stool		<input type="checkbox"/> Passage of more than 3 stool samples per day	
PERSONAL INFORMATION			
Name (Last Name, First Name, MI)		Date of Birth (mm/dd/yyyy)	Age (years)
Place of Birth (Barangay, Municipal/City, Province, Region)		Height/length (cm)	Weight (kg)
Occupation (if applicable)	Present Address (Brgy, Municipal/City, Province, Region)		Telephone/Cellphone No(s)
Referring Physician (Full Name)	Name of Hospital	Hospital Address (Brgy, Municipal/City, Province, Region)	
CLINICAL INFORMATION			
Date of admission/consult (mm/dd/yyyy)	Date of onset of diarrhea (mm/dd/yyyy)	History of previous attack <input type="checkbox"/> Yes <input type="checkbox"/> No	Maximum no. of stools per day (24-hour period)
<b>Signs and Symptoms</b>			
<input type="checkbox"/> Weight loss	<input type="checkbox"/> Dehydration	<input type="checkbox"/> Abdominal pain	<input type="checkbox"/> Fever
<input type="checkbox"/> Headache	<input type="checkbox"/> Nausea	<input type="checkbox"/> Vomiting	<input type="checkbox"/> Stomach cramps
<input type="checkbox"/> Stomach upset	<input type="checkbox"/> Loss of appetite	<input type="checkbox"/> Muscle soreness	<input type="checkbox"/> Weakness
<input type="checkbox"/> Others			
<b>Presence of another similar case in the household</b>		<b>Other illness</b>	
<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Don't know		Identify: _____	<input type="checkbox"/> Don't know
<b>Case Management</b>			
<input type="checkbox"/> Antibiotic	<input type="checkbox"/> ORS	<input type="checkbox"/> Others	
<b>Type of antibiotic</b>			
<input type="checkbox"/> Metronidazole	<input type="checkbox"/> Ciprofloxacin	<input type="checkbox"/> Amoxicillin	
<input type="checkbox"/> Others			
Date antibiotic was started (mm/dd/yyyy)		Duration of antibiotic intake (days)	
FOOD INFORMATION			
<b>Method of cooking food</b>			
Beef, pork	<input type="checkbox"/> Raw	<input type="checkbox"/> Half-cooked	<input type="checkbox"/> Well-cooked
Chicken, poultry	<input type="checkbox"/> Raw	<input type="checkbox"/> Half-cooked	<input type="checkbox"/> Well-cooked
Fish, shellfish	<input type="checkbox"/> Raw	<input type="checkbox"/> Half-cooked	<input type="checkbox"/> Well-cooked
Vegetables	<input type="checkbox"/> Raw	<input type="checkbox"/> Half-cooked	<input type="checkbox"/> Well-cooked
Fruits	<input type="checkbox"/> Raw	<input type="checkbox"/> Preserved	
Milk	<input type="checkbox"/> Pasteurized	<input type="checkbox"/> Not pasteurized, fresh	

**FOOD INFORMATION**

**Food storage**

<input type="checkbox"/> On the table	<input type="checkbox"/> In pots/pans	<input type="checkbox"/> In the refrigerator
<input type="radio"/> Covered container	<input type="checkbox"/> In food cabinet	<input type="checkbox"/> In the freezer
<input type="radio"/> Uncovered container	<input type="checkbox"/> Hung in baskets	<input type="checkbox"/> Others _____

**DRINKING WATER INFORMATION**

**Source of drinking water**

<input type="checkbox"/> MWSS and similar sources	<input type="checkbox"/> Well	<input type="checkbox"/> Others _____
<input type="checkbox"/> Untreated surface water (spring, river, pond, lake)	<input type="checkbox"/> Bottled water	
<input type="checkbox"/> Water tanker	<input type="checkbox"/> Refilling Station	

**Drinking water container**

<input type="checkbox"/> None (direct from faucet)	<input type="checkbox"/> Plastic jar	<input type="checkbox"/> Glass bottle
<input type="checkbox"/> Earthen jar/bottle	<input type="checkbox"/> Pail	<input type="checkbox"/> Dispenser

**ENVIRONMENTAL INFORMATION**

<b>No. of household members</b>	<b>No. of rooms in the house</b>	
---------------------------------	----------------------------------	--

**Excreta disposal**

<input type="checkbox"/> Own toilet	<input type="checkbox"/> Communal toilet	<input type="checkbox"/> Pail system
<input type="checkbox"/> Surface	<input type="checkbox"/> Pit	<input type="checkbox"/> Others _____

**PERSONAL HYGIENE PRACTICES**

**Handwashing**

<input type="checkbox"/> Before handling and preparing food	<input type="checkbox"/> Before eating	<input type="checkbox"/> Before going to toilet
	<input type="checkbox"/> After eating	<input type="checkbox"/> After going to toilet

**Filled up by:**

Name: \_\_\_\_\_

Phone/Contact #: \_\_\_\_\_

Date: \_\_\_\_\_

DO NOT FILL BELOW THIS LINE

**SPECIMEN INFORMATION**

*(to be filled-up by RBD Personnel)*

<b>Date of collection (mm/dd/yyyy)</b>	<b>Type of specimen</b>	<input type="checkbox"/> Blood
	<input type="checkbox"/> Stool	
<b>Organism identified</b>	<b>Method of detection</b>	
	Microscopy	DNA studies
<input type="checkbox"/> <i>Cryptosporidium sp.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> <i>Giardia sp.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> <i>Cyclospora sp.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> <i>Isoospora sp.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Others _____	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>

**Remarks**

Name of Research Nurse	Name of Technical Assistant
------------------------	-----------------------------

## ACKNOWLEDGMENTS

This study was supported by a grant from the Ministry of Health, Welfare and Labor of Japan through the National Institute of Infectious Diseases with Dr. Haruo Watanabe as Project Leader and Dr. Takuro Endo as Head of the Enteric Protozoa Network . Financial support was also provided by a project grant (05-024) to C.C. Buerano and F.F. Natividad from St. Luke's Medical Center - Research and Biotechnology Division.

## PART II: ACCOMPLISHMENTS

### 2004-2005

#### 1. Thesis

- Detection and Molecular Characterization of Enteric Protozoans in Formalin-fixed Diarrheic Stools (Undergraduate Thesis). PS Macasaet. University of the Philippines, Diliman, Quezon City. April 2005.

#### 2. Meetings

- 2004 – Meeting with San Lazaro collaborators
- 2004 – Meetings with Quezon province collaborators
- 2004 - Meetings with Baguio city collaborators
- 2004 – Meetings with Panay collaborators
- September 2004 – Meeting with Cebu collaborators
- October 2005 – Meeting with Dr. Takuro Endo

#### 3. Others

- Memorandum of Agreement with local government health officials of Iloilo Province

### 2006

#### 1. Manuscripts for Publication

- *Cyclospora* and *Isoospora* in Diarrheic Patients from the Philippines. CC Buerano, CB Lago, RR Matias, BB de Guzman, S Izumiyama, K Yagita, and FF Natividad. Japanese Journal of Infectious Diseases. Submitted January 2007.
- Prevalence of *Giardia* and *Cryptosporidium* in Stool Samples of Diarrheic Patients from the Philippines. FF Natividad, CC Buerano, CB Lago, CA Mapua, BB de Guzman, EB Seraspe, LP Samentar, S Izumiyama, K Yagita, RR Matias. Japanese Journal of Infectious Diseases, undergone revision.

#### 2. Oral Presentation of Papers



- *Cryptosporidium* in Filipino Children: Detection, Identification, Prevalence, and Risk-factor Analysis (Graduate Thesis). CB Lago. University of the Philippines in the Visayas, Iloilo City. 30 September 2006.
- *Cryptosporidiosis* and Associated Risk Factors in Filipino Children with Diarrhea. CB Lago, CC Buerano, CA Mapua, LP Samentar, BB de Guzman, EB Seraspe, and FF Natividad. Joint International Tropical Medicine Meeting, Bangkok, Thailand. 01 December 2006.

**3. Creation of a Database:** The database includes the following:

- Demographics
- Clinical information
- Results of microscopy and DNA Studies

**4. Scientific Visits**

- By Project Research Assistant Catherine B. Lago to the Department of Parasitology of the National Institute of Infectious Diseases (NIID), Japan for 2 weeks from January 30 to February 11, 2006

**Purpose of visit:** To train Ms. Lago on the following techniques: immunostaining, fluorescence microscopy, differential interference contrast microscopy, purification of cysts or oocysts, DNA extraction, and polymerase chain reaction

- By Dr. Ronald Matias, Co-Project Leader to the Department of Parasitology, NIID in March 2006

**Purpose of visit:** To discuss standardization of DNA isolation techniques with Japanese counterparts

- Counterpart visit by Dr. Shinji Izumiyama to the Research and Biotechnology Division (RBD) of St. Luke's Medical Center, Philippines from July 10-19, 2006

**Activities during the visit:**

- Discussed relevant matters with RBD scientific team,
- Performed laboratory experiments to standardize methodologies used together with the following RBD staff:
  1. Dr. Ronald Matias
  2. Dr. Corazon Buerano

3. Ms. Joyce Reyes
4. Ms. Catherine Lago

- Helped in the optimization of protocols for molecular characterization, and
- Gave a short lecture on the progress of the project on the molecular characterization part

#### 5. Meetings with Collaborators

- March 20, 2006 – Meeting with Panay island collaborators
- April 10, 2006 – Meeting with collaborators from Health Centers of Quezon City
- July 10, 2006 – Meeting of Philippine Enteric Protozoa Study Group with Dr. Izumiyama

### 2007

#### 1. Manuscripts for Publication

- Identification of *Cyclospora* and *Isospora* from Diarrheic Patients in the Philippines. CC Buerano, CB Lago, RR Matias, BB de Guzman, S Izumiyama, K Yagita, and FF Natividad. Philippine Journal of Science. Submitted 7 Sept. 2007, Accepted Jan. 2008.
- Prevalence of *Giardia* and *Cryptosporidium* in Stool Samples of Diarrheic Patients from the Philippines. FF Natividad, CC Buerano, CB Lago, CA Mapua, BB de Guzman, EB Seraspe, LP Samentar, S Izumiyama, K Yagita, RR Matias. Southeast Asian Journal of Tropical Medicine and Hygiene, In preparation.
- Identification of *Cryptosporidium* in Filipino Children. CB Lago, CC Buerano, RR Matias, EB Seraspe, CA Mapua, BB de Guzman, MJ Formacion, and FF Natividad, Philippine Journal of Science, In preparation.

#### 2. Oral/Poster Presentations

- Molecular Characterization of *Cryptosporidium* from stools of Filipino Children with Diarrhea; Filipinas F. Natividad, Catherine B. Lago, Joyce D. Reyes, Corazon C. Buerano, Blanquita B. de Guzman, Shinji Izumiyama,

Kenji Yagita, Ronald R. Matias, and Takuro Endo; Joint International Tropical Medicine Meeting 2007; Bangkok, Thailand; 29-30 Nov. 2007.

- *Cryptosporidium*: Detection, Prevalence, and Risk Factors in Filipino Children with Diarrhea; CB Lago, CC Buerano, CA Mapua, LP Samentar, BB de Guzman, EB Seraspe, MJ Formacion, and FF Natividad; 2<sup>nd</sup> UPV Graduate Research Conference, University of the Philippines in the Visayas, Iloilo City, 15 Dec. 2007, awarded second prize.

### 3. Meeting(s)

- Meeting with RITM collaborators, Research Institute for Tropical Medicine, Alabang, Muntinlupa City, 05 Dec. 2007
  - RITM has initial agreement for collaboration on a study on selected enteric protozoans from AIDS/HIV- and mentally retarded-patients
  - finalization of proposal is going on
- Enteric Protozoan Research Network Meeting, Bangkok, Thailand, 26-28 November 2007

## PART III: PROPOSED FUTURE ACTIVITIES

### 1. On Epidemiology

- Target susceptible populations (HIV-AIDS patients of Research Institute for Topical Medicine, Dept. of Health)
- Collaborate with community-based health centers in urban slum areas
- Continue collection in Visayas and Mindanao
- Establish a National Surveillance System for Enteric Protozoa in the Philippines

### 2. On Molecular Studies

- Use other DNA extraction procedures for *Giardia*
- Perform additional sequencing work for *Cryptosporidium*
- Generate phylogenetic trees for *Giardia* and *Cryptosporidium* in the Philippines

- Establish mode of transmission of *Giardia* and *Cryptosporidium* in the Philippines
- Provide basic information on *Giardia* and *Cryptosporidium* in the Philippines to the international community

### **3. On Risk Factors**

- Investigate the association of environmental quality on water-borne diarrheal diseases
- Health impact of malnutrition, water source, sanitation, season, immunostatus, age, gender, etc.

### **4. Network Activities**

- Exchange visits of technical staff between collaborating countries
- Regional scientific meeting for all collaborating groups
- Technical working group meeting/s to:
  - write manuscript/s for publication
  - prepare standard manual for laboratory surveillance
  - plan continuing future collaborative activities

**Research Project at Chulalongkorn University,  
Thailand**

**Research Title**

**“Molecular characterization of *Cryptosporidium* spp,  
*Isospora belli*, *Giardia intestinalis* and *Blastocystis hominis*  
among patients in Thailand”**

1

*Isospora belli*

Objectives:

1. Search for cryptic species in *Isospora* infecting humans by morphologic and molecular analyses.
2. Study on ex vivo development of *Isospora* oocysts from patients.
3. Comparative analysis of *Isospora* oocysts from immunocompetent patients and immunocompromised hosts.
4. Test if the internal transcribed spacer I and II sequences are as informative as the 18S rRNA sequence for phylogenetic construction.

2

## Materials and Methods

Subjects: Isosporiasis patients attending King Chulalongkorn Memorial Hospital in Bangkok.

Morphometric study of individual oocysts from each patient.

Observation on *ex vivo* development of *Isospora* oocysts.

Determination of 18S rRNA, ITS1, 5.8S and ITS2 sequences.

Phylogenetic analysis.

3

TABLE I  
Clinical profiles of isosporiasis and morphometry of *Isospora belli* oocysts\*

Patient profiles	n	Age (years) mean ± SD (range)	CD4+ cells/ $\mu$ L mean ± SD (range)	Eosinophils (%) mean ± SD (range)	Oocyst dimensions†		
					Length ( $\mu$ m) mean ± SD (range)	Width ( $\mu$ m) mean ± SD (range)	Shape index mean ± SD (range)
HIV infection (18 males, 12 females)							
Diarrhea							
≤ 3 weeks	5	35.6 ± 11.0 (23–52)	104.3 ± 25.7 (89–134)	5.4 ± 3.6 (0.4–9.1)	27.2 ± 2.6 (18–33)	12.8 ± 1.8 (8–19)	2.2 ± 0.3 (1.3–3.0)
> 3 weeks < 1 year	22	36.7 ± 6.9 (25–50)	60.4 ± 52.9 (8–480)	4.5 ± 3.3 (0.1–14.0)	28.4 ± 2.9 (17–35)	13.7 ± 1.9 (8–21)	2.1 ± 0.3 (1.3–3.3)
≥ 1 year	3	27.7 ± 8.3 (21–37)	80.3 ± 53.6 (25–484)	3.5 ± 1.8 (2.0–5.5)	28.4 ± 3.8 (18–34)	13.8 ± 2.2 (10–19)	2.1 ± 0.4 (1.4–3.0)
Corticosteroid treatment (1 male, 2 females)							
No symptom							
	1	37	ND	0.8	33.7 ± 2.0 (30–37)	14.0 ± 1.6 (12–18)	2.4 ± 0.2 (1.9–2.7)
Diarrhea							
≤ 3 weeks	1	51	ND	0	28.3 ± 2.6 (23–32)	12.8 ± 1.2 (10–15)	2.2 ± 0.3 (1.8–3.1)
> 3 weeks	1	23	ND	1.0	27.4 ± 2.1 (23–30)	13.4 ± 1.3 (11–16)	2.1 ± 0.3 (1.4–2.6)
Immunocompetence (3 males, 2 females)							
No symptoms							
	1	37	ND	12.0	28.0 ± 1.9 (25–31)	14.0 ± 1.9 (11–17)	2.0 ± 0.3 (1.5–2.5)
Dyspepsia							
	1	31	ND	11.1	30.3 ± 2.6 (25–35)	13.7 ± 1.2 (12–16)	2.2 ± 0.3 (1.6–2.5)
Diarrhea							
< 1 year	2	30.5 ± 2.1 (29–32)	ND	8.5 ± 0.7 (8.0–9.0)	27.0 ± 2.4 (20–32)	12.6 ± 2.2 (9–18)	2.2 ± 0.4 (1.5–3.1)
≥ 1 year	1	57	730	16.0	28.4 ± 1.4 (26–30)	15.6 ± 1.7 (12–17)	1.8 ± 0.2 (1.6–2.3)

\* HIV = human immunodeficiency virus; ND = not determined.

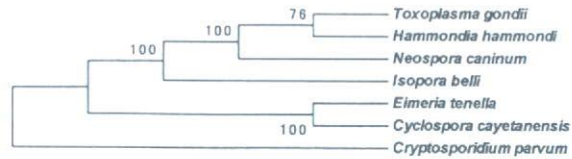
† Measurements under 400 $\times$  magnification from 20 oocysts from each isolate.

4

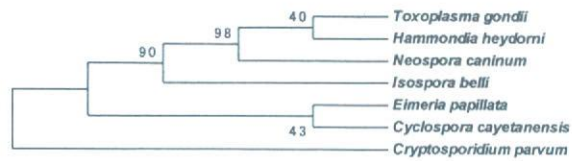


Topology of neighbor-joining trees derived from the SSU rRNA (A) and the ITS-2 region (B) of *Isospora belli* and other coccidian protozoa

**A**



**B**



7

## Conclusion

1. No evidence of cryptic species in *Isospora* infecting humans based on oocyst morphology and sequences of the SSUrRNA and ITSs.
2. *Caryospora*-like oocysts occur ex vivo.
3. Disease severity in isosporiasis seems to depend on host immune status rather than parasite strain difference.
4. ITS2 sequence is informative for phylogenetic construction.

8

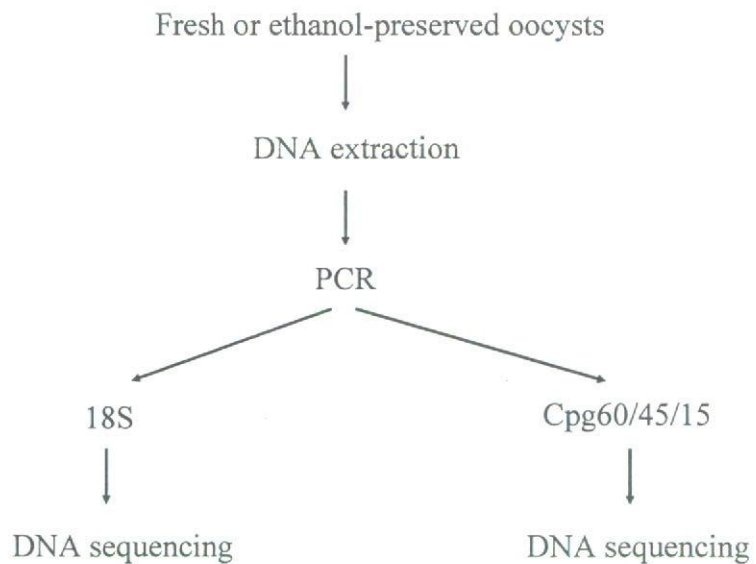


# *Cryptosporidium*

Objectives:

1. Determination of *Cryptosporidium* infecting humans in Thailand based on the 18S rRNA sequences.
2. Analysis of clonal diversity in *Cryptosporidium parvum*, *C. hominis* and *C. meleagridis* as inferred from the Cpg60/45/15 sequences.

9



10

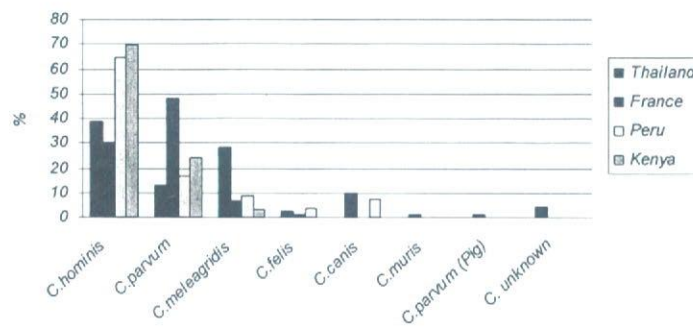
*Cryptosporidium* species found in 67 HIV-infected Thai patients

Species*	Number	%
<i>C. hominis</i>	27	38.6
<i>C. meleagridis</i>	20	28.6
<i>C. parvum</i>	9	12.9
<i>C. canis</i>	7	10.0
<i>C. felis</i>	2	2.4
<i>C. muris</i>	1	1.4
<i>C. parvum</i> (Pig genotype)	1	1.4
Unknown species	3	4.3

\*3 cases were co-infected with *C. hominis* and *C. meleagridis*.

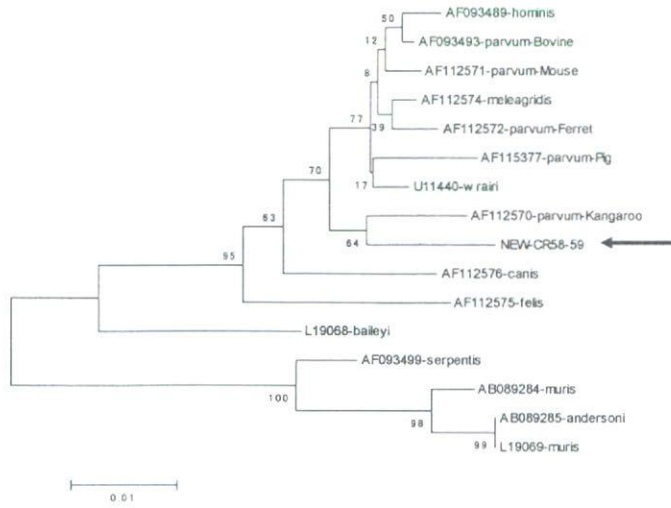
11

Geographic distribution of *Cryptosporidium* species in Thailand, France, Peru and Kenya



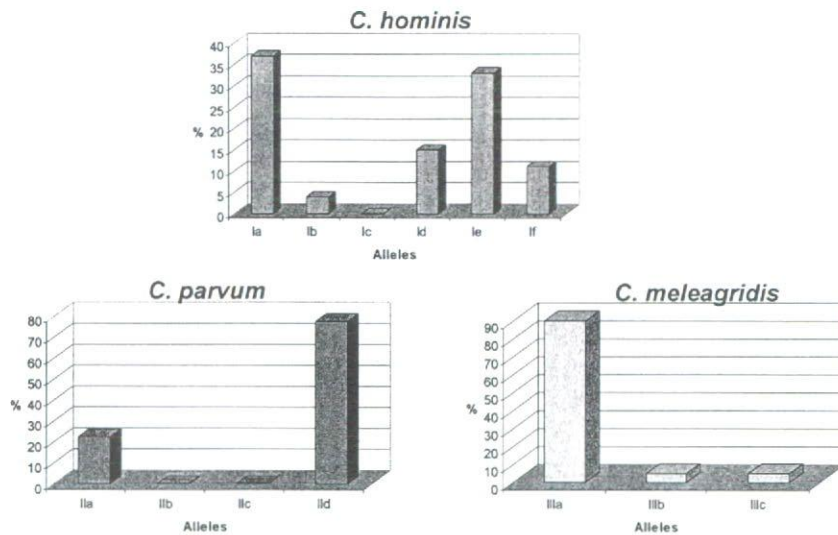
12

Phylogenetic relationship of the novel species of *Cryptosporidium*



13

Distribution of Cpg60/45/15 alleles of *Cryptosporidium* found in Thailand



14

## Conclusion

1. Both zoonotic and anthroponotic species of *Cryptosporidium* circulate among HIV-infected patients in Thailand.
2. Cryptic or novel species is identified.
3. Strain variation occurs in *C. parvum*, *C. hominis* and *C. meleagridis* as inferred from the cpg60/45/15 sequences.