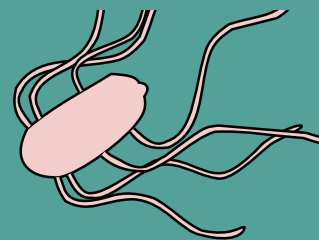


# Náaysaj óol ti'



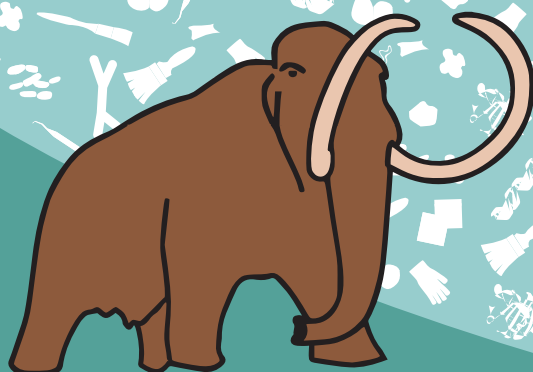
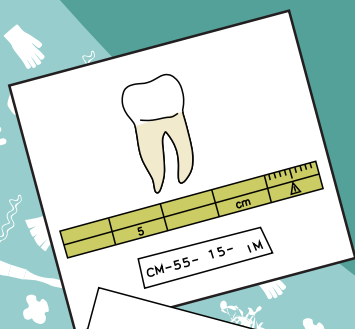
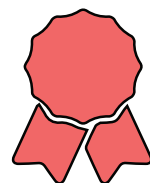
# U XOOKIL YO'OSAL U XAAK'ALIL ÚUCHBEN BA'ALOB TI' U KUXTAL MÁAK

Máax u yuumil le áanaltea':

\_\_\_\_\_

k'aaba'

Táan u kanik u xaak'alil  
úuchben ba'alob ti' u  
kuxtal máak



Jump'eel áanalte' tia'al  
boonbil tumen

U nu'ukbesajil Max Planck u tia'al  
u k'ajlayil wíiniko'ob

**Publisher:** Max Planck Institute for the Science of Human History

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**Assistant Editor:** Jessica Hendy

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Ke Wang

Christina Warinner

This coloring book was produced as part of a training course in scientific illustration.



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# MÁAXÓONT'

Le máax ku xaak'altik úuchben ba'alob ti' u kuxtal máak, ku xak'altko'o jejelas ba'alob ucha'antak yéetel u jaajil, u túumbenil tia'al kaj k'akolt bix máako'ob ka'achij



U nukulil u lochaal luum

## Ti kax

Le ku xaak'al úuchben ba'alob ti' u kuxtal máak, ku meyajo'ob yéetel le máako'ob ku xaak'alo'ob tio'olal úuchbem baáolo'ob tia'al u páantiko'ob yéetel u ch'akob jump'it ba'ax tu kaxto'obi' yo'osal u xak'altiko'ob ti' u kúuchil u meyajo'ob.

Je'el u táakpajal ichil le meyaja' k xak'altik muka'an máako'ob, núukulil, wáaj u baakel ba'alcheo'ob tia'an túux ku pu'ulul ta' miis wáaj xak'al u xiixel pak'alo'ob.

## Tu kuchil k meyaj

Le ken meyajnako'on yéetel u yúuchbenil u ch'íibal wíinik (ADN), k'abet bíibíilki tu'ux yano'on; k bukintik nook, xaanab yéetel pix k'ab u tia'al le je'elo'; yo'osal kanantik ma' u xa'akpajal yéetel u túumbenil ADN.

Le máaxoob jach chuka'an u naát to'olal xook ku meyajo'ob yéetel jejelas nu'ukulil yo'osal u xak'al-tiko'ob úuchbem ba'alo'ob



U nukulil u mansaal jumpit ja ti u lak tuux



# U PÁANTIL

Le máako'ob ku xaak'altiko'ob úuchben ba'alob ti' u kuxtal máak ku bino'ob yok'ol kab tia'al u yojeltiko'ob yo'osal ba'ax ucháantak tio'olal máak. Ma' chéen yéetel u núukulil u meyajobi', ba'ale' yaan k'iine' k'abet jela'an ba'alob. Je'el bix ti' Himalaya, le máako'ob ku xaak'alo'ob tio'olal úuchbem baáolo'ob k'abetio'ob u nu'ukulil utia'al u na'akalo'ob yéetel u kátko'ob wáa je'el u beeytale'

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**NATIONAL TRUST FOR NATURE CONSERVATION**  
**Entry Permit (ACA/MCA/GCA)**  
Schedule - 2 (Relating to Sub-Rule (1) of Rule 19)

Receipt No. **0281630**

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

Date of Birth: \_\_\_\_\_

Passport No. \_\_\_\_\_

Nationality: \_\_\_\_\_

Purpose of Visit: \_\_\_\_\_

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

Entry Permit Issuing Authority: \_\_\_\_\_

Signature: \_\_\_\_\_

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

Designation: \_\_\_\_\_

**NATIONAL TRUST FOR NATURE CONSERVATION**  
**NTNC/ACA/ENTRY FEE RECEIPT**

Ticket No. **0281630**

Date \_\_\_\_\_

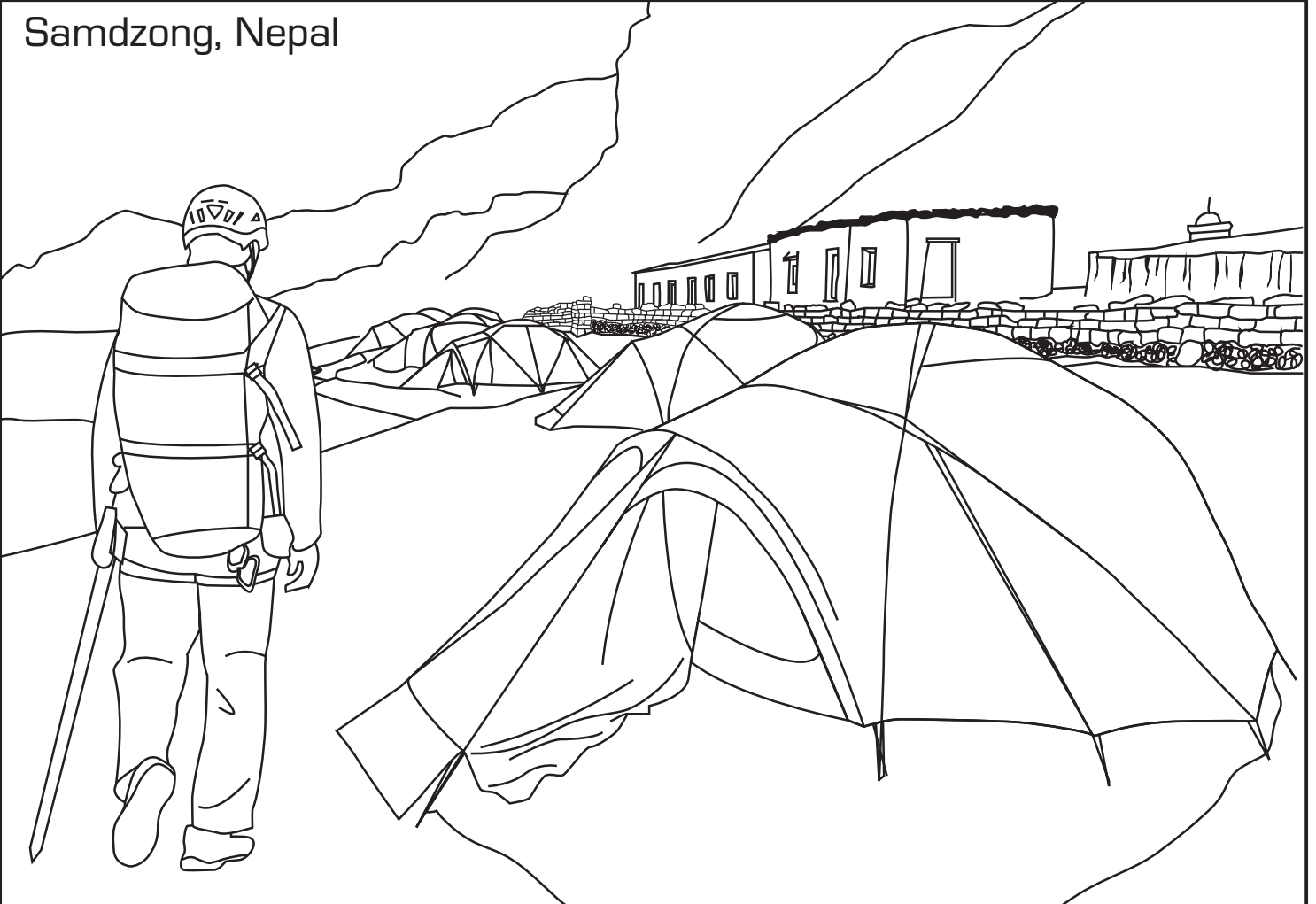
Received from Mr/Ms/Ms  
Passport Number \_\_\_\_\_  
Date of Birth \_\_\_\_\_  
Nationality \_\_\_\_\_

Agency Name **SHERPA SHALBU-LA** Authorized Signatory

**TOURIST COPY**

gration Officer  
da No

## Samdzong, Nepal



## U tail koj

Ti' u ta'il koje' ti' yaan jejeláas xixelo'ob janli' yéetel u yik'elo'obi'. Le je'ela' je'el u páajtal u xakalta'ale' tia'al u yojeta'al báax ku jáantik u yuumil yéetel wáa toj u yóol

## Baak yetel koj

Ti' baak yéetel koje' ti' yaan u xix u yúuchbenil u ch'íibal wíiniki' (ADN) tia'al u xakalta'al tu'ux seten máan máaki' yéetel tia'al yojeta'al bix u yicho'ob, u tso'otsetel u poolo'ob. Wáa u yuumil kiim tio'olal yaaj koja'anile', je'el u kaxta'al bix u úuchik u tsaayati'

## Xixel ti kat

U xiixel janal p'atal ti' k'at je'el u beyta'al u xakalta'al tia'al u kaxta'al u jejeláasil yik'elo'ob ku tal ti' ba'alcheo'ob wáa ti' che'o'ob, je'e bix u ch'ach'alkil le janalo'ob. Le kan xak'altake' je'el u chikpajal ba'ax ku jantiko'ob yéetel bix u beetiko'ob yócho'ob ka'ache'.

## U baakel baalcheoob

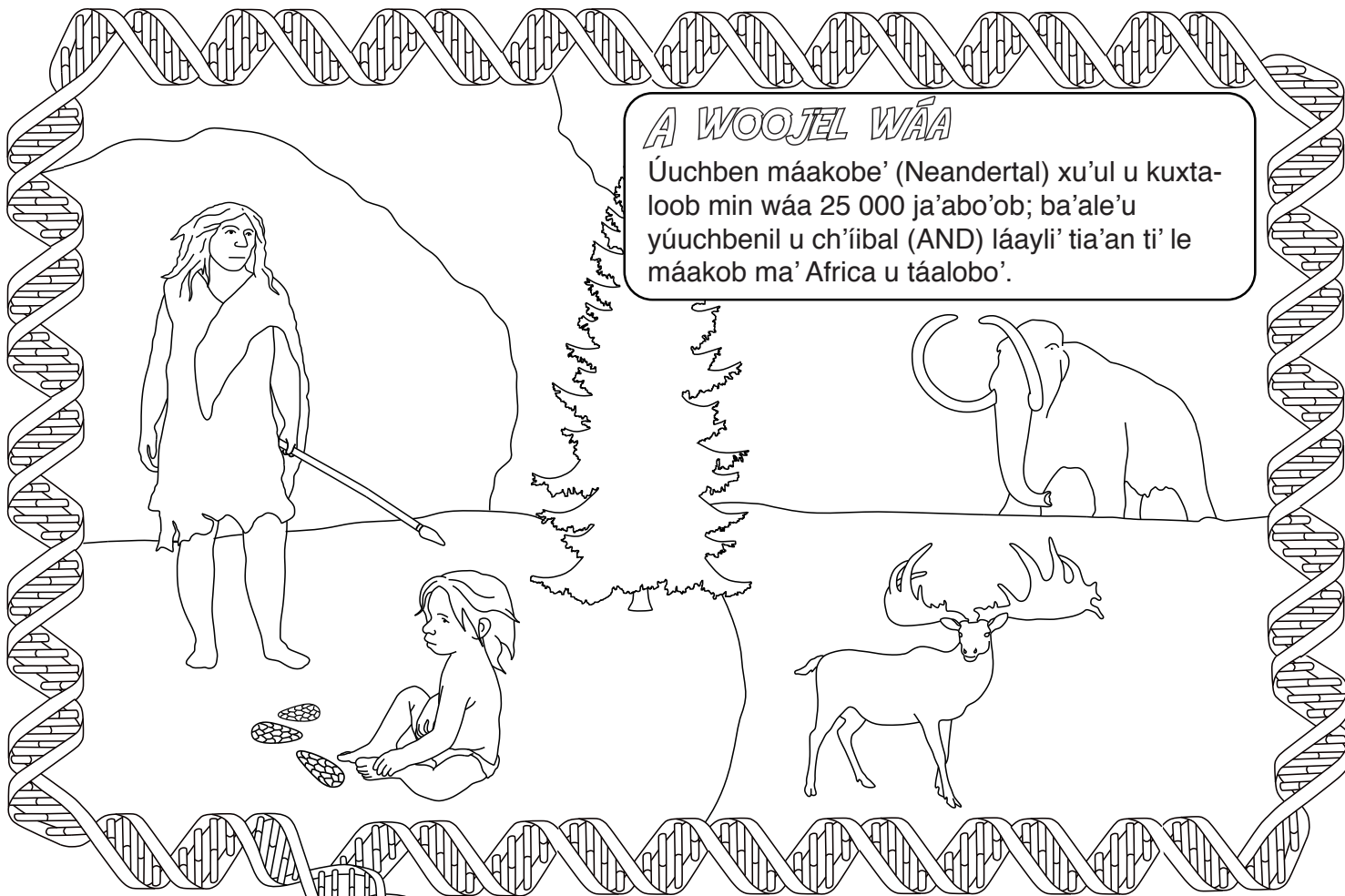
U baakel ba'alcheo'ob je'el u meyaj tio'olal ojeeltik ba'ax ku jaantiko'ob yéetel bix ku kanáantalo'ob ka'ach. Layli' u beeytal u xakaltaal tio'olal u yojeta'al bix ka'ach yok'ol kab.

## BA'AX XAK'ALTIK

Le máaxo'ob ku xaak'altikoob úuchben ba'alob ti' u kuxtal máak k meyaj yéetel u jejeláasil núukulilo'ob beyxan yéetel u túumbenil k'aj óolal tia'al kaxtik máaxoni' yéetel tia'al ojeeltik tio'olal k ch'íibal way yok'ol kabe'. Yéetel u nu'ukul jach k'a'anan tio'olal, je'el u beytale'; ya'abach ba'alob je'el kanik chéen yéetel junp'éel koj, baak wáa junp'éel kuum.

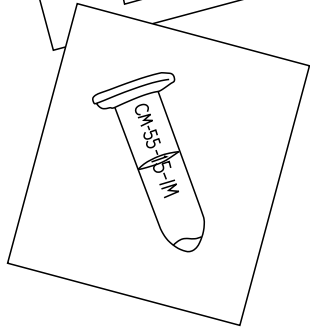
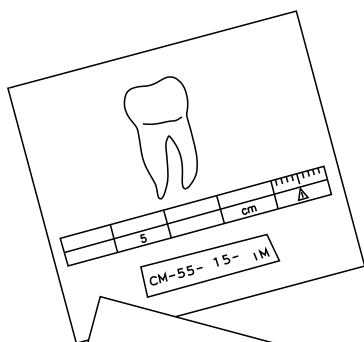
## A WOJEL WÁÁ

Úuchben máakobe' (Neandertal) xu'ul u kuxta-  
loob min wáá 25 000 ja'abo'ob; ba'ale'u  
yúuchbenil u ch'iibal (AND) láayli' tia'an ti' le  
máakob ma' Africa u táalobo'.



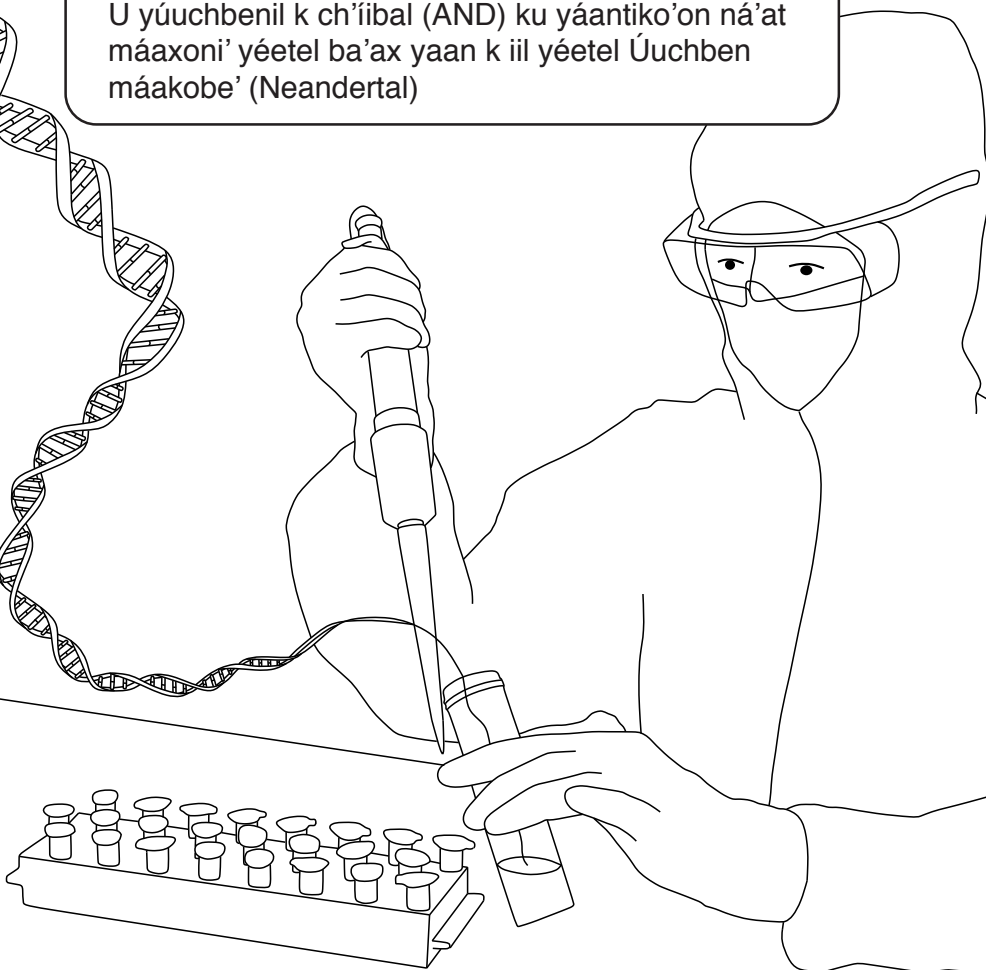
## TU'UX U TAAL WÍINIK

U yúuchbenil k ch'iibal (AND) ku yáantiko'on ná'at  
máaxoni' yéetel ba'ax yaan k iil yéetel Úuchben  
máakobe' (Neandertal)



## U Kexpajal winik

Je'el u páajtal kaambal tio'olal  
úuchben wíinike' chéen yéetel  
u xak'alil u koj yéetel u  
baakelo'obe'. Le je'ela' je'el u  
yáantiko'on ná'at bix úuchik  
p'ataj je'e bix yaniko'on bejláe'.



# LE KA'AJ JO'OP'OL U MAAN ÚUCHBEN WÍINKIK JEJELÁAS TU'UX

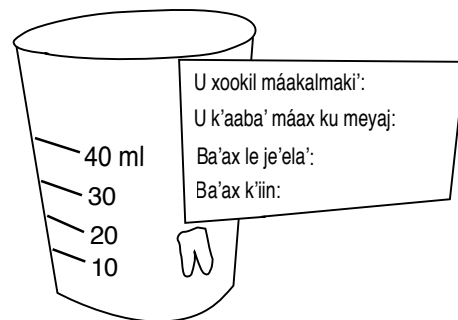
U yúuchbenil k ch'íibal (AND) ku kaxta'al ti' baak yéetel ti' kojo'obe' ku meyaj yo'osal u yila'al tu'ux seten maanja'an máakobi'. Le ken xak'alta'ak yéetel u jeelasáasil núukuliloób tial yoojeta'al buka'aj u yúuchbenil; je'el u beeytal k ojéeltik ba'ax k'iin bin le máakobo' yéetel bix úuchik u bino'ob



## A WOOJEL WÁA

Le ku ya'alal radiocarbono, ku ch'abal ti' iik' tumen xiwo'ob táan u beetiko'ob u yocho'ob tumen. Ku yantal ti' u w'iinklilil ba'alcheo'ob le kan u jaanto'ob xiwo'ob. Ba'ale' ti' ku p'atali', leo'olale' le ken máanak k'iine', je'el u páajtal u yiilale' wáa uuch kimik wáa ba'ax kinsej

## Bix ku jetsel u yuchebenil yetel radiocarbono



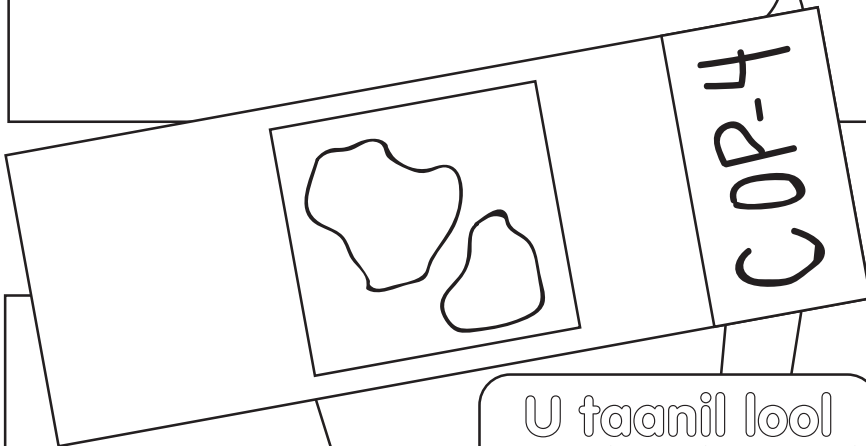
U xookil máakalmaki:  
U k'aaba' máax ku meyaj:  
Ba'ax le je'ela':  
Ba'ax k'iin:

U jets'el buka'aj úuchben ba'alche'ob yéetel che'o'obe' ku beetal yéetel jump'éeel ba'al ti' yan je'e ba'axak kuxa'ane' (Carbono), tumen ku ye'esik tak 40.000 ja'ab u yúuchbenil

# BA'AX KU JANTA'AL ÚUCHIJ

Copán, Honduras  
Ja'ab 300 AC

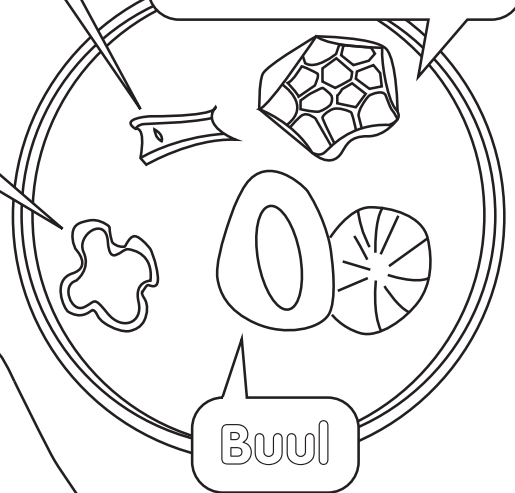
Yaan k'iine' le máako'ob ku xak'alo'ob tial u kaxtix túumben na'ato'ob ku k'abetkunsiko'ob jumpéel núukul tial u yiko'ob mejen balo'ob (microscopio). Le je'ela' tial u yiko'ob u mejen xéexet'al janal ti núukul wáa ti kojo'ob. Yéetel le je'elo' je'el u beytal u yila'ale' ba'ax tu janto'ob úuchben Mayab wiiniko'ob maanaj ti 2.000 ja'abo'ob



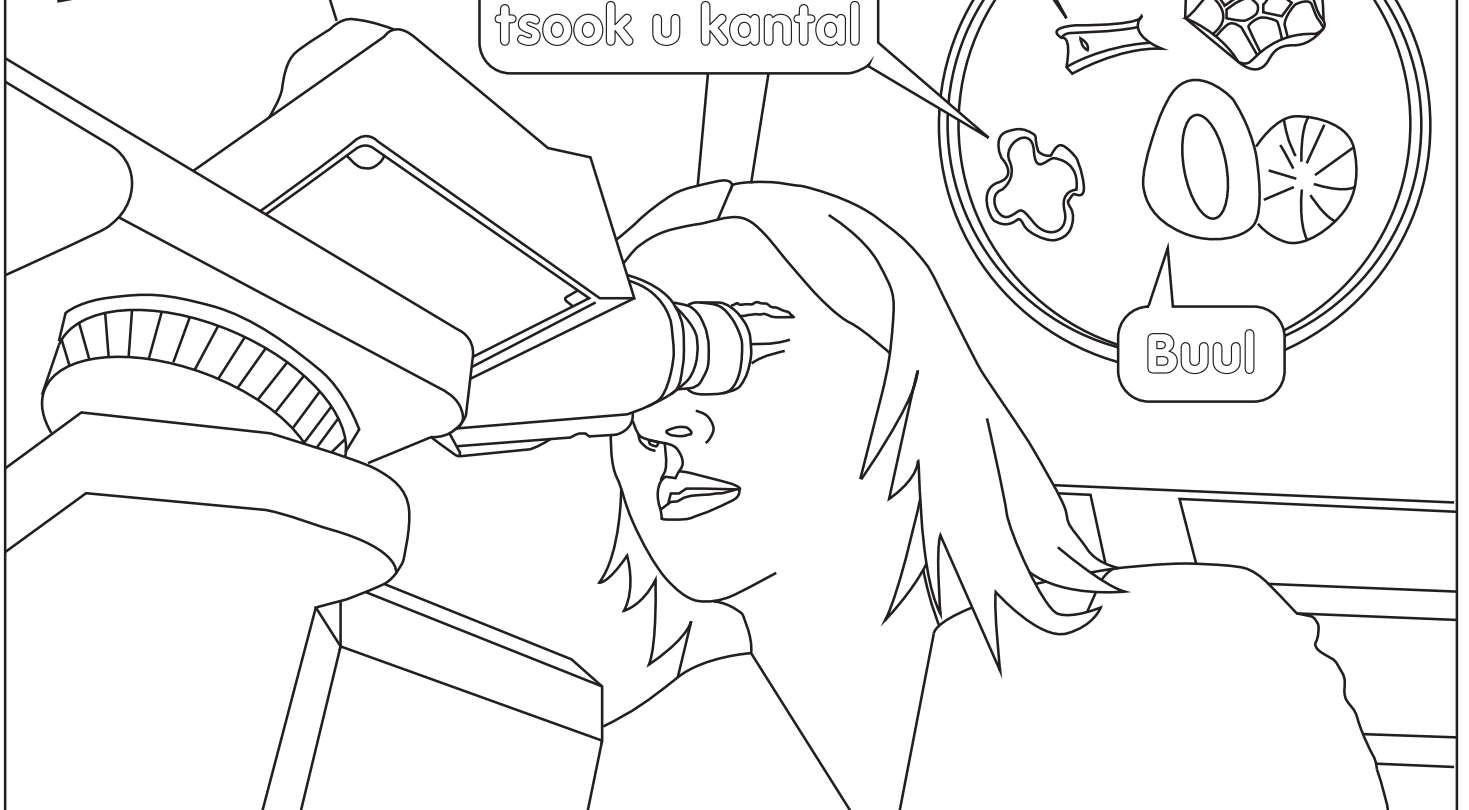
Jumpit ixiim

Junxet neek

U taanil lool  
tsook u kantat



Buul





# ALAK'T BA'ALCHE'O'OB

Ts'ok u máan mas ti' 10 000 ja'abo'ob, wíinik jo'opol u pak'al yéetel u alak't ba'alche'ob tial jejeláas beelalo'ob. Táanile' wakax, le yaax kanan wakaxo'obo' ku ts'aako'ob kuuch, yéetel ku ch'a'abal u bak'el, yéetel u k'aab u yiimo'ob

## A WOOJEL WÁA

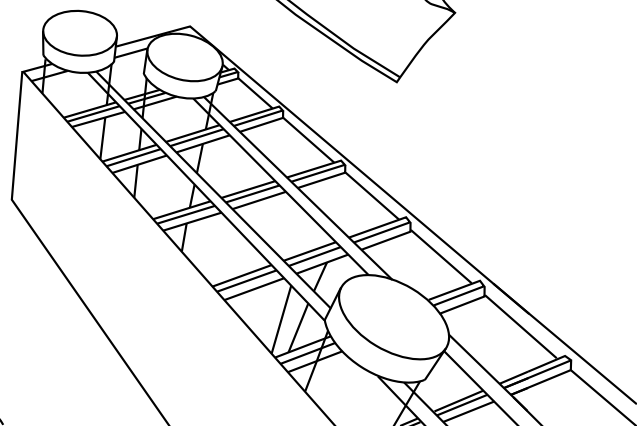
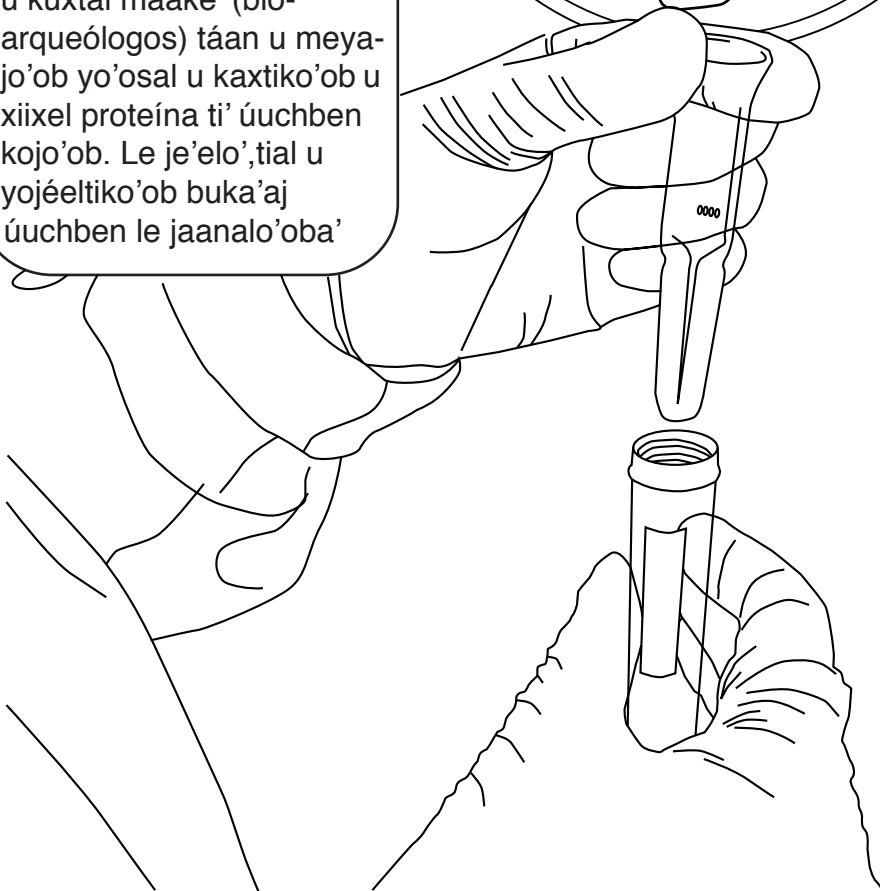
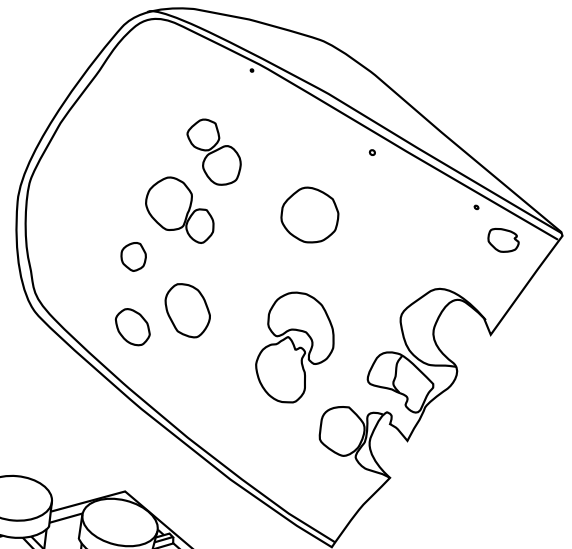
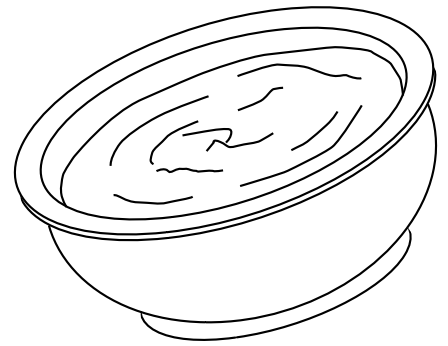
Wakaxe' alak'tabi' je'el bix úuchik yéetel le ba'alche'o' u k'abatik bisonte. Je'el beey wakaxe' ba'ale maas. Nojoch. ojéela'an tumen u maas úuchbenile' ti' ku taal Anatoliae', bejlae' u noj kaajalTurquía.



Bix junkach  
baax jach kaanan  
ti winklil (protena)

Tuux u taal  
janal beetaan  
yetel u kaab u  
yiim wakax

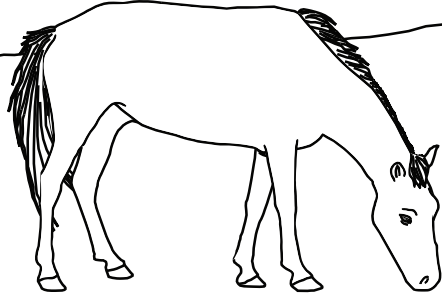
Mixmáak yojel tu'ux u taal janal beeta'an yéetel u k'aab u yiim wakax, ba'ale', le máako'ob ku xaak'al-tiko'ob úuchben ba'alob ti' u kuxtal máake' (bioarqueólogos) táan u meya-jo'ob yo'osal u kaxtiko'ob u xiixel proteína ti' úuchben kojo'ob. Le je'elo', tial u yojéeltiko'ob buka'aj úuchben le jaanalo'oba'



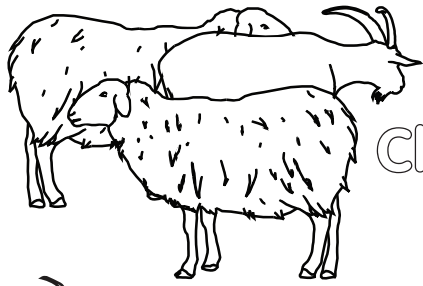
# Mongolia

Ya'ab ba'alche'o'ob yaan tu'ux óoli ma' tu k'axa ja' ti' u noj lu'umil Mongoliae'. Yaan tsiimini' wakaxo'obi', taman, yéetel chivo. Máako'ob chéen bey u máanobo' yéetel ma' u jets'kunmo'ob u yotoch ti' junp'éel kúuchili' ku beetiko'ob jejéelas jaanal yéetel u káb u yiim le ba'al che'oba'.

Tsimin

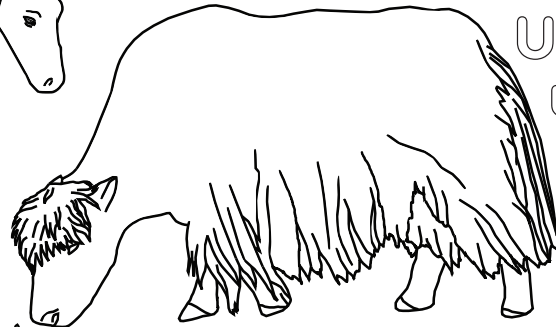


Taman

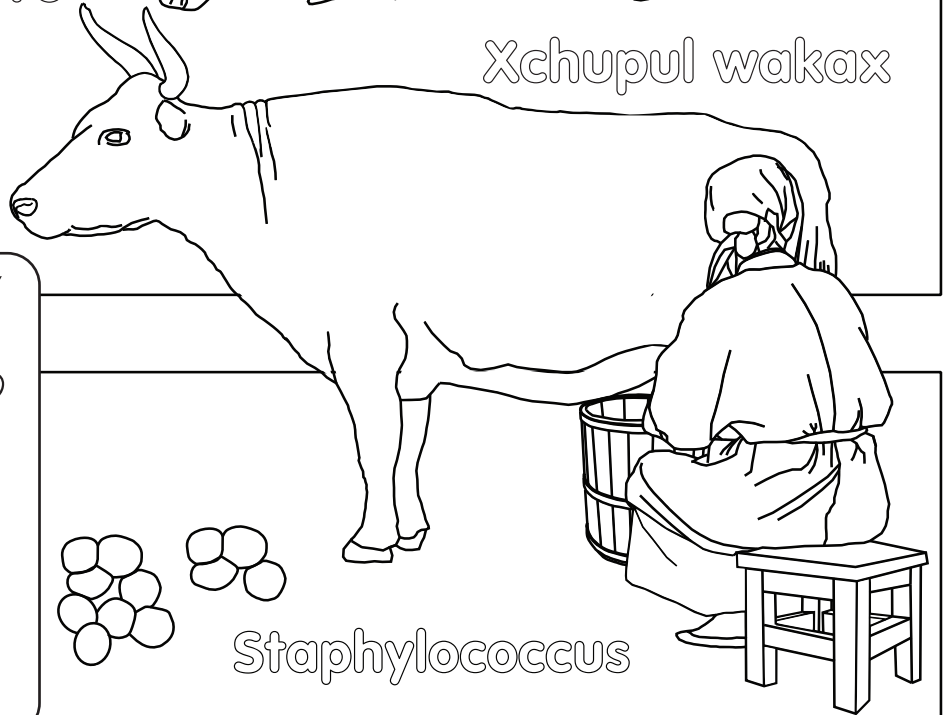


Chivo

U wakaxil u noj luumil Tibet

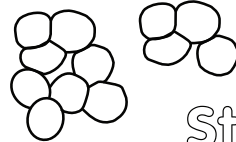


Xchupul wakax

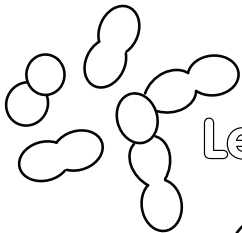


## JANAL BEETA'AN YÉETEL U K'AAAB U YIIM WAKAX

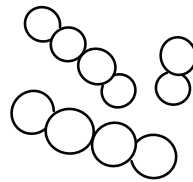
Tí Mongloliae' le Janal beeta'an yéetel u k'aab u yiim wakaxo' jach k'a'anan. Ts'ok u xak'alta'ale' yéetel ojéeltalé máanja'an 3.500 ja'abo'ob.



Staphylococcus



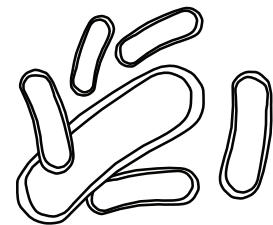
Leuconostoc



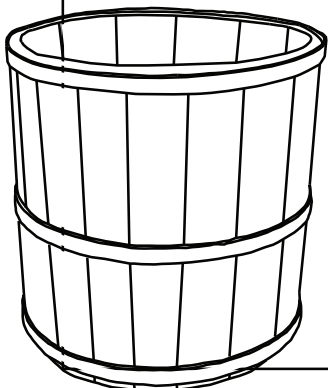
Lactococcus

## U yikel kaab iim

Ik'elo'obe' jach k'ana'an tial u beta'al jejéelasil Janal yéetel u k'aab u yiim wakax je'el bix yogurt, mantequilla yéetel. Yan xan ma' k'ajóolani' je'el bix queso, aaruul (chokoj k'aab iim) wáa airag (u k'aab u yiim tsiimin) ti' Mongolia.



Lactobacillus



# ÚUCHBEN K'OJA'ANLIO'OB

Koj yéetel baakelo'obe' jach k'a'anan tial u yojéetal bix u tooj óolal úuchben máako'ob. Je'el bix yéetel ADN je'el u páajatal u yila'al ba'axten luub u koj wáa máax.

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s' u' g' g' e' l' e' s' t' i' b' i' m' i' t' e' s' t' i'  
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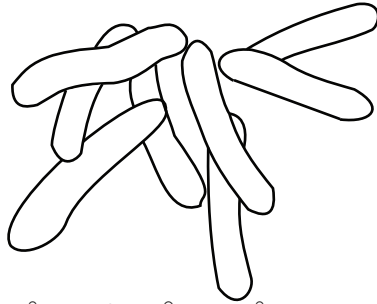
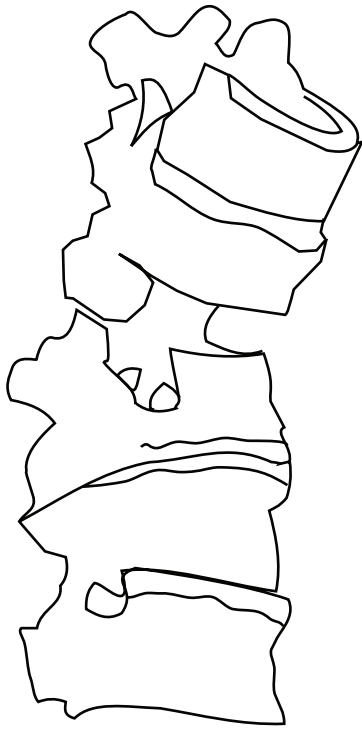
**Omne Bonum**

Jump'éeel úuchben áanalte' ts'íibta'an ich Laatin, ku tsikkaltik yo'osal kuxtal ti' u noj lu'umil Europa. Ku t'aan yo'osal kanan koj yéetel bix ku kananta'al wiinklil tial ma' u k'oja'antalo'ob ka'ach, min 500 ja'abo'ob yak.

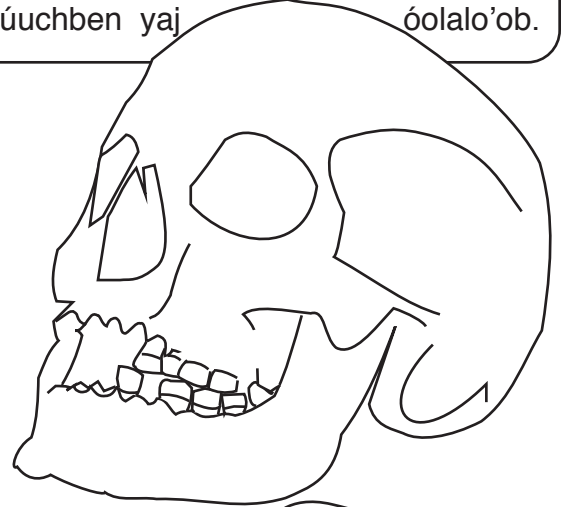
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mento fisci; iohes n

# JÁAWAY YÉETEL YAJ SE'EN (TUBERCULOSIS)

Jáaway yéetel yaj se'en (tuberculosis) ku tasa'al tumen yik'el Mycobacterium tuberculosis yéetel Mycobacterium leprae. Je'el u páajtal u k'oja'ansik baakele', leo'olale' le máako'ob ku xak'alo'ob yo'osal úuchbem kuxtalo' yaan k'iine' ku kaxtiko'ob u xiixel baakel; yéetel le je'eolo' ku yojéeltiko'ob yo'osal úuchben yaj óolalo'ob.

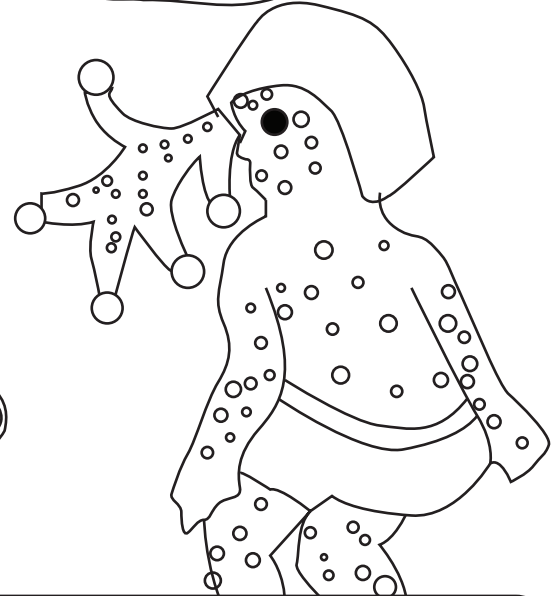


Mycobacterium leprae



# COCOLIZTLI

Jump'eel ik'el ma' k'ajóola'an ka'achi', ku ya'alal Cocolitz tumen le aztekaso'ob tu kíimsaj jach ya'ab máako'ob ti' u noj lu'umil Mexico ichil 1545 wáa 1550 (ts'ok u síijil Cristo) DC. Le' ma' úucha'a ti' u xak'allil u koj le máako'ob kimo'ob yo'osal le k'oja'ana', kaxta'ab le k'ak'as yik'el Salmonella enterica Paratiphy C.



u yikel  
Salmonella

# Tsak yaj Schnabel

Ka'ache' ts'akyajoóbe' ku pixik u yicho'ob yéetel jump'eel ba'al beey u pool ch'íich'e' tial ma' u chuklo'ob tumen k'as iik'.

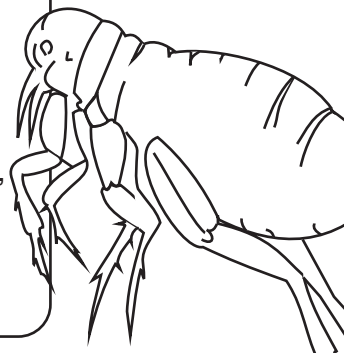


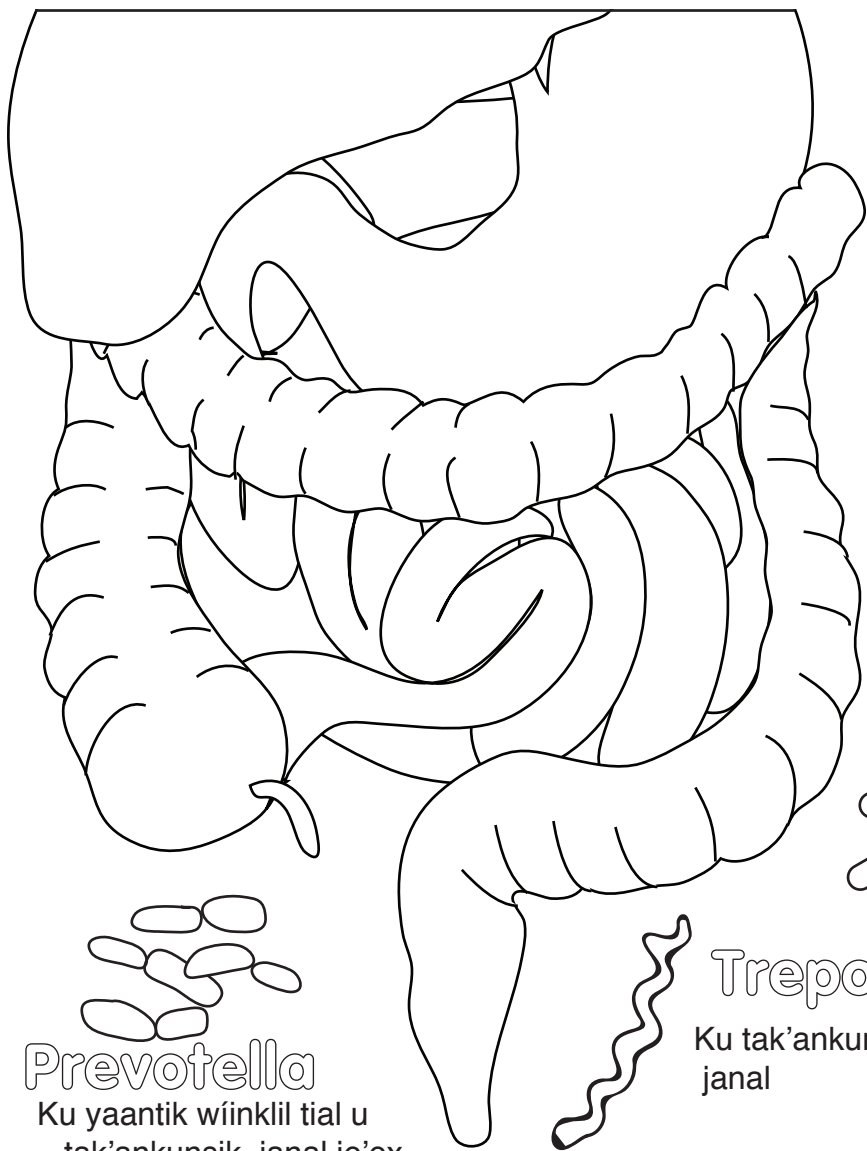
# Uchbem tsib ti Cruz

Le úuchbem ts'iiba' yo'osal bix u k'oja'anil Cocoliztli: chokwij, we'ech yéetel ma' tu xu'ulul u k'i'ik'ankil le k'oja'ano'

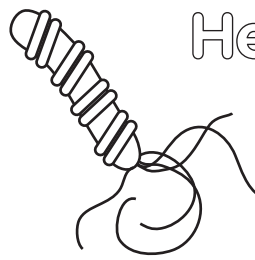
# K'OJA'ANIL KU MEENTIK U YANTAL BÁAN KÍIMTILIL

Le k'as yik'el Yersinia pestis, leti' ku taasik k'oja'anil ku kíinsik ya'ab máako'ob, ku máan ti' ch'ik yaan ti' ch'o'. Le máax ku chi'ibil men le ch'ika' ku tsa'aya ti' k'ak'as k'oja'anil. Le k'oja'ana' ku beetik u yantal báan kíinil, je'el le bix k'ajoólta'an beey Muerte Negrae' tu kinsaj táanchumuk u kajil u noj lu'umil Europa ti' ja'ab 1346 taak ti' 1353.





## Helicobacter pylori



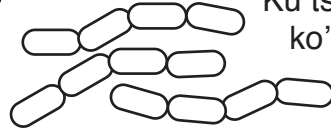
Kuxa'an ti' u nak' máak, je'el u beetik u tsa'ayal ulcera wáa yaj k'oja'anil

## Bifidobacterium



Ku yáantik mejen paalal ma' u k'ojáantalo'ob le kan u yuk'o'ob u k'ab iim

## Faecalibacterium

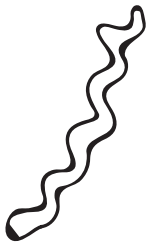


Ku tsentik jejeláas báalta-ko'ob ti' ba'ax jach k'a'anan ti' wíinklil (células)



## Prevotella

Ku yaantik wíinklil tial u tak'ankunsik janal je'ex xiwo'obo'

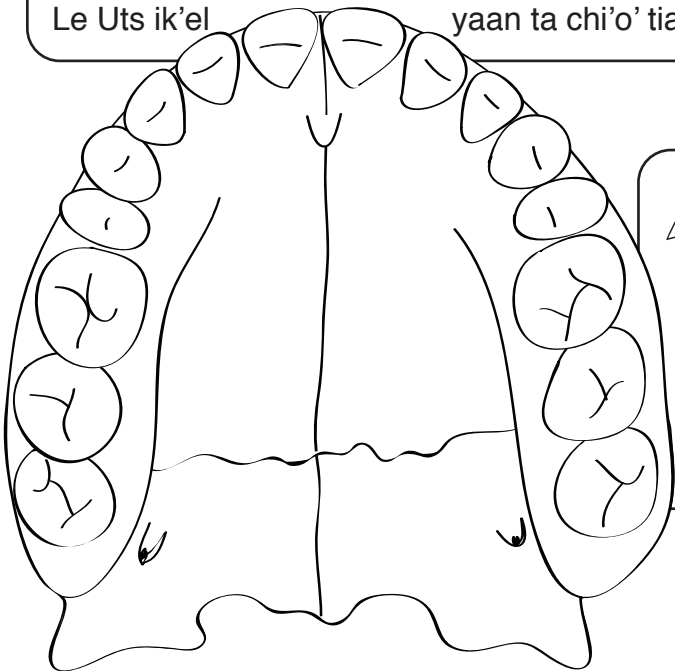


## Treponema

Ku tak'ankunsik janal

## UTS YIK'EL YAAN TI' A WÍINKLIL

Ti' u wíinklil máake' manja'an u ya'abil uts yik'elo'ob yaani', kajóolta'an beey microbioma. Le uts ik'elo'oba' ti' yano'ob ta naak'e' tial u yantik a tak'ankunsik a wo'och yéetel tial a tooj ólal. Le Uts ik'el yaan ta chi'o' tial ma' seen k'oja'antal

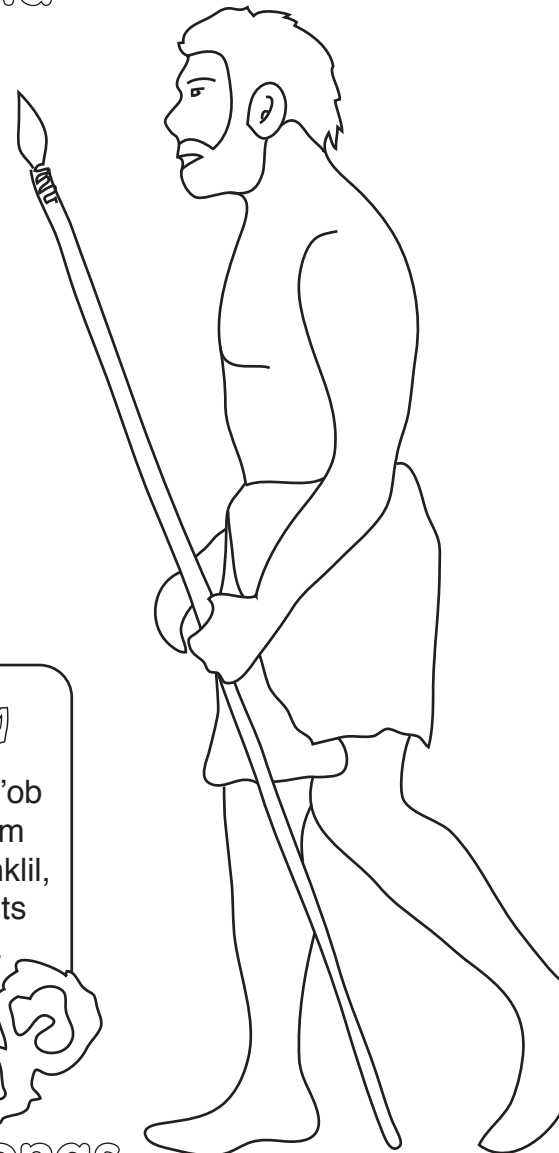


## A WOOJEL WÁA

Le máako'ob ku xak'alo'ob yo'osal u kaniko'ob túum ben ba'alo'ob utial wíinklil, ku meyajo'ob yéetel iuts yik'el yaan ti' k wíinklil.



## Porphyromonas

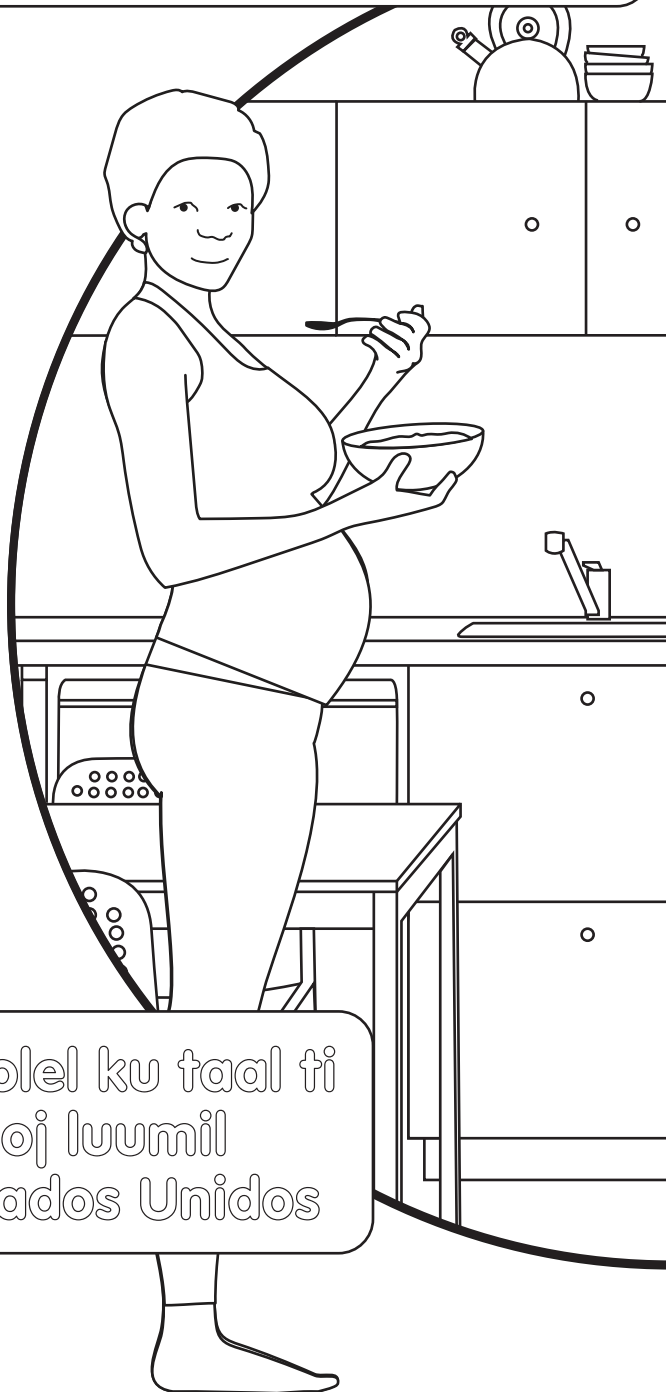


# MÁAKO'OB KU MÁAN U MOOL YO'OCHO'OB

K'ajóolano'ob ku máano'ob ts'on yéetel u mool yo'ochob. Leti'obe' ku jantiko'ob ba'ax yaan k'áax, yéetel ba'ax k'iin yano'ob.

Le ma' tu yuuchul pak'ale', tuláakal máake' ku máan u mool yo'och. Min ts'ok 10 000 ja'abo'ob.

Máako'ob ku máan u mool yo'ochob tak bejlae' yaan máas u yutsil u yik'el ti' u wiinkliio'obe' tak ti' le kaja'ano'ob tu'ux yaan túumben baáolo'ob.



Kooel ku taal ti  
u noj luumil  
Estados Unidos



Kooel yetel  
chaambal, ti  
Tanzania

# MÚUCH'TÁAMBAL TU'UX TULÁAKAL TÚUMBEN

Tu'ux tuláakal túumben ku jantiko'ob ba'ax ku tal ti' k'áax, ba'ale óoli mixmáak ku beet u kool.

Tial u ko'onol te'elo', ku ts'abal xa'ak' tio'lal ma' u kástal. Le janalo' úuchn beta'ak, yéetel ya'ab tu'ux ku máan tumen ku bisa'al tu'ux kun konbil.

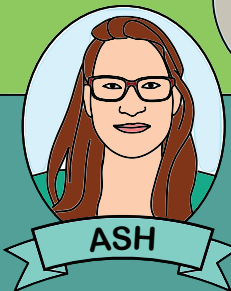
Le máax kaja'an tu'ux yaan túumben ba'alo'ob óoli minaán u yutsil u yik'el u naak'e', yo'osal ba'ax ku jaantiko'ob. Leo'lal le kan k'oja'an-cháako'obe' yaan k'iin ma' tu se'eb uts talo'ob.



# U nu'ukbesajil Max Planck u tia'al u k'ajlayil wíiniko'ob



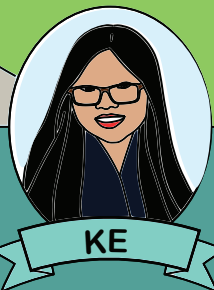
ALLIE



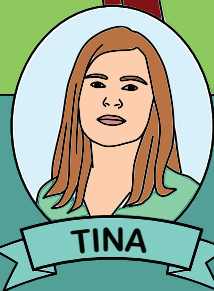
ASH



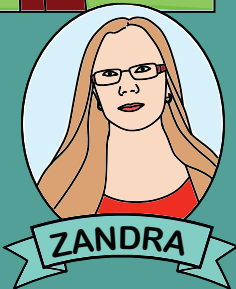
JESSIE



KE



TINA



ZANDRA

## Náaysaj óol ti'

# U XOOKIL YO'OSAL U XAAK'ALIL ÚUCHBEN BA'ALOB TI' U KUYTAL MÁAK Áanalte' tial boonbil

¡Kan ba'ax k beetik yo'osal na'atik bix úuchben wíiniko'ob. Láak'into'on tial k ilik máaxoni'. Ba'ax seten betik tial ojéeltik le ba'alo'ob ucháantak le ka síj wíinik tak le ka'aj uch le k'oja'anil tu beetaj u yantal báan kíimilil. Kan bix úuchik u máan wíinik yok'ol kab yéetel yo'osal bix ku beta'al xak'al tiolal k ojéeltik ba'ax kíins wáa máax; yéetel jejeelas núukulil je'el bix Radiocarbono .Il a wil bix k xak'al yo'osal ba'ax ku jaantik úuchben wíiniko'ob. Kan bix úuchik u suuktal ba'alche'o'ob yéetel máak. Kan yoosal jejeelas úuchben k'ojanilo'ob yéetel ba'ax uts ik'elo'ob yaan tak bejlae' ichil máak tial ma' k se'eb k'oja'antal.

U nu'ukbesajil Max Planck u tia'al u k'ajlayil wíiniko'ob  
Su'ut ich Maaya t'aan tumen Mirna Canul Aké



MIRNA