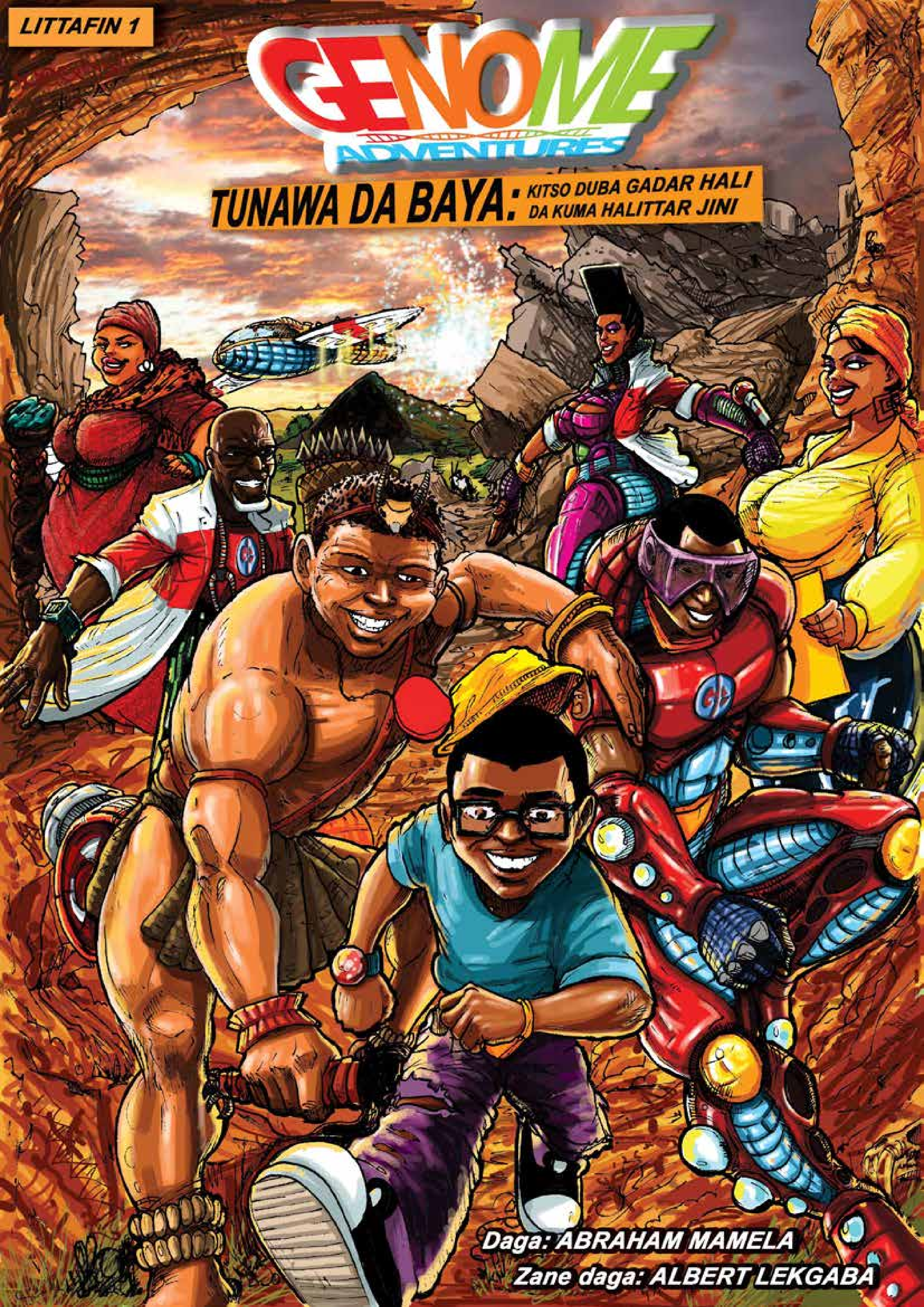

LITTAFIN 1
GENOME
ADVENTURES
TUNAWA DA BAYA: KITSO DUBA GADAR HALI DA KUMA HALITTAR JINI
Daga: ABRAHAM MAMELA
Zane daga: ALBERT LEKGABA

FOREWORD

Investment in research and development has proven to be a driving factor for economies in developed countries and is included on the African Union agenda as a solution to poverty and other socio-economic problems. There is a consensus that supporting science and technology will contribute to the creation of knowledge economies in Africa. Indeed, science communication and engagement can bridge the knowledge gap between academia and the general public in Botswana and elsewhere.

"Where Science Meets Fun" is the motto of Genome Adventures, an innovative Wellcome Trust-funded community engagement initiative of the Collaborative African Genomics Network (CAfGEN). CAfGEN is a member of the Human Heredity and Health in Africa Consortium (H3Africa) and is coordinated by the Botswana-Baylor Children's Clinical Centre of Excellence (COE)- a key partner to the Ministry of Health. Genome Adventures utilizes capacity building workshops, educational comics, and social media to engage community stakeholders, media practitioners, and the general public - especially the youth – in furthering the understanding of genomics and biomedical research.

This four-part Genome Adventures comic book series aims to educate readers on the history of heredity and genetics, the structure and function of DNA and genes, the link between genomics and health, and the process for enrolling in a biomedical or genomics research study, including ethical issues pertaining to informed consent, sample shipping and storage, and community engagement.

This first issue of the Genome Adventures comic book series - Blast to the Past: Kitso Explores Heredity & Genetics – is the result of many months of development by a diverse team of writers, editors, reviewers, and advisors. The team's collective love for biomedical science, African history, Batswana, and the important role of women in science shines through the pages of this book.

I would like to acknowledge the Wellcome Trust for supporting Genome Adventures and to thank them for their vision "to improve health by supporting bright minds in science, the humanities and social sciences, and public engagement." I would also like to thank all members of the Genome Adventures team and appreciate the generosity of The Botswana Gazette newspaper, and the Printing & Publishing Company Botswana (PPCB) for assisting with printing and distribution of the comic books. Last but not least I want to thank the Botswana-Baylor Children's Clinical Centre of Excellence for bringing together this wonderful and innovative endeavor.

Science should no longer be seen as being confined solely to laboratories. Rather it should become an integral part of our daily lives and each of us should participate in its development. This approach of simplifying complex scientific concepts and communicating them in an educative yet entertaining way is an important step towards achieving that reality. Each Motswana, young or old, who reads these books, will be taking our beloved country a step closer to closing our Vision 2016 Pillars of an Educated, Informed and compassionate, just caring nation

Dorcas K Makgato
MINISTER OF HEALTH
REPUBLIC OF BOTSWANA

KITSO

BARKA! SUNA NA KITSO. INA ZAUNE A GARIN TLOKWEND A GIDAN GOGGO NA. INA SHA'AWAR. AN HAIFE NI DA CUTAR SIDA AMMAN WANNAN BAI MAIDA NI BAYA BA!

DR. MABOKO

NINE SHUGABAN KUNGIYAR GENOME ADVENTURES (DUK ABUNDA KGOSIDADI ZAI GAYA MAKU) INA DA SIDDABARU MAI KAYATARWA DA HAR ZAN IYA SHIGA BANGO KUMA ZAN IYA BACEWA NI DA KEKE NA. KUMA BA IYA KAR SHI BA KENAN- (INA FASSARA MAFARKI!)

KGOSIGADI

INA DA DADIN ZANCE KUM SHUGABAR MUTANE NA, EN BATSWANA!INA KAMA DA MATSAKAITAR KAKA, AMMA SANDAR TAFIYA TA NA DA (SPECIAL POWERS) DAGA KAKANNINMU! DA WADANNAN DIN, INA IYA (IKO DA OR CANZA) YANAYIN ISKA, TAFIYAR DA DABBOBI, KUMA DA'WASU ABUBUWA MASU BADA AL'AJABI!

PHODISO

SUNA NAN PHODISO, AMMA KUNA IYA KIRA NA "GOGGO". INA RIKON DIYAR 'YAR-UWA TA KITSO BAYAN TA RASU, KUMA INA KAUNAR KITSO KAMAR YADDA NAKE KAUNAR SAURAN YARA NA! MUNA ZAUNE TARE A TLOKWENG, A WAJEN GARIN GABORONE-KILA MUNA MAKWABTAKA DAKU!

XGAO-TCGAI

SUNA NA XGAO-TCGAI (KO XT A SAUKAKE). INA ALFAHARI DA NI MUTUMIN SAN NE- WASU NA KIRAN MUTANEN MU " MUTANEN DAJI" KO "BASARWA". NI MA SHAHARARREN JARUMI WANDA KE IYA ZUWA ZAMANI DABAM DABAM! MA'ANAR SUNANA "KAIFIN-HANGE" SABODA KAIFIN GANI NA KAMAR WUKA, ZAN IYA HANGO ABUNDA ZAI FARU NAN GABA.

MARANYANE

BARKA! KAMAR YADDA SUNANA YAKE, INA SON FASAHA. KU DUBA JIKI NA! RABI NA NA'URA, RABIN KUMA MUTUM. INA DA BASIRA KUMA INA SON AMFANI DA NA'URORIN ZAMANI!

MMATLI

SUNA NA MMATLI.NI DAN BINCIKE NA KIMIYYA NE! KUMA NA IYA SIDDABARU NA MAIDA ABUBUWA KANANA DA IDO BAYA IYA GANI, HAR MA DA MUTANE! INA SHA'AWAR ABUBUWAN KAYATARWA DA KIMIYYA KE TAIMAKA MANA WAJEN GANOWA KUMA ZON SO A BOTSWANA, YAN MATA DA YAWA SU ZAMA YAN KIMIYYA KAMAR NI!

WATA SAFIYA A HILIN WASAN ASIBITIN YARA TA KGALAGADI, ASIBITIN YARA MASU CIWON SIDA...
KITSO! LOKACI YAYI
ZUWA!
LIKITA NA JIRAN KA.

BARKA, DR. TAPIWA
BARKA, PHODISO. YAYA KIKE?
INA LAFIYA, NA GODE
KITSO
KAI FA, SAURAYI, YA KAKE?
INA LAFIYA, YANZU NA GAMA WASA DA ABBUKAI NA
WANNAN KAM MOTSA JIKI NE MAI KYAU
AI KANA A TAWAGAR KWALLON KAUYEN KU KO?
ZOMAYEN TLOKWENG.... KO?
A'A MU BA ZOMAYE BANE! MU NE TLOKWENG RHINOS!
KANA TSAMMANIN TAWAGAR KU NA IYA KADA ZEBRAS? TAWAGAR KASAR BOTSWANA?
TABBAS RHINOS ZASU IYA KADA ZEBRAS!
HAHA! KO? TOH ALLAH BAKU SAA!

CD4 DA DIN KA SUN YI KYAU CHAMP!
KA SAN ME YAKE NUFI? YANA NUFIN KANA DA KARFIN JIKI KAMAR RHINO.
TANDA KUMA KANA DA KARFIN JIKI, MUNA SO MU GAYYACE KA KA SHIGA WANI BINCIKE.
GASHI, KA TAFI DA WANAN GIDA KA KARANTA DA GWAGGON KA.
SAI KA GAYA MANA IDAN KANA SO KA SHIGA.
KA CI GABA DA WASA KANA KARA HORO SOSAI, CHAMP. ZEBRAS NA DA WUYAR KADA WA.
ZAN YI, DOCTOR, SAI ANJIMA.
SAI MUN KARA GANIN KA.
DR TARIWA

SABODA KANA DA KARFIN JIKI, MUNA SO MU GAYYACE KA SHIGA WANI BINCIKE...
TAFI DA WANAN WASIKAR GIDA... KA TABBATA KA FAHIMCE TA.
GWAGGO, INA TA TUNANIN WASIKAR DA LIKITA TA BAMU
HMMM, KO?
TLOKWENG ROUTE 6
BINCIKEN MINENE?
TA HANYA GUDA DAYA ZAMU GANE
DEAR M YARON, WANNAN WASIKAR NA GAYYATAR YARO/YARINYAR KA SHIGA WANI BINCIKE...
BINCIKEN NAN ZAI TAYA MU FAHIMTAR DIN A KAN YAYA YARA MASU HIV DA TB SUKE SAURIN KAMA CUTOCI
DEAR CAREGIVER,
THIS LETTER S
TO PARTICIPATE
HELP US LEARN M
GENES ON HOW
AND TB GET SIC
DA FARKO, ZAMU ANSHI SAMFURORIN JINI...

KAI! ME YA SA ZASU DIBA JINI NA?!
SABODA SUNA SO SU SAN YADDA YARA KAMAR KA SUKE KAMA CIWO DAGA HIV DA TB.
AMMA ME YASA SUKE BUKATAR JINI NA DAN HAKA?
SABODA...
KUMA ME NENE GENE...
UMM...
DA NA SANI NA SA MAKA SUNAN MALLAMIN TAMBAYA!
KAWAI KA TAFI DA WASIKAR DAKIN KA, SAI KA KARA TUNANI KAMIN SAFE
MUNA IYA SHAWARA DA SAFE
NA KASA BACCI
SAI NA KARANTA TAKARDAR

SWIISSHHHH!
ZWING!
ZWING!
KAI!
KAR KA JI TSORO, KITSO
SWIISSHHHH!
KU SU WAYE? KUMA YA KUKA YI WANNAN ABUN?
FIIIZZZZZ!
MU SHAHARARRUN JARUMAI NE!

NI SUNANA DR. MABOKO.. NA IYA KARANTA TUNANIN MUTUN.. KUMA NA SAN ME KAKE TUNANI
KUMA YANZU NA SAN KANA TUNANIN WANNAN WASIKAR. MUN ZO MU TAIMAKA MAKA NE
NI SUNA NA KGOSIGADI. DR. MABOKO NA GANIN SHI NE SHUGABAN WANNAN TAWAGAR AMMA NI NE SHUGABAN MU NA GASKIYA
DA SANDAR TAFIYA TA, INA DA DUK WATA HIKIMA DA KARFIN KAKANNINMU NA DA.
NICE MMATLI. ZAN KOYA MAKA KOMI GAME DA SECRET CODE NA MUTUM. KARFINA NA IYA MAIDA KA KARAMI SOSAI HAR GA MUTANE BASU GANIN KA.
KAI! DA AGSKE? KAMAR SIHIRI! KAI FA, ME KA IYA YI?
SHHHHHHI..... NI NE XGAO TCGAI. KANA IYA KIRA NA XT. INA IYA SA KA KA BACCE KUMA INA IYA KAI KA
KAR KA DAMU, BA ZAMU CIKE KA BA
MUN ZO MU KAI KA ZUWA ADVENTURE

INA SON ADVENTURE
MU TAFI WAJE MU HADU DA WANI DAN TAWAGAR MU, MU HAU A KAN DIN MU?
KAR KA DAMU KITSO, BA ABUN DA ZAI SAME KA TARE DA MU. AUNTY DIN KA KO SANI BAZA TAYI BA CEWA KA TAFI. KA TUNA, INA KARANTA TUNANIN KA.
MU RIKE HANNAYEN MU!
*C'ÉÉAN CHÓÒ NX'ÁÉ DI TAMA A, QÃÉ TA A TS'ENE CGÒÀ NA KA ÚÚ TA A GÀÀ TA DI NI CÍÍ NE KHOE NE KOE!
* WUTA DAGA ENDLESS TIME
...
KUNSHE MU CIKIN HAYAKIN KI KUMA KI MAIDA MU LOKACIN KAKANIN MU NA CEN BAYA!

TWING!
BARKA! HALA KAI NE KITSO. SUNA NA MARANYANE, ZA KA IYA KIRANA MAX.

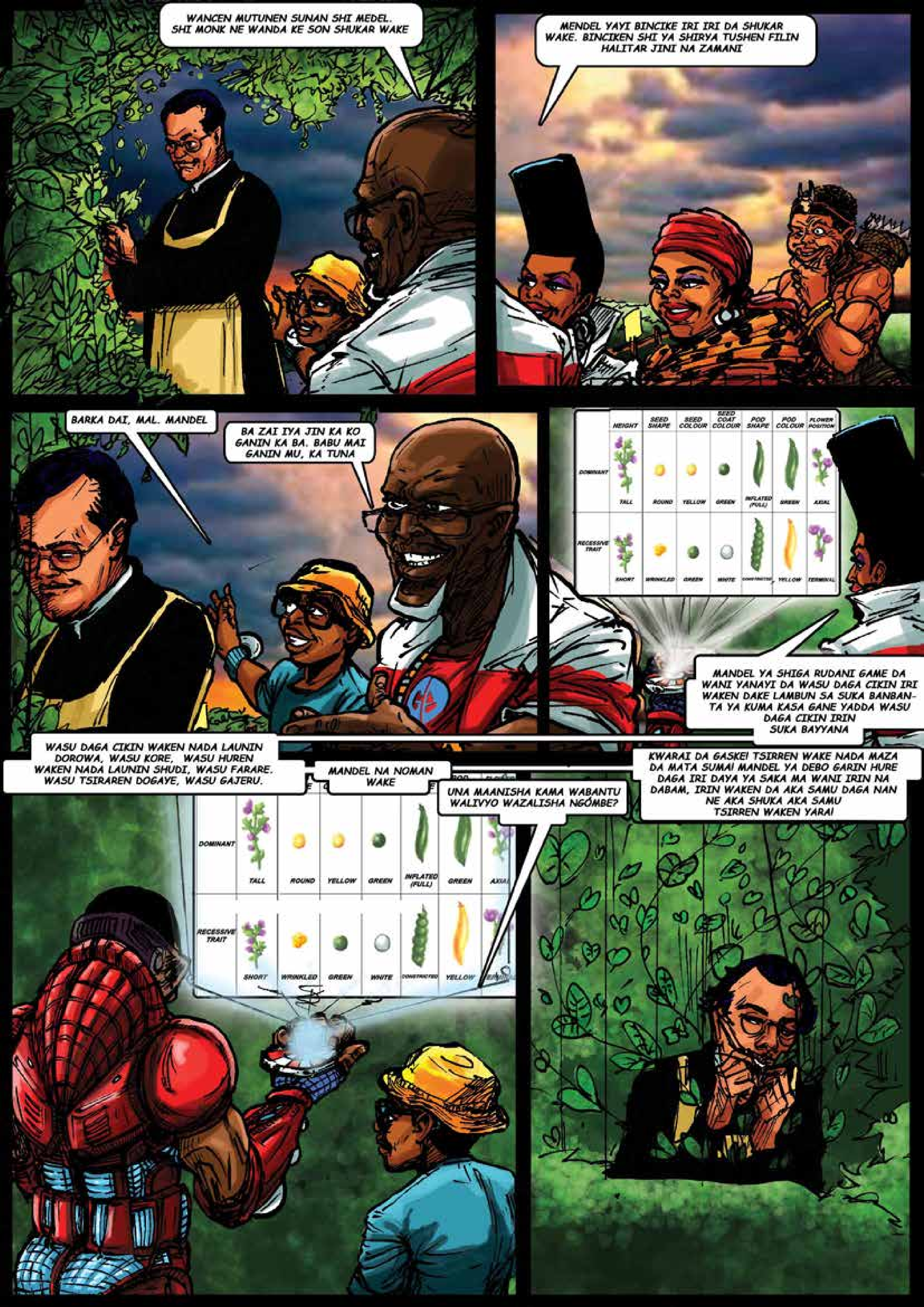
MARBA DA ZUWA KYAKKYAWAN JIRGI NA. DON ALLAH ZAUNA KA SA BEL DIN KA.
TSÁÁ TSI GÚÙ NCÁMÁ!
NAKA? D'ALLAH! KADA KA YI KATON KAI!
NAKA? D'ALLAH! KADA KA YI KATON KAI!ZAMU JE TUDUN TSODILO YANZU. MARANYANE, ZAN ANSHE KI DAGA NAN
TSAYA MANA, AI NA FI KA IYA TUKU. MI YASA ZAKA ANSHE NI?
SABODA YANKUNAN ASALI NA ZAMUGE. SAURARA YARO, KANA GANI BAN IYA TASHI BA?
ZAKA SAMU KAN KA WAJE DAURE A KAN BISHIYAR MORULA IDAN NA KARA JIN KALAMA DAYA DAGA BAKIN KA.
WAI KU BIYUN NAN BAZA KU BARI BA!?
KAR KA DAMU DA SU BIYUN NAN KITSO.BASU TABA BARI.
ZOOOOOM!!
WANNAN NA DA SUARI SOSAI!

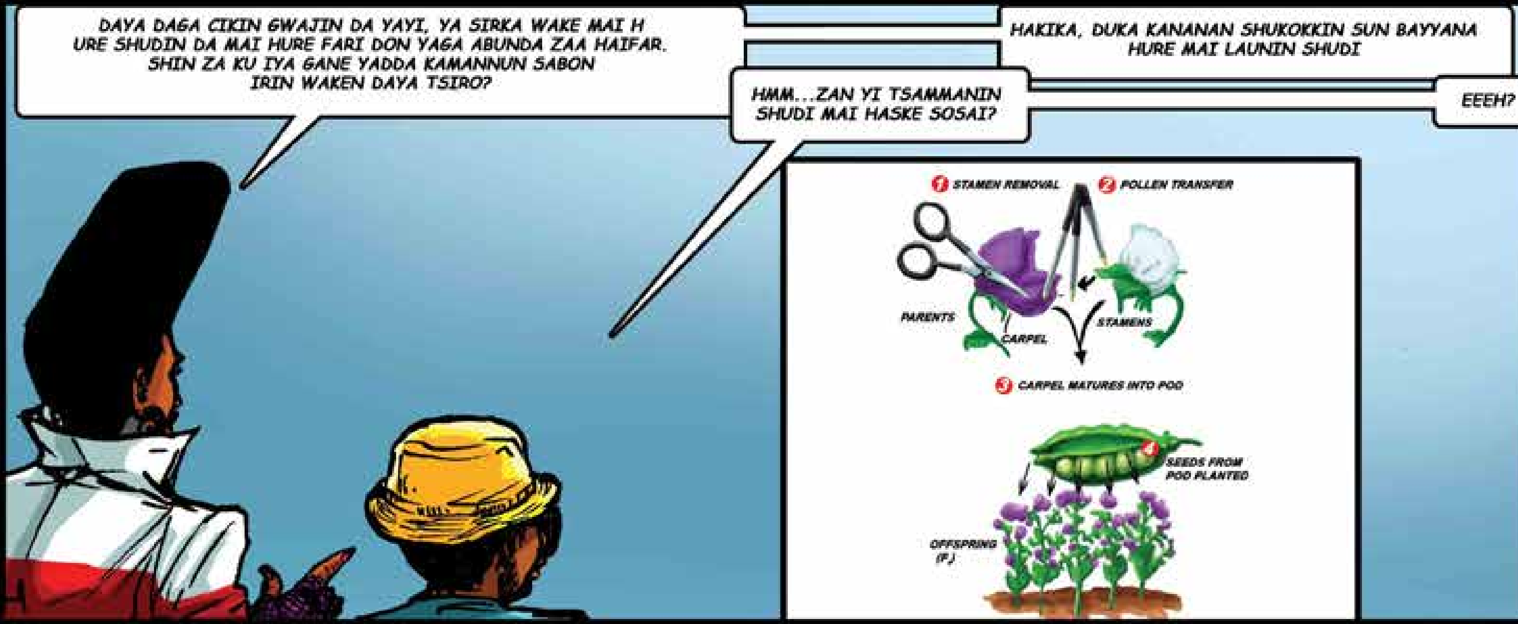
BARKA DA ZUWA KASAR MUTANE NA, EN SAN. ANA CE MASU MUTANEN DAGI KO BASARAWA
ZOOOOOM!!
ME YA SA MUKA ZO NAN?
NAN NE DAYA DAGA CIKIN WURAREN DA KAKANNI NA, MUTANEN FARI, SUKA ZAUNA
WA'INCEN YAN UWAN KA NE?
KAKANIN MU NA DA DAYA NE DA SU, KAMAR MUTANE DA YAWA DAGA CIKIN MU, HAR DA KAMAR KA KITSO
IN HAR MUNA DA KAMMANNI DA YAWA, ME YASA BA MU KAMA DA JUNAN MU KUMA MUNA DA HARSHE DABAN DABAN?
KAMIN AYI BABAR HIJIRASA, KUNGIYAR MUTANEN SAN ITA CE BABBAR KUNGIYAR MUTANE A DUNIYAR NAN MASU DABIU MASU BAMBANCI
DABIU?
DABIU SUNE HALAYE DA KE BA DUK DAYA DAGA CIKIN MU KAMMANNI MASU MUSANMAN. KAMAR KALAR IDANUN MU KO SIFFAR KUNNUWAN MU.
years ago

AKWAI WASU LITTATTAFAI A CIKIN JIKIN MU DA KE BA SHI UMARNIN DABI'UN MU SUNAN SU GENES. BAMU KAMA DA JUNAN MU SABODA GENES DIN MU DABAN-DABAN NE..
MASU ILIMIN KIMIYYA NA KIRAN HALAYEN MU PHENOTYPE
DA KAKANNIN MU NA DA SUKA YI HIJIRA, KAMMANIN SU SUN CHANZA SUNA BAYYANA WASU ALAYE.
WASUN MU BASU TASHI BA DAGA WANNAN YANAYIN SAI BASU FUSKANCI CANGI BA DA YAWA
YAYIN DA WASU SUNA HIJIRA, HALAYEN SU NA CHANZAWA DAN SU DAIDAITA DA YANAYIN KASASHEN DA SUKA SHIGA. WASU SAI SUKA ZAMA MUTANEN DA MUKE KIRA BANTU, DAGA SU AKA SAMU EN KABILAN ZULUS, XHOSAS, HAR DA EN TSWANA, KABILA TA KENAN.
NI MA!
SHUKE-SHUKE DA DABBOBI SUMA SUNA DAIDAITAWA DA YANAYIN KASA, SUNA BA KWAYOYIN HALITTUN SU ZUWA GA YARAN SU, WANI TSARIN DA MUKE KIRA GADAR HALI.
KUMA ANA KIRAN NAZARIN GARDAR HALI HALITTAR JINI. MUNA TARE?
EH, SA!

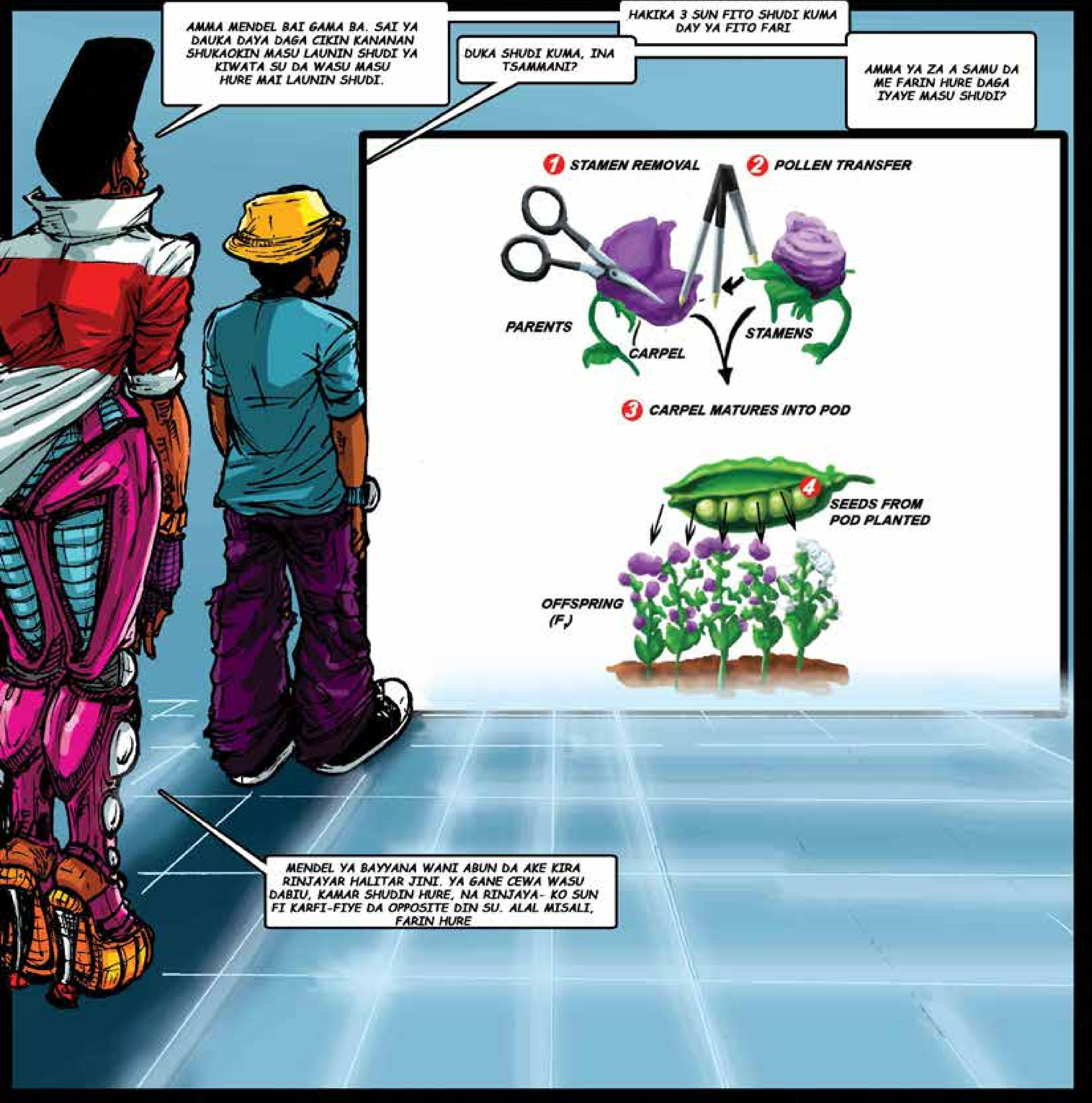
BARI MU YI TAFIYA ZUWA WASU SHEKARU GUDA DARI DA BAYA ZUWA KASAR DA MUKE CE MA UGANDA YANZU DAN MU KOYA WASU ABUBUWA MASU MAMAKI GAME DA DABBOBI. HEBU TWENDE MIONGO
ZOOOOOM!!
SPLOSH!
KAI, SHANUN CEN NA DA KAHO MAI TSAWO DA YAWA.
WA'INCEN SHANUN ANKOLE NE. KAHOHIN SU SU NE SHAHARARUN HALAYEN SU
SUNA DA KYAU KUMA SUN YI KAMA DA MASU KARFI. BAN TABA GANIN IRIN SU BA
KAKANNINA NA DA NE SU SUKA ZABA HALAYEN SU NA MUSANMAN. SUNE AKE CE MA MAKIYAYEN BANTU KO MASU KIWON SHANU
SU MAKIYAYEN SUNA KIWON SHANU MASU KYAU TARE DA BIJIMAI DAN SU SAMU IRIN DABI'UN DA SUKE SO.
SUNA AMFANI DA BIJIMAI MUSANMAN SABODA GIRMAN JIKIN SU DA FARAREN KAHUNNAN SU MASU GIRMA DA SASSAKA SAMA. ZABIN WADAN NAN DABIUN NA A CIKIN ILIMIN MU NA ASALI.
AMMA ME YASA SUKE SO SU ZABA DABIUN?
KO?
TOH, WASU SUN KARBA CEWA ANA KIWON SHANUN (ANKOLE) MUSANMAN SABODA KYAUN KAHHUNNAN SU- MASU MANYA-MANYAN KAHO AKE BA SARKI- AMMA KAHUNNAN NA MASU AMFANI: SUNA TSARE SHANNUN KUMA SUAN TAYA SU FIDDA ZAFI DAGA JIKIN SU.

YANZU KA GA BA MUTANE KADAI KE DA DABIU NA MUSANMAN BA, DABBOBI NA DA SU MA.
SHI YASA MASU BINCKEN ASIBITIN KA SUKE SO KA SHIGA BINCIKEN SU NA HALITAR JINI, DAN SU FAHIMCI DABI'UN KA NA MUSAMMAN. AMMA YANZU BARI MU KARA KOYAN WASU ABUBUWA GAME DA DABIU, KO?
TABBAS!
XT, ZAKA YI MANA?
BA MATSALA
SHOOOOF !!!
INA MUKE YANZU?
WANNAN ITA CE SHEKARA 1985. MUN SHIGA LAMBUN AUGISTINIAN ABBEY NA ST. THOMAS, A KASAR DA AKE CEMA CZECH REPUBLIC.

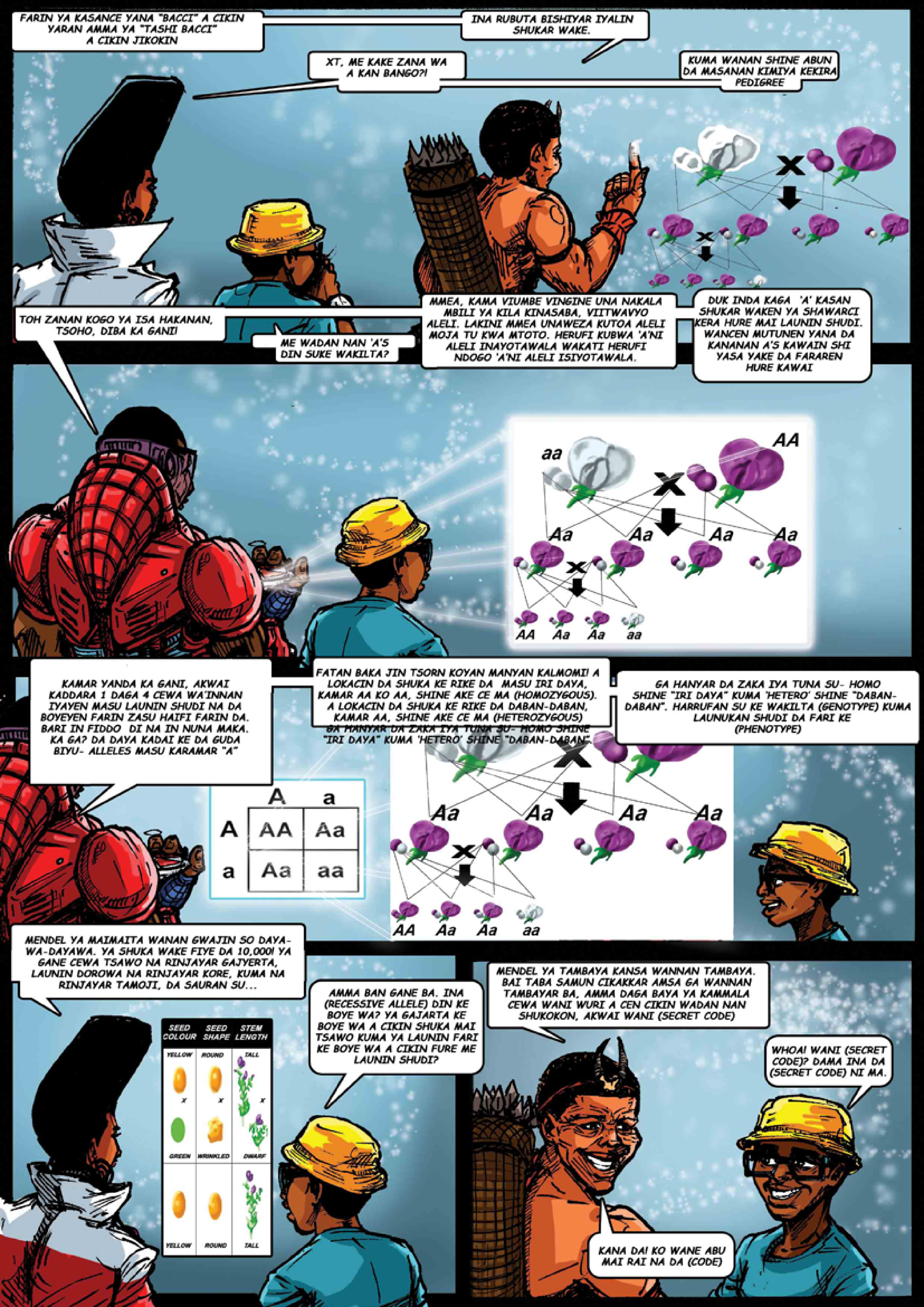

WANCEN MUTUNEN SUNAN SHI MEDEL. SHI MONK NE WANDA KE SON SHUKAR WAKE
MENDEL YAYI BINCIKE IRI IRI DA SHUKAR WAKE. BINCIKEN SHI YA SHIRYA TUSHEN FILIN HALITAR JINI NA ZAMANI
BARKA DAI, MAL. MANDEL
BA ZAI IYA JIN KA KO GANIN KA BA. BABU MAI GANIN MU, KA TUNA
HEIGHT
SEED SHAPE
SEED COLOUR
SEED COAT COLOUR
POD SHAPE
POD COLOUR
FLOWER POSITION
DOMINANT
TALL
ROUND
YELLOW
GREEN
INFLATED (FULL)
GREEN
AXIAL
RECESSIVE TRAIT
SHORT
WRINKLED
GREEN
WHITE
CONSTRICTED
YELLOW
TERMINAL
MANDEL YA SHIGA RUDANI GAME DA WANI YANAYI DA WASU DAGA CIKIN IRI WAKEN DAKE LAMBUN SA SUKA BANBANTA YA KUMA KASA GANE YADDA WASU DAGA CIKIN IRIN SUKA BAYYANA
WASU DAGA CIKIN WAKEN NADA LAUNIN DOROWA, WASU KORE, WASU HUREN WAKEN NADA LAUNIN SHUDI, WASU FARARE. WASU TSIRAREN DOGAYE, WASU GAJERU.
MANDEL NA NOMAN WAKE
UNA MAANISHA KAMA WABANTU WALIVYO WAZALISHA NGÓMBE?
KWARAI DA GASKE! TSIRREN WAKE NADA MAZA DA MATA SUMA! MANDEL YA DEBO GARIN HURE DAGA IRI DAYA YA SAKA MA WANI IRIN NA DABAM, IRIN WAKEN DA AKA SAMU DAGA NAN NE AKA SHUKA AKA SAMU TSIRREN WAKEN YARA!
DOMINANT
TALL
ROUND
YELLOW
GREEN
INFLATED (FULL)
GREEN
RECESSIVE TRAIT
SHORT
WRINKLED
GREEN
WHITE
CONSTRICTED
YELLOW



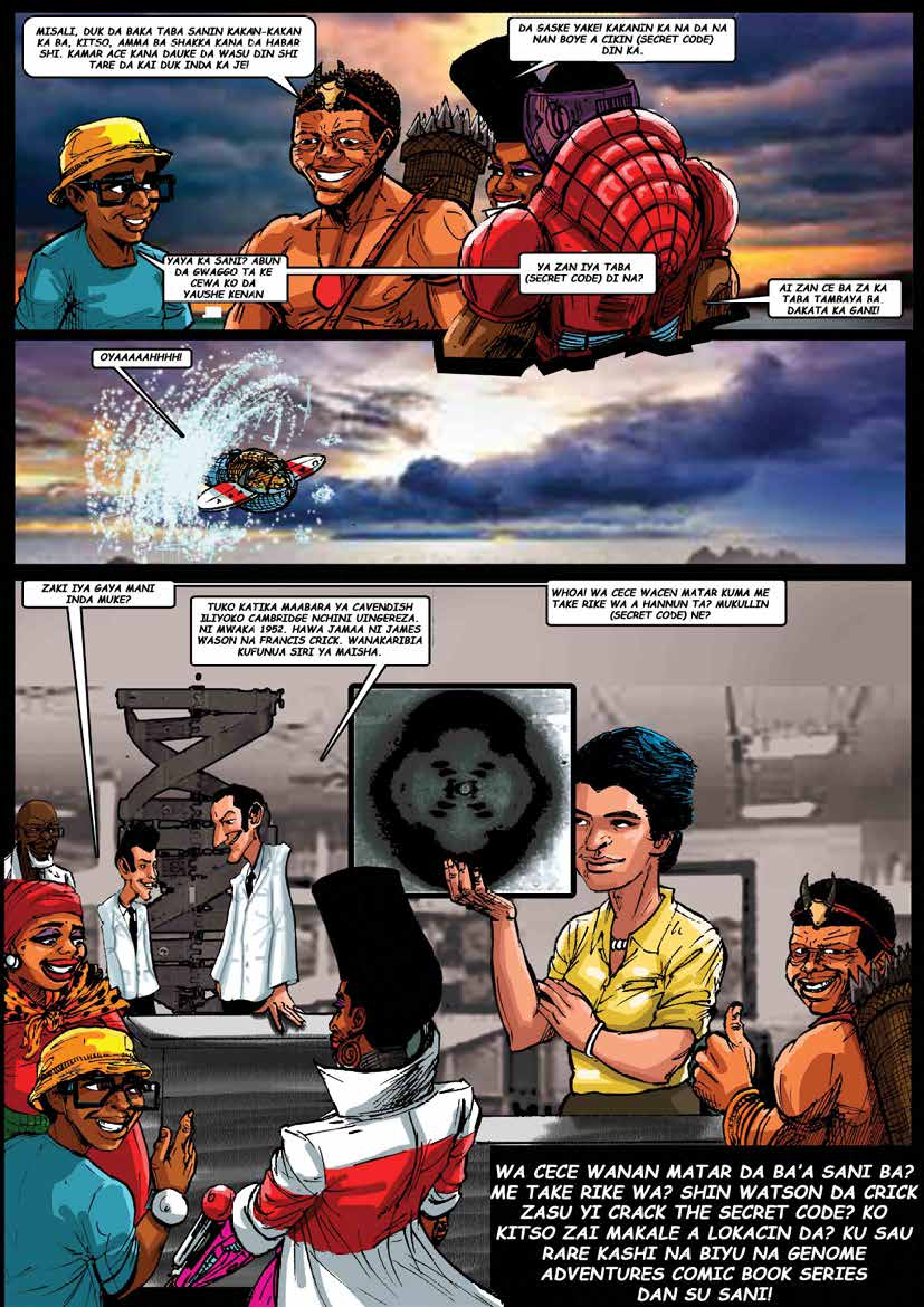
DAYA DAGA CIKIN GWAJIN DA YAYI, YA SIRKA WAKE MAI H URE SHUDIN DA MAI HURE FARI DON YAGA ABUNDA ZAA HAIFAR. SHIN ZA KU IYA GANE YADDA KAMANNUN SABON IRIN WAKEN DAYA TSIRO?
HMM...ZAN YI TSAMMANIN SHUDI MAI HASKE SOSAI?
HAKIKA, DUKA KANANAN SHUKOKKIN SUN BAYYANA HURE MAI LAUNIN SHUDI
EEEH?
STAMEN REMOVAL
POLLEN TRANSFER
PARENTS
CARPEL
STAMENS
CARPEL MATURES INTO POD
SEEDS FROM POD PLANTED
OFFSPRING (F)



AMMA MENDEL BAI GAMA BA. SAI YA DAUKA DAYA DAGA CIKIN KANANAN SHUKAOKIN MASU LAUNIN SHUDI YA KIWATA SU DA WASU MASU HURE MAI LAUNIN SHUDI.
HAKIKA 3 SUN FITO SHUDI KUMA DAY YA FITO FARI
DUKA SHUDI KUMA, INA TSAMMANI?
AMMA YA ZA A SAMU DA ME FARIN HURE DAGA IYAYE MASU SHUDI?
1 STAMEN REMOVAL
2 POLLEN TRANSFER
PARENTS
CARPEL
STAMENS
3 CARPEL MATURES INTO POD
4 SEEDS FROM POD PLANTED
OFFSPRING (F)
MENDEL YA BAYYANA WANI ABUN DA AKE KIRA RINJAYAR HALITAR JINI. YA GANE CEWA WASU DABIU, KAMAR SHUDIN HURE, NA RINJAYA- KO SUN FI KARFI-FIYE DA OPPOSITE DIN SU. ALAL MISALI, FARIN HURE



FARIN YA KASANCE YANA "BACCI" A CIKIN YARAN AMMA YA "TASHI BACCI" A CIKIN JIKOKIN
INA RUBUTA BISHIYAR IYALIN SHUKAR WAKE.
XT, ME KAKE ZANA WA A KAN BANGO?!
KUMA WANAN SHINE ABUN DA MASANAN KIMIYA KEKIRA PEDIGREE
TOH ZANAN KOGO YA ISA HAKANAN, TSOHO, DIBA KA GANI!
ME WADAN NAN 'A'S DIN SUKE WAKILTA?
MMEA, KAMA VIUMBE VINGINE UNA NAKALA MBILI YA KILA KINASABA, VIITWAVYO ALELI. LAKINI MMEA UNAWEZA KUTOA ALELI MOJA TU KWA MTOTO. HERUFI KUBWA 'A'NI ALELI INAYOTAWALA WAKATI HERUFI NDOGO 'A'NI ALELI ISIYOTAWALA.
DUK INDA KAGA 'A' KASAN SHUKAR WAKEN YA SHAWARCI KERA HURE MAI LAUNIN SHUDI. WANCEN MUTUNEN YANA DA KANANAN A'S KAWAIN SHI YASA YAKE DA FARAREN HURE KAWAI
aa
AA
Aa
Aa
Aa
Aa
AA
Aa
Aa
aa
KAMAR YANDA KA GANI, AKWAI KADDARA 1 DAGA 4 CEWA WA'INNAN IYAYEN MASU LAUNIN SHUDI NA DA BOYEYEN FARIN ZASU HAIFI FARIN DA. BARI IN FIDDO DI NA IN NUNA MAKA. KA GA? DA DAYA KADAI KE DA GUDA BIYU- ALLELES MASU KARAMAR "A"
FATAN BAKA JIN TSORN KOYAN MANYAN KALMOMI! A LOKACIN DA SHUKA KE RIKE DA MASU IRI DAYA, KAMAR AA KO AA, SHINE AKE CE MA (HOMOZYGOUS). A LOKACIN DA SHUKA KE RIKE DA DABAN-DABAN, KAMAR AA, SHINE AKE CE MA (HETEROZYGOUS)
GA HANYAR DA ZAKA IYA TUNA SU- HOMO SHINE "IRI DAYA" KUMA 'HETERO' SHINE "DABAN-DABAN". HARRUFAN SU KE WAKILTA (GENOTYPE) KUMA LAUNUKAN SHUDI DA FARI KE (PHENOTYPE)
A a
A AA Aa
a Aa aa
Aa
Aa
Aa
Aa
AA
Aa
Aa
aa
MENDEL YA MAIMAITA WANAN GWAJIN SO DAYA-WA-DAYAWA. YA SHUKA WAKE FIYE DA 10,000! YA GANE CEWA TSAWO NA RINJAYAR GAJYERTA, LAUNIN DOROWA NA RINJAYAR KORE, KUMA NA RINJAYAR TAMOJI, DA SAURAN SU...
SEED COLOUR
SEED SHAPE
STEM LENGTH
YELLOW
ROUND
TALL
x
GREEN
WRINKLED
DWARF
YELLOW
ROUND
TALL
AMMA BAN GANE BA. INA (RECESSIVE ALLELE) DIN KE BOYE WA? YA GAJARTA KE BOYE WA A CIKIN SHUKA MAI TSAWO KUMA YA LAUNIN FARI KE BOYE WA A CIKIN FURE ME LAUNIN SHUDI?
MENDEL YA TAMBAYA KANSA WANNAN TAMBAYA. BAI TABA SAMUN CIKAKKAR AMSA GA WANNAN TAMBAYAR BA, AMMA DAGA BAYA YA KAMMALA CEWA WANI WURI A CEN CIKIN WADAN NAN SHUKOKON, AKWAI WANI (SECRET CODE)
WHOA! WANI (SECRET CODE)? DAMA INA DA (SECRET CODE) NI MA.
KANA DA! KO WANE ABU MAI RAI NA DA (CODE)


MISALI, DUK DA BAKA TABA SANIN KAKAN-KAKAN KA BA, KITSO, AMMA BA SHAKKA KANA DA HABAR SHI. KAMAR ACE KANA DAUKE DA WASU DIN SHI TARE DA KAI DUK INDA KA JE!
DA GASKE YAKE! KAKANIN KA NA DA NA NAN BOYE A CIKIN (SECRET CODE) DIN KA.
YAYA KA SANI? ABUN DA GWAGGO TA KE CEWA KO DA YAUSHE KENAN
YA ZAN IYA TABA (SECRET CODE) DI NA?
AI ZAN CE BA ZA KA TABA TAMBAYA BA. DAKATA KA GANI!
OYAAAAAHHHH!
ZAKI IYA GAYA MANI INDA MUKE?
TUKO KATIKA MAABARA YA CAVENDISH ILIYOKO CAMBRIDGE NCHINI UINGEREZA. NI MWAKA 1952. HAWA JAMAA NI JAMES WASON NA FRANCIS CRICK. WANAKARIBIA KUFUNUA SIRI YA MAISHA.
WHOA! WA CECE WACEN MATAR KUMA ME TAKE RIKE WA A HANNUN TA? MUKULLIN (SECRET CODE) NE?
WA CECE WANAN MATAR DA BA'A SANI BA? ME TAKE RIKE WA? SHIN WATSON DA CRICK ZASU YI CRACK THE SECRET CODE? KO KITSO ZAI MAKALE A LOKACIN DA? KU SAU RARE KASHI NA BIYU NA GENOME ADVENTURES COMIC BOOK SERIES DAN SU SANI!

KAMUS

KIMIYANCE

ALELI- DAYA DAGA CIKIN KWAFI BIYU NA (GENE). MUTANE NA DA (ALLELES) GUDA BIYU GA KO WANE DABIU KO HALAYE, DAYA DAGA UWA, DAYA DAGA UBA.

CD4- GWAJIN (LAB) DA KE AUNA YAWAN (CD4 CELLS), WANI IRIN (CELL) MAI FARIN JINI DAKE TAIMAKA MA JIKI YAKI DA CUTUTTUKA, A CIKIN SAMFURIN JIININ KA.ANNA AFANI DA SHI DOMIN SANIN KO RIGAKAFIN JIKIN MUTUN NA AIKI.

RINJAYE- (MAI RINJAYA)- KWAFIN (ALLELE) KO (GENE) MAFI KUSANTAR MAI SARRAFA WANI HALI A ZURIYARSU; ALLELE DIN DA KE NUNA KANSHI KO DA MUTUM KWAFI GUDA DAYA KADAI YAKE DA SHI NA ALLELE DIN. MUSAMMAN, ALLELE DIN IDANU MASU LAUNIN KASA SHI KE RINJAYA, SABODA HAKA MUTUM NA BUKATAR KWAFI DAYA NA ALLELE DIN KAWAI DOMIN YA SAMU IDANU MASU LAUNIN KASA

GENE - WANI ⊠ANGARE NA KOWANE (CELL) DAKE DAUKAR BAYANIN DA KAYYADE FASALI KO HALAYE DA AKE GADO DAGA IYAYE.

HALITTAR JINI DOMINANCE– A LŌKACIN DA WANI IRIN HALI NE MAFI RINJAYE KO DA KARFI FIYE DA M

HALITTAR JINI- NAZARIN KWAYOYIN HALITTU DA KUMA GADAR HALI

GENOTYPE- DUKAN (SET) NA GENES A CIKIN WANI ABU MAI RAI; KWAYOYIN HALITTU - KO SAITA NA ALLELES DAKE NUNA WANI HAAYYAR KO HALI (PHENOTYPE) A CIKIN MUTUM.

GADAR HALI- TSARIN WUCEWAR HALAYE DA KWAYOYIN HALAYE DAGA IYAYE ZUWA ZŪRIYARSU.

HETEROZYGOUS - SIFFOFIN GENE GUDA BIYU MASU DABAN-DABAN-DAYA DAGA CIKIN 'UWA' SAI SAURAN DAGA CIKIN 'MAHAIFI' DABAN-DABAN; ABU MAI RAI NA DA ALLELES GUDA BIYU DABAN-DABAN / KOFE NA GENE.

HIV: WANI IRIN CUTAR DA CEWA INFECTS HALAKAR DA JIKI TA RIGAKAFI DA TSARIN

HOMOZYGOUS- IRI BIYU NA NAU'IN GENE - DAYA DAGA 'UWAR' DA SAURAN DAKE CIKIN 'MAHAIFI'IRI DAYA NE; A LOKACIN DA WANI ABU MAI RAI KE DA WANNAN ALLELE DIN GUDA BIYU/ KOFE NA GENE.

PEDIGREE- JERIN KAKANNIN MU NA DA. IYALIN ITACE, HOTON DA KE NUNA GADON WANI HALI KO CUTA TA HANYAR (SEVERAL GENERATIONS)

PHENOTYPE –HALAYE NA MUTUM DA AKE IYA GANI. MISALI LAUNIN IDO, LAUNIN GASHI

PUNNET SQUARE- ZANE DA AKE AMFANI DA SHI DOMIN A HANGO WANI SAKAMAKO NA MUSAMMAN NA KIWON GWAJI, MASU ILIMIN DABBOBI NA YIN AMFANI DA SHI DOMIN SANIN YIWUWAR ZŪRIYA GA SAMUN WANI GENOTYPE NA MUSAMMAN.

RECESSIVE ALLELE- KWAFIN ALLELE/ GENE WANDA YAFI YUWA ZAI ZAUNA A ⊠OYE A CIKIN ZURIYA. ALLELE DIN DA KE NUNA TASIRINSHI KAWAI A LOKACIN DA WANI MUTUM YANA DA KOFI BIYU NA ALLELE DIN. ALAL MISALI, ALLELE NA IDANU MASU SHUDIN BULA SHI NE RECESSIVE DON HAKA IDAN WANI MUTUM YANA DA IDANU MASU SHUDIN BULA, YANA DA ALLELE KOFI GUDA BIYU NA 'BULAN IDO' .

DABIU- TAKAMAIMAN HALAYEN JIKI NA ABUBUWA MASU RAI DA KE YIN MU MUSAMMAN KAMAR LAUNIN IDO KO GIRMAN JIKI. MUN GAJI DABIU DAGA IYAYENMU.

DA TARIN FUKA- AN DAUKE DA KWAYAR CUTAR KWAYAN CUTA DA CEWA ZAI IYA SHAFAR KUSAN DUK WANI NAMA A CIKIN JIKI, MUSAMMAN CIKIN HUHU

KWAYAR LOAD- MA'AUNIN YAWAN KWAYAR BARBASHI A CIKIN WANI ABU MAI RAI, MUSAMMAN YAWAN ⊠WAYOYIN CUTAR HIV A CIKIN JINI.

SETSWANA TERMS

DUMELA – GREETINGS; HELLO; PLURAL – DUMELANG.
KGALAGADI- SETSWANA TERM FOR THE KALAHARI DESERT
MMA/MME – MADAM; MOTHER.
MORULA – A COMMON TREE IN BOTSWANA AND SOUTHERN AFRICA WITH EDIBLE FRUITS.
MOSIMANE – A YOUNG BOY.
RRA/RRE – SIR; FATHER.
THOBANE – A TRADITIONAL WALKING STICK.
EISH! – AN EXCLAMATION EXPRESSIVE OF SURPRISE, FRUSTRATION, DISAPPROVAL, ETC.

TSÂWA DA DA: KITSO DUBA HALITTAR JINI DA KUMA GADAR HALI
AN BUGA A JAMHURIYAR BOTSWANA DAGA BOTSWANA-BAYLOR CHILDREN'S CLINICAL CENTRE OF EXCELLENCE.
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AMINCEWA

WANNAN COMIC LITTAFI NE SAMFURIN NA HA] IN} O} ARIN DA WADANNAN:

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GARGADI

DOMIN MUN YI} O} ARIN TABBATAR DA AMINCIN KIMIYYA ABINDA KE CIKI NA WANNAN LITTAFIN, DA BAYANIN KUNSHE A CIKIN WANCAN BA DOLE BA NE YA NUFIN CEWA A MAIMAKON LIKITA SHAWARA. JAMA'A A KARKASHIN DOKOKIN, MARUBUTA DA KUMA WALLAFA WANNAN LITTAFI DA SU JAMIÁI, BA ZA M, DA LISSAFI DA KUMA YARDA, KO KUMA RAUNIN DA YA FARU, ASARA KO LALACEWAR ABIN DA YA TASO A AMINCI DA BAYANAI A CIKIN WANNAN LITTAFI.

DUK HAKKOKI

BA NA WANNAN ▯ABA'AR IYA REPRODUCED, ADANA A CIKIN GYARA TSARIN, KO DAUKAR KWAYAR A KOWACE TSARI KO TA KOWANE HANYA, LANTARKI, INJI,
PHOTOCOPYING, RIKODI, KO BA HAKA BA, BA TARE DA NA DA IZINI A RUBUCE DAGA BOTSWANA-BAYLOR YARA CLINICAL CENTRE NA KYAU, PLOT 1836, ASIBITIN WAY, PRINCESS MARINA HOSPITAL, PRIVATE BAG BR129, GABORONE, BOTSWNA.

CAfGEN

GENOME ADVENTURES

GKUNGIYAR BINCIKE AKAN KWAYOYIN HALITTA KUNGIYA CE WADDA WELLCOME TRUST TA DAUKI NAUYI, TARE DA COLLABORATIVE AFRICAN GENOMICS NETWORK (CAFGEN). CAFGEN MEMBA NE NA KUNGIYAR BINCIKE AKAN KWAYOYIN HALITTA DA LAFIYA NA AFRICA, KUMA BOTSWANA-BAYLOR CHILDREN'S CLINICAL CENTRE OF EXCELLENCE (COE) KE KULA DA SHI.
KUNGIYAR BINCIKE AKAN KWAYAR HALITTA YANA AMFANI DA GAYYATA, LABARAI MASU ILMANTARWA DA KUMA YANAR GIZO DOMIN ILMANTAR DA KUNGIYOYI, LAUYOYI, DA KUMA KUNGIYOYI GABA DAYA, MUSAMMAN MA MATASA, A BINCIKEN KWAYOYIN HALITTA.
KUNGIYAR BINCIKEN KWAYOYIN HALITTA TANA KOKARIN ILMANTAR DA MUTANE A KAN TARIHIN ILIMIN KWAYOYIN HALITTA, YADDA KWAYAN HALITTA TA KE, DA KUMA AIKIN SU, DANGANTAKA TSAKANIN KWAYAN HALITTA DA LAFIYA, DA KUMA YADDA AKE SHIGA BINCIKEN KWAYOYIN HALITTA; WANDA YA HADA DA TAKARDAN AMINCE WA, AIKAWA DA ABINDA AKA DAUKA A JIKIN MUTUM DA KUMA ADANAWA, DA HALARTAN GARI GABA DAYA.

DOMIN NEMAN KARIN BAYANI KO NEMAN SHAFIN MU, A TUNTUBI:

- *GENOMEADVENTURES.WEEBLY.COM*
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